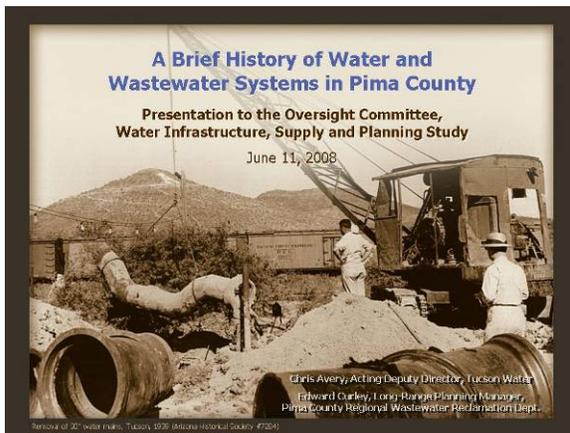


**PRESENTATION MADE TO THE CITY/ COUNTY
WATER & WASTEWATER STUDY OVERSIGHT COMMITTEE
JUNE 11, 2008**

**Speakers: Chris Avery, Interim Deputy Director for Tucson Water
Ed Curley, Long Range Planning Manager of Pima County
Regional Wastewater Reclamation Department
Harlan Agnew, Deputy County Attorney, Pima County
Larry Dozier, Deputy General Manager, Central Arizona Water
Conservation District**

**OVERVIEW: WATER/WASTEWATER SYSTEMS
HISTORY: WATER/WASTEWATER SYSTEM
PRESENTATION BY
CHRIS AVERY, INTERIM DEPUTY DIRECTOR FOR
TUCSON WATER**

**&
ED CURLEY, LONG-RANGE PLANNING MANAGER FOR
PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT**

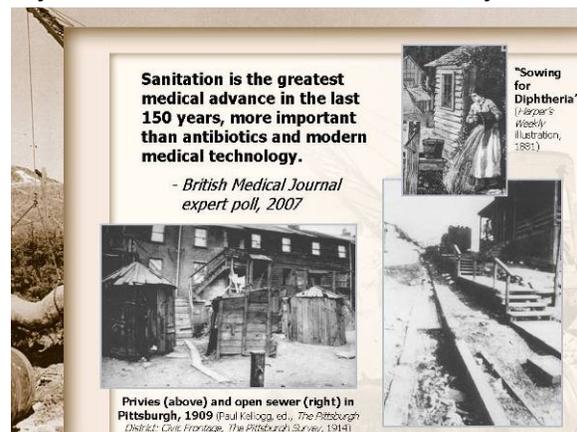


MR. AVERY: Good evening. I'm Chris Avery, and I'm the Interim Deputy Director of Tucson Water, and I'm going to be joined tonight by Ed Curley, who's the Long-Range Planning Man- - Long-Range Planning Manager for the Pima County Regional Water Reclamation Department.

And we'd like to start our presentation tonight by giving you a brief overview of the history of water and wastewater in the area, and then we'll proceed to an overview of

how water and wastewater systems currently work, and we'll be followed by a presentation from Harlan Agnew of the Pima County Attorney's Office on the regulations that govern water and wastewater issues in the area.

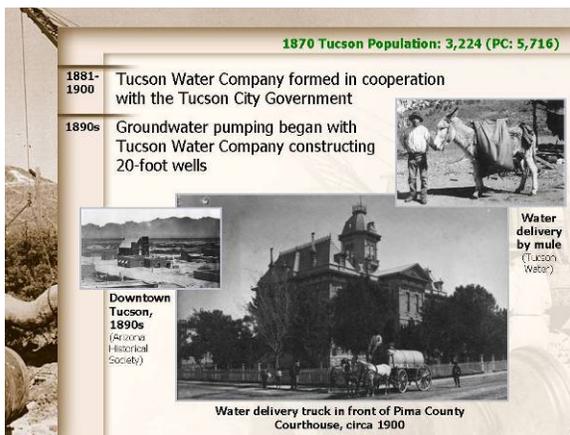
This is a photograph of a 30-inch main replacement in the Tucson Water service area below "A" Mountain in 1930 1939, and one of the interesting things about this presentation is the quality of work lighting and the age of the



- in
the

equipment. It's - it's no - it's no surprise that today any kind of infrastructure replacement or program costs more in real dollars than it did in 1939.

And last year the *British Medical Journal* commissioned a poll of experts about the most important medical advances of the last 150 years, and experts selected sanitation, which they defined as the provision of clean piped water and the disposal of flushed sewage into a wastewater treatment plant system as being more important than anesthesia or vaccines, and I'm not sure I'd want to do without any one of those three, but the importance of water and wastewater systems to the health of a modern community and to the cities that have grown up in the last 150 years can't be denied. And the history of the water and the wastewater system in Tucson, in the beginning at least, is an effort to try to provide those basic necessities to a community that lacks them.



In 1881, Tucson Water Company was formed with the cooperation of the Tucson City government. Tucson Water, at that point, was a private company, but the City of Tucson gave the former Mayor an opportunity to use the City streets and franchise in order to collect water to provide a safe water supply to the citizens. I think it's no surprise that the Tucson Fire Department was also formed by Tucson City government that same year.

For the first few years of Tucson Water Company's existence, it provided water directly from the Santa Cruz River. But, by 1890 or so, following a devastating series of floods on the Santa Cruz River that lowered the surface of the Santa Cruz by about 20 feet, it had to rely on groundwater for its supply, and the initial groundwater pumping through - in - in - in those wells along the river was through a series of shallow 20-foot wells. And, if you've ever wondered why some of the streets south of downtown are a little crooked and curve toward the Santa Cruz as you go south toward Twenty-Second Street, the reason is they follow those old canals and irrigation systems that brought water into town.

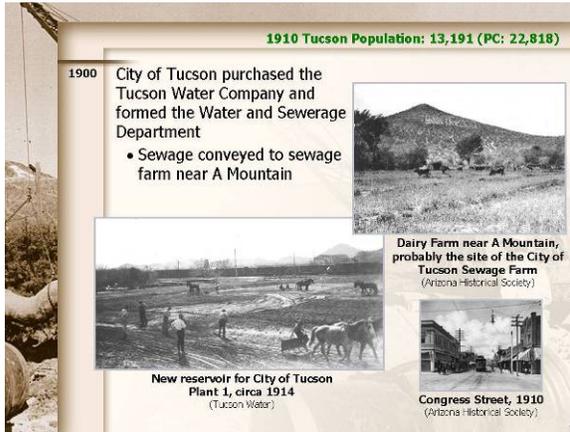
This is a - a photo of a water delivery truck in front of the old Victorian Pima County Courthouse in 1900.

MR. CURLEY: Picking up on the wastewater side of things. In 1900, the first sewer was

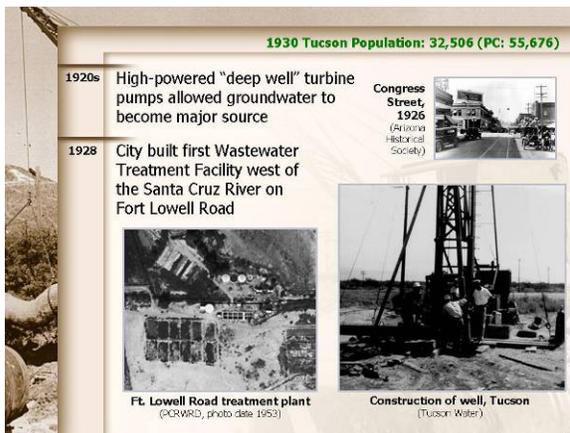


installed on Main Avenue. These photographs are from the Arizona Historical Society, which has been very kind to allow us to use them and to put them up on the website so you can access all these on our website.

We've also got an example of sewer plans over on the right-hand side and you can see that, in some cases, they even had to go to New York City to get engineers to put in the sewers.



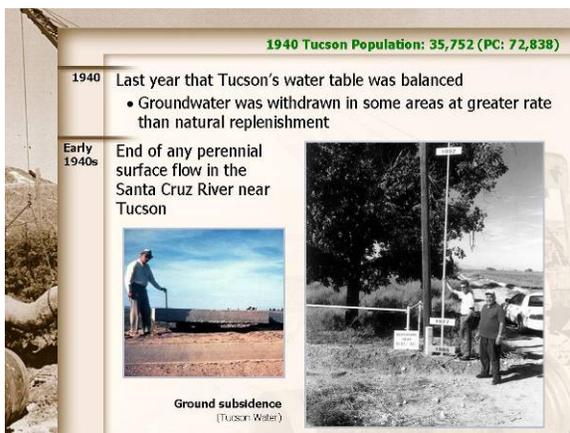
On the next side, then the Tucson Water Company was taken over by the City, formed the Water and Sewerage Department, and the sewage was conveyed to a sewage farm near "A" Mountain, which you can see in the upper, right-hand picture; that was a dairy farm. And then things started getting really intense; they put a new reservoir in. And you can see in the bottom right photo, the streetcar on Congress Street and the population figures as we go along.



MR. AVERY: In the 1920s, high-powered, deep-well, turbine pumps allowed groundwater to become a major water source for a growing city. About the same time, Tucson Water began the revolutionary practice of metering its services. Before 1920, water was available at a flat rate to its customers.

MR. CURLEY: The first real Wastewater Facility was west of the Santa Cruz River on Ft. Lowell, and you can see the

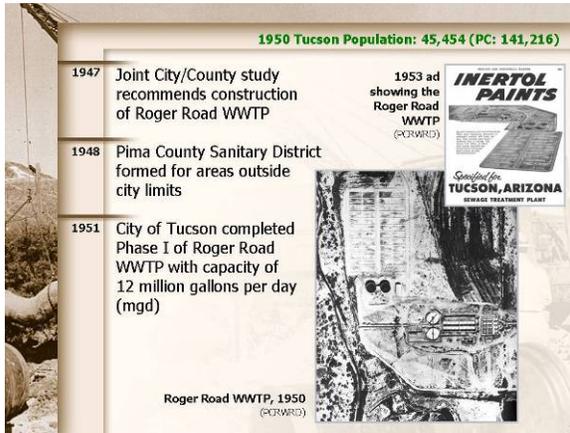
Ft. Lowell Road Treatment Plant there in the lower, left-hand side; and, again, Congress Street for 1926 in the upper, right-hand side - but now Tucson's population started to increase and has real effects on the wastewater and water systems.



MR. AVERY: Experts believe - and you can challenge me on this - experts believe that in 1940 or so was the last year that Tucson's water table was balanced. You'll notice that the population of Tucson in 1940 was 35,752, and the entire population of Pima County that same year was 72,838.

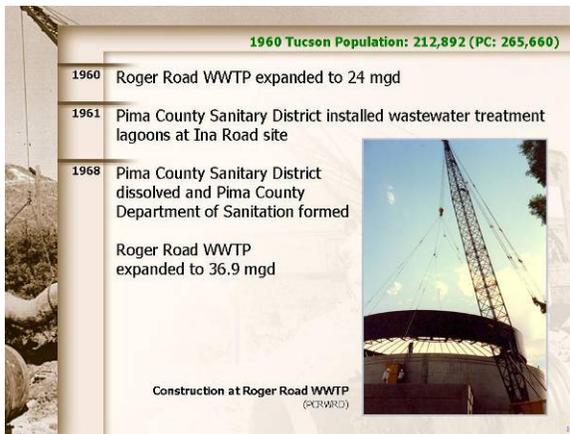
As the groundwater supply became unbalanced, and wells pumped more water

from the local aquifer than was naturally replenished, the Santa Cruz ceased to flow by the end of the 1940s - was the end of perennial surface flow on the Santa Cruz River near Tucson. And the consequences of over-pumping a local aquifer - illustrated here - this is a rather famous USGS marker on the surface of the ground in - near Eloy, Arizona - this flag shows the surface of the ground as it was in 1952, 1977, and here in 1985. This photograph was taken by a Tucson Water employee in the mid- to late-1990s.



MR. CURLEY: To deal with the population then, the City and the County jointly constructed a wastewater facility at Roger Road. The Pima County Sanitary District was formed because areas outside the City limits began to have higher densities and need sewage treatment, and so Phase I of the Roger Road Facility with 12 million gallons per day was done in 1951.

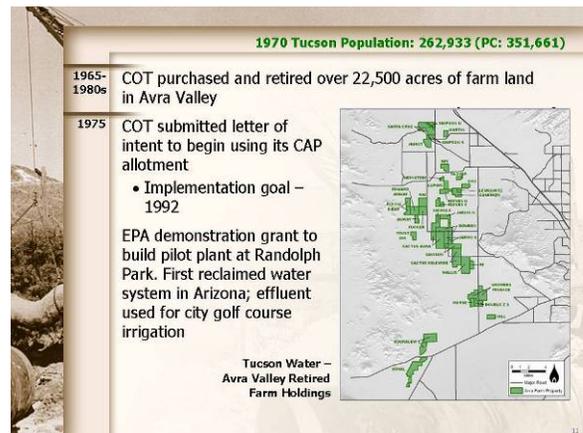
And the easiest way to look at the 1-million-gallon-per-day figure is to think that 1 million gallons per day is about the output of 10,000 to 12,000 people, depending on each individual per capita usage. So, you can see we've got a population here of 45,000 for the City, and a 141,000 for the entire County.



At this point then, in the '60s, the Roger Road Treatment Plant was expanded. Lagoons were begun at Ina Road for the growing northwest area. The Sanitary District was dissolved, and Pima County then had to take it over as the governmental entity that would regulate it, and the Pima County Department of Sanitation was formed at the same time that we're expanding Roger Road on the City

side to about 37 million gallons per day.

MR. AVERY: Following World War II, Tucson coped with what can only be considered explosive population growth. By 1960, the Tucson population expanded to 212,000; and, by 1970, Tucson's population was 262,000 people. And, as the population grew, the effects of

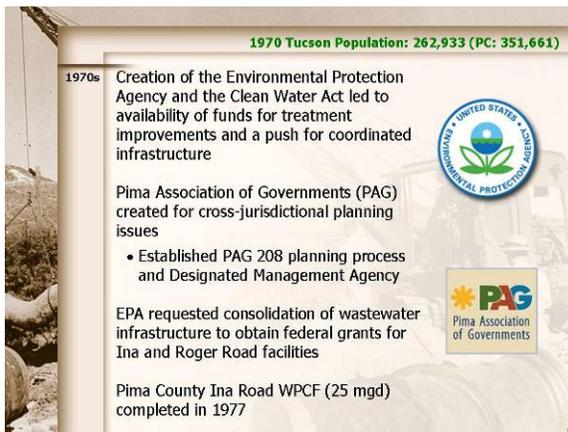


groundwater withdrawals became increasingly apparent. So, beginning in the mid-1960s, and continuing on throughout the 1970s, Tucson began to try to develop new sources of supply to replace groundwater.

1975 was a particularly important year; in that year, Tucson first submitted its Letter of Intent to begin the process of obtaining a CAP allotment. And, even in 1975, 35 years after the groundwater was out of balance, the benefits of CAP water were not universally accepted. In fact, I have an editorial from the *Star* and *The Citizen* in late 1974 arguing that the City should not allocate water from the - from the CAP because abundant groundwater was available, and because CAP water would be too costly.

In 1975, the City also built and developed the first reclaimed water system in the entire State of Arizona; that EPA Demonstration Grant developed a package plant at the Randolph Park here, and this golf course out the back window was the first site where reclaimed water was actually put to use in a reclaimed water system.

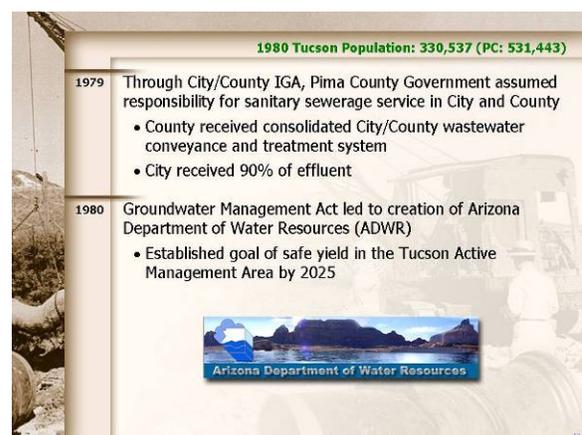
Also, in - starting in 1970 - in the early - late - mid-1960s to the mid-1980s, Tucson Water began purchasing large amounts of farm land in the Avra Valley Basin, about 20 miles west of town, for the purpose of obtaining groundwater rights that were formerly used for irrigation of cotton farms and fields. Though those lands were initially purchased to obtain the water from Avra Valley, they've become an important site where we put water into the Avra Valley Basin these days.



MR. CURLEY: Moving into the '70s, many of you may be aware that the Clean Water Act was passed by Congress in 1972, and, concurrently with that, the Environmental Protection Agency was created - and two things happened. They began to give out funding for treatment improvements to bring everybody up to secondary treatment standards, and there was a big push for a coordinated system of local planning. So, the Pima Association of Governments was created and designated as the local Water Quality Planning Agency, and they were to

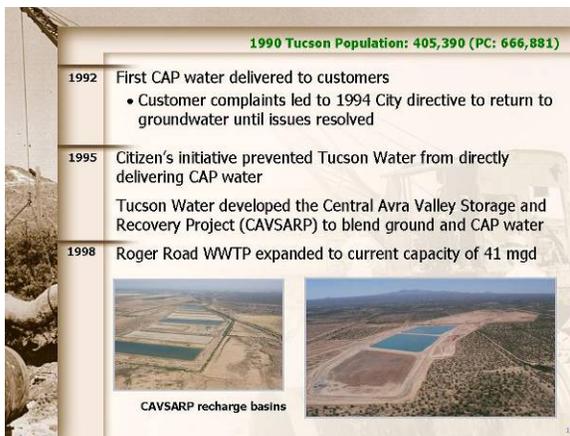
choose a designated management agency.

At the same time, the EPA looked at the request for \$25 million from the City and \$25 million from the County for two facilities five miles apart and said, "Perhaps, you all need to consolidate and coordinate your infrastructure." So, at the same time they're finishing that plant in 1977,...



in 1979 we went to the City/County IGA in which the County government assumed responsibility for the wastewater and City government kept the water system. So, the County took the wastewater treatment system and Conveyance System from the City, and the City received 90% of the effluent as a water supply in exchange.

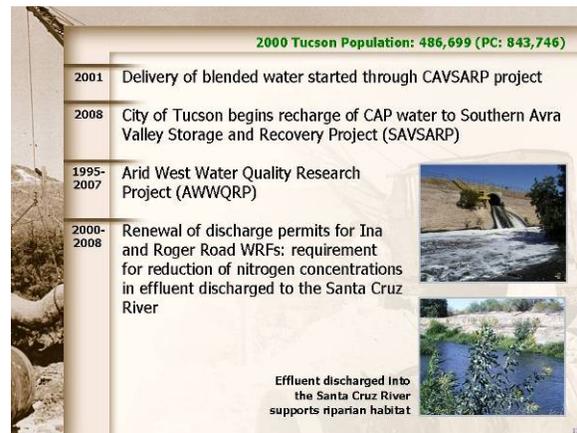
MR. AVERY: In 1980, the Arizona Legislature passed the Landmark Groundwater Management Act which led to the department - the creation of the Arizona Department of Water Resources, and established the management goal of safe yield groundwater pumping in the Tucson Active Management Area by 2025. As we move forward through this process, we'll discuss the Groundwater Management Act in - in more detail, but it was one of the most important things that happened in - with respect to water quantity legislation in the State of Arizona and still a landmark piece of legislation nationwide.



As a consequence of the City's effort to obtain CAP water starting in 1975, the City spent most of the '80s building a complex delivery system to bring water from the Central Arizona Project canal through a Service Water Treatment Plant and into the City of Tucson. When that facility was complete in 1992, Tucson first began to deliver CAP water to its customers. And for customers located in most of the City of Tucson, the changeover was immediate.

There were significant water quality differences between the Colorado River water that was developed - that was being provided to customers, and the groundwater that had been the source of Tucson's water supply up until then. Most notably, the Colorado River water had a higher pH than the native groundwater and was, therefore, more - more corrosive, and the subsequent water quality complaints caused the City to discontinue delivery of Colorado River water in 1994, and resulted in the passage of a citizens' initiative in 1995 that prevented Tucson Water from directly delivering CAP water to its customers.

In response, the City of Tucson developed the Avra Valley Storage and Recovery Projects; those Storage and Recovery Projects, which are shown here, allow City to take its allocation of Colorado River water, recharge it on about 500 surface acres in Avra Valley, pump the water to the surface again as a mixture with Colorado River water and groundwater, and deliver it to its customers.



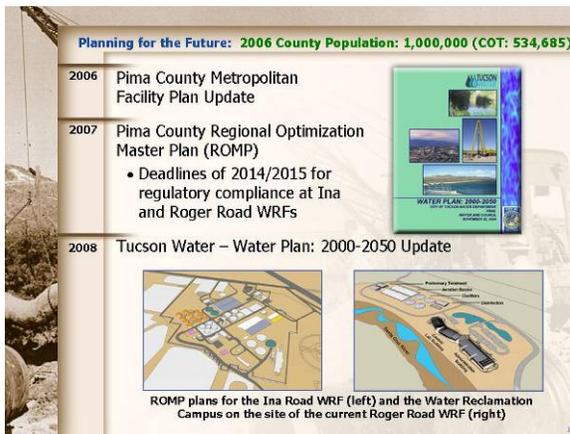
the

In 1998, the Roger Road Wastewater Treatment Plant was expanded to its current capacity.

In 2001, the City began delivering the blend of water from the Avra Valley Storage and Recovery Projects. And just this last month, the City of Tucson began recharging Central Arizona Project water in the new facility, the Southern Avra Valley Storage and Recovery Project, located about five miles south of the initial CAVSARP Project.

MR. CURLEY: As Pima County Wastewater moved from being a teenager into more of an adult status, the EPA contracted with us to run a \$5 million, 12-year study to look at appropriate water quality standards for the arid west. And so we retained researchers and engineers to look at all aspects of water quality for ephemeral streams and effluent-dependent streams, and the results from this project have been used all across the west, in Colorado, California, and even into Canada – who asked us if they could have our standards for aluminum which is a big water quality issue in Canada.

About the same time, we had our discharge permits for Ina and Roger Road Wastewater Reclamation Facilities, which were on a five-year cycle, and we worked with the Department of Environmental Quality to come up with a schedule because, as we moved forward into the 21st Century, we wanted to bring the nitrogen concentrations in the effluent down, and so we are now implementing that.



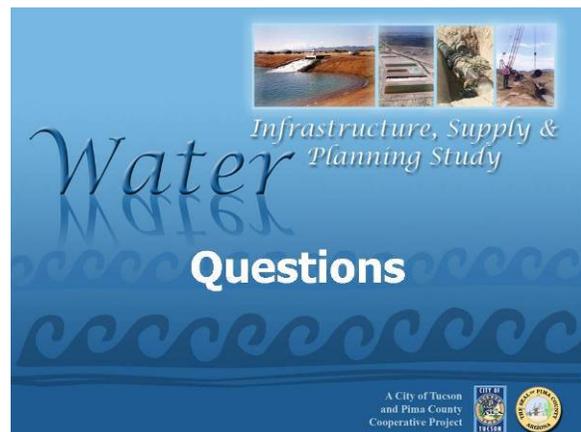
two pictures of what the new facilities will look like - which we'll deal with later in this presentation. So, basically, these are more of the adult years as we're maturing and growing as an agency and doing a lot of planning for the future.

MR. AVERY: In 2008, Tucson Water completed its Water Plan 2000-2050 Update, which also is a systematic process by Tucson Water to try to incorporate plans for the future of Tucson Water up until 2050.

MR. CURLEY: We can take questions now if anyone has some about any of those historical issues.

CHAIRMAN JIM BARRY: Let me say the - the slides, we will have hard copies of that available and it'll be on the website; it's just

We're now planning for that through the Metropolitan Facility Plan Update and what we call our "Regional Optimization Master Plan," in which we've said, "What should happen at Ina and Roger Road?" Those are



- there was a snafu that we didn't have them beforehand. Dan Sullivan?

MEMBER DAN SULLIVAN: We will be getting then a written digest of these Power Points from Staff at some point for the Committee; is that correct?

MR. AVERY: Yes.

CHAIRMAN JIM BARRY: Yes, that's - that's my understanding.

MEMBER DAN SULLIVAN: Second question: Is there a story behind the story of the 1979 IGA between the County and the City?

CHAIRMAN JIM BARRY: That's just a "yes" or "no" answer; let's not get into that.

MR. AVERY: Yes.

MEMBER DAN SULLIVAN: Uh-huh. Big is the imagination that such a one-sided agreement could've been negotiated by the County.

CHAIRMAN JIM BARRY: Moving right along. Now, the procedure was we were going to hold questions until the end, unless there was a direct question from a Committee member that could be answered simply.

MR. CURLEY: Right. Well, we just need to have time to set up. Yeah, we have to have a little time.

CHAIRMAN JIM BARRY: Okay. If - if you - ma'am, I see your hand -

MARGOT GARCIA: Yeah.

CHAIRMAN JIM BARRY: - and I'm trying to tell you the procedure is: Fill out a card, and there will be a time when we will - we will call on you, but we're not going to call on the audience as they raise their hand, okay? We'll just never get through this process if we - if we do it that way.

So, you're setting up for - for the next? So . . . why don't we take your question then? Go ahead and ask it. Yes, please, go ahead.

MARGOT GARCIA: I'm just writing down my question, so -

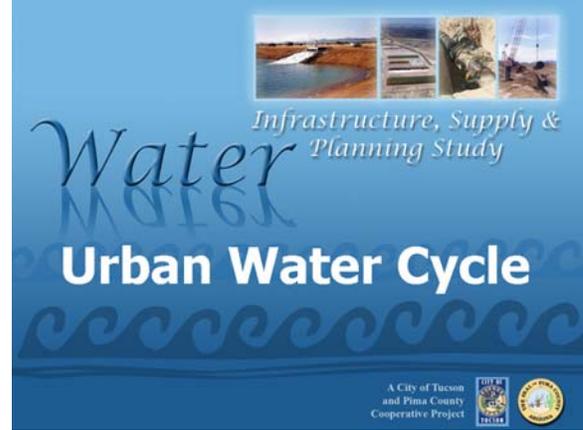
CHAIRMAN JIM BARRY: Okay. Could you have - give us your name, please?

MARGOT GARCIA: Sure. My name's Margot Garcia. My question to you is: If there was a time in the late '70s where there was something called MUM, which was the City and County cooperating on water and sewers. Do you want to just add that little piece about what happened to MUM? Why it was put in there? Why it was (inaudible; not speaking into a microphone)?

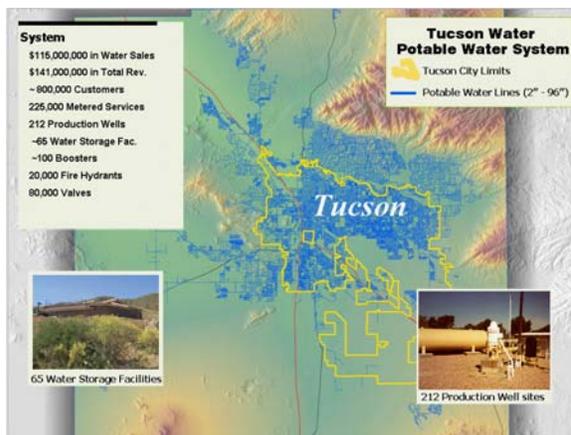
MR. AVERY: I wanna report that in 1979, I was a sophomore in high school in Flagstaff, Arizona.

CHAIRMAN JIM BARRY: There are people who know that history, Margot, and we will make sure that that's reflected in the report; that - that was important and it should be included.

Are we ready to go on now? Please.

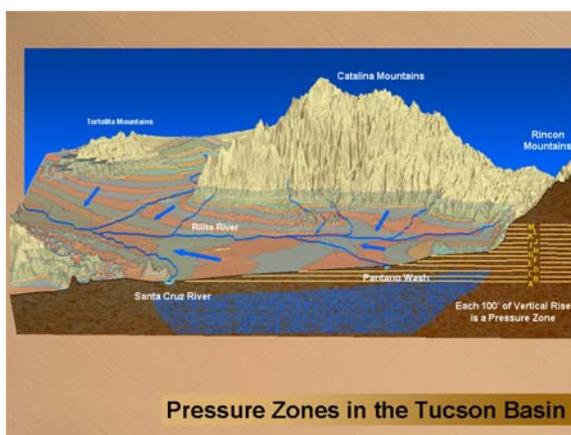


MR. AVERY: So, we spent the first few minutes of our evening tonight telling you about the history of Tucson Water and Wastewater. Now we'd like to present to you a short overview of how the systems are currently configured today, and we've tried to do this in figurative or graphic form as much as possible in order to try to convey information. And, as we go forward in this educational process throughout the summer and into the fall, we hope that we'll be able to fill in some of the basic information that we're providing to you today with more sophisticated and detailed information going forward.



This is where Tucson Water System is today, and I'll talk about Tucson Water first, and - and then we'll talk about Pima County Wastewater in a second. Tucson Water System today, relative to the Tucson City limits, is primarily located to the north. One of the interesting things about Tucson Water, compared to most other water providers in the west United States, is the amount of water service that Tucson Water provides outside the Tucson City limits; the Catalina Foothills in here, and Marana in here, and on the southwest side. About 40% of Tucson Water's customers are located outside the City limits, correspondingly 60% of its customers are inside the City.

The Water Department sells about \$115 million worth of water today; its total revenues are about \$140 million. And we provide service through 225,000 metered connections to approximately 800,000 customers. We have a large and complex facility; it has 212 production wells, 20,000 or so fire hydrants, and 80,000 or so valves.

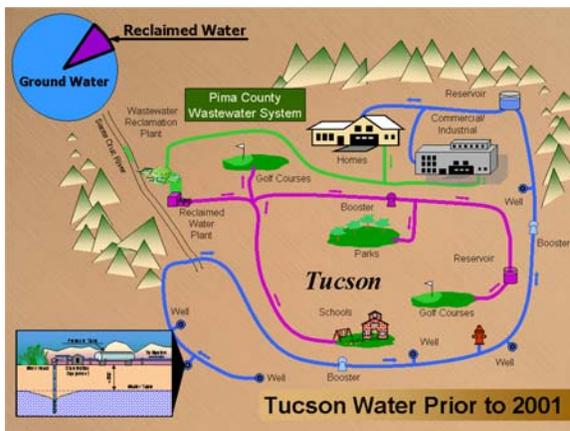


In addition to being complex from a plan view, Tucson Water System is also fairly complex if you look at it sideways. Every one of these individual bands on this map is, in fact, an entirely separate water system, separated by approximate 100-foot boundaries. The connections between these water systems are either pressure-reducing valves, which allows water to flow at - under controllable conditions into a lower elevation, or boosters that pump water up into the next higher elevation, but each of these little

bands shows a separate water system as we move up in elevation; and it's this drop in elevation that Pima County uses to collect water in its sewer system to its treatment plants that are located about here at the intersection to the watersheds in the Tucson Basin. And anyone who's ever climbed "A" Mountain or Tumamoc Hill knows that this is not an exaggerated vertical scale.

This is where we started. A couple of million years ago it was a lot shorter drive to San Diego than it is today. But as California essentially tried to pull away from the rest of the United States, a process which continues, a large series of - of what's called basin and range topography formed; Tucson's pretty near the eastern edge of that topography. But, basically, the mountains that surround Tucson are large blocks of relatively intact rock that have, essentially, been buried in their own debris. The Central Tucson Basin is probably several miles deep and, from time in memorial, those sediments and sands were filled by water that flowed down from the adjacent mountains.

Tucson has some topographical advantages, if you - if you think about it, from a geologic point of view. Santa Catalina Mountains are relatively high and full of granite; the Rincon Mountains are relatively high and full of granite; and then they produce a lot of core sediments that doesn't degrade very seriously in - in arid conditions. So, when the first settlers arrived in Tucson, they found a flowing Santa Cruz River and a shallow aquifer.



We immediately - as discussed in the history slide - proceeded to develop that aquifer to provide water to a growing community. The primary method of accessing the groundwater is through our wells. And this is a side view of a typical well installation; several hundred of these occur in - in the Tucson Water Service Area prior to 2001.

Generally, about - in 2001, the depth to the water table in the Tucson area is approximately 350 feet. Water is pumped from the aquifer through a well to the surface. The water is then disinfected, pressurized, and boosted into our system. So, in many ways, the Tucson Water System prior to 2001 was a fairly complex distribution that were supplied by 200 or so different sources of supply.

Once water reaches the surface of the ground, Tucson Water uses a piece of infrastructure called "boosters" to lift water up to higher elevations in order to get water to the reservoirs where it's distributed out to our customers, commercial, industrial, as well as residential.

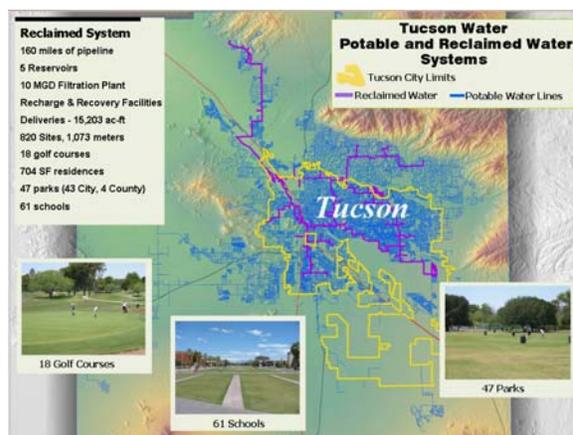
Along the way, Tucson Water's distribution system provides fire service for the Tucson community. And fire hydrants - there are 20,000 of them as noted on Tucson Water's system - fire hydrants derive essentially no revenue for the Department, but

they're a major driver in terms of our infrastructure requirements, both in terms of the size of the pipes that are in the streets, as well as in the sizes of the reservoir that make water available to protect the community.

Once Tucson Water pumps water uphill to a reservoir, it then flows by gravity which creates the pressure to deliver water to homes and businesses. Whatever - generally, as an easy way to think about it: Whatever makes it into a home or business, subject to very minor losses, is captured by the plumbing system in the home, collected by the Pima County Wastewater Sewage System and delivered to treatment plants on the Santa Cruz River.

The reclaim system takes advantage of this collection. In essence, the sewer system is a watershed of itself; it's a pipe - it's a series of pipelines, but in - in many ways it's a watershed. And - and Tucson Water takes advantage of this watershed by collecting water after it's treated at Pima County treatment plants. It further treats the water either through groundwater recharge, or through filtration; it disinfects the water and - and delivers it through an entirely separate distribution system to its customers on the reclaim system. This is reclaimed purple; and, as a matter of safety, reclaim water facilities and piping are required to be purple, so we use it as - as the marker for that system. Most of our customers on the reclaim system are - are large-scale customers.

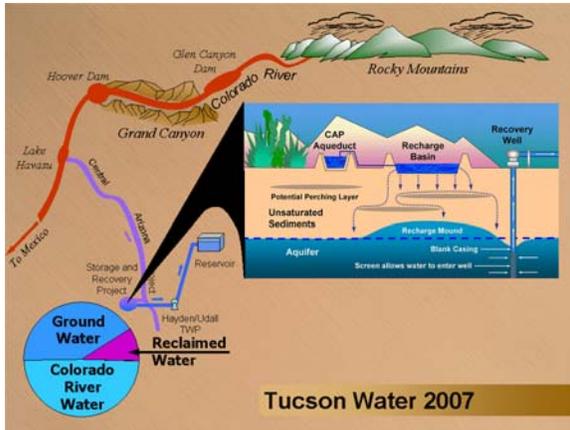
And, in 2001, you can see our - our water supply balance. Almost all of the water that we pumped and delivered to customers in the year 2000 was native groundwater; only about 8% of our total supply was reclaimed water; and this water was primarily used on - on turf irrigation.



This is a little bit of a representation of the combined system and plan view. With the reclaim system laid over the top of Tucson Water's distribution system, you can see that the primary drivers for the reclaim system are golf courses. And, although there are 700 single-family residences that are served from the reclaim system, those residences are clustered near existing pipelines in the Sovania area, and there's some - also some customers in the Tucson Country Club area. But, primarily, it's the golf courses, the

schools, and the parks that are the customers of the reclaim system.

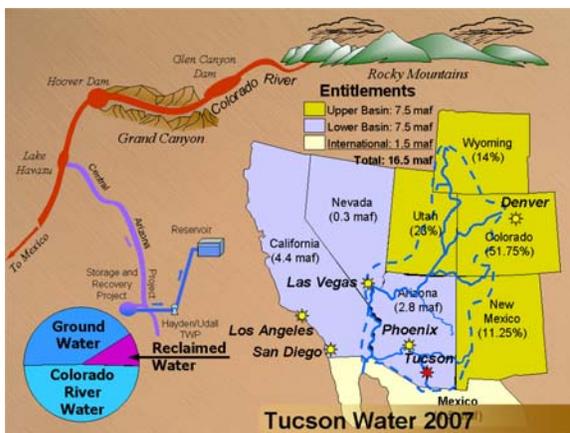
Now, here we are today in 2007, and what's changed? We are now connected to a much larger system than just the Tucson Basin. The water that - that supplies Tucson generally originates in the Wind River or Rocky Mountains in Wyoming and Colorado; it flows through some of the most spectacular scenery in the United States, and down to Lake Havasu where the Central Arizona Project pumps the water uphill to Phoenix and Tucson.



As a result of the failure - initial failure of delivery of Central Arizona Project water in 1992, Tucson Water developed the Avra Valley Recov- - Storage and Recovery Projects. The way they work is that water is pumped from the CAP aqueduct to the recharge basins where the water percolates at a very rapid rate, resulting in small evapo-transfer losses.

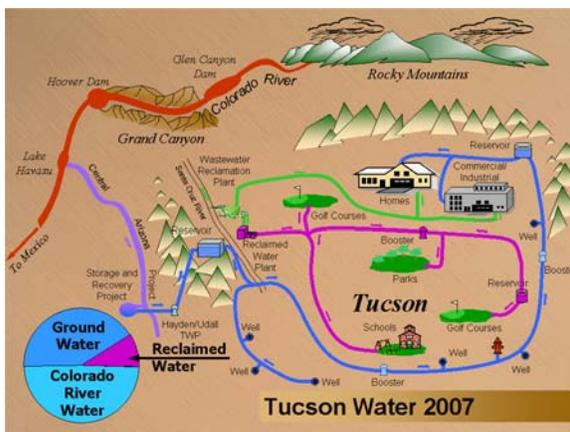
As a noted before, in order to recharge the entire Colorado River water allocation of the City of Tucson, it takes about 500 surface acres. The water flows rapidly into the ground where it mixes with native groundwater; it's pumped up through an entirely new system of wells and distribution system back to Tucson Water's main distribution system on the west side of the Tucson Mountains.

In 2007, though, we are now not only connected to the Colorado River as an ecological system, we're also connected to the major cities in the western United States: Denver, Las Vegas, Los Angeles, San Diego, and Phoenix also rely on the Colorado River for supply. In addition to supplying these rapidly-growing western cities, the Colorado River also supports some of the most spectacular ecosystem (sic) in - in the world. It was my pleasure as a smarter and stronger guy to work on the Colorado River for a few summers as a river guide, and it was one of the great experiences of my life.



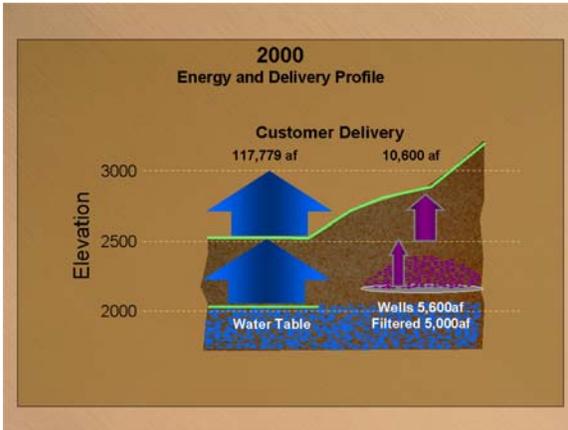
The use of Colorado River, though, allows us to reduce our dependence on groundwater.

Today we use Colorado River water for about half of our supply; about 40% is groundwater and about 10% is reclaimed water.



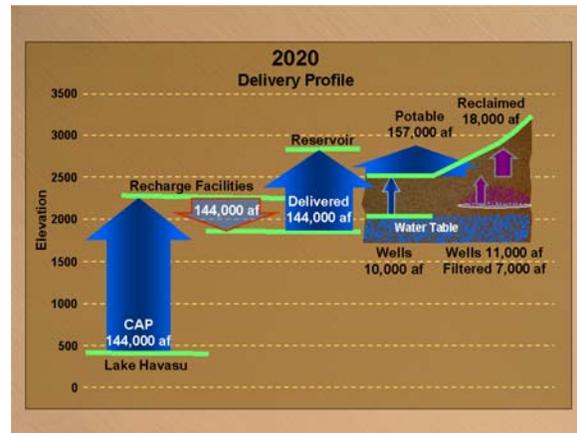
As we move forward, though, Colorado River water poses its unique set of challenges; some of those challenges are based on water quality; some are based on the infrastructure that's necessary to deliver Colorado River water to Tucson; and some of

it's based on energy.



When we operated Tucson Water in 2000, energy was an important part of our financial portfolio. In order to lift water from the water table to the surface, it takes energy. And, in order to lift water from the surface to the reservoirs, it takes an additional energy supply. We do the same thing for the reclaim system: We pump some percentage of the reclaimed water from wells to the surface of the ground and then boost it out to our customers.

But, in 2020, that local energy portfolio just a small picture, because in 2020 we've reduced our dependence on native groundwater, we've essentially replaced this water pumping from the surface of the aquifer to the surface of ground with delivery from Lake Havasu Tucson; that requires us to lift water from Lake Havasu at 500 feet to our recharge facilities in Avra Valley and then deliver water, again, from Avra Valley to Tucson.

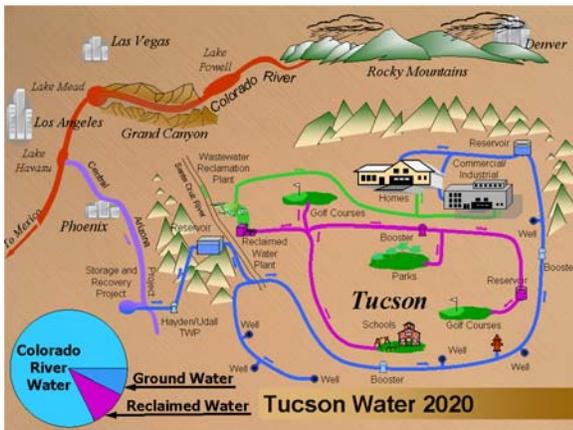


is

the to

These facility are, essentially, a brand-new system of wells, a brand-new recharge, a brand-new recovery system and distribution system, and some of these energy costs are paid for by Tucson Water ratepayers. This infrastructure here, the Central Arizona Project Canal, the lifting and boosting costs are paid for by the Central Arizona Water Conservation District, and Larry Dozier's going to talk about that later this evening.

But, as we move forward then, not only are we connected to the Colorado River for water, but we're connected to the western energy grid. This local Tucson system was supplied electricity by one supplier, Tucson Electric Power. This system is supplied energy by Trico Electric, and this system is supplied by Central Arizona Water Conservation District through some federally-subsidized power and contracts. So, in addition to - to building a more expensive energy portfolio, we've also developed a more diverse energy portfolio.

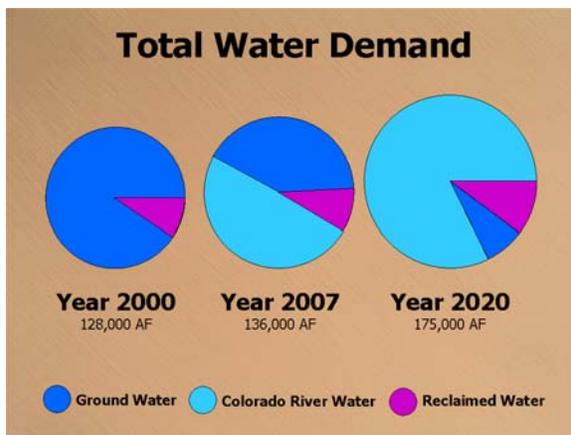
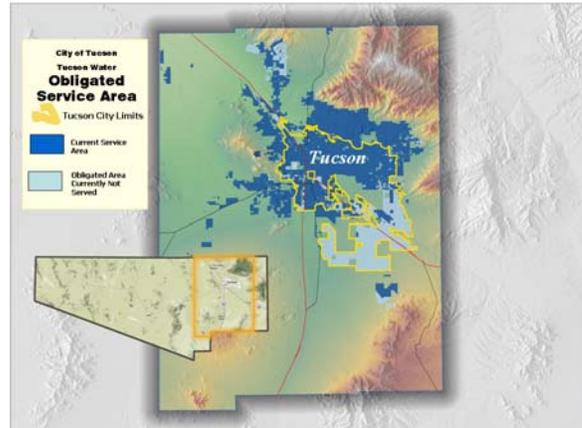


And, as we move forward to 2020, the benefits of that diversity start to become apparent also in

water supply. By 2020, as this fully-integrated system starts to work, our dependence on groundwater reduces back to about 10% or less of our total supply; in fact, it becomes exceeded by reclaimed water as a water supply source, and Colorado River forms the bulk of our supply.

If you think about the history presentation that I made earlier tonight, we talked about Tucson water's aquifer coming out of balance in 1940, which meant that in 1940 we were pumping - probably at least - pumping more groundwater than was being naturally replenished.

What this reliance on Colorado River allows us to do is turn the clock back; it allows us to use a diverse portfolio of supplies to - to supply our existing customers located in blue, as well as the areas we're legally obligated to serve by contract, or by virtue of the fact that our City limits extend outside the area where we currently provide water. And, as we move forward to do that, and as we start to discuss our options to do that, I'd like you to keep this graph in mind.



Here we are in the year 2000, we supplied about 128,000 acre feet of water to our customers. This year, we'll supply about 136,000 acre feet to our customers. And, in 2020, we expect to serve about 175,000 acre feet to our customers. We'll show you some of the tricks of the trade that come in making these kinds of projections as we move forward in this educational process. But, whether it's 2020 or 2017, or 2023, this is a reasonable assumption of what our future will look like.

The most important thing to remember, though, is that our reliance on groundwater in 2020 is back to sustainable levels, with some additional supplies available to us in the future, even in 2020. In essence, Colorado River water allows us to go back to the future; it allows us to rely on the same kind of water supply portfolio, in terms of its local effects on the groundwater system as we had in 1920. 1920, what did we have? We had a renewable supply that in 20 years might become out of balance. The Colorado River allows us in 2020 to be about in the same position.

So, as we move forward to meet those challenges, we'll - we look forward to talking with you about all of the infrastructure, energy, and water supplies portfolio that'll be necessary to move us along. Thank you very much.

CHAIRMAN JIM BARRY: Dan, if it's a question that can be answered quickly.

MEMBER DAN SULLIVAN: Chris, are there any other entities that access the Colorado River water in the same elaborate way that Tucson does, or are there - the other entities, do they have a more direct access to CAP water than we do? In other words, are we the only ones that go through this whole recharge process?

MR. AVERY: As far as I know, we are the only entity that goes through the recharge process to such a large scale, but that recharge process allows us some advantages that aren't available to folks who rely on Colorado River directly for supply.

MEMBER DAN SULLIVAN: Such as?

MR. AVERY: For example, there's a - a nasty contaminant in - in surface water supplies that results from organic compounds in the water mixing with chlorine. By recharging our water through the Central Avra Valley Recharge Projects we, essentially, eliminate organics from our water supply portfolio. So, Tucson water that's recovered from those projects is low in chlorination byproducts.

In addition, we can use the aquifer in Central Avra Valley to mitigate any long-term, or - or short-term effects, in water supply quality or quantity. If something interesting starts happening on the Colorado River, we have time to react and, if something interesting started happening in Colorado River in terms of supply, we have a recharge profile in Central Avra Valley that allows us to live off that profile for a while, while we can adapt.

MEMBER DAN SULLIVAN: Is it worth the cost in the meantime?

MR. AVERY: In my opinion, it is.

CHAIRMAN JIM BARRY: Now, let me - the ground rules - short questions - if you got more elaborate questions, let's figure out a way -

MEMBER DAN SULLIVAN: I didn't think it was that elaborate. I just simply asked whether it was worth it.

MR. AVERY: And - and my opinion doesn't really matter, so much as the fact that it's a decision that's been made by the Mayor and Council in consultation with the Tucson Water Department over the last 13 years.

CHAIRMAN JIM BARRY: Okay. John Carlson and then Bruce.

MEMBER JOHN CARLSON: Yeah, a quick one. With that chart up there and that small high slice for groundwater, what's happening to the aquifer? Are - are we letting the aquifer, in general, in the whole area recover, or is it still being drawn down?

MR. AVERY: We - we expect that in the area where Tucson Water's wells are located, and in the area that Tucson Water has historically relied on for supply, that the aquifer will start to recover and, in fact, we're seeing signs of that already today.

MEMBER JOHN CARLSON: Okay. When you mention about minor losses and everything going into the sewer system, are you - and I - and, of course, the treated water - and sewer water's another thing - but, are you saying that all the irrigation and watering we do is minor, or how many acre feet of that

MR. AVERY: No, I'm saying that of all the water that makes it into a house or building, there are only minor losses before that water makes it into the sewage collection system.

MEMBER JOHN CARLSON: Well, but you're ignoring the fact that they water their lawn; it goes in the house -

MR. AVERY: About -

MEMBER JOHN CARLSON: - and comes out in a spigot in their -

MR. AVERY: That's right.

MEMBER JOHN CARLSON: - backyard.

MR. AVERY: About - about - depending on - on the estimate, about 45 to 50% of the water that Tucson Water delivers to customers is used outside and -

MEMBER JOHN CARLSON: That's what I was looking for.

MR. AVERY: - the Arizona Department of Water Resources gives us an incidental recharge credit of about 4% of the water we serve. So, there's an assumption that some percentage of the water we deliver to customers that's used outside also replenishes the aquifer.

MEMBER JOHN CARLSON: Thank you.

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: You may have said this, and I may have missed it, but let me ask it anyway: What's Tucson's total CAP allotment?

MR. AVERY: Our CAP allocation currently is 144,000 acre feet.

MEMBER BRUCE GUNGLE: 144,000. Okay.

CHAIRMAN JIM BARRY: Why do you say "currently?" Can it change?

MR. AVERY: It - it's changed a few times in the last couple of years, and there's currently a process that CAP is working with to identify new supplies on the river; it won't be CAP water as we traditionally think of it, but it may end up in a water supply that's delivered by the Central Arizona Water Conservation District.

CHAIRMAN JIM BARRY: Gotcha.

MEMBER BRUCE GUNGLE: And did I understand you to say that 40 to 50% of the water is used outside the house that's delivered to the house?

MR. AVERY: Forty - between 40 and 50% of the water that we deliver to all our customers, whether they're

MEMBER BRUCE GUNGLE: All right.

MR. AVERY: - residential customers or commercial -

MEMBER BRUCE GUNGLE: And - and -

MR. AVERY: - customers.

MEMBER BRUCE GUNGLE: - of that 40 to 50%, only 4% is - is counted as an incidental recharge credit, meaning that supposedly 46% of it's ET?

MR. AVERY: The numbers would probably work out if you think that half the water or so is - is used outside and we get a replenishment credit of 4%, then you can assume that 8% of - of that water is - is replenished into the aquifer; it's - it's not a perfect number, but it's close enough.

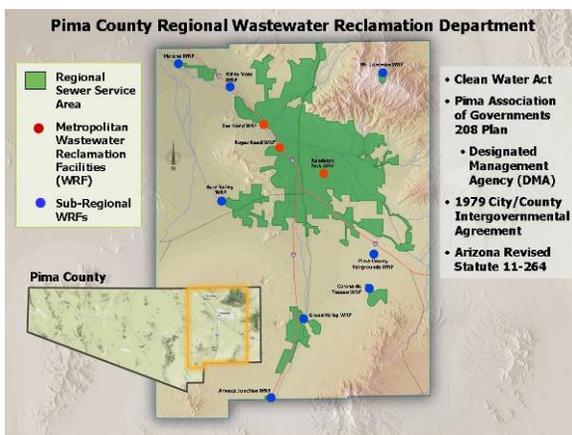
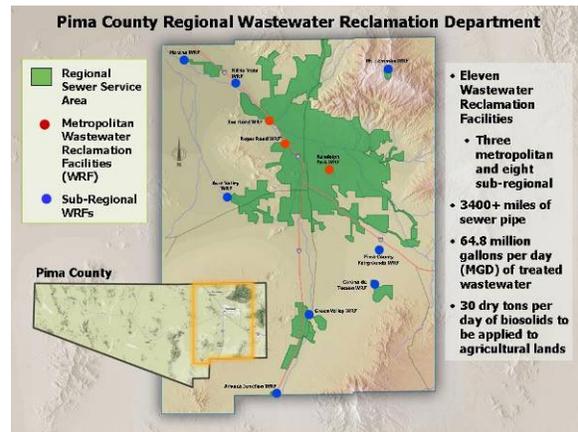
MEMBER BRUCE GUNGLE: Okay. Thank you.

CHAIRMAN JIM BARRY: Any other questions? Okay. Please continue. Thank you, Chris.



MR. CURLEY: I'll go back and look at the wastewater system that Chris referenced. An important thing to note in all these presentations is that the purpose of this overview is to discuss some of the issues, kind of bring some light to bear on things that we want to, and then go in and discuss in more detail in the future, both at this presentation tonight and subsequent presentations.

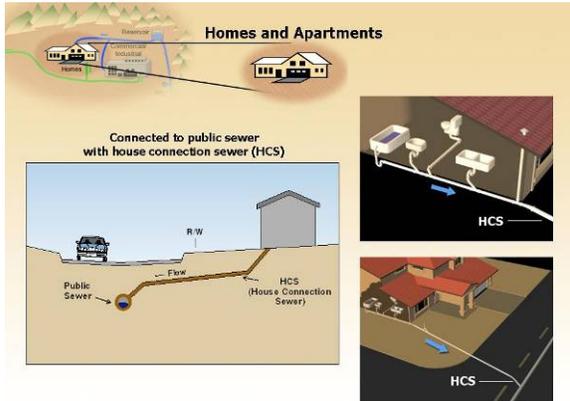
The Pima County Regional System has all of Pima County as our service area, but primarily we're located in the metropolitan area in eastern Pima County. We've got 11 facilities, three metropolitan, eight sub-regional. You can see the metropolitan are red; the sub-regional ones are in blue. Thirty-four-hundred-plus miles of sewer pipe; that's an amazing amount by normal standards across the U.S. Here's the MGD figure again. We do almost 65 million gallons a day of treated wastewater, and we produce 30 dry tons per day of biosolids which are applied to agricultural fields.



Authorizations come from the Clean Water Act which allows the State of Arizona and the Pima Association of Governments to do what's called "208 planning" in which we're the designated management agency for all of Pima County, except within the town limits of Sahuarita. Then, again, the '79 City/County Intergovernmental Agreement gave us by contract the idea that we can serve all within the City limit. We have individual IGAs with South Tucson, Marana, Oro Valley, and throughout the - the area.

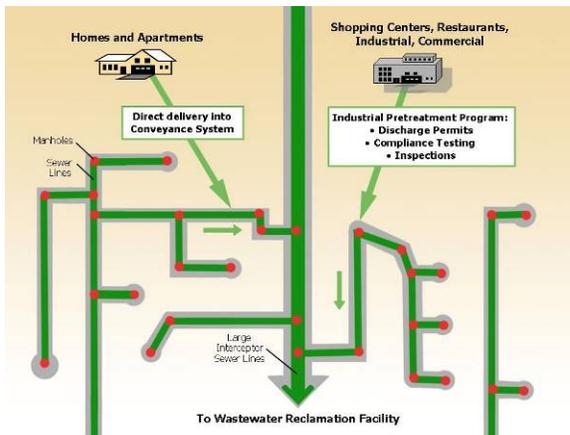
Arizona Revised Statutes were specifically established to allow a County to provide

sewage service. Most sewage service in Arizona is provided by municipalities and private corporations.



Here's how it works: If you go back to our little house that we had before, coming out of the house you have the plumbing fixtures inside going to what we call a "House Connection Sewer," comes out here; that HCS, fits to the line in the street, which is the public sewer, and this is all done by gravity. So, we're taking advantage of all the energy that Chris and Tucson Water used to get the water to the house, we reverse the process, and use our system entirely by gravity. This

is a rough schematic. We have manholes on the sewer lines, wherever you want to turn corners.



The issue here we're illustrating is that while homes and apartments, the majority of you can go directly into the Conveyance System. If you're a shopping center or restaurant, industrial or commercial, you don't; you come down and we look at your precise discharge through our industrial pretreatment program. So, you may be required to upgrade or improve the quality of your discharge; you'll get your own discharge permit to have compliance testing

and inspections. We have one of the most vigorous programs in the country where we even allocate to restaurants what they have to do in the way of grease traps, because it's very important to keep toxics and other substances out of the system on a preemptive basis, and that makes the whole system work better and makes the treatment plants more able to meet their discharge permits.



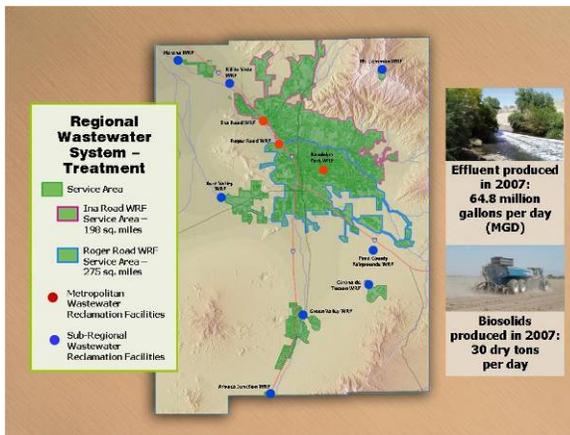
The flow by gravity in the Tucson area is to the northwest, and so what we have here, in addition to those individual sewer lines in streets, is a whole system of interceptors, which are our version of highways, and these are all going to the Roger Road and Ina Road Plants. We have a very large operations division that runs these. We do about \$5-6 million a year of repair and rehabilitation.

We have odor control, chemical dosing in and throughout the system, and that very important feature of roach control to keep them out of your sinks and bathrooms.



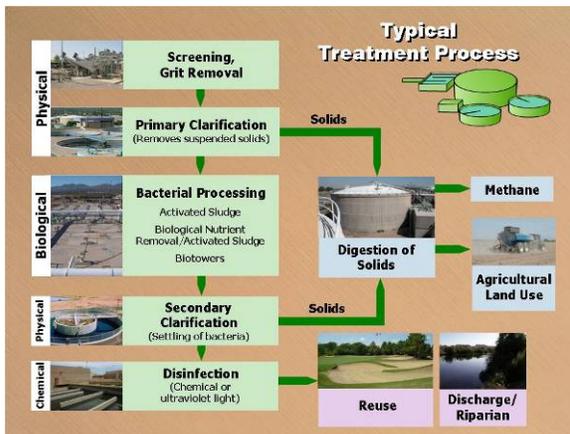
Our Conveyance System has been ISO certified most recently. We're very pleased with this in terms of our processes and procedures for operating the Conveyance System being certified both from a standards point of view and a health and safety point of view, and we're the first agency in the U.S. to get all these certifications simultaneously, because if you're running 3,400 miles of pipes and multiple chemical dosing stations, it's very important that everything be

standardized. In our procedures, it's just like painting the Golden Gate Bridge, we start at one end and we go to the other end - and we start back again. So, it's a continuous maintenance program; a continuous improvement program.



For the treatment portions we have here the service area, you can see the lines that differentiate the Ina Road system; what goes from the north and from the east to Ina Road, and from the south and the east to Roger Road. So that's how the metropolitan area is divided up with flows coming to Randolph Park from the southern part of this system. Again, we're looking at the products that we produce and we're regulated on which is our 65 million gallons of effluent and our 30 dry

tons of biosolids.



A real quick entry into the treatment process starts out with physical issues, screening, grit removal, clarifiers that remove suspended solvents. Then the bacteria take over and we unleash the bugs on the solids through a variety of different processes. When the bacteria settle out, these solids, plus the solids from primary clarification are treated through a process called "digestion," which creates methane gas, which we use to run our engines, and the solids go out to agricultural

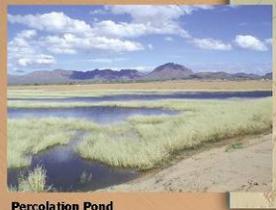
land, as I mentioned before.

Then the liquids come down through disinfection, chemical or ultraviolet, and go out to the reuse system, or our discharge and riparian area in the Santa Cruz. So, this is a brief sketch; we'll be coming back to this later. In one of our sessions we'll be talking about our entire system from start to finish and talk about some of the alternative processes and how these are actualized at each plant.

Avra Valley WRF

Capacity: 2.2 MGD
 Latest Improvements:
 Expansion to 4.0 MGD
 (underway) – \$54.3 million
 Effluent: 1.22 MGD
 Effluent Quality: Class B+

2.2 to 4.0 MGD Expansion

Percolation Pond

Here's a quick tour of some of the plants. You may not know what exists out in Avra Valley, which is a very rapidly growin

g area. We have this right now, percolation ponds, capacity of 2.2 MGD, and we're moving that to a 4.0 MGD mechanical facility with these kinds of features, which are specially engineered to be attractive to bird watchers, wildlife watchers. So, we're looking to make this a park area in conjunction with the Black Wash rehabilitation that Flood Control is doing. So, we're now looking at just how can we take sewer treatment systems and make them into a community asset, as well as providing the sanitation that is our basic requirement.

The effluent quality here is B+, which is one of the higher qualities; B means it would be suitable for use on fenced golf courses, for example.

Corona de Tucson WRF

Capacity: 1.3 MGD
 Latest Improvements:
 0.3 to 1.3 MGD
 Expansion – \$9.3 million
 Effluent: 0.204 MGD
 Effluent Quality: Class B+




Combined Oxidation Ditch / Clarifier

Roger Road WRF

Capacity: 41.0 MGD
 Latest Improvements:
 Odor control and process upgrades – \$20 million
 Effluent: 33.70 MGD
 Effluent Quality: Class B




Proposed 32 MGD Water Reclamation Campus with Class A+ effluent adjacent to the current Roger Road WRF (Regional Optimization Master Plan)

At Corona de

Tucson, in the far southeast part of town, again, we have a much smaller plant, but it's still 1.3 MGD, which could carry up to 12-15,000 people. This has been recently done at about a \$10 million cost.

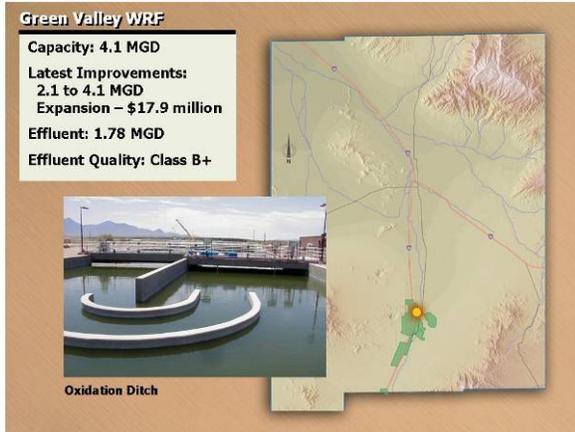
Ina Road WRF

Capacity: 37.5 MGD
 Latest Improvements:
 25.0 to 37.5 MGD
 Expansion – \$92 million
 Effluent: 24.87 MGD
 Effluent Quality: Class B




Proposed expansion to 50 MGD with Class A+ effluent (Regional Optimization Master Plan)

So, one of the things we care most about is exactly where we locate our plants because, once we start building, then we use that site to add to the plant, to expand the plant and upgrade the processes. These are



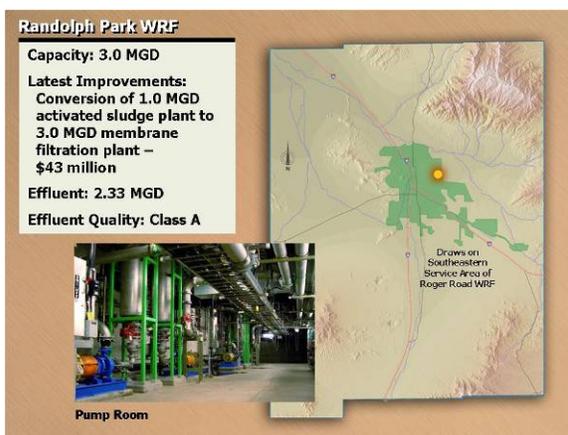
decisions involving tens of millions of dollars, and we work very hard to get them right.

We've got the Green Valley Treatment Plant here; again, we're picking that up from a 2 MGD to a 4 MGD plant, and we spent \$18 million over the last four or five years doing that, and the effluent is utilized entirely by the adjacent Quail Creek Golf Course. First we put in recharge basins; then it goes over to the golf course. So, all that effluent replaces groundwater that would otherwise be used to irrigate the golf

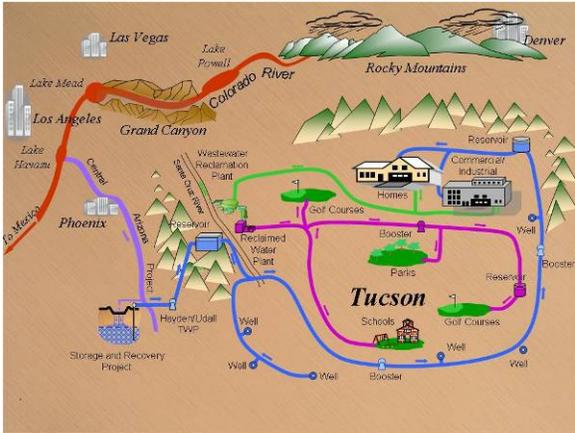
course.

Coming back to our major plants - and now I can talk a little about the future - we've got 37.5 MGD at our Ina Road Plant. But, what we're basically going to do with our Regional Optimization Master Plan is not only to bring the effluent from Class B to Class A+, which is denitrified and suitable for use anywhere, and expand it to 50 MGD, but we're basically going to renovate every single process in the existing plant and bring them all into line in the same kind of treatment producing a very high quality of water, and that will serve that whole northwest and northeast side of town.

At the Roger Road Plant, what we're going to do is something quite different; right now it's 41 MGD. We've spent at least \$5-8 million over the last two years making a conscious effort to improve the odors. This plant was built, as you saw in the history section, in the '50s, and that technology is still being used. So, we're taking things that already have gone way past their useful life, and that's why the odor's just so hard to control. But, we didn't want to wait for the ROMP Program, we wanted to move on the odors now, and we used odor testing and sampling at the plant boundaries and there's been a substantial decrease in our testing instrument readings and local complaints. So, we're basically going to pick up the Roger Road facility and move it north of the existing facility, and completely rebuild it and demolish, ultimately, the existing facility.



Right as you look over your left shoulder is what Chris referred to as the very first irrigation reclamation plant in Arizona, the Randolph Park plant, which provides all the effluent to water the plants; it's a very, very small footprint; this is an example of their pump room; it cost \$40 million and is odorless and silent, and people don't even know it's here. So, that's the example of what you can do in a small footprint for something that is on a golf course.



So, we've now given you a tour through the water system, the reclaim system, and the wastewater system,...

and we'd like you to have these take-away points: All these systems are shaped by the history, the geography, and the climate. They're complex systems and they depend on a lot of technology and energy; we'll be getting into this in our future discussions. They're expensive and we'll be talking about

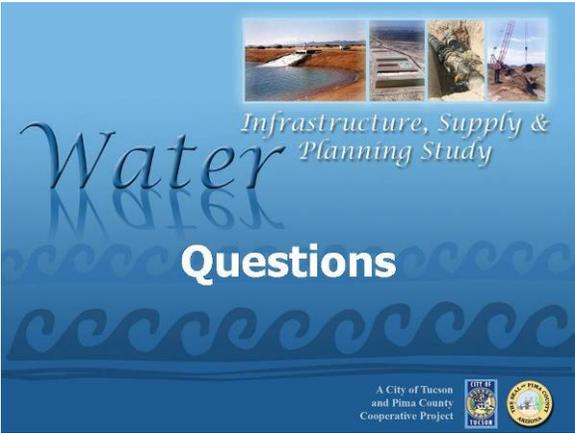
finances on August 13th. We have a whole session on utility finance.

We have quality and quantity issues. Harlan's going to talk about some of the quality issues for wastewater next. Larry will be talking about the CAP, which involves the quantity issues; and Harlan will talk a lot about the regulatory framework for both water and wastewater.

Key Elements of Local Water and Wastewater Systems

- Shaped by history, geography, and climate
- Complex systems dependent on technology and energy
- Expensive to build, operate, and maintain
- Quantity and quality issues
- Complex regulatory framework

So, we appreciate your attention and if you have any questions, we can take them, or we can just go straight to Harlan -- Jim, however you want to go.



CHAIRMAN JIM BARRY: Sean?

MEMBER SEAN SULLIVAN: How many - how many mechanisms do you utilize for the expansion on this? What - how many mechanisms do you use for the expansion of wastewater treatment plants?

MR. CURLEY: Okay. There's two major -

CHAIRMAN JIM BARRY: Answer into the mic.

MR. CURLEY: Thank you. We get two major forms of revenue: One is from

connection fees that are paid by developments and individuals who connect to the system; and the other is by user fees. We pay for the debt service for the growth projects entirely from the connection fees; those are paid all by the new users. So, they're all bonded and that produces debt service and the connection fees pay off the debt service.

MEMBER SEAN SULLIVAN: And the - but, the bonds are reliant on voter approval; is that correct?

MR. CURLEY: That's correct.

CHAIRMAN JIM BARRY: Marcelino?

MEMBER MARCELINO FLORES: Mr. Chair, I have a question that might be more appropriate for follow-up later on, but it was mentioned by Ed there the flood - flood waters or flood control projects, and I don't know that it's - it's on - on our radar, in terms of how significant that amount of water is, and - and what projects may be - are pending in that area. So, just kind of, you know, where - where is the flood control or flood play into the water system that we just saw, the water cycle?

CHAIRMAN JIM BARRY: We'll respond to that at a later time.

MR. CURLEY: Yes, I think so, because we'll have a whole section talking about the system.

CHAIRMAN JIM BARRY: John?

CHAIRMAN JOHN CARLSON: The ownership of the wastewater with the City of Tucson, a lot of the stuff you treat is not coming from the City of Tucson anymore. What - what are the legal ramifications? What thought has been given of who's going to control or can the control partially change or the outlying have any say in it? And - go ahead.

Mr. Curley: Yeah, I appreciate - John, that's a good follow-up question - but, it's a little more complex and I think we'd rather lay that out for you - it's - it's a three or four-page answer rather than a sentence or two.

MEMBER JOHN CARLSON: I - I - okay - I - I agree, but I'm going to - you going to promise to get it; right?

MR. CURLEY: Yes, sir.

MEMBER JOHN CARLSON: Yeah, and - you know I brought this up in our Committee and that is: Look at the water coming all the way from new Tucson and way out there in Vail going clear down to Roger Road and Ina Road, and then you're going to pump it clear back up there and you talked about the costs and everything, then you show us you got a little one here that takes care of this complex here. I had asked the question, and supposedly you all looked into it, but I can't believe the answer that we ought to not have interim treatment plants somewhere up the - the thing so you don't have to carry it so far and then pump it up so high again. Is there any thought to re-examine that since you got proof right here of something that does work?

MR. CURLEY: It's a yes, and it's a chicken and the egg. We have to get so much development in the area to be able to start investing, and we're actively looking now at treatment plants in that whole southlands area and on the far east side, so we're aware of that. But, there's a balance, you know, the cheapest treatment plant you could build is \$10 million.

MEMBER JOHN CARLSON: Yeah.

MR. CURLEY: So, we really take our time before we commit.

MEMBER JOHN CARLSON: But, you are - got it as an open question and you will examine it as we go along and -

MR. CURLEY: Yes, sir.

MEMBER JOHN CARLSON: Okay. I won't -

MR. CURLEY: Yeah.

MEMBER JOHN CARLSON: - be here, but that's all right.

CHAIRMAN JIM BARRY: Let me ask a quick question. What's the - the extent of overlap between the two service areas? If you - if you overlay the - your sewer service area and the Tucson Water service area would they be pretty much coextensive?

MR. CURLEY: Correct, if you look at what's being served now. Our mandate is to serve all of Pima County no matter whether it's in our jurisdiction or not. And so we have an overlay right now because most of metropolitan Tucson is Oro Valley, Tucson, Marana, et cetera. So, there is an overlay at this point, but that's in terms of actuality. Our mandate is far larger than the City's.

CHAIRMAN JIM BARRY: No, I understand. But - but, just the sewer area that we got on there in green looked a lot like the Tucson Water service area that the - I just -

MR. CURLEY: Right. They're close; if you take out the Marana facilities and the Oro Valley facilities, the metro where they don't serve, then they overlap.

CHAIRMAN JIM BARRY: Thank you. Quickly: What percentage of the residential properties and the nonresidential properties in Pima County are served by Tucson Water in the service area for wastewater?

MR. CURLEY: We'd have to check that; that figure has been developed, but I don't have it on the top of my head. We can give that to you.

MEMBER TINA LEE: I have a quick question.

CHAIRMAN JIM BARRY: Okay. Tina?

MEMBER TINA LEE: Ed, could you clarify the 65 million gallons per day? Is that raw sewage or that's effluent that's produced after treatment?

MR. CURLEY: Okay. That is wastewater which has been treated which then is called "effluent."

MEMBER TINA LEE: Okay.

MR. CURLEY: So, that goes both into the reclaim system and is recharged - discharged into the river.

MEMBER TINA LEE: Thank you.

CHAIRMAN JIM BARRY: All right. The next thing is the History, Harlan and Chris.

MR. CURLEY: Well, actually, we flipped that because we did History first. Sorry, Jim. So, the next one is actually Harlan doing the Regulatory for Water and Wastewater.

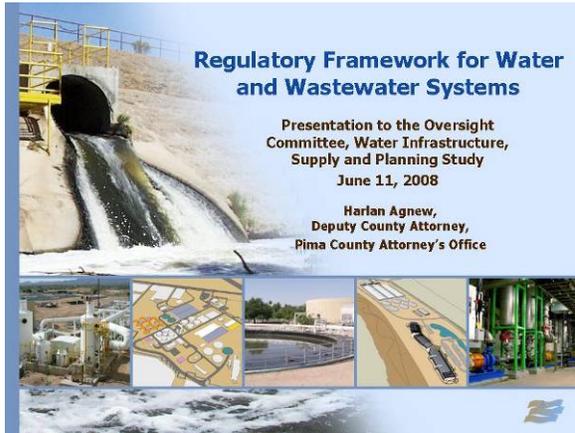
And if I can give Harlan a little bit of an introduction. He's worked both for the Arizona Attorney General's Office with environmental programs, and then over at EPA and then at Pima County. So, Harlan has a lot of experience, and some people think he wrote all these regulations.

MEMBER JOHN CARLSON: And what's the subject of his talk; what's it titled?

CHAIRMAN JIM BARRY: Regulations.

MEMBER JOHNSON CARLSON: Okay.

**DEVELOPMENT AND REGULATORY FRAMEWORK
PRESENTATION BY HARLAN AGNEW,
DEPUTY COUNTY ATTORNEY
PIMA COUNTY ATTORNEY'S OFFICE**



MR. AGNEW: I'm going to be covering Regulatory Framework. I have to really thank Ed Curley and his Staff for putting together this Power Point presentation for me; they took a presentation that usually takes 80 hours in two weeks and summarized it in a ten-minute presentation. So, hopefully, this is going to be a real *Reader's Digest* condensed version, and I really appreciate their help.

I wanna create two messages in my presentation. Number one, I want you to go away with the concept that the Regulatory Program for Water and Wastewater is very complex and changing every year, practically every month; and, secondly, that these changes are making the quality of the water as provided to you, and protection of public health and protection of the environment to an ever increasing better level. So, things are improving and it's a very complex Regulatory Program.



There's a regulatory hierarchy that we're dealing with. The U.S. Congress adopts federal legislation for environmental protection; that then mandates the Environmental Protection Agency to develop those programs, technically with regulations, and then they delegate these programs down to the states to implement and adopt their own laws and regulations, and their own improvement for the program to apply to the local environment.

The state then issues permits and does enforcement making sure there's compliance by the local entities that would be in this - our case, Tucson Water and Pima County Regional Reclamation Department. The - this is then implemented by treatment, by testing, and by the industrial pretreatment program.



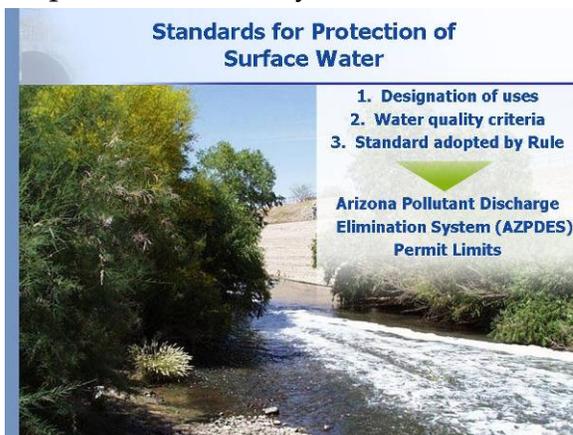
A quick thumbnail sketch of some of the environmental statutes that apply. The Drinking Water Program is basically regulated by the Safe Drinking Water Act; that's a program of standards and enforcement and monitoring. The wastewater is regulated by the Clean Water Act, which has been delegated in 2002 to the Arizona Department of Environment Quality, who - which issues what's called an "AZPDES Permit," an Arizona Pollutant

Discharge Elimination System Permit that sets the standards for wastewater.

They also, under Babbitt, developed a program called the "Aquifer Protection Permit," or the "Aquifer Protection Regulatory Program," because Arizona was primarily regulated - or primarily using groundwater. They wanted to create an additional protection program for groundwater that paralleled the Clean Water Act. Most states don't have an Aquifer Protection Permit Program; we're unique in Arizona. And then Arizona went a step further - further, only three or four states have reuse regulatory programs like Arizona - and so we have a comprehensive program because the importance and necessity of protecting our - our water.

The Biosolids Program is another program that results in the protection of groundwater. We generate three products at a wastewater treatment plant: We generate water; we generate biosolids; and we generate methane for energy production. The Resource Conservation Recovery Act adopted in - adopted in '76, in conjunction with the Clean Water Act, regulates the use of biosolids so that when they're applied to soils they don't contaminate groundwater.

We also have other ancillary regulatory programs: The Clean Air Act, the Water Quality Assurance Revolving Fund, which is, basically, protection of your groundwater and your drinking water supply, the Comprehensive Environmental Response Compensation Liability Act, which I had the privilege of helping develop in - in



Washington, D.C. when I was with the National Hazardous Waste Task Force with EPA, and that protects, again, the groundwater so that it can be reused safely, and the Emergency Planning and Community Right to Know Act, which is a result of the Bhopal incident and protects the public from hazardous waste - hazardous material storage.

Moving along now to looking at each one of these programs in a little bit more detail.

We have standards for the protection of surface water out of the Clean Water Act. The

State of Arizona goes out and first says, okay, "What are we going to use our surface waters for?" They designate the uses.

Santa Cruz is an effluent-dependent water, which is an aquatic and wildlife use, and a partial body contact standard which, in case you fall in the Santa Cruz, you're not going to get sick, and agricultural livestock water and agricultural use. Those designated uses then have standards applied - or developed based on data that is called "criteria documents."

Our Water Quality Standards Research Project helped support the Environmental Protection Agency in developing those criteria.

A little aside with regard to toxicology. All of these environmental standards look at the release of substances into the environment, or how they are going to be used. The water quality criteria developed by the Environmental Protection Agency takes a look at a pollutant or chemical, they look at the concentration of that chemical in the environment and how - how it is - how long it is released into the environment and

what species might be exposed to that chemical. Under the Safe Drinking Water Act, we'd be looking at people; under the Clean Water Act, we're looking at species, aquatic

species; that database is used with the designated beneficial use to come up with a standard adopted by rule by the Arizona Department of Environmental Quality.

They've just gone through an update of that standard called "the tri-annual review." Every year - every three years, they look at the data that's developed and adjust those standards to be more protective of the environment and public health. Those standards are then - result in effluent limits

that are put into our discharge permits called the "AZPDES Permit."

The Safe Drinking Water Act works in - basically the same way; toxicologies apply to contaminant levels of pollutants that are adopted as standards by EPA and then adopted by the State of Arizona. The Arizona Department of Environmental Quality then requires Tucson Water, and other water providers, to sample on a regular basis and determine compliance with those

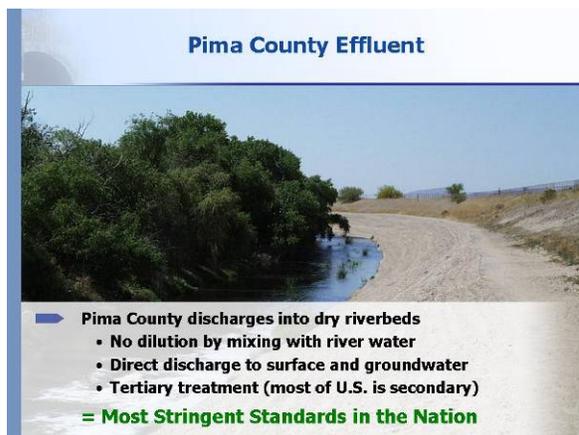


standards to protect public health. They also require reporting if there's any - any exceedances of those standards so that you can be warned if there is a problem. We're very fortunate here in Tucson that we've - we've not had drinking water problems that had to be reported and - with, you know, emergency procedures to be implemented to protect the public health, because the water's safe.

Standards for protection of groundwater are also implemented; these standards are in the Aquifer Protection Permit Program; and, again, you're looking at, basically, drinking water standards that the treatment plant has to meet when it discharges so that it doesn't create a contaminant level in the groundwater; the groundwater stays safe. We receive a permit in the Aquifer Protection Permit Program that tells us what those limits have to be out of the pipe going into the Santa Cruz River to protect your drinking water resource.

There's also an importance to the Aquifer Protection Permit Program because, in that permit program, we assure that water that comes from the treatment plant that is used in the reuse program, which is the next program, will be safe for toxics and other chemicals so that we can reuse it safely.

So, when you get a reuse permit, the reuse regulations basically look at two factors: They look at disinfection standards, so it's safe - it's not going to be disease-causing - and nitrogen standards to protect the groundwater from nitrogen contamination. We then can use different classes of water, depending on their classification of nitrogen for landscape irrigation. And Class A+, there's multiple uses and free uses of that; Class B water, you may have to have - and when you do landscape irrigation - you may have to have an application rate to keep it from having groundwater contamination; and then Class C water is your lowest level; that Class C water, as far as Pima County's concerned, is being phased out.



Pima County effluent is some of the best effluent in the United States for a couple of reasons: Number one, when you discharge to the Pacific Ocean, or to a flowing river, you get a dilution factor in your standards. Here, we have to meet all limits and all quality standards at the end of the pipe when it's being released. So, we end up with the most stringent standards in the nation.

Additionally, most parts of the country don't have nitrogen as a standard but, because of the Aquifer Protection Permit Program, and best available control technology as a technology baseline, we are now treating for nitrogen, so you have high-quality water. Additionally, it's a self-enforcement program, so we have to report on ourselves if there's a - there's a problem.

Certification Statement – AZPDES & NPDES Liability

Penalties under state regulatory statutes may include fines up to \$25,000 per day per violation, and imprisonment from six months up to two years



if prosecuted by the federal government, these fines and penalties and - and - and duration in prison is much longer.

Every report that wastewater issues - and this is Mike Gritzuk - and we don't want to see him like that. Mike Gritzuk is the Director of our Wastewater Program. He has to certify on each one of the reports that are sent in that he has a system in place to assure compliance with these standards, and if - if there is a violation we're subject to \$25,000 per day per violation, and he could face up to six year - six months to two years in prison if prosecuted by the State regulatory agencies;

Pima County Regulatory Structure 70+ employees dedicated to regulatory compliance

Compliance and Regulatory Affairs Office



State-certified laboratories

- PCRWRD performs over 15,000 analytical lab tests per year



Industrial Pretreatment Program

- Discharge permits
- Compliance testing
- Inspections



Permitting

- PCRWRD treatment facilities operate under 38 distinct permits

Certified Law Enforcement Officer

Investigation of vandalism that causes sanitary sewer system overflows

Pima County has a system in place to assure compliance. We have 70 employees just dedicated to regulatory compliance. We have state-certified labs. Pima County performs over 15,000 analytical lab tests per year. The industrial pretreatment program with inspectors assures that industrial discharges are cleaned up so that it's safe to go into our wastewater treatment plants and it's safe to go out into the Santa Cruz or use the reuse program.

We also have an extensive permitting program. We have 38 distinct permits, regulatory permits, for our - our Roger Road and Ina Road Treatment Plants to assure environmental compliance. We are also the only State-regulated wastewater entity who has their own criminal investigation law enforcement officer; this - this gentleman is particularly been involved in vandalism. About a third of all sewer system overflows, which is a serious public health matter, are caused by vandalism.

Record of Regulatory Compliance – Wastewater Reclamation Facilities

 Gold	 Silver
<p>Facilities that consistently meet all National Pollutant Discharge Elimination System (NPDES) permit limits during a calendar year</p> <ul style="list-style-type: none"> ➤ Randolph Park WRF (2005) ➤ Roger Road WRF (1999) ➤ Avra Valley WRF (1987, 1988) ➤ Green Valley WRF (2005, 2006) ➤ Marana WRF (2005, 2006) 	<p>Facilities that have had five or fewer National Pollutant Discharge Elimination System (NPDES) permit violations during a calendar year</p> <ul style="list-style-type: none"> ➤ Roger Road WRF (1977, 1978, 1991, 1992, 1995, 1998, 2000, 2001, 2009, 2010) ➤ Ina Road WRF (1991, 1992, 1999, 1996, 1999, 2001, 2003, 2005)

Tucson Water Regulatory Structure
40 employees dedicated to water quality compliance

Sampling and Analysis of Water Quality



- 212 wells and 266 distribution points
- 4,229 compliance-related samples collected in 2007
- 19,000 regulated contaminants reported to ADEQ in 2007

Tucson Water also has an extensive regulatory safety program. They have 40 employees dedicated to water quality compliance. They have 212 year - -12 wells and 266 distribution points that are monitored. They have 4,229 compliance-related samples collected in 2007, and 19,000 regulated contaminated - contaminants reported to ADQ in '07. Extensive comprehensive safety program for your public health.

Pima County has had a great success rate with regulatory compliance. We've received all these gold awards from EPA and the National Association of Clean Water agencies in these years. We had no violations at these treatment plants of the standards we had to meet. In the - in the silver award program, we've had five or less exceedances of any of these regulatory parameters at these treatment plants; very successful program.

Future Planning and Capital Improvements – Regulatory Drivers

Regional Optimization Master Plan (ROMP): \$1+ billion over 15 years



- ▶ Best Available Technology for current regulations is adopted for all treatment plant expansions and upgrades
- ▶ Biosolids Partnership brings latest biosolids research and best practices
- ▶ Continuing challenges – ROMP, pharmaceuticals and EDCs

Future Planning and Capital Improvements and Regulatory Drivers. Regulations are driving higher and higher qualities; they're complex and they're getting tougher all the time, but they mean better quality water for the community to reuse. The best available technology for current regulations is adopted for all treatment plant expansions. We are involved in the Biosolids Partnership group of municipalities finding better and safer ways to use our biosolids for - in a beneficial fashion, and we are continuing to focus on challenges of the Regional Optimization Management Plan, pharmaceuticals and endocrine disruptors. We're looking at higher and higher levels of treatment.

Infrastructure, Supply & Planning Study

Water

Questions



A City of Tucson and Pima County Cooperative Project



This Regional Optimization Master Plan expansion of Ina Road and the complete, rather green field development of the - of the Roger Road Treatment Plant and expansion of the Ina Road Treatment Plant is looking at \$1 billion over the next 15 years.

CHAIRMAN JIM BARRY: Now, what does "EDC" mean?

MR. AGNEW: That's endocrine disruptors, contaminants, those - those are . . .

different hormones or other chemicals that can affect your endocrine systems.

UNIDENTIFIED COMMITTEE MEMBER: Just ventilate.

MR. AGNEW: Pardon?

UNIDENTIFIED COMMITTEE MEMBER: Just ventilate.

MR. AGNEW: Yes. Any - any questions?

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: At - at this time, can you effectively remove all of the known pharmaceutical and endocrine disruptors that are coming out of the pipe?

MR. AGNEW: Well, the Environmental Protection Agency has not yet established what the safe standards are for that. Their assumption, at this time, is that those standards will not be more stringent than what we're currently discharging; however, the Regional Optimization Management Plan will create an even greater reduction of those discharges using the technologies that are being selected.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: That first slide where you had all those acronyms, some four letters, some 17 letters, are those all federal acts?

MR. AGNEW: Yes -

MEMBER JOHN CARLSON: And you make -

MR. AGNEW: - except for the Aquifer Protection Permit Program, which is a State program.

MEMBER JOHN CARLSON: But, you make no mention of the State regulatory items that we have, like the AMA, and stuff like that; right?

MR. AGNEW: Well, they're delegated down. The Clean Water Act is delegated to the State of Arizona; they're implementing it in their AZPDES Permit Program. So, we are regulated, basically, by the State of Arizona, Arizona Department of Environmental Quality; however, the Environmental Protection Agency has an overview role. If - if ADEQ doesn't effectively regulate for the Clean Water Act and the Safe Drinking Water Act, they will over-file and regulate directly for dischargers.

CHAIRMAN JIM BARRY: Anyone here? Marcelino?

MEMBER MARCELINO FLORES: This probably would be a more detailed answer to the question, but within the hierarchy - the - the Acts, the Clean Water, Safe Drinking Water Act, would - kind of a brief question: Where is recharge governed? And then the - the larger: What is the role of the Court system and how does that affect then the operation of wastewater and water systems?

MR. AGNEW: Well, when you look at recharge, look first at - in Arizona - at the Safe Drinking Water Act and the Aquifer Protection Permit Program, because you're protecting a drinking water source. So, the hierarchy, or the priority for standards comes out of the Safe Drinking Water Act and the Aquifer Protection Permit Program.

The role of the Courts? Well, they interpret law and the - the Courts don't make law, they merely enforce the law. So, you'll find that 99% of all environmental regulatory enforcement is done administratively by the regulatory agencies, and the Courts don't usually get called upon to get involved in the enforcement aspects of it.

CHAIRMAN JIM BARRY: Well, listen, I think I had some - Rob and then Dan.

MEMBER ROB KULAKOFSKY: You mentioned that Tucson Water has consistently had a clean record as far as contaminants. Well, what about the TCE problem we had recently, and - and we're still cleaning that up; it's one of the largest Super Fund sites in the country . . .

MR. AVERY: Can I - can I answer? When you talk about "recently," are you talking about the Scottsdale incident of last summer, or are you talking about Tucson's history in the mid-'80s?

MEMBER ROB KULAKOFSKY: The mid-'80s, yeah. We're still cleaning it up; that's why I'm saying -

MR. AVERY: Yeah, the -

MEMBER ROB KULAKOFSKY: - it's still ongoing.

MR. AVERY: - the - the responsible parties for the TCE contamination in the area generally located near the Tucson Airport have contracted with Tucson Water run the Tucson Airport Remediation Project, or TARP, which is located approximately north of the Irvington and I-19 Interchange, and Tucson Water successfully operated that plant since its - since its inception with no exceedance of any of the maximum contaminant levels that are set by the (inaudible), which are even lower than the federal standards, even through the process itself, much less discharged into waters that - that would head to customers. So, we consider that program a success; it allows us to remediate water that would otherwise go unused; it allows - the pumping that we do helps control the contaminant plume.

We also have an extensive set of infrastructure in place to try to control a similar plume of contamination migrating from the Broadway landfills kind of on the area of - where Speedway intersects the Pantano Wash. And, again, you know, we're moving forward to try to ensure that any contamination that's caused by bad waste disposal practices of the past don't impact our future and that we retain as much flexibility as we can to use our aquifer in cases of severe shortage or droughts on the Colorado River.

CHAIRMAN JIM BARRY: It might be useful to get some written documentation to go through. I think that's a very good point.

MR. AVERY: Yeah, we're going to go through an extensive water quality discussion and water quantity discussion at the next session and we'll discuss that.

MEMBER ROB KULAKOFSKY: And I'm -

CHAIRMAN JIM BARRY: Oh -

MEMBER ROB KULAKOFSKY: - just in - in the future if you could bring us the information. What percentage of our groundwater that we're using now, and also projected in the future, would be coming from wells that have to be treated for -

MR. AVERY: I - I can show how - the schedule for TARP as it goes forward.

MEMBER ROB KULAKOFSKY: Okay. Thanks.

MR. AVERY: Thank you.

CHAIRMAN JIM BARRY: Dan Sullivan.

MEMBER DAN SULLIVAN: I would assume at some point you'll get into the regulatory framework required for the permitting process -

MR. AGNEW: If you'd like.

MEMBER DAN SULLIVAN: - the 208 process; Marana, for instance, today was on the receiving end of a Court decision which allowed it to get into the sewer business, you know, where does an entity go next; that sort of thing?

MR. AGNEW: Yes, if you wanted more detail, you know, permitting process -

MEMBER DAN SULLIVAN: Yeah.

MR. AGNEW: - sure, but that is quite - that's quite extensive detail on the regulatory program. We'll be glad to.

CHAIRMAN JIM BARRY: Any other questions? I have a request. Council Member Leal sent a letter, and I believe it was forwarded to (inaudible) asking about certain other discharges that he wanted to ask, and I just want to make sure that we get a written answer to his letter. Okay. Thank you. Any other questions?

"History of the Central Arizona Project"

Presentation by Larry Dozier

Deputy General Manager, Central Arizona Water Conservation District

I'm not going to talk a whole lot about the Colorado River issues but you can't talk about the CAP without talking about them some. I don't have a PowerPoint tonight. I'm going to try to give you a kind of a history of CAP, where we are today, where we're going in the future. Broad brush it. Some of you may know the details. I will try not to bore you too much in that but I'm going to try to level the playing field give a general overview. And when I get done I want you to hopefully know what to expect from your CAP contractor and CAP supply. And to talk about the CAP you have to go back a little bit in history and understand the dream Arizona had to put its full Colorado River entitlement to use and bring it into Central Arizona. I mean, everybody along the river had their shot at it. But, to bring it into Central Arizona so that the citizens in the center part of the state that had agriculture and wanted to grow could use their water also.

To do that you needed some regulation on the Colorado River some reliable stores to make that water reliable and of course that was the Boulder Canyon Project or Hoover Dam. But the US wasn't willing to build that until they had a compact among the states that agreed to have what's right to what water. The states the seven states that are involved agreed to that compact almost, in 1922. Arizona refused to ratify it. Finally, the U.S. had enough. 1929 the Boulder Canyon Project Act we'll go ahead and build Hoover Dam. And with that now we have some control over the wildly fluctuating Colorado River. And you can begin to make plans to put your water supply to use. California could begin to build the all-American canal; Metropolitan Water District began to build their canal over from the Colorado River into the southern coastal plains area. And CAP could dream a little bit more about the Central Arizona Project. But instead we argued about whether we got our fair share of the water. Did California get too much? And, we carried those arguments on until about 1944 in which we then ratified the compact, and signed the contract, but we still didn't agree. So, in 1952 there was a Supreme Court decree that settled again once and for all what rights Arizona had,

what rights California had, what rights Nevada had for that matter and the priority of those rights were. And in a few years, like 12 of the, we had a Supreme Court decree that laid out that Arizona had a right to 2.8 mil Acre Feet and California did have a right to 4.4 mil acre feet. And the priority of those rights was equal acre feet all that's what the compact was about. It was to reserve to each state the right to use some water and not have to worry about the western first in time, first in right. Obviously, California was going to use it first. So, it reserved to the other states and the upper basin states a share of the Colorado River a share to develop when they got around to it. With the Supreme Court then Arizona could pursue Congressional funding.

California said yes you've got your Supreme Court Decree and we will help you get your act through Congress. And they did, with a few caveats, what they didn't quite win in the Supreme Court they managed to take back in the legislation and that was junior priority. In order to get their support for authorization and subsequent funding we had to agree that when shortages did come on the Colorado River, and they will and we will talk about that later, that CAP would have to be junior to all of California's water rights. So, if we get in too severe of shortages, in theory, CAP could be reduced to zero. Before then, we would start pro-rata sharing our more senior rights those that have been developed along the river over the years with California. Now, when the compact was signed they thought there was 17-18 million acre feet annual flow. They split up 15 million acre feet; Mexico got 1.5 million acre feet. So, they promised 16 million acre feet thinking there was 18 million acre feet out there. And they found out there was around 15 mil acre feet split between California and Arizona. So, we've getting along for quite a few years on the fact that the upper basin is not using all of their water supply. And, out of the 7.5 they're entitled to they'll probably never be able to develop more than 6. They're kind of entitled to what's there acre feet they make some ability to deliver the lower basin share at Lee's Ferry just below the Glen Canyon Dam. So, we've got it, but we've got junior priority. And we got started building then in the early 1970's. We got a little setback with the Carter years. He came in with a hit list on water projects and he asked to have them all justified. That slowed down the Central Arizona Project in the 1970-1978 timeframe. Then we got the Groundwater Management Act that was also linked to the CAP. Then Governor Babbitt and Secretary of the Interior Cecil Andrus struck a deal that if you're going to get Colorado River water over here with federal assistance you should be managing your groundwater better too. So, we got the Groundwater Management Act to go along with CAP and got going in earnest about 1980 and around 1985 we were ready to deliver a little water.

In that later period, around 1980, we needed to finish up the water allocation process. Who was going to get a share and how much of the CAP water? That was kind of a Department of Water Resources effort to lead local associations of government participants for the municipal, industrial and agriculture folks to come in and make a case for how much water they needed? What did you expect your growth area to be? What other sources do you have? How much was your share of groundwater? Did you have Salt River water? And put all of those in a public process, decide what was overlapping, and then allocate water, so many acre feet based on need. In the meantime,

the federal government was trying to identify the need for the Indian tribes. And so all of that information, and there were several allocations starting in the 1970's every secretary of the interior had one to three proposed allocations that went through a process. Then, finally a final allocation was adopted in 1983. It had about 310,000 acre feet going to the Indians and about 640,000 acre feet going to municipal and industrial customers. The agriculture users then understood they were junior priority. They got a percentage of what was left over with the understanding that they'd have a lot of water in the early years before the cities and the Indians put their water to use but would have less water in the later years and during shortages would be the first to suffer shortages. So, we had that sort of public process run by the Department of Water Resources based on some basis of need.

Then you got a contract with the CAP, or a subcontract, that said we will deliver your water to you under these various terms and conditions. And, most of those contracts were signed in the mid-1980's. Not quite all of them. Some of them weren't. There was a little water left over to be reallocated. That process is being finished up today. Essentially, where we are today then, all of the CAP water except a little of the low priority water, what we call the non-Indian Ag priority water, there is a little bit of that left to allocate in the 2010-2030 areas and it's again a junior within a junior priority. So, it's essentially all out there contracted. The odds of getting more of the original allocation are slim, but there may be little out there. So, now we've got a project by the mid-1980's that is built. They've got contracts in place. There's good federal financing coming along. They're designing and building the project, the Bureau of Reclamation is, they'll always hold title to it unless Congress decides otherwise. And you've got the Central Arizona Water Conservation District; the local political subdivision of the state. We're not a state agency. We're a little more like a municipal utility in that we have the, we're a political subdivision, a municipal corporation in a sense under the laws of the state. We have our own elected board of directors; 15 of them split with the numbers and votes on population between the three-county area with one being from Pinal County and four being from Pima County and 10 from Maricopa County. They serve 6-year terms. We elect five new ones every two years. The four in Pima County and the one in Pinal County are up this year. They serve without pay; mileage and meals is all they get for their time and effort. And, it is a difficult and challenging job to understand the complexity of the issues.

Meanwhile, CAP is over here. We're in the mode. We're repaying our loan to the federal government. We're collecting our operations and maintenance costs. Our source of fund then the annual operation and maintenance with a capital replacement fund in it so we call it an OMNR are collected primarily through water rates with some subsidies from our taxes. Our source of funds then is taxes which go to pay our debt and to pay some of the rate subsidies for agriculture and recharge water. Capital charges are what you pay on your annual contract allocation fee whether or not you use the water. Of course, the water delivery charge is on the actual amount of water you take. Finally, we have some power sales. For the project owned, about 24-1/2 percent of the Navajo generating station, a coal-fired station at Page. We obviously use lots of

energy; our share of that which will meet our peak needs in the months when we're not having peak needs we have quite a bit of energy left to sell. And that is sold through a western area power administration marketing process. It does bring in considerable funds to help pay off some bonds we floated and help pay off our debt. And by 2011 the bonds will be paid off and we should have enough funds coming in to pay our total annual debt service.

CAP gets reallocated to Indian settlements which affect our repayment. As I said, a certain portion of the water was allocated to the Indian communities and Indian tribes. We repay the reimbursable portion of that debt. But, for that portion of the project costs that are allocated to supplying water to the Indians we don't pay that debt; that is a direct federal government Indian tribe relationship. The Indian tribes' lands are not part of our tax base; they do not pay any of the taxes. So, we don't pay any of their debt. Now, the more water the Indians get the less our debt is. We would rather have the debt up and the water back but, that has been part of the gist of many of the Indian settlements. Many of the tribes have legitimate claims to native water rights, Federal Reserve water right claims to that. So, as they began to litigated those claims it began to make sense to the local people that were involved in that litigation to give up some as yet contracted for or unused CAP water to the Indians to either use or lease back to raise money. And do that instead of taking probably the native waters the tribes were making their claims against. Instead of taking those away from the people who were using them give some CAP unused water there. CAP has been a piece of every major Indian settlement that has come along. It has an impact on our repayment. We think we've got that nailed down with the recent Arizona Water Resettlement Act that took care of the Tohono O'odhams, the Gila River Indian community, and finished up some of those. There are a few out there. But, in this process the water reserved for those settlements has been reserved from the United States withheld from our ability to use it and reduced our repayment obligation. So, we think that's pretty well behind us.

So, we've been delivering water since about 1985. By 1993, the canal system was through an operational all the way to Tucson. Tucson was experiencing its own issues with CAP water at that time. The system was done and did deliver down here for a while. The United States said okay, it's done. It's now time for you to start paying for it. And, since that 1993-1994 time-frame we have been in a repayment mode. We've had the operational and maintenance responsibilities transferred to us. We have to work under the oversight of Reclamation. And we pay them a quarter of a million (\$250,000) or so to do that oversight for us. But, we operate pretty much independently from any day-to-day input from Reclamation. We have been delivering about a million acre feet since the mid-1990's. We've been delivering about million and a half or more since 2001. The nominal supply available to CAP is 2.8 million acre feet to Arizona about 1.3 of that on the river. Of that all but 160,000 is higher priority water and the other 165,000 on the river is shared CAP priority. And that leaves for us about a million and a half acre feet. Frankly, we've been getting about 1.6 million acre feet for most years in the last six or seven years. We're not delivering that to all of our long-term contractors. Our long-term contractors probably with some relationship change with the agriculture people and

that but, they're probably taking less than a million acre feet of it. Water is available for long-term contractors but not being used by them is what we term as excess water. That is what we sell on an annual basis with no promise of it being there next year. That goes to sometimes golf courses, sometimes road contractors, and uses like that but, the majority of it goes into the underground storage or recharge programs either purchased directly by cities and water providers and others to do that for themselves. And that which is not purchased directly by others is delivered to the Arizona Water Banking Authority. The Arizona Water Banking Authority was created so it could use the unused CAP water and make sure we could put it to use instead of leaving it on the river for California or go to Mexico in flood events. We'll get it over here. We'll store it underground. We know we've got the junior priority. We are eventually going to need that water during shortage times. So, the Arizona Water Bank is the administrative agency created to help us get that water over here. While we don't need it for direct use and will need it to firm up your CAP contract supplies in the future when there are shortages. CAP is the operating arm of Arizona Water Banking. We do the operational planning, the water accounting, we assist them with their financial accounting, we raise an additional 4 cent tax to buy water to be stored underground. So, we are pretty much integrated with their four person staff. We just become their operational arm and they are the administrative arm. In addition to the role the Water Bank plays, I need to take a half a step back and talk about agriculture because that is where our some of our subsidized rate issues come in.

Agriculture thought they would use water when the cities didn't need it and would wean themselves off it and go back to groundwater when the cities' needs grew. There was too much water for them and it was too expensive for them. They couldn't afford it at prices approaching \$75, \$80, today \$90 for delivery. We struck a deal with agriculture that if they gave up their long-term rights, albeit junior priority, and allow those to be used some in Indian settlements and some to go to more cities in the future we would help them out with some of the debt they had for building their systems and would sell them a set amount of water and that starts at 400,000 acre feet for incremental costs delivery, just pumping energy only cost, and would not charge them any O&M (operations and maintenance) for a period extending to about 2030 with the amount of water set aside declining by about 25 percent in 2017 and again in 2024 and dwindling away in 2030. We need agriculture to help us get the water off the river. If they quit using that 400,000 acre feet and the 200,000-300,000 they're using in the groundwater savings facilities, or another form of underground storage, we would not be able to get our water off the river. It's cheaper to subsidize their price than to go build a bunch more directory charged basins that in a few years you wouldn't have any water to put in. So, we've got kind of a balance between using agriculture and giving them some water and having them leave groundwater down there that nobody gets credits for and using agriculture and having them leave it down there on a cost shared basis that gives somebody credits for it. And then having recharge sites; basins that we operate and CAP has six of those that we operate and use in conjunction with several

cities in the Arizona Water Banking Authority. We constructed them, operated them, and maintained them.

That puts us in a good position today of being able to get all of our water off the river, store some water underground, replace or offset the groundwater pumping that would otherwise have been done, and store some water to deal with the fact that we do have a junior priority. And, it will, eventually come back to back to be a situation we deal with. Now, we've known for years we had that. We've tried hard over the years to get some shortage criteria developed for river operation so we would at least have some certainty in our planning horizon to know what to expect, to recognize the conditions that would bring us a shortage and know how much that shortage would be at least for as well as anybody can predict the climate and the weather. We managed to get that adopted last year after a five or six year strong effort with really a lot of push with the other seven basin states and the U.S. Bureau of Reclamation in the final 2006-2007 period. So, now we have shortage sharing criteria that tells us that when Lake Mead gets down to a certain elevation level, 1075 feet elevation, and its full at about 1215 feet, the amount of water available for delivery from the Hoover Dam gets reduced by 400,000 acre feet. When it gets down another 25 feet it gets reduced another 500,000 acre feet. When it gets down another 25 feet the water is again reduced by 600,000 acre feet. So, now we're down at 1025 feet elevation and if it approaches an elevation of 1000 feet the states will get together and decide what the next level of cuts should be; get together with the United States and do that. And, we know then with that reduced flow out of Lake Mead, reduced delivery, how much of that then is assessed to Mexico. We've got a number in there that everybody sort of takes for granted but that is not final with the State Department; how much is Mexico going to take (about 16-2/3 percent) and then of the remainder amount how much is California going to take and we know that is zero. So how much do Arizona and Nevada take. Nevada has only a 300,000 foot allocation so they take 4 percent and Arizona takes 96 percent. What do we do when we get it here in the state? About 10 percent is applied to those junior contractors on the river and 90 percent comes to CAP. All of that numbers let's us say that in the first stage of shortage Arizona's share will be 320,000 acre feet and CAP then will get 90 percent of that, or 288,000 acre feet. Kind of the same way when it's down to the highest level 600,000 acre feet out of Lake Mead. Arizona's share is about 480,000 acre feet and CAP's share then comes down to about 422,000 acre feet out of that. So, now what are we going to do with that when our delivery is reduced by 288 or 422 or whatever the exact number is? Well, we have a priority within the CAP. The first thing we do is cut out that excess water that we've been delivering to direct recharge. The second thing we do is cut out that excess water that has been going to groundwater savings facilities. So it will take a little water away from some of the irrigation folks. The next thing we will do is cut out the water that has been going to golf courses and roads and such. And, finally, we'll cut back on the water that has been going to agriculture. That for the next 15 or 20 years is as deep as that will go. We would not have to until sometime in the 2025 time period or so, would not have to make any cuts to the high priority uses by the municipal, industrial, and Indian customers because they will not have grown into their full

utilization and supplies yet and partly because we don't think any cuts will go deeper than that. But, if they do we know how we're going to assess them within that. There's a formula in the Water Settlement Act that says how they'll be shared and prorated between the municipal, industrial, and Indian contractors. Then when that happens we will go to the Water Bank and say we need 20,000 acre feet 50,000 acre feet, 100,000 acre feet to be able to meet all of the orders we have pursuant to the water contracts that we have for our municipal and industrial customers and we'll go recover that water or either deliver it directly or put it back into the canal system so that the municipal and industrial contractor will get their full supply.

That's what we're doing to plan for when those shortages come. What we're doing to try to offset them is, as a basin states with the river system it's the same thing everybody does - you try to conserve. You try to conserve wherever you can. You try to make the water supply go farther and you try to do things to enhance that water supply. So, conservation vs. augmentation is a little fuzzy. But, conservation are things like we spilled some water out the lower end, if it was an irrigation ditch (that's what some people think the Colorado River has become) you have tail water. So, we're going to put a tail water collection system on irrigation water; a reservoir (drop two reservoir) on the American Canal that will help us recover some years 200,000, some 20,000, but on the average 75,000 acre feet of tail water that has been lost that will save the storage in Lake Mead. We're going to do things like xeriscape landscaping. We're going to look at those water dense non-native plants like Tamarisk along the river. We're going to manage that, I'd like to say eradicate it but we'll never get to that, but manage it; take out as much of it as well can and replace it with less dense thickets of Cottonwood, Willow, and upland grasses and mesquite that will save a few hundred thousand acre feet a year when we get it all done. But, that's a constant process. It improves the environment, but it costs money. You got to get in and manage it and replace it just like you do your own xeriscaping project. We're going to do some other things like manage Lake Mead and Lake Powell together to make sure that we share that water supply a little bit better instead of having one too full and one too low. We're doing cloud seeding. The upper basin states are doing it. We've been throwing money at it for several years. Studies suggest that 5-15 percent overall increase in yield when you have big reservoirs downstream to capture the water. That may bring another million acre feet or 600,000 - 700,000 acre feet more than is already being done with cloud seeding up there. Healthy forest initiatives. The more park-like open forest habitat on the water shed that has been recognized as a much preferred improved environment also manages the runoff better. It allows you to get a little bit more. It allows it to soak in and come back and form a spring. Those are things we can do to make our system yield a little bit better and to use the water a little bit more efficiently. It will be difficult to quantify exactly what that will do for you.

The other things you can do then is look at importation - new water supplies coming in from somewhere else. If you have conserved as much as you can conserve your quality of life is all you're going to do. You managed the supplies as well as you want then you are going to have to go after new supplies. And, that means importation

from other means. That may mean brackish groundwater resources. It may mean ocean desalinization. Those kinds of studies were put out in 1968-1970. There were also studies about bring in water from the Columbia Basin. Those are big projects; expensive projects. About the kind of dream the CAP was in 1946. So, if you don't get started you won't get there. And if you don't need those supplies for 30 or 40 or 50 years you're a little bit late if you're starting right now.

The other thing we are doing within the CAP is called the ADD water process. ADD is an acronym for Acquired Develop and Deliver new water supplies. It is looking at the fact that we have more capacity in the CAP system than we have water supply legally from our 2.8. So we have the capability to develop some of those new water supplies. Whether they are moving water from Yuma, or other places along the river, or outlying groundwater basins, or whether they are part of that totally new water supply those supplies would be new to the CAP area but not new to the river. They would just be relocation of supplies off the river and all of the attendant and third party economic impacts. But some of it can and will be done. And then whether it's new water supplies that you brought in from some other basin or brought over from the ocean. Some people say that's a big dream. The ocean is an unlimited resource that is drought proof; and it's only 120 miles and 200 feet elevation away from the CAP intake structure. That's because if you go to Mexico and get in the Gulf of California you can deliver desalted water to Imperial Dam at Yuma with a canal of 120 miles with a lift of about 200 feet. And they manage 6,000,000 acre feet released from Lake Mead each year at the Imperial Dam. If you were to replace 25 percent of that 1.5 million acre feet from ocean desalinization that means you can displace and leave 1.5 million acre feet up in Lake Mead. From there it can go to Las Vegas, Los Angeles, or CAP through the existing delivery systems. So, it's not so far away. And, not as far away as going to the Pacific Coast which California wouldn't let you develop it anyway and try to bring it over here or try to change it for California's supplies.

Let me say some Tucson-specific issues. Tucson is at the end of the line and the top of the hill. The canal is 336 miles long and lifts water about a half a mile. To get that you start at Lake Havasu and calculate down to the delivery point at the south end of town where the last pumping plant takes the water recovered from the SAVSARP and CAVSARP areas out there. The CAVSARP brings it over and puts it in that pumping plant and delivers it to the high point to the edge of Tucson. There's about a half a mile of lift that uses a lot of energy. That puts you with some level of vulnerability. From Phoenix on down the pumping plants have a single discharge. The ones from the Colorado River and in and through the Phoenix area have two. That means that if you need to do maintenance on discharge valves or discharge lines you can do off-season stuff and do a half a plant at a time. The other nine pumping plants or six or seven or eight that you go through depending on where you are every year you probably need to do a little work on the discharge lines or discharge valves. You can't do them all in one year so that means ten days to two weeks outage every fall. So, you'll be disrupted from your CAP supply. We brought that in with the plan of what's now called Tucson Reliability but it was originally Tucson Terminal Storage and thought it might be a

single big reservoir when we thought all the water was going to funnel through Tucson Water. You still need to look at that and think about it.

Tucson for a variety of reasons that now recharge and recover all of their water supply are insulated from any interruptions of CAP supply for months, weeks, or whatever on end. They need to get their water delivered into that groundwater basin out there on a rolling multiple-year average. We're going to try to do it on an annual basis but if you're taking it out of a large groundwater reservoir that you're replenishing with your 140,000 acre feet of water each year you can store some of it in advance you can take your time about putting the system back in service. Tucson is well insulated.

Tucson has also been part of the project from the beginning. And like most water projects and federal projects everybody pays the same rate whether you're at Glendale and have 130 miles of canal and four pumping plants or you're in Tucson and got 336. And that's the deal. But, it probably won't be the deal for new water supplies. For new water supplies, I expect that, but I don't know that because it hasn't been decided, but I expect the issue to be brought up that you should pay for your new water supply and to the point of delivery. So, that will make new water supplies more costly both in the acquisition and in getting the delivery down here.

And, I think those are probably the major two Tucson-specific issues that I think you will have to deal with when you look at in your water future. I think what you can expect from the CAP is we're here, we're reality, we're built, we're operating. From that standpoint the dream has come true. We've been reliable and cost-effective to date. We've got good plans for the future both in how we deal with shortage so that we can have some certainty for that planning and we're looking for new water supplies. Both just relocation of existing water supplies be they existing Colorado River or groundwater supplies and addition of new supplies be they come from ocean desalinization or cloud seeding, or imports from the Mississippi River. The Mississippi River sends 430,000,000 acre feet a year through New Orleans. If we were to get a couple million acre feet more I don't think anyone would notice. Their average flow is 160,000 CFS. And, that's their average. It's a lot worse than that in times like this during floods. And to take another 1500 or 2000 CFS over there wouldn't do it, but it's a long way and a lot of lift and you would never take it over the mountains so you give it to Denver and such on that side and reduce their reliance on trans-basin and the Colorado River.

So there are a lot of things going on. We're planning for shortages and know what to do with it. We're planning on new water supplies. We think we're going to be able to expand the capacity of the canal with modest increases once we use the additional 300,000-400,000 acre feet that is there right now. And, I think you can count on your CAP subcontracted allocation that you have today to be reliable and about as cost effective as any water supply you've got as far as being able to predict and manage the costs.

That's kind of an overview of where the CAP came from and what to expect from it. I've used up most of the time allotted for it. I'll take questions.

CALL TO THE AUDIENCE

CHARLES COLE: My concern is with the -

CHAIRMAN JIM BARRY: Make sure you give us your name -

CHARLES COLE: Oh, Charles Cole -

CHAIRMAN JIM BARRY: Oh, never mind. We've got it here. We've got it. Go ahead.

CHARLES COLE: Charles Cole, 6381 West Sweetwater Drive. We built a house five years ago up on the eastern foothills of the Tucson Mountains and we're off the water grid, and we were told at the time that we would never be on it; in an area where wells are unreliable.

What I'm here for is to plead with you to please take very seriously, study the option of future water supplies, present water supplies from the rainfall, harvesting rainfall; that's what we did when we built our house. We designed it so that we'd capture the rain off the roof. We have a cistern of almost 26,000-gallon capacity. With the rainfall even less than normal in the last few years, the cistern's been gradually filling; it now overflows in good rains, and it can provide 100% of the water that we need year-round for all household purposes. We capture the rainfall, we store it temporarily, we treat it, and we utilize it in the house for all purposes, including watering in the xeriscape, and the - the potential is tremendous. Just start imaging anywhere, especially off the grid, where there are housing developments and malls, and so and so forth that, with the proper planning and design, the rainfall can be captured off all the roofs that are involved and the water treated and then used for all purposes in local communities or - or what have you.

So, my wife and I offered to - for anyone who's interested, come and see our system. We're not selling anything. We have nothing to do with water supplies and water systems, and we're welcome to demonstrate to people what we're doing; it's - to a lot of people it sounds like a wild idea, but we've proven that not only is it possible, but it's also practical and - and it really works, and there's a lot of potential for that for the future, particularly in Pima County and off the grid.

We'd also - we extend our invitation to everyone on the Board. We hope you'll really take this seriously. I'm available to consult with anyone who wants to. There are a lot of ideas that could be put to play here. Telephone number: 743-3402, 743-3402. Please don't call in the next two weeks. We're overloaded with commitments and deadlines, but after the 1st of July, we'll be able to be available for whatever you might like. We could also do a short slide presentation at one of your meetings some night if you wanted to, so we're available. Thank you.

CHAIRMAN JIM BARRY: Thank you, Charles. I think that we had somebody here before talking about your - your system. Dorothy O'Brien?

DOROTHY O'BRIEN: Good evening, Mr. Chairperson, Members of the Committee, and the audience. My name's Dorothy O'Brien. I am the Assistant Utilities Director for the Town of Marana.

As has been discussed tonight, the Town of Marana is a developing community within the northwest region. We commend you on regional planning for both water and wastewater and would very much like to be a part of this effort.

As what you heard today, the - Judge Christian Hoffman ruled in favor of the Town of Marana in its suit against Pima County, and we will - we will be in both the wastewater business, as well as the water business and, as a regional partner, we would love to be a part of the Committee in the future. I know that Phase I has already committed. But, as Phase II and other areas open up, we would very much like to be not just a stakeholder, but also a member of the Committee. And, if there are any questions regarding anything going on, feel free to give us a call. We'd be happy to assist. Thank you for your time.

CHAIRMAN JIM BARRY: Thank you. Tracy?

TRACY WILLIAMS: Good evening. My sources for my discussion this evening come from the City of Tucson website, the Arizona Water Institute, Water Resources Research Center, Metro Water, CAP, and online.

The Arizona Water Institute reports, "Our water supply is uncertain. The climate change, dry, makes water resources in the southwest unreliable. Conservation in one state alone cannot mitigate region-wide problems affecting large multi-state watersheds. Just because we have an allocation of CAP water, doesn't mean there will be wet water available."

Now, infrastructure. Outdated infrastructure is more sensitive to hazardous events; that means it's more fragile. Various demands on the Colorado River may be incompatible. Short-term decisions may have long-term consequences.

Now, climate change is something that concerns all of us and, with climate change, we have surface temperature changes, evaporation rates, reduced snow pack, earlier and shorter runoff seasons, increased water temperatures, and decrease in our water supply.

Now, with this comes various risks, hazards and vulnerabilities; those include: fires, as we've seen on our very previous Mt. Lemmon; floods, like in San Manuel, Winkelman, and the Butterfield Ranch at Pantano Wash; the loss of threatened and endangered species, which would be owls, bats, snakes and cactus; and, in general, reduced water supplies.

Now, as Larry Dozier talked about, the CAP add, A-D-D, water process - and I'm taking this very recently from March 4th, 2008, page 7 - "Our long-term water demands and CAP's three-county service area are projected to exceed current available supplies. There is not a comprehensive strategy to acquire and deliver enough water to meet the future demands." Now, that sentence right there is very startling to me as a citizen. I'm going to read it again. "There is not a comprehensive strategy to acquire and deliver enough water to meet these future demands." More information is needed on - and these are very simple questions and I will, of course, email them to you - how much water is needed? When is the water needed? Who will acquire, develop, and deliver the water? Where will the water be shared? And how will the water be paid for? And

those questions come right off the CAP website, and I think that we deserve some answers. Thank you.

CHAIRMAN JIM BARRY: Thank you. Laura Mays?

LAURA MAYS: Hello, my name is Laura Mays, and I live at 1349 North Fifth Avenue. I'm here on behalf of the Feldman's Neighborhood Association.

I moved to Tucson ten months ago for sustainable reasons strictly; before that, I lived in Phoenix, Arizona, for 37 years. And, at the top of my list of concerns around sustainability is water, so I am very excited and pleased that the City of Tucson and Pima County are now talking about this.

For about four years now I've been working with a couple of different groups doing rainwater harvesting systems. Rainwater is the thing that I'm the most excited about.

About a year before I moved here, I joined a group called "Watershed Management" as a volunteer and we've done a lot of commercial sites, and we're currently working on residential sites. I'm applying for their apprenticeship program so that I can learn even more about rainwater harvesting, take it back to my community, the Feldman's Neighborhood Association, where we will start our own residential co-op in my neighborhood.

CHAIRMAN JIM BARRY: (Inaudible; not speaking into a microphone.)

LAURA MAYS: That's just how excited I am about rainwater; it obviously came through so, yeah.

There's lot of benefits about rainwater and I - and I won't amuse - amuse you with more than just a couple. The thing that I'm most excited about rainwater is it will, if - if we all start utilizing it, it will start to build up our aquifers and then we will also not have to use our aquifers as much by pulling it out of the ground. And the thing that I'm most excited about rainwater harvesting and utilizing it is that we will not find ourselves as dependent or reliant on the CAP.

And your presentation was really lovely, but I still am not feeling comfortable with the dependence and reliance we do have on the CAP, and especially with what was projected, the - the more use of it in the future. So, I say: "Let's count our rainwater as part of the inventory, let's utilize it and then - to quote Lisa Shipeck (ph.) - 'Let's leave no drop behind.'" Thank you.

CHAIRMAN JIM BARRY: Thank you. Bob, let me see if there's anybody out here in the - anybody in the audience - call to the audience. All right, Bob.

BOB COOK: I'm Bob Cook. I live at 2101 North Tucson Boulevard. I'm here representing Sustainable Tucson, and I have a short statement to read from one of our corps team members who is out of town for a month and she wanted me to read this, Madeline Kiser. She's spoken before the Committee before.

"Dear Committee Members: As we've been discussing these past three weeks, these past weeks, the decisions you reach and the recommended - recommendations that you make will be greatly influenced by the data you examine and by the expert witness and testimony you choose to turn to. In particular, for some of us, the effects of climate change on both surface and groundwater remain a concern, as does the question

of how much these effects are or are not entering into the data informing your decisions.

In August, the California Groundwater Resources Association will hold a symposium, *Climate Change, Implications for California Groundwater Management*. Some of the subjects it will include - some of the subjects it will include, the potential changes in overall ground sup- - ground- - groundwater supply due to climate change, and the need to include scenarios of climate change in groundwater modeling. Moreover and importantly, the tone of the conference is one which suggests - which suggests that this is a unique time, an urgent time, a time of potential crisis.

The conference flier appears with a quotation from Governor Schwarzenegger, 'I say the debate is over. We know the science, we see the threat, and we know the time for action is now,' unquote. The policy recommendations that result from this basic understanding about climate change will ultimately differ, likely significantly from those made by experts who see climate change and its effects in a more neutral light.

So much of our discussion these weeks about data has to do with how audible to the public is this range of scenarios we might face, worst to best, and what kind of preparations we might need to make if, in fact, we'll face harsher versus milder scenarios. So far in our cities, regions, and states, public debate over water, as presented by experts, what is audible is that the times we're facing don't seem to be exceptional or potentially dangerous; that through accommodation of new high-tech solutions, such as desalinization, the use of effluent, cloud seeding, and other sources, we will basically be unable to continue our current way of life. But, how true is this?

Once, again, therefore, I'd like to recommend that all underlying data and the paradigm which ties it together be subjected to third-party review by a range of experts from outside our state, include those - including those whose training and expertise is in holistic, adaptive water management and to complement more traditional engineering and economic management approaches used in this state. Respectively, Madeline Kiser."

I'd just like to add to that, that I just received - I think some of us have been reading this, this past week - this is the first major study by the U.S. Climate Science Change Program; this is our "A" Team of scientists in the United States who are studying the national and regional impacts of climate change and the name - the title of the subject - of the study is: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*; it was just released a couple weeks ago, and I suggest that we enter this into the record for the Committee; be part of our resource bank and take this seriously, because most climate modeling has been on a global basis, the IPCC reports all deal with climate modeling on a global basis, because climate modeling is the most computer-intensive types of modeling because of the very extensive data sets that are required; doing regional modeling has been very, very expensive to date. This is the first report that we've seen as citizens of this country regarding what the possible impacts are. So, I - I just underline this issue that this question about climate change is here for us to take serious attention to. Thank you.

CHAIRMAN JIM BARRY: Okay. One last Call to the Audience.

* * * * *

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentation) excerpts of the City County Water & Wastewater Study Oversight Committee Meeting held on June 11, 2008.

Transcription completed: August 24, 2008.

DANIELLE L. KRASSOW-TISDALE

**PRESENTATION MADE TO THE CITY/ COUNTY WATER &
WASTEWATER STUDY OVERSIGHT COMMITTEE
JUNE 25, 2008**

**Speakers: Ken Seasholes, Senior Policy Analyst, Central Arizona Project
Jeff Tannler, Acting Area Director of ADWR Tucson AMA
Cliff Neal, P.E. Manager, CAGR
Laura Grignano, Water Resources Specialist, ADWR Tucson
AMA
Chris Avery, Interim Deputy Director Tucson Water
Eric Wiedulwilt Interim Deputy Director RWRD**

**HISTORICAL/HYDROLOGIC OVERVIEW OF TUCSON
ACTIVE MANAGEMENT AREA (AMA)**

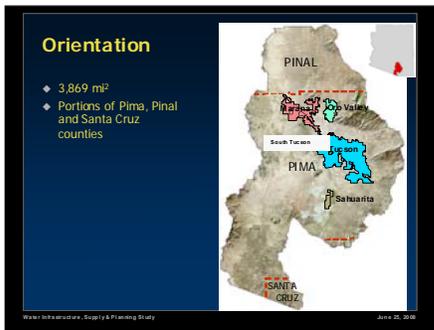
**PRESENTATION BY KENNETH SEASHOLES,
SENIOR POLICY ANALYST, CENTRAL ARIZONA PROJECT (CAP)**

MR. SEASHOLES: Yes, the last time I spoke to the Committee was the first meeting and I had a different job then. The purpose of this presentation is to provide a broad overview of the water resources and the management framework for the region, and there's a ton of ground to cover, so we're going to divvy it up among four folks.

I'm Ken Seasholes, and I'm a Policy Analyst with the Central Arizona Project, and I'm going to be followed by Jeff Tannler, who's the Acting Tucson Area Director for the Arizona Department of Water Resources. He's going to be followed by Cliff Neal, who's the Manager of the Central Arizona Groundwater Replenishment District - sitting next to him. And then, finally, finishing up, is going to be Laura Grignano, who's a Water Resource Specialist with the Tucson Active Management Area.

The statistics we're going to be citing are for the Tucson AMA as a whole. Jeff's going to give some background on the role of the AMA a bit later in the presentation. But, I'm going to begin just with some - some orientation and some background.

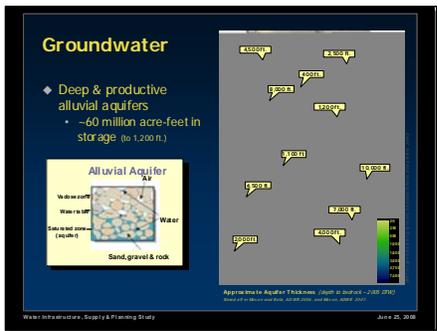
The AMA is largely defined by groundwater basins, basin boundaries, including the entire Metro Tucson area, and it extends to Picacho Peak in the north, Kitt Peak to the west, Mexico and Elephant Head Road to the south, and then the ridgeline of the mountains, bringing us to the east; slightly larger than the State of Delaware, the area contains a million people, and a diverse water-user group.



A little bit on the water resources. As you're all aware, there are no large-scale reservoirs, like SRP has to serve the Phoenix Metro area, and our major river systems are ephemeral, which is to say they flow only in response to direct precipitation events; they're dry much of the year. There are, however, some notable exceptions to that, including some localized perennial and intermittent stream reaches that are fed from sources directly into the mountains. While these are not a major component of the water supply for human uses, those flows sustain important aquatic and riparian habitat; a number of these also - also have high aesthetic and recreational value, obviously.

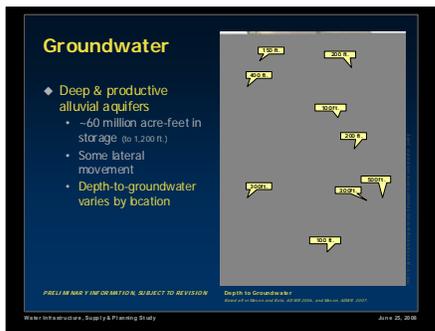
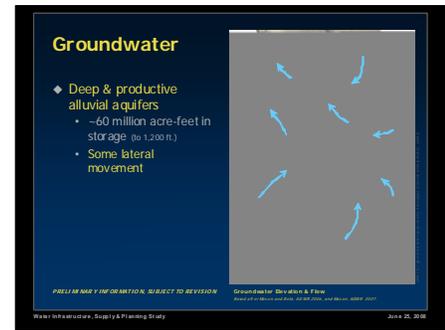
There is also perennial flow in the Santa Cruz River downstream of the two major regional wastewater treatment plants at Roger Road and Ina Road here that follow the flow of the Santa Cruz that way; and that stretch also has ecological value, and increasingly the supply itself, of course, has economic value and has been contentious as a consequence. And, of course, there's the Central Arizona Project, CAP water, as Larry Dozier explained last meeting is also, indeed, a perennial supply. And then there's groundwater which, for most of this region's modern history, was the sole source of water supply.

As the mountains around us have eroded over the eons, broad basins have created from a mixture of silt, sand, gravel and rubble. It's the tiny spaces between those materials that have gradually filled with water, and most of that water has resided in place for thousands of years.



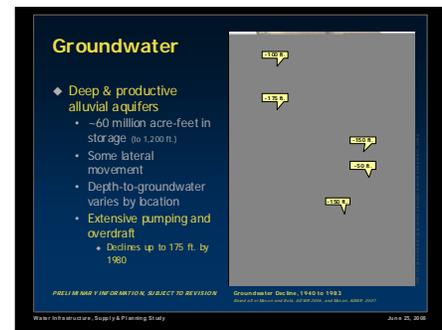
So, when we talk about groundwater in the Active Management Area, we're typically talking about this regional groundwater system, which is comprised of these very large, loosely interconnected alluvial aquifers. In some places, they extend down thousands of feet, though they generally thin out as you get closer to the mountains. The total amount of groundwater in storage is staggering; it's enormous; an estimated 60 million acre-feet just down to the first 1,200 feet.

Now, some of that groundwater does actually slowly move following the general - same general path as the surface water, but the flow rates are on the order of feet-per-year, so most of it actually just stays in place.



The accessibility of the water varies across the AMA, with depths to groundwater ranging from less than 50 feet to over 600 feet, but current depths to groundwater are typically in the two to 400-foot range below land surface. This means that groundwater can be pumped relatively economically in much of the AMA, and it has.

The accessibility of the water varies across the AMA, with depths to groundwater ranging from less than 50 feet to over 600 feet, but current depths to groundwater are typically in the two to 400-foot range below land surface. This means that groundwater can be pumped relatively economically in much of the AMA, and it has.



The end of the Second World War and the advent of the turbine pump led to a sustained increase in groundwater pumping; mostly for agriculture; that reached a peak in the 1970s; and, by that time, groundwater overdraft in central Arizona, as a whole, was viewed as an increasing threat to the economy of the entire State. When overdraft is sustained, water levels drop, riparian areas are damaged, costs increase, quality declines, and the land can subside, sinking as the water is removed from those deep layers of sand, silt and gravel; it can also lead to fissuring, in which the land literally cracks open. So, while we are fortunate to have a large and highly-productive aquifer system, there can be severe consequences to sustained overdraft.

Moreover, also in the late-1970s, competition among groundwater users was creating conflict. The outcome of lawsuits between the mines and agriculture in Green Valley was threatening the ability of other users, including the City of Tucson, to use and move groundwater as they saw fit. And, finally, at this same time frame, funding for the Central Arizona Project was imperiled. This perfect storm of events could have been ruinous; it could've come out really poorly; but, instead, it resulted in the 1980 Groundwater Management Act, and Jeff is going to take a look at that.

* * * * *

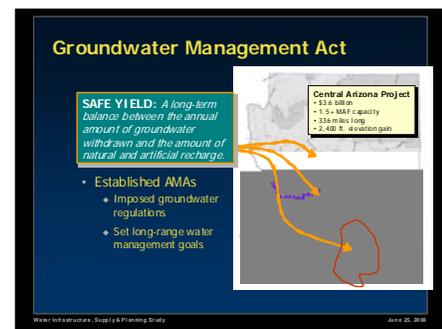
STATEWIDE PROVISIONS OF GROUNDWATER MANAGEMENT ACT PRESENTATION BY JEFF TANNER, ACTING AREA DIRECTOR ADWR, TUCSON AMA

MR. TANNER: So, Ken has described the circumstances that led up to the creation of the Groundwater Code. Let's take a look at the language now within the Code. In its Declaration of Policy, the Arizona Legislature concluded quite clearly that over-reliance on groundwater in the most urbanized areas of the State was threatening to place Arizona's economic future in danger.



In response, they enacted a sweeping set of regulations in a management framework that were, indeed, comprehensive. Taken together, the two statements make the overall intent clear: Arizona would manage its water resources and, in particular, would do so, so that it could continue to grow.

The Groundwater Management Act did a number of things: It created the Arizona Department of Water Resources; it ensured the completion of the Central Arizona Project; and it established Active Management Areas, or AMAs, with a system of water rights, provision for well-impact rules, a



strict limit on expansion of agricultural irrigation, mandatory conservation requirements for all sectors, compulsory water use reporting, and long-range water management goals. The goal for the Tucson AMA is Safe-Yield, which is a balance between pumpage and recharge, with a target date of 2025.

Groundwater Management Act

- ◆ Purposes
 - **Protect groundwater**
 - Management goals
 - Assured Water Supply
 - Conservation
 - **Protect existing users**
 - Grandfathered rights
 - Well impact analysis
 - **Protect the economy**
 - Service Area rights
 - General Industrial Use permit
 - Recharge & recovery

Water Infrastructure, Supply & Planning Study June 25, 2008

While the Groundwater Management Act is rightfully praised as a progressive piece of legislation, it was also a compromise that had to balance protection of the groundwater with the investments of existing users, and the desire for economic growth.

One of the tools that was used was the establishment of groundwater rights. The

Groundwater Rights

- ◆ Right Types
 - **Irrigation** (تربية)
 - For irrigation purposes
 - **Retired Irrigation** (تربية)
 - For appurtenant non-irrigation purposes
 - **Non-Irrigation** (تربية)
 - For non-appurtenant, non-irrigation purposes
 - **Municipal** (تربية)
 - Can increase volume as population increases

Water Infrastructure, Supply & Planning Study June 25, 2008

system of water rights and permits that are set forth in the Groundwater Code forms the foundation of water management framework. In a nutshell, you can see that there are different types of water rights issued for different water uses. Grandfathered rights, which are the first three types listed here, are based on historical use of groundwater in the years immediately before the Groundwater Code was adopted in 1980.

There are some limited opportunities for rights to be converted from one type of water use to another. So-called Type 1 rights allow for the conversion from agricultural use to municipal or industrial. The City of Tucson has some large Type 1 rights that are associated with farms they bought in Avra Valley years ago and, actually, Tucson Water has had all of these types of water rights listed here at one time or another.

Service Area Rights, the last one here, are issued to municipal water providers, including both public and private water companies. Municipal provide - providers can grow over time, but their growth, generally, must be tied to an assured water supply. We'll touch on - touch more on that in a bit.

Withdrawal Permits

- ◆ General Industrial Use Permits (GIUs)
 - For industrial users far from municipal provider
- ◆ Mineral Extraction Permit
 - For mining purposes
 - "Shall issue," subject to criteria
 - No Well impact analysis

Water Infrastructure, Supply & Planning Study June 25, 2008

The Code also allowed for some expanded use of groundwater through withdrawal permits; these are similar to groundwater rights, except they're limited both in volume and duration. There are a number

Well Construction/Operation

- ◆ Driller licensing
- ◆ Well registration
 - > 13,000 wells

Tucson AMA Wells, by Type

Well Type	Percentage
General Industrial Use	55%
Retired Irrigation	20%
Non-Exempt Private	19%
Municipal	7%
Other	2%

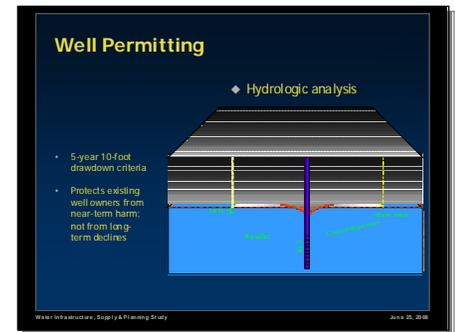
Water Infrastructure, Supply & Planning Study June 25, 2008

of different types of withdrawal permits, but they're generally issued in relation to mining or industrial uses. Depending on the type of permit, there are different criteria that must be met; and, well, sometimes when they're issued, it can be controversial.

Now, as far as wells go, all wells statewide are required to be registered with ADWR. New wells have to be drilled by a

licensed well driller and they must be permitted through DWR. For all existing wells that were drilled before 1980 when the Groundwater Code went into effect, the well owner must register his well with DWR. There are over 13,000 wells currently registered within the Tucson Active Management Area.

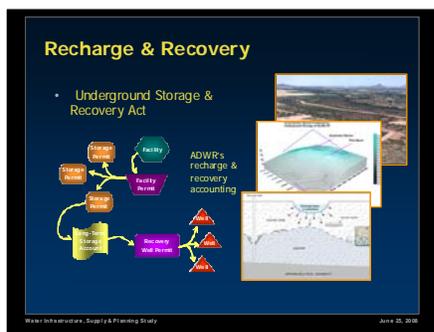
With a few exceptions, large new wells in AMAs are subject to



well spacing and well impact rules. There are specific criteria set forth in the well rules, such as the five-year, ten-foot draw-down analysis illustrated here. I'll give you a minute to watch what it does. These rules are meant to protect existing well owners from being unduly impacted by pumpage from a new well, but note that they do not address long-term water level declines; for that, we have the Management Plans.

The Code provided for creation of a Management Plan for each AMA every ten years, with conservation requirements for each sector, including farms, water providers, industrial uses in mining, water use projections into the future, planned for augmentations of supplies, and a conservation assistance program.

Pursuant to the Code and Management Plans, municipal providers in the past have been required to meet a gallon-per-capita-per-day limit. For turf facilities, like golf courses, and for agriculture, there has been a volume limitation on use so, in effect, an allotment to which they're limited. Best Management Practice Programs for industrial, agricultural and municipal uses are becoming available.



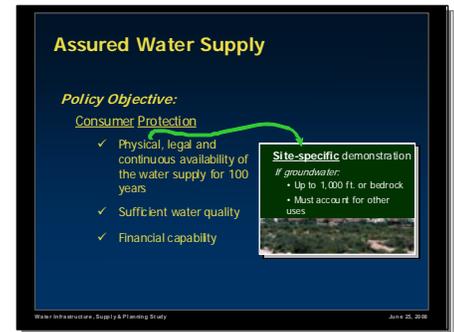
There are also Management Plan incentives for the use of renewable supplies such as effluent.

The recharge program was established after the Code's inception, but it's been an increasingly important tool that's helped the State use renewable supplies earlier and more extensively than would otherwise have been possible.

Recharge is one of ADWR's more complex programs so, of course, there are lots of permits, forms and regulatory requirements. But, in terms of complexity, it's hard to beat the Assured Water Supply Program.

The Department adopted its Assured Water Supply Rules in 1995. The Assured Water Supply requirements trace their lineage to two different policy objectives; the first of which is consumer protection.

There had been a history in Arizona of land being sold without water. In 1973, the State adopted requirements that dictated that water adequacy had to be determined for land before it was sold. If it was found that there was an inadequate supply of water for a piece of property, that land could still be sold, but the inadequacy of the water supply had to be disclosed to buyers. Water adequacy rules still apply outside the AMAs.



Now, within AMAs, the Assured Water Supply Rules prohibit the sale of land without water. A developer subdividing land must either demonstrate that there's an onsite supply to meet the projected demands for 100 years, or they must be served by a water provider who has done that demonstration of a 100-year supply for their entire service area. The physical supply can be groundwater down as far as 1,000 feet, but the majority of that water must be replenished with renewable supplies.

The second policy objective is to meet the water management goals of the AMA. Since the adoption of the Assured Water Supply Rules in 1995, all subdivisions must contribute to Safe-Yield by directly or indirectly relying on renewable supplies. With the exception of a minimal phase in allowance, growth is not allowed to rely on mined groundwater. So, these rules strongly influence municipal water management. In the Tucson AMA, more than 90% of the municipal demand is covered by the Assured Water Supply provisions.

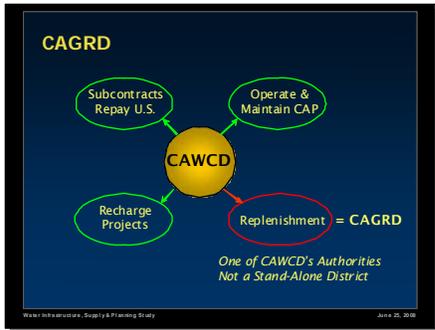
Now, just prior to the rules taking effect in 1995, a mechanism was created to allow developers and others to satisfy the renewable supply requirement, even if they don't have their own renewable supply. The CAGRDR does not help you demonstrate a 100-year physical supply, but it does recharge water to offset the groundwater pumping by its members. Because Safe-Yield is an AMA-wide goal, the Assured Water Supply Rules allow the CAGRDR and others to replenish the aquifer anywhere within the AMA, not necessarily just where the pumping occurs.

Now, for more on how the CAGRDR operates and how it links with the Assured Water Supply, here is Cliff Neal.

* * * * *

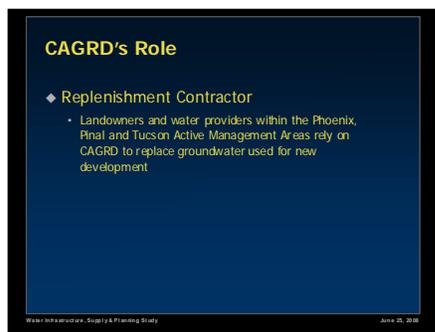
**ASSURED WATER SUPPLY RULES AND ROLE OF
CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT
PRESENTATION BY CLIFF NEAL, P.E. MANAGER, CAGRDR**

MR. NEAL: As Jeff said, my name's Cliff Neal. I manage this - the Central Arizona Groundwater Replenishment District, and I thought I'd start out by making sure that there's not - or try to clear up some misconceptions about what the CAGRDR really is. It's really not a stand-alone district, in spite of it being called a "District" itself, Central Arizona Groundwater



Replenishment District; it's actually part of the Central Arizona Water Conservation District, CAWCD. And I think that you've had a discussion with Larry Dozier, who is the Assistant - or Deputy General Manager of CAWCD, at your last meeting.

CAWCD's initial role was to subcontract and repay the United States federal government for the construction of the Central Arizona Project; it also then took on the responsibility of operating and maintaining the Central Arizona Project aqueduct system. Then, in the mid-'80s, we got the authority to plan, develop, and construct and operate recharge projects. And then in 1993, the Legislature saw fit to give CAWCD the authority to provide replenishment services within its three-county service area, Maricopa,



Pinal and Pima Counties. So, CAGR D then is really just one of the authorities of CAWCD, not a stand-alone district, and there's been a lot of confusion on that and I wanted to make sure that's clear.

CAGR D's primary role then is to, basically, be a replenishment contractor; to provide replenishment services for water providers and landowners within the three counties where we serve. As Jeff indicated, CAGR D's role is not to be a water provider to its members but, basically, to serve the aquifers in the AMAs where we do replenishment. We support the Assured Water Supply Program that the state's put into place, and that's primarily our role.

There are two types of members in the CAGR D; member service areas are when a water provider enrolls its entire service area. In that case, that's where the water provider has decided to get a designation of Assured Water Supply for its service area, and so then enrolls its entire service area in the GRD.

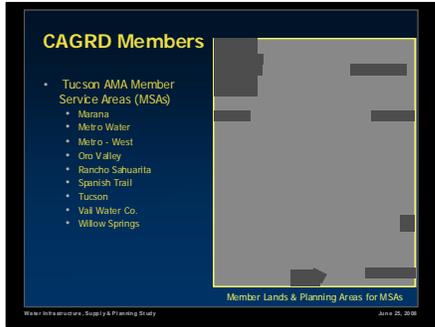
For those cases where the water provider has chosen not to, for whatever reason, get a designation of Assured Water Supply, then each new subdivision within that service area needs to prove up its own Assured Water Supply through getting a certificate of Assured Water Supply; and, in that case, those subdivisions are enrolled as member lands of the CAGR D. So, that's the two types of members.



A key distinction between these two types of members is actually how they pay for replenishment. Member Service Areas, the water provider is required every year to submit a report to us telling us what their total groundwater use is in the service area and what their excess groundwater use is; that's the amount that we have to replenish. And so we send a direct bill to the water provider to pay the costs of that replenishment.

It's significantly different for member lands. In that case, the water provider submits a report to us indicating how much groundwater and excess groundwater is delivered to each

parcel within each subdivision of the member lands. We apply our CAGR assessment rate to each of those parcel's groundwater use, and then that becomes part of their property tax bill; that assessment is collected through there. So, it's a significantly different way of collecting money, depending on the type of member.



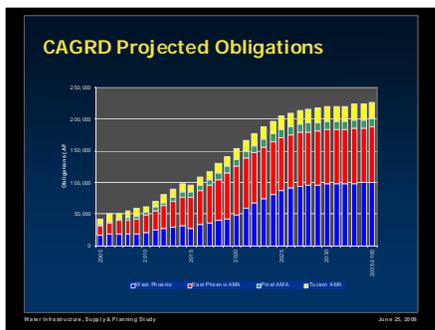
This is a map of the Tucson AMA, which you've seen several times; it depicts where our members are located. The small green dots are the member lands, and you can see them primarily down in the Green Valley area - we also have some up in the northern and in the little areas where the big water providers are not serving.

The shaded areas represent the designated water providers who are enrolled as member service areas; we have nine of them in the Tucson AMA. All the water providers who have designations of Assured Water Supply are member service areas of the GRD; that's a little bit different than up in the Phoenix AMA; there's four or five that are not members, but are - but are designated, so . . .



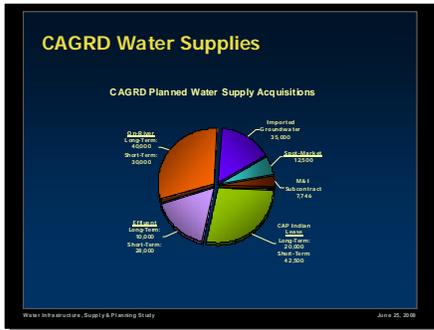
This is a graph showing what our historic replenishment obligations have been - there comes Tucson, okay? Each of the bars represents what our total obligation has been. We enrolled our first members in 1995. So, obviously, our replenishment obligations didn't start picking up until a couple years after that point when - when houses and whatnot were built.

The different colors represent each of the AMAs that we serve. The blue is the west portion of the Phoenix AMA; the red is the east portion of the Phoenix AMA; the green, which is a very small portion, nearly zero so far, is Pinal Active Management Area; and then the yellow represents what our obligations have been for the Tucson AMA. You can see they've - not surprisingly - just grown pretty steadily over the last ten or 12 years.



This is a graph from our current Plan of Operation which was submitted to the Department of Water Resources in '04, and approved in '05. You can see that it projects that our total replenishment obligation out at about the 2035 time frame is about 225,000 acre-feet per year. The vast majority of that obligation is going to be in the Phoenix AMA; again, that's the blue and the red. The Pinal and Tucson AMA obligations are projected to be relatively small. We'll see how that changes in the next Plan of Operation.

As you can imagine, with the 225,000-acre-foot projected obligation, we have to worry about water supplies, just like everyone. Part of our Plan of Operation is to show the Department of



Water Resources the potential water supplies that would be available over the next 100 years to meet those obligations, and this pie chart represents what we propose to DWR to be potentially available supplies to the CAGR. You see that we have CAP Indian leases; we are in the process of seeing that we can lease them from the Indians.

Effluent arrangements with cities and towns in the three Active Management Areas. On-river water supplies from the Colorado River through option arrangements and leasing arrangements with farmers and Indian communities on the river, and then importing groundwater from those basins in the west portion of the state that the statutes allow groundwater to be imported from.

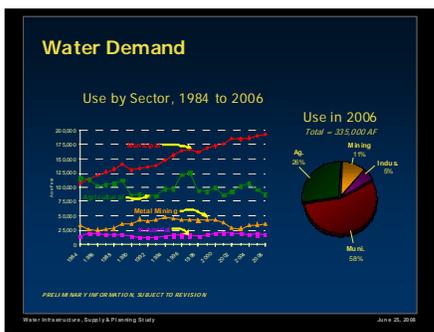
M&I subcontracts which we currently hold, which were contracts held by providers that serve members lands and no longer need them; they were transferred to the CAGR to meet replenishment obligations, and then we'll work on a spot market excess water availability for that remaining slice of our water rights.

That's the end of what I have, and I think Laura's up next. Thank you.

* * * * *

TUCSON AMA WATER SUPPLY AND DEMAND ("WATER BUDGET"); RECHARGE; OVERDRAFT PRESENTATION BY LAURA GRIGNANO, WATER RESOURCES SPECIALIST, ADWR TUCSON AMA

MS. GRIGNANO: Good evening. So now that you've gotten a sense of the regulatory framework in the Tucson Active Management Area, let me walk you through what has happened to water supply and demand over the last two decades in the AMA. I'll start by describing the water use trends, and then I'll discuss the supplies used to meet those demands.



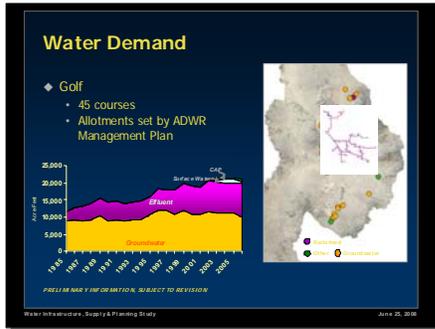
As you might expect, municipal demand has continued to increase over time as the region's population has grown. Municipal demand is now 58% of the total water used in the Tucson AMA. Agricultural demand has fluctuated somewhat over time due to crop prices and subsidies, but the trend of non-Indian ag demand is starting to show a slight decline; this decline is predominantly due to the urbanization of farmland. Non-Indian agriculture is now 26% of the total water demand in the Tucson AMA.

The water used by the large metal mining operations in the Green Valley area has also varied over time, usually corresponding to the price of copper, with peak use in the mid-'90s, then a slow decline over the next decade. In the last few years, however, with copper prices at all-time highs, mining use is starting to climb back up. Currently, mining use is approximately 11% of the overall AMA demand. And, finally, other industrial uses have bumped along at a

relatively constant rate, and they currently account for approximately 5% of the overall demand.

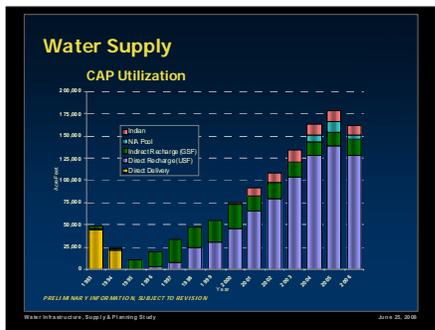
Now, golf isn't usually considered a separate sector but, because of its visibility in the desert, it tends to get a lot of scrutiny, so let's talk about golf supply and demand in a little more detail.

There are approximately 45 golf courses in the Tucson AMA, and these accounted for approximately 6% of the AMA's total water use in 2006.



First, let's look at the graph on the left. As you would expect, as the number of golf courses in the AMA increased over the last two decades, water use by the golf sector has also increased, though a growing portion of that demand has been met with reclaimed water, and that's shown in purple. This graph shows not only how turf demand has changed, but how we are putting a portion of our growing effluent supply to use.

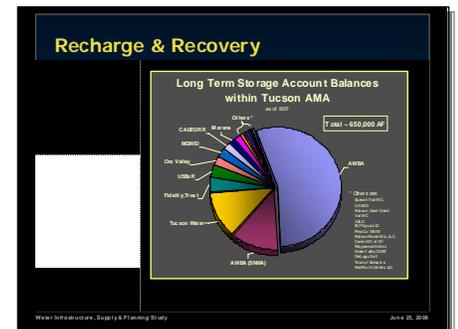
As Ken mentioned earlier, most of the region's effluent is discharged into the Santa Cruz River; a fair amount of that does recharge the aquifer, but there is ongoing interest in managing that supply to a higher degree. Currently, more than 14,000 acre-feet of effluent receives additional treatment and is delivered through the City's reclaimed system. As you can see from the golf course map on the right, that system now extends throughout the metro region, and was recently connected to systems as far north as Oro Valley. Purple dots represent courses now using reclaimed water; and yellow dots represent courses still on groundwater; green represent courses using CAP credits or surface water.



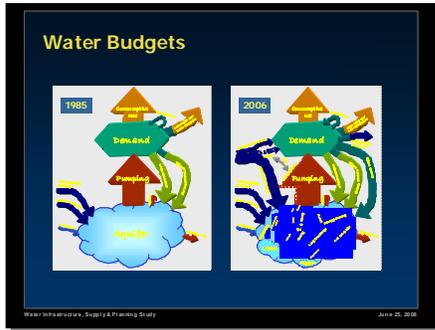
In addition to using more reclaimed water, the region is also putting a greater portion of its CAP water to use. Since the end of Tucson Water's direct delivery more than a dozen years ago - shown here in yellow - the region's use of CAP water has steadily increased. Most of that use has been through direct recharge - shown here in light blue. Direct recharge is when water is delivered to large basins or washes where it can infiltrate rather quickly. We also have used CAP water at local farms where a credit is earned for groundwater that would've otherwise been pumped; this is called "indirect recharge," and is shown in green.

Agriculture also has been taking some CAP water that does not earn an offsetting credit; this water is called "non-Indian ag pool water" or "NIA water" - shown here in aqua. And, finally, the Tohono O'odham have been using CAP water on their farms and for recharge - and that's shown here in pink. So, as you can see recharge is the primary way the Tucson AMA is using its renewable supplies.

So, as you can see recharge is the primary way the Tucson AMA is using its renewable supplies.



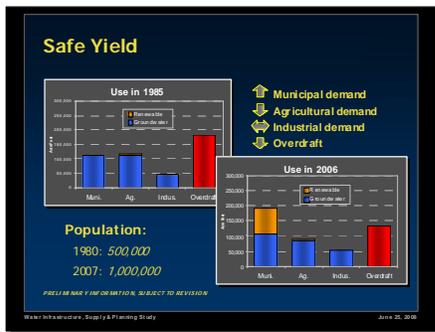
As Jeff briefly explained earlier, recharge activity is tracked and regulated by ADWR, and serves a variety of purposes. Some recharged water is being used to satisfy annual requirements of the Assured Water Supply Rules and some is being stored for later use. This pie chart shows some of the largest recharge credit holders in the Tucson AMA; the Arizona Water Banking Authority is by far the largest. Recharge has allowed Arizona to use its renewable supplies earlier and more extensively than otherwise possible, but it is also one reason that tracking the components of our water budget has become much more complex.



A water budget is a tool that provides an accounting of gains and losses, or fluxes of water in a specific area over a specific period of time. The Tucson AMA's water budget in 1985 was relatively straightforward and simple: There was no CAP, no recharge, no Arizona Water Banking Authority, and no Assured Water Supply Rules to factor in. Now, however, as you can see from this illustration of a more current water budget, there are a myriad of components that need to be considered. The Tucson AMA's management goal of

Safe-Yield is tightly linked to the water budget calculation of overdraft. Overdraft occurs when an aquifer's losses exceed its gains over a period of time.

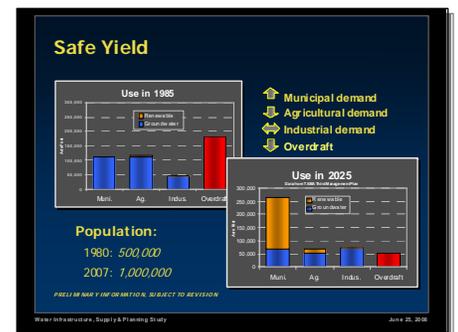
Currently, ADWR is in the process of calculating overdraft for all five AMAs using a standardized budget template. The numbers I'm about to present today are still in draft form, but should be finalized sometime in July. This work is part of the Department's assessment of the AMAs, which will eventually lead to the development of the Fourth Management Plans.



This slide shows us a number of important things: It shows us that overdraft, illustrated by the red bars, is still a major policy concern in 2006; however, it also shows us that overdraft in 2006 is approximately 25% less than it was in 1985, in spite of the fact that the population has doubled since 1980. Some of this was due to reduction in agriculture and improved

conservation, but the main factor is the increased use of renewable supplies, primarily in the municipal sector, and the renewal supplies are shown in yellow; groundwater supplies are shown in blue.

We can take this approach one step further and using the third Management Plan, Water Use and Supply Projections, display what things might look like in 2025 when overdraft is reduced to close to 50,000 acre-feet; this scenario involves a greater reduction in active farmlands and the use of more renewable supplies by all three sectors.



So, in summary, even as the region continues to grow, the Tucson AMA is making progress toward Safe-Yield, and we expect to continue to see groundwater reductions and

increase use of renewable supplies in the future. It is, however, important to note that, as our population continues to grow, it will start to get more difficult and expensive to secure each new increment of renewable supply. Furthermore, as we get closer to achieving Safe-Yield, the attention of water managers is increasingly focused on areas without direct access to these non-groundwater supplies. Thank you.

CHAIRMAN JIM BARRY: Thank you, Laura.

* * * * *

QUESTIONS AND ANSWERS WITH PRESENTERS

CHAIRMAN JIM BARRY: All right. We'll open it to questions for these four - (phone ringing) - it's not me - anybody have any questions in the audience? Yes?

UNIDENTIFIED FEMALE SPEAKER: (Inaudible; not speaking into a microphone.)

CHAIRMAN JIM BARRY: If they're willing to do so, I have no problem with that. Okay. Now that you're all up there, does anybody have any questions? We'll start here.

UNIDENTIFIED MALE SPEAKER [Chuck Fritas]: (Inaudible; not speaking into a microphone) - large amount of recharge, are you satisfied with recovery of that recharged water? (Inaudible).

MR SEASHOLES: I'll take that. In part because the largest block of water is held by the Arizona Water Banking Authority, and it's held for a number of different purposes, and one of those purposes is for firming the subcontract supplies of CAP in times of shortage - of declared shortage on the Colorado River. CAWCD, CAP has a responsibility of doing that recovery and is partway through a recovery planning process.

A conceptual plan was presented to the community; it was approved by the CAWCD Board; it was also presented and approved by the local Groundwater Users Advisory Council; and we're now working on the implementation phase of the recovery planning process. There's a meeting in the Tucson field office on July 2nd to do the kick-off for that phase of the recovery planning. We expect that to be probably a year-long process, but there is an ongoing process to make sure that we can get the water back out of the ground both for times of shortage on the Colorado, and also for interstate recovery. We've stored water both in this AMA and the other AMAs on behalf of Southern Nevada Water Authority that we will recover earlier.

CHAIRMAN JIM BARRY: I think there's a question right there. We'll move across the room. Okay.

KIP VOLPE: Yes, this is for Cliff Neal.

CHAIRMAN JIM BARRY: Could you give us your name, please, for the record?

KIP VOLPE: Kip Volpe (ph.), Vail Water Company.

CHAIRMAN JIM BARRY: Thank you.

KIP VOLPE: I noticed on your chart, your bar chart, that while your obligation for future provisions for water has increased over the state, it looked like Tucson AMA's has actually shrunk, and what would be the cause of your future obligations shrinking in Tucson?

MR. NEAL: I think probably what you're referring to is our historic obligations; that chart. What we had negotiated with the City of Tucson was a Member Service Area

Agreement in which they agreed to report a 5,000-acre-feet-per-year as excess groundwater through the years 2001 through 2006, just as a way of generating revenues for the CAGR, kind of as a payment for enrollment. Tucson's enrollment fee was about \$50 at the point that they enrolled, and the only way that CAGR generates revenue is if their members actually report excess groundwater use and pay us an assessment. So, that was by arrangement; that arrangement ended - '07 was the first year, and that's why you saw that kind of shrink down in '07. Does that answer it for you? Okay.

CHAIRMAN JIM BARRY: Bob, we've got Chris Avery saying this is not a meeting, 'cause we don't have a quorum and the members of the Committee are asked to not ask questions. The audience can, but we can't.

ALTERNATE MEMBER BOB COOK: (Inaudible; not speaking into a microphone.)

CHAIRMAN JIM BARRY: Now, you are - now you don't because you're a member - alternate, but you don't. I'm sorry.

UNIDENTIFIED FEMALE SPEAKER: It's a catch 22.

MARGOT GARCIA: Margot Garcia. In looking at what's happening to the mining, I wondered if you could comment at all about the Rosemont - the proposed Rosemont mine, what it would do to those kinds of projections. There's a lot of discussion about where their water might come from and how that would impact some of your slides and projections of tables.

MR. TANNLER: Rosemont Copper Mine has a mineral extraction permit - one of those controversial things I mentioned; it allows 6,000 acre-feet per year of groundwater withdrawal; and that's a 20-year permit. Now, there's been talk in the community about possible recharge and recovery of water, other options. We haven't had any applications that have been submitted. So, what we have on the table at Department of Water Resources is 6,000 acre-feet per year of groundwater. Laura, do you want to add?

MS. GRIGNANO: Just to put that in perspective, the current mines - and I showed you the graph that fluctuates, depending on the price of copper - the current mines are using a little more than - probably 30 to 35,000 acre-feet currently, so that would add about five to 6,000 acre-feet to that, if they used what their Mineral Extraction Permit is good for.

CHAIRMAN JIM BARRY: Any other questions?

MR SEASHOLES: Let me -

CHAIRMAN JIM BARRY: Oh -

MR SEASHOLES: - and one other piece of that, too, and that is that Augusta Resources, which is the parent company, has an excess CAP contract - this is not a long-term contract; it's a year-to-year ability to acquire CAP water - spot-market CAP water - and they have been recharging that water in the lower Santa Cruz Recharge Facility and accruing long-term storage credits for that activity.

MS. GRIGNANO: One more thing to add - I'm not exactly clear on the figures - but, I do believe in our projections in the Third Management Plan, we were projecting that the mines were using more than they're using right now, just the ones that are in existence, and I think that might've been around 40,000, but I'd have to check that figure. So, we're still under that.

NANCY FREEMAN: Augusta Resource -

CHAIRMAN JIM BARRY: Could you give us your name, please, for the record?

NANCY FREEMAN: Sure.

CHAIRMAN JIM BARRY: Thank you.

NANCY FREEMAN: Nancy Freeman. Augusta Resource plans to use a dry stack tailing (inaudible), which really hasn't been tested in the U.S. at all, and should they decide that they need more water, couldn't they just go in and get another permit for another 6,000 feet for 20 years? So there's - this is just a pie-in-the-sky estimate at 6,000.

MR. TANNLER: If they applied for a second Mineral Extraction Permit, or applied to modify the one that they have now, they would need to back up with evidence why they need more water. They would need to supply documentation showing that they needed "X" amount more. So, it is theoretically possible that they could get more water if they needed it.

DALE KYES: Dale Kyes (ph.). I'm looking at your bar chart for 2025. The overdraft numbers are still pretty significant. Is this an admission that it's not possible to reach Safe-Yield by 2025?

MS. GRIGNANO: Well, again, that was in the Third Management Plan; those were the Third Management Plan projections, and we're currently working on the assessment; that will lead us into the Fourth Management Plan. We'll also be working on new projections based on the results that we get from the assessment that we're working on, so they could change.

MR. TANNLER: One other thing I'll add to that, to get to Safe-Yield we're going to need to, of course, continue to conserve water, but it's also going to be very important to find new sources of renewable supply; that's what's likely to get us closer to Safe-Yield.

COLETTE ALTAFFER: Colette Altaffer. I'd just like clarification on the Assured Water Supply designation. If you a member land and you are located in an Active Management Area, but you are not located anywhere near infrastructure, water infrastructure, like Tucson's Water infrastructure, does that mean when you get a contract with CAGR D that, in essence, you are saying on paper that 8% of your water is groundwater and 92% is renewable sources but, in reality, 100% of your water is groundwater?

UNIDENTIFIED MALE SPEAKER: Cliff, take a shot at that?

MR. NEAL: Yeah, if they don't take direct delivery of renewable sources and they are going to rely solely on groundwater, then the water that will be delivered to those homeowners will be groundwater; however, to comply with the consistency with management goals, it has to be replaced or replenished, and if it's a member land, that's CAGR D's job; if it's not a member land, somebody else may be doing it for them, but I think you're correct. Does anybody have anything to add to that?

MR. SEASHOLES: Just to clarify, there's a phase-in allowance, 8% under the Third Management Plan - the groundwater doesn't have to be replenished, so there's a small block of water that does not require this offsetting replenishment.

In the Fourth Management period in 2010 and - through 2020, that drops to 4%, and then it drops to zero. So, the 8% just represents the portion of the groundwater that's associated with the certificate that doesn't require Cliff to replenish, but all of the water that's associated with that certificate with the member land is considered groundwater.

CHAIRMAN JIM BARRY: Any other questions?

UNIDENTIFIED MALE SPEAKER: Yeah. Yeah, I'm sorry. Did I scare you? I have a couple questions.

CHAIRMAN JIM BARRY: Can you give us your name, please?

UNIDENTIFIED MALE SPEAKER: (*Transcriber's Note: This gentleman is very hard to understand due to an accent.*) My name is (inaudible). One of the questions is about the reuse of effluent. From the presentation, I had the impression that the wastewater effluent is reused for the golf course and irrigation purpose. So, the question is: Wastewater can also be reused for potable water purpose, reused for membrane technology and treat the water to the potable water quality and we can recharge that and pump it out, so this is one application which might be of interest in some areas of the world. So, the question is: Is this something we can consider for this planning?

The second question is about the salt. You know, we are relying on the CAP water, which has a very high concentration of salt, so there is a flux from the CAP water of the (inaudible) salt, you know, deposit in this area, so which may result in the steady increase of the groundwater salt concentration. So, it is something also of this study. Thank you.

MS. GRIGNANO: The first issue that you brought up, I believe that the municipal providers are looking into that for future use, using reclaimed water for potable use.

And, yes, you're right, as we use more, as we reuse water - as groundwater we use through the reclaimed system gets saltier and saltier, the more times you use it, as well as CAP, salt will become an issue, the more renewable supplies we use in the area. I think Phoenix is experiencing those issues sooner than we have because of more surface water supplies and saltier supplies.

CHAIRMAN JIM BARRY: Anything else?

TRACY WILLIAMS: Good evening. This is Tracy Williams. And I have a couple of questions for Cliff, and I'm really glad you came all the way and we could finally get a little more acquainted. It's not -

MR. NEAL: It's on.

TRACY WILLIAMS: Hello?

MR. NEAL: I hear you. I can hear you loud and clear.

TRACY WILLIAMS: I usually don't need a mic. Where will the water to meet the replenishment obligations come from? I would like to have a dialogue, so I have four questions for you. And then, once you answer one, if you would indulge me, I'll answer - ask the second one.

MR. NEAL: It's the Chairman's show, so if that's okay with the Chairman, it's fine with me.

I had put up a pie chart indicating the portfolio of supplies that's in the Plan of Operation that includes effluent, and the imported groundwater, Indian leases of CAP water, along with CAP M&I subcontract that we currently hold, and then some spot markets - so, it's a portfolio of supplies. So, hit me with your next one -

TRACY WILLIAMS: Okay.

MR. NEAL: - extension on that one.

TRACY WILLIAMS: What effect will the CAGR'D's activities to obtain additional water supplies have on the plans of other entities?

MR. NEAL: That's a good question. I hope that we'll be able to work together, because I don't know if you noticed from the map that I showed, but any other entities at least in the

Tucson Active Management Area that are out looking for supplies are already members of the CAGR. So, we won't be competing with those folks because, to the extent they can get a renewable supply themselves and deliver it directly, it reduces our obligation, and we don't have to get the supplies. So, from that perspective, I hope we shouldn't be competing with them.

Now, if you're talking about mines or something else, that may be a different story, and I think we would be competing directly with that type of an entity; but as far as the municipal uses and those municipal providers, I hope we won't be competing; at least I hope they don't think we'll be competing with them, because we don't plan to.

TRACY WILLIAMS: Have you figured out the costs? We never see any money associated with the replenishment. Is there any pie chart with money?

MR. NEAL: Well, under our Plan of Operation, we made a projection that the cost to acquire those water rights would be over a quarter of a billion dollars. In our initial work with respect to effluent, that's looking like we've undershot that.

So, I don't know if you've been following what's going on with our Board of Directors over the past six or eight months, they've been looking at new rates and fee structures for CAGR members; and, in fact, made a fairly significant increase in rates and fees just last week to address those increased projections of costs.

TRACY WILLIAMS: Thank you. And are we allowing too much growth not based on showing the 100 years' worth of firm supply to occur in the Tucson AMA?

MR. NEAL: I don't think so, because I think that any new growth has to show 100 years' of firm supply. Now, what is your definition of "firm supply?"

TRACY WILLIAMS: That's what we're trying to figure out here.

MR. NEAL: Okay. Well, in order for a certificate to be -

TRACY WILLIAMS: Firm supply to me is not pay for water, for one. Firm supply would be drinkable, potable, good for the environment, wet water.

MR. NEAL: Well, that's a heavy-duty requirement. No, the Department of Water Resources' job is to make an analysis, or review an analysis, of the water supplies that any new prospective Assured Water Supply applicant proposes to use, and that would include groundwater backed up by replenishment from CAGR.

So, from the perspective of a certificated area or a homeowner in a designated provider service area, DWR should have reviewed the analysis showing whether there will be water to serve that project; that's part of the proof of an Assured Water Supply is showing there's water physically, legally, and continuously available for 100 years; that it meets quality requirements; that it's consistent with the goal; and there's a couple of other ones I don't remember, Tracy, but that's their job.

Our job then is, to the extent that any of that is groundwater, we find a renewable supply and bring it in and keep the aquifers, the AMA, in Safe-Yield. Our job isn't to deliver water to the homeowner; the homeowner's getting water from their provider. I don't know if that answers your question. I hope it starts to.

CHAIRMAN JIM BARRY: Anybody else? Any other questions? Yes?

COLETTE ALTAFFER: Yes, Colette Altaffer again. I just have two questions. One is: When you get subsidence, your aquifer loses some of its capacity to hold water, does that aquifer ever recover? And, if so, does it recover to 100%, or only 80%?

And then, second of all, is it possible for someone to have an Assured Water Supply designation or certificate and still drill a well deeper than 1,000 feet?

MR. SEASHOLES: The answer to the first question is: It depends. The answer to the second question is: Yes. So, there can be some recovery; some elastic rebound if water levels are brought back up in an area of subsidence, but that does, in fact, depend. You can have inelastic compaction of the subsurface layers and you don't get all of that back. I'm not -a geophysicist so, you'd have to ask them how much you get back.

There is some confusion about the depth of wells relative to the assured supply requirements associated with the maximal draw-down. The analysis that's done for either - for an application for assured supply, if it's based on groundwater, shows that the projected decline of the water levels can't exceed 1,000 feet or the bottom of the aquifer, whichever is shallower; that isn't a prohibition on the depth of the well - operational wells. Oftentimes for production purposes, or for other operational reasons, wells are drilled deeper and screened deeper. The 1,000-foot requirement is not a prohibition against deeper than 1,000-foot wells.

CHAIRMAN JIM BARRY: Dale?

DALE KYES: Dale Kyes again. To what extent do your projections take into account the continuation of long-term drought, perhaps very significant drought in the southwest, and the very real possibility that the Arizona's allocation from the Colorado River can be cut back significantly?

MS. GRIGNANO: I'll address the projections that I showed on the 2025. I think we kept the net natural recharge at an even keel throughout the years. I think - is that fair to say? Or we did not include the drought? That was done in 1995, so . . .

DALE KYES: So, would the next plan include some anticipation of droughts, or at least some uncertainty about it?

MS. GRIGNANO: That would be a good thing to talk about as we're working on those projections, yes.

MR. NEAL: Let me add to what - CAGRD's projections. CAGRD's projections are admittedly conservatively high. We did not assume a drought, because we assume that in a drought people will start cutting back. Our obligations reflect normal kind of pumping activities, so just to make sure that you're clear on that; that's what our projections represents.

VINCE VASQUEZ: Just a point of clarification, I think for Ken.

CHAIRMAN JIM BARRY: You want to give us your name, please?

VINCE VASQUEZ: I'm sorry. Vince Vasquez. You said 60 million acre-feet of groundwater, Tucson AMA? I just wanted to put the overdraft thing in perspective saying the 50,000 acre foot draw-down or overdraft -

MR. SEASHOLES: Yeah.

VINCE VASQUEZ: - and 60 million acre-feet of available groundwater and, if my math's correct, that's 1,200 years of - I mean, given localized declines, that 1,200 years without - that's -

MR. SEASHOLES: Then let me respond to that. There wasn't actually a question there, but I'm going to respond it anyhow, which is: The calculation of how much groundwater there is - first of all, that's a rather loose estimate; this comes out of work done by the USGS and ADWR - down to 1,200 feet. How much water is there down to 1,200 feet? There's - as one of the maps that I showed, showed the aquifer extends many thousands of feet, down to 10,000 feet in some places, but that number is not especially meaningful - it's a very large number - but, it's not very meaningful in terms of a water supply, because if you actually tried to access that 60 million acre-feet, you would make the place unlivable because you would have severe consequences associated with subsidence, fissuring, drops in water quality.

So, there is a lot of water down there, but taking that water and assuming that it's available to use in an area that's urbanized is not a very good assumption; and that is, in fact, a major reason why overall Water Management goal of Safe-Yield makes sense.

VINCE VASQUEZ: I just wanted to clarify (inaudible; not speaking into a microphone) procedures (inaudible).

DALE KYES: But, there is a legal requirement that we reach Safe-Yield as well.

MR. SEASHOLES: Attempt to achieve.

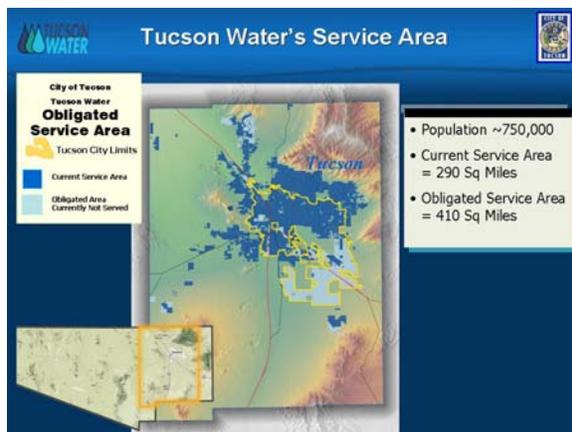
CHAIRMAN JIM BARRY: Any other questions? I - I want to thank Ken, Jeff, Cliff and Laura; that was very good. We appreciate your coming here and . . . (applause). Why don't we take a short break and then we'll get Tucson Water and Wastewater to get up here and give us their words of wisdom.

* * * * *

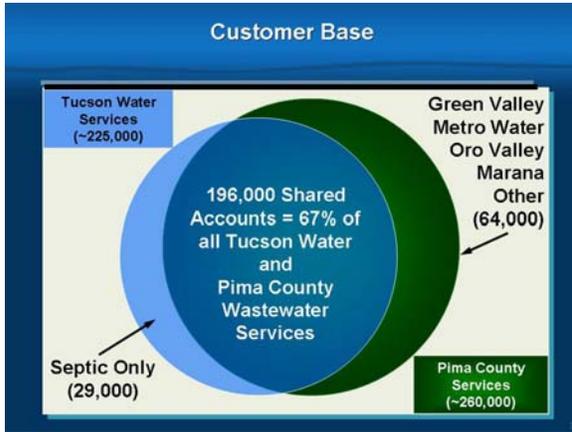
(Break taken at this time.)

* * * * *

**CUSTOMER DEMOGRAPHICS; WATER DEMAND;
WATER QUALITY; WATER SUPPLIES
PRESENTATION BY CHRIS AVERY, INTERIM DEPUTY DIRECTOR
TUCSON WATER
AND
ERIC WIEDUWILT, INTERIM DEPUTY DIRECTOR, RWRD**



MR. AVERY: - and the way that these demographics work out is illustrated by this diagram on this slide. Tucson Water's total services are approximately 225,000; and, of those 225,000 customers, about 29,000 are septic-only largely located in those three areas: Tucson Mountains, older parts of the Catalina Foothills, and the Tanque Verde Wash area.



In addition, Pima County has approximately 20 - 260,000 separate accounts; and, of those accounts, approximately 64,000 are not Tucson Water customers. Those customers are located in the Metropolitan Domestic Water Improvement District Area, the Town of Oro Valley, Town of Marana, Green Valley, and other unincorporated areas of Tucson. The overlap accounts for 196,000 accounts, or approximately two-thirds of the

total customers are shared in common by Pima County Wastewater and Tucson Water.

Last - two weeks ago, last meeting, we - we showed this slide that shows Tucson's use in the year 2007, and we'll talk a little bit about what an acre foot is later, but I think it's important to note that if gasoline were sold in acre-feet, an acre foot of gasoline would cost about \$1.3 million. And, if you pay more than a buck for your bottle of beer, it costs you about \$4 million an acre foot or more. So, an acre foot's a substantial amount of water.

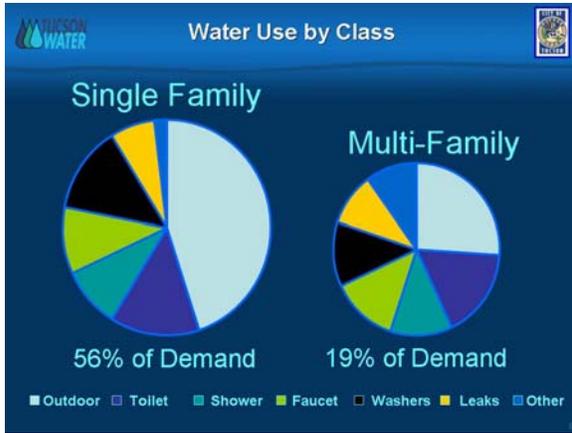
Tucson Water's customer demographic works out this way: About 93% of our customers' accounts are residential, either single-family residential or multi-family residential, with the remainder commercial and industrial accounts. About 75% of our water use also goes to serve residential use, whether single-family or multi-family residential customers. Twenty-five percent of our water use goes to support commercial customers. This 25% of Tucson Water's delivery is what, essentially, supports the backbone of Tucson's economy.

And two weeks, when I answered the question about how much water is used outdoors, I answered that about 45 to 50% of the water is used outdoors, and that's based on the residential category. If you add the total between residential, multi-family, and commercial, about 40% of the water that Tucson delivers to its customers is served outdoors and isn't available to the wastewater systems for recapture.



This is a way those demographics work out on the single-family and multi-family categories. You can see that most of the water used for single-family, as well as multi-family customers is used outdoors. The other dominant consumers of water in both categories are toilets and washing machines in - in these particular

categories. And that, as we move forward to discuss conservation in the - in future discussions, those uses are going to form some of the prime candidates for conservation potential in the Tucson Water Service Area.



In the commercial and industrial category, you can again see that outdoor water use and restroom use here are the predominant consumers of - of water in that particular sector.

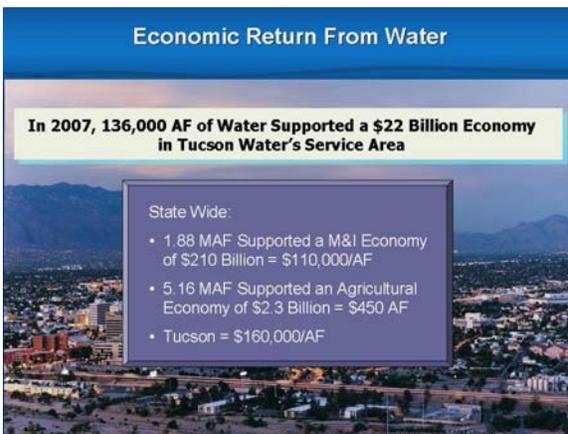


And, when you look at reclaimed use by customer category - you know, Laura also showed how reclaimed water is - is distributed spatially throughout the system - and in Tucson Water's particular system, you can see that the dominant users of reclaimed water are golf courses, and that dominance's even more enhanced when you understand that most of the deliveries to Pima County for the

Arthur Pac - former Arthur Pac Golf Course, now called Crooked Tree, and to the Town of Oro Valley, also go to golf course usage, and the remainder is to parks and schools and to other customers, including private residences and outdoor landscaping. By far the majority of customers on the reclaimed system are located in this category in terms of numbers, but their volumetric use is small.

How does this all work out? Well, in 2007, we estimate that Tucson Water served about 80% of the potable municipal and industrial water that was served in the Tucson area, and the entire economy of the Tucson area was about \$27 billion in gross domestic product. So, I think it's fair to say that 136,000 acre-feet of Tucson Water delivery supported a \$22 billion economy in our service area.

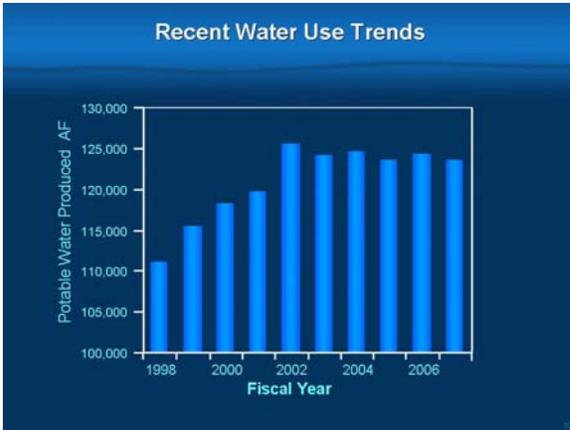
How does that compare? Well, statewide, on the municipal and industrial sector,



approximately 1.88 million acre-feet supported a municipal and industrial economy in Arizona of \$210 billion, which averages out to about \$110,000 an acre foot. For agriculture, 5.16 million acre-feet supported an approximate \$2.3 billion economy; and, even rounding up, you get \$450 an acre foot.

And Tucson is especially efficient in its use of water. The way it works out in the Tucson area, an acre

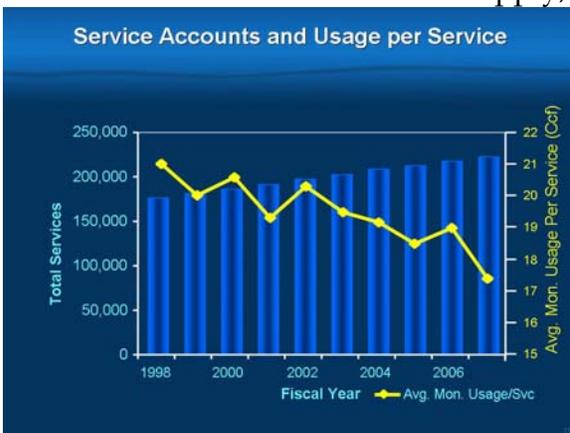
foot of water delivered to Tucson Water's customers supports about \$160,000 worth of gross domestic product.



Here's some of the recent water use trends. This is a chart that shows Tucson Water's accumulated deliveries in - in - in potable water over the last decade, and you can see that there's a relatively steep climb for the first few years. And, starting in 2002, some interesting things started to happen in Tucson Water's demographics. That's even more interesting when you take into account

what was happening in terms of our increased number of customers or accounts. Between 1998 and 2007, you can see that we grew from approximately 175,000 accounts to the 230,000 accounts that we have today.

What does that mean with a flat supply, increasing number of accounts? It



means decreasing demand per account; and, in fact, these numbers with - are - are - are very startling to me. If you look at this number, you can see that between 1998 and 2007, the average customer of Tucson Water's use diminished from somewhere around 21 Ccf per month to somewhere around 17 Ccf per month. And, although there's some statistical variation in this sample, I

think it's fair to say that, on a per-customer basis, or per-account basis, Tucson Water's demands have decreased about 15 to 20% over the last ten years on a - on that per-account measurement.

As we move forward, the fact that the water that Tucson delivers supports a robust economy, and the fact that Tucson Water's deliveries to

customers has diminished on a per-account basis over time means that we have a lot of opportunity to meet the challenges of the future, and we'll talk a little bit about those challenges in a few minutes when we get into the water resources picture.

Water Matters
Infrastructure, Supply & Planning Study
A City of Tucson and Pima County Cooperative Project

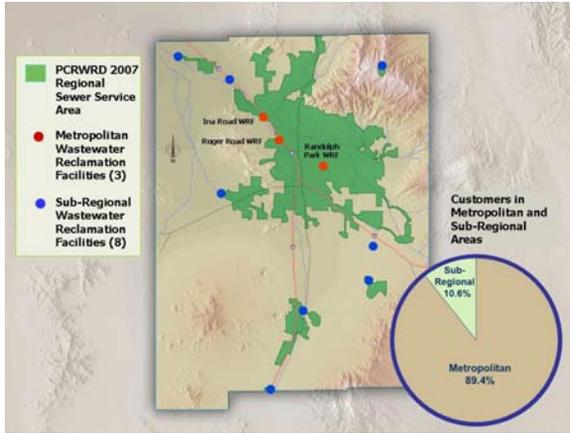
Customer Demographics

QUESTIONS

Chris Avery, Acting Deputy Director, Tucson Water
Eric Wieduwilt, Acting Deputy Director, Pima County Regional Wastewater Reclamation Department

June 25, 2008

I'd now like to introduce Eric Wieduwilt, who's the Acting Deputy Director of Pima County Wastewater, or Pima County Water Reclamation Department. I've been practicing that for two months and I just can't quite get it.



MR. WIEDUWILT: Thank you, Chris. Good evening everybody. I do want to start out to say that after the presentation we saw on the AMA, talking about customer demographics is not really exciting. So, hang on, let us go through this information.

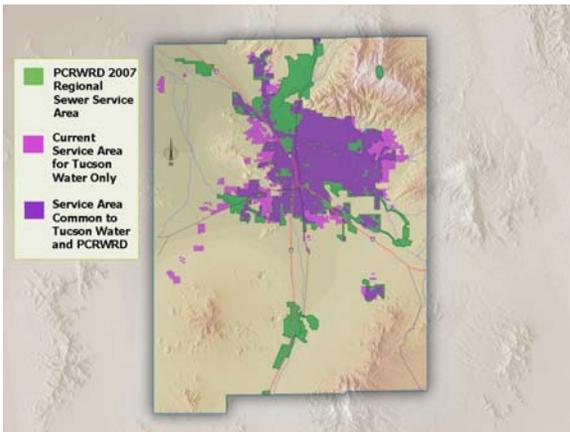
There are two points that I think you'll walk away with when we get done with this part of the presentation. The first is that between

our two agencies, there's a lot of similarities; and the second thing is there's also a lot of differences, and those are the ones we'll try to emphasize as we go through.

Again, to refresh your memory of where we are with Pima County Regional Wastewater Reclamation Department, we have three major metropolitan facilities: Ina, Roger, and the Randolph Park Facility, and eight sub-regional facilities that serve those areas that we call "non-metro."

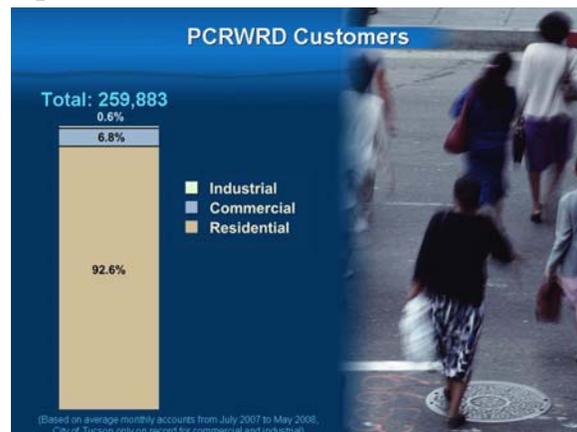
If you look at the customer demographics pie chart on the lower right, about 10% of our customers

come from those outlying areas, and 90% come from the metropolitan area.

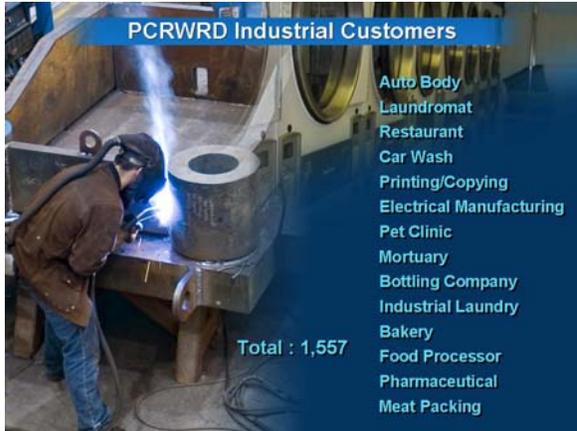


As Chris mentioned, our two current service areas overlap a bit. There's also outlying areas where Tucson Water supplies and we do not supply equal wastewater service, other areas

that we do the wastewater service for other water companies, and scattered throughout are those septic systems Chris mentioned in the foothills predominantly, but we also have them in central Tucson; they're everywhere.

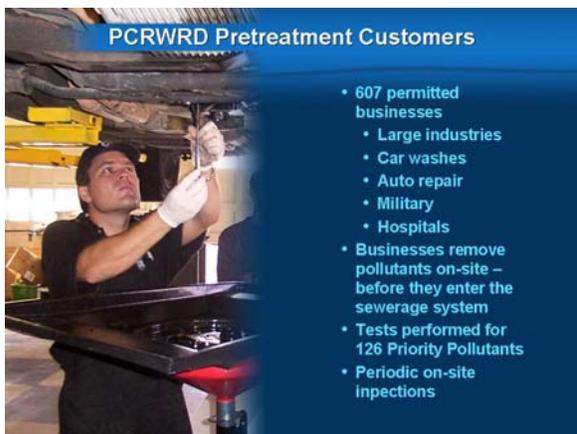


Looking at our demographics for our customers, 92% are residential, and the remaining small percentage are industrial and commercial. We separate our two, industrial/commercial, residence, because of our pretreatment program. I'll go into that in a little more detail in a second.



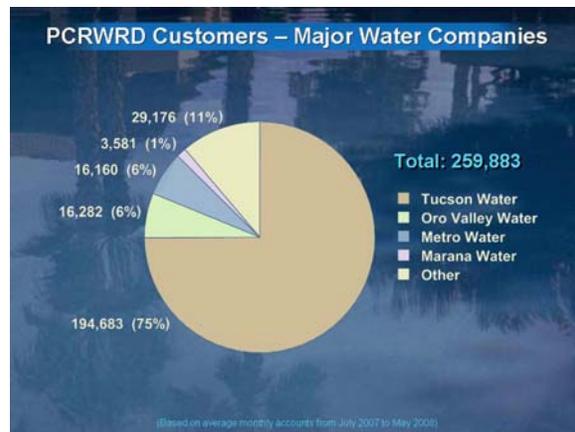
that which we send down to the wastewater system. Our industrial customers cover the gamut of everything you could imagine is in the City of Tucson; listed are a few of them, anywhere from meat packing to laundromats, to pet clinic mortuaries. We have 1,557 industrial customers, and we do have a regulatory requirement to have a pretreatment program where all the significant industrial dischargers are monitored.

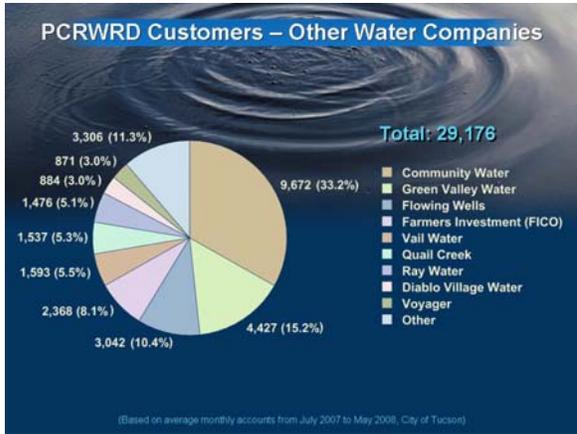
If we look at by volume, I think we're seeing the same numbers that Chris presented. The commercial/industrial portions use a lot more water than they have number of customers. We are also seeing our residential water usage dropping dramatically. And I think, as we update our design standards, we have to take that into account; that we are becoming much more efficient in our water use and



We have 607 permitted businesses right now, and the intent is to protect the biological activities in our treatment plants, and to make sure the effluent that we discharge has a minimal amount of contaminants and pollutants.

Looking at our major water suppliers that we serve from the wastewater side, Tucson Water, Oro Valley, Metro Marana are the larger ones. The pie chart goes from top center to the right if you wanted to try to match colors with names.





And then from that smaller chunk, we have a large diverse group of water providers that we provide the sewer service to.

We'll also mention that for these numbers, we have references of which report they came from. When our report is developed at the end of this process, that reference document will be incorporated. So, walk away with maybe the percentage distributions, and don't focus so much on the specific numbers.



In 2007, we also implemented an outreach subsidy program for those residents that need some help with their sewer user bills, and we have a total of 1,233 enrolled currently, divided into different tiers of needs for their sewer user bills.

Very exciting -- that's the end of the demographics part. We're going now to open the floor for questions for customer demographics, and then Chris will come back and we'll sort of tag team as we move into the resource part of it. So, any questions?

UNIDENTIFIED FEMALE SPEAKER: (Inaudible; not speaking into a microphone.)

MR. WIEDUWILT: Six percent of our customers come from Metropolitan.

TRACY WILLIAMS: Okay. This is for Chris Avery. Tracy Williams. (Inaudible; not speaking into a microphone) in the southlands that - and - and you said that you were obligated to serve, and can you explain what that obligation is?

MR. AVERY: Sure. I'd be glad to. Generally, the law in Arizona states that when a city that owns a municipal water company generally has an obligation to provide water on a more-or-less equal basis to all of the areas or



spaces in the City limits, and so the City of Tucson's City limits include that - that large southlands area that hasn't been developed yet, but the annexation of those lands brought with it an obligation that Tucson Water provide service to the residents - the future residents of those areas on the same basis as residents who may - might move in somewhere else.

TRACY WILLIAMS: (Inaudible; not speaking into a microphone.)

MR. AVERY: The area that's shown on the map is the area within the City limits. There's - there's a Swan southlands area that's owned by Diamond Ventures, I think - am I getting that right? That isn't within the City limits, but the - generally that area's called the "southlands," and there was an annexation that was done approx- - Albert you got the answer to that? Eight years ago? Yeah, eight to ten years ago, there was a large annexation on the south - south side of Tucson.

UNIDENTIFIED FEMALE SPEAKER: I was wondering when you were talking about the water usage going down in Tucson since 2002, if you did figures on how many people dug their own wells and got off the grid because, obviously, the people that wanted to invest in drilling their own well and getting off the grid were people that were heavy water users?

MR. AVERY: I can answer that question partially, but not completely. We've got folks at Tucson Water who are looking into this question extensively, and the question of whether private well ownership might be a factor, it - it's not a - it's not a factor that we think is important, but it's something that I will look into and get back to you with an answer about some estimate for the number of private wells that may have been drilled since 2002 and what their effect might've been on our - on our customer demographics.

There's no question that there were some private wells that were drilled in the - in the Tucson Water Service Area during that period of time, but that era is largely over now with some recent amendments to the Arizona Revised Statutes that preclude the drilling of private wells, or exempt wells, within a Water Provider Service Area.

UNIDENTIFIED FEMALE SPEAKER: Thank you.

COLETTE ALTAFFER: Colette Altaffer. That annexation that occurred in the southlands area, when that annexation occurred the pre-annexation agreement indicates that the State retained both the mineral and the grazing rights. Is it possible that they could permit some form of mining to occur in that area that would then throw off your water projections?

MR. AVERY: I don't know the answer to that question. Albert - Albert, though - Albert Elias, the City of Tucson Planning Director, can probably help you with that, though.

Albert Elias?): You know, Col- - Colette, on that question, I'm - I'm not aware of any provision in there regarding mining rights, but I suppose, in theory, the State Land Department could grant a license for someone to do some kind of mining in that area. I know that that was never really contemplated from

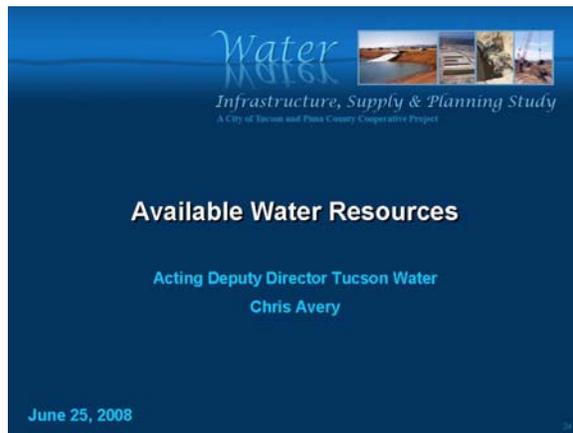
the City's point of view, and I think if they did try to issue a mining license in that area, they would be required to notify the City and - so, I don't think that was ever given, you know, much thought, and I think the way the system is set up for them to issue a mining license, I would say it's probably pretty unlikely.

MR. AVERY: I can answer the question from a quasi-geological point of view, and - and the answer to that question is that the southlands annexed area is largely alluvial basin fill and the - I don't know what the depth of the hard rock is there, but it's substantial.

COLETTE ALTAFFER: So - so, if there's a sand-and-gravel operation in there, how much water do they typically use?

MR. AVERY: I don't know the answer to that question either. Laura - Laura can help you, though. We got lots of expert here, yeah. Right? Got to be careful I don't overstep myself here. All right.

After talking about customer demographics, it's now time to talk a little bit about available water resources, and I'd like to start my discussion tonight with a little bit of a reference to an article that appeared in the newspaper this morning that was a consequence of a talk that was given yesterday morning at the Water Resources Research Center Conference at the Biltmore in the Phoenix.



And one of the presentations during that conference was a look to the future about how the tri-county, CAWCD Service Area would be using water 40 years from now, and one of - one of the components of the speaker's talk was a discussion of how Colorado River Water, effluent, and groundwater would be used 40 years from now. And the speaker predicted that the - there would be dramatic reductions in the use of - in

groundwater pumping, almost to effectively zero in the three-county area; that reclaimed water would form about 30% - that reclaimed water would be captured at about a 40% rate; and that it would be distributed to customers at about a 30% rate; and that most of the major contractors of - of Colorado River Water and the CAP canal would use Recharge and Recovery Operations in order to forestall the short-term effects of drought, shortages, or infrastructure failures on the CAP. And I'm here to report today, as we go through this presentation, that Tucson and Tucson Water is already 40 years ahead of the game with respect to all those water resources.



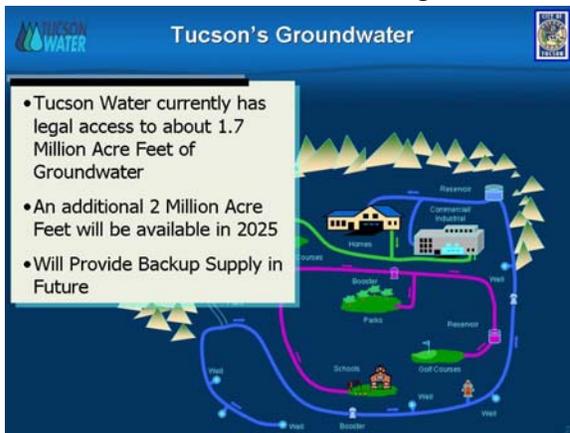
Let's talk about those three resources: Colorado River Water, groundwater and effluent. The most important resource in Tucson's past has always been groundwater, and it's the source of supply that we relied upon virtually from the inception of the City of Tucson until the year 2000. And we

talked a little bit about the groundwater system and supply in last - in the last meeting, and - and about the infrastructure that Tucson Water built over the years and that's still available to deliver that source of supply to Tucson.

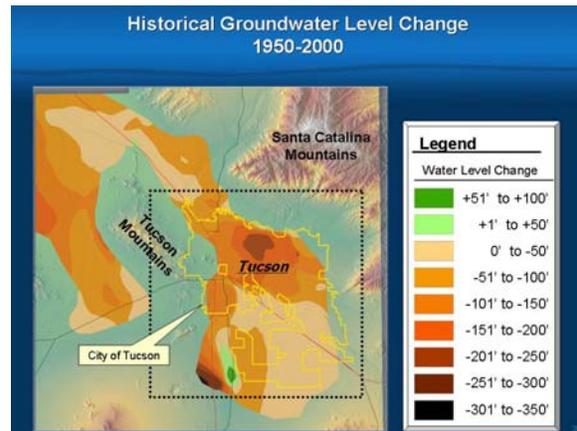


As - as - as for legal rights to groundwater, Tucson currently has legal access to about 1.7 million acre-feet of groundwater credits under the Assured Water Supply Rules. In addition, it has access to an additional 2 million

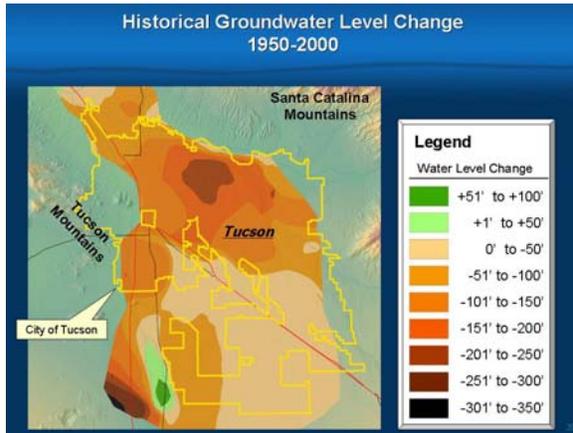
acre-feet of credits in 2025 that are primarily based on farmlands that Tucson Water purchased in Avra Valley in the 1970s and '80s, and it's this supply that will provide an important backup supply for the region in the future.



One of the reasons we're not relying upon groundwater as a source of supply was illustrated in the earlier presentation by ADWR, and I don't want to get into this too far except to note some interesting things about this map. One of them is that on a regional basis there were substantial depletions in the aquifer; and the other is that

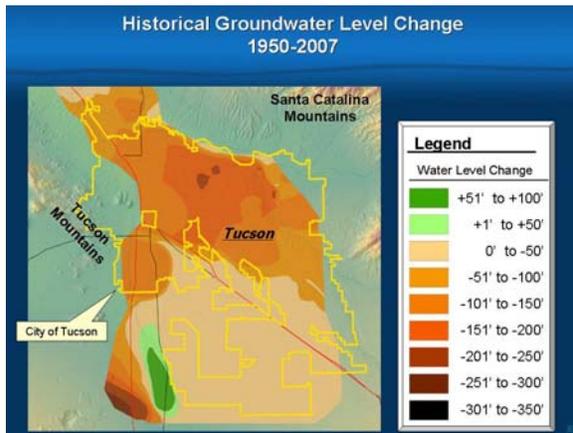
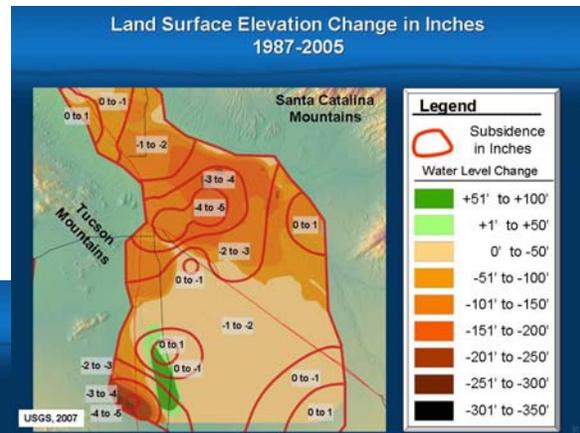


there's an interesting little comment here down on the south side; that's a consequence of the Pima Mine Road Recharge Project that's been operated by the City and the Central Arizona Water Conservation District since the late 1990s; that Recharge Project is putting water into the aquifer upstream of the central well field in Tucson.



If you look on the Tucson area a little bit closer, you can see that the groundwater declines in the - in the City of Tucson and Tucson Water's Service Area are primarily concentrated in the central well field that's located about where we are right now, and a little bit to the north. And if you look at that groundwater decline from 1950 to 2000, you see depletions in - in some areas of about 300 to 350 feet. But, since Tucson has

started relying on - increasingly relying on Colorado River Water as a source of supply, some of the worst effects of those groundwater declines has started to become attenuated. There we go, 2000, today. So, in addition, you can see that even more water in the last seven years is coming in from Pima Mine Road.



We talked a little bit earlier in this meeting about subsidence. This is a little graph that overlays subsidence effects on top of the groundwater declines in the Tucson region, and one of the interesting drives I think - to think about this is if you took a drive

along Twenty-Second Street from "A" Mountain to the Pantano Wash, you'd come across an area where subsidence effects in the last 20 years or so range

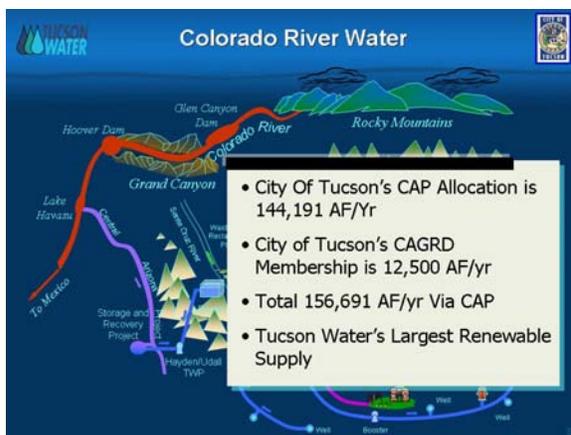
from three to four inches, four to five inches - about where we are right now - and starting to feather out toward the Pantano Wash.

If you're to take a similar drive along a similar cross-section in some of the aquifers in the Phoenix area, you would see similar kinds of numbers across the ten-foot trans-set. In Luke Air Force Base, though, those numbers would be in meters; not in inches. And the difference would be a couple of blocks in this wall behind me to the - the entire depth of the wall behind me in terms of subsidence effects that are produced from 300 feet of draw-down.

So, when you heard earlier from Ken Seasholes that Tucson has a deep and productive aquifer, this measure of subsidence effects is one way to analyze that. And this aquifer remains as an emergency source of supply for Tucson Water and its customers into the future and it provides a buffer against unvariables (sic) and uncertainties on the Colorado River.



So, let's talk about Colorado River resources. As mentioned two weeks ago, Tucson Water uses Recharge and Recovery as a method of use - using its Colorado River allocation. And those Recharge and Recovery Projects located in Avra Valley, as well as Pima Mine Road - that's down about here - connect us to a much larger system on the Colorado River, including the entire Seven Basin States.



Right now, the City of Tucson CAP allocation is 144,191 acre-feet a year. In addition, the City of Tucson has a Central Arizona Groundwater Replenishment District Membership of 12,500 acre-feet a year, and that means that the Central Arizona Water Conservation District has some obligation to deliver approximately 157,000 acre-feet a year to these Recharge and Recovery Facilities.

And if there are any issues about the Central Arizona Groundwater Replenishment District and its proximity to areas where water can be beneficially used, those questions are largely attenuated by Tucson's Operation of Storage and Recovery Projects along the Central Arizona Project canal, as well as infrastructure available to deliver those supplies directly to its customers.

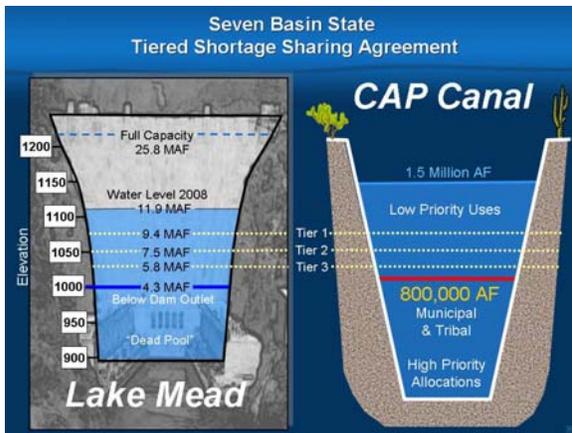


Let's talk a little bit about the Seven Basin States. We - we had some questions earlier in this presentation about the effects of the drought that began on the Colorado River system in 1999. And one of the ways to react to a drought is to sort of cover your hands - cover your eyes with your hands and pretend like nothing's happening, and the other way is to try to respond collectively to a crisis that

affects not just Tucson, but the entire western region, and that's what the Seven Basin States have done.

As of last spring, the Seven Basin States entered into novel arrangements about how to manage the Colorado River during times of shortage, and what those agreements do, in the first respect, is manage Lake Powell, which stores two years' of Colorado River supply, and Lake Mead, which stores another two years' of Colorado River supply in some kind of conjunctive fashion.

We've heard a lot about Arizona - Central Arizona Project allocation and the fact that it's junior priority on the river, and Larry Dozier talked about that extensively two weeks ago. We'd like to show you a little bit about how the shortage-sharing criteria that were developed as a result of the Seven Basin States' agreement work with respect to the water supplies that Tucson Water has entitlement to.



Here's how it works: Lake Mead, when it's full, has a capacity of 26 million acre-feet; that's about two years' worth of runoff on the Colorado River. Right now, the elevation, after the unpredictable weather of the last decade or so, is at about 1,110 feet in elevation, which means that the reservoir is about 40% at capacity, or 11.9 million acre-feet. If the elevation of Lake Mead were to drop to 1,075

feet - something that's actually never happened during the entire history of the reservoir - the lowest it's ever been is in 1955 when there was a huge drought on the Colorado River, Lake Mead's elevation went to 1,089 feet, and elevation also dropped to 1,089 feet in 1965 when the Bureau of Reclamation began taking Colorado River and filling Lake Powell. However, if Lake Mead drops to 1,075

acre-feet, or about another million and a half acre-feet from today, we end up with a tier-one shortage, and that tier-one shortage takes about 400,000 acre-feet off of the - Arizona's allocation and - and leaves that water in the reservoir to try to maintain water levels.

If Lake Mead drops another 2 million acre-feet or so, to 10,050 (sic) feet in elevation, another 100,000 acre-feet or so comes off of Arizona's allocation. And, finally, if it drops another 2 million acre-feet or so, to 5.8 million acre-feet, or 10,025 (sic) feet, there's another shortage. But, none of these shortages that are predicted or accommodated by the Seven Basin States' shortage-sharing agreement would reach Tucson Water's current allocation which is protected, along with other municipal and tribal allocations of Colorado River Water.

And the one of the ways that Tucson Water has been able to protect this allocation is by building the CAVSARP and SAVSARP Storage Projects in Avra Valley which, as of this summer, we'll be able to take all of Tucson's Colorado River allocation and protect it from shortage.

Let's talk about effluent resources for a minute.

MR. WIEDUWILT: I'm back.

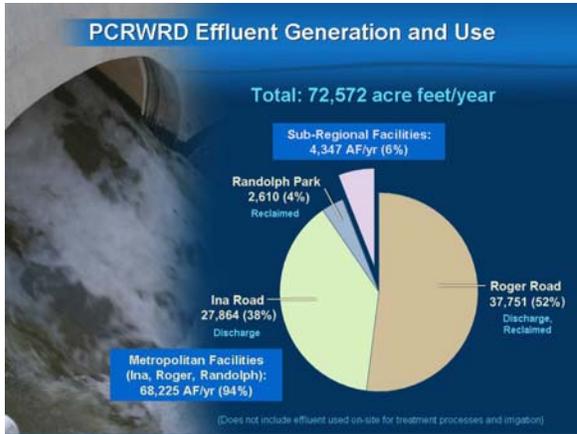
MR. AVERY: Thank you.



MR. WIEDUWILT: Of course, when we talk about effluent resources, remember we have the metropolitan area and then the outlying area.

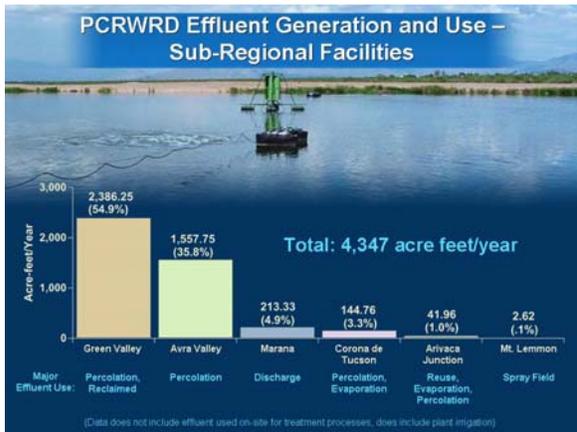


Another reminder is the acre-foot conversion. We, in Wastewater, work in the million-gallons-per-day world. They like to say that water is in acre-feet; about the size of a soccer field, one foot deep.



When we talk about the difference between our effluent from the sub-regional areas in the metropolitan facilities, this chart, again, is very similar to our demographics; 6% comes from those outlying eight smaller sub-regional facilities, and the largest portion from the metropolitan area. Roger Road Facility discharges both to the Santa Cruz River and is the primary source of effluent to the

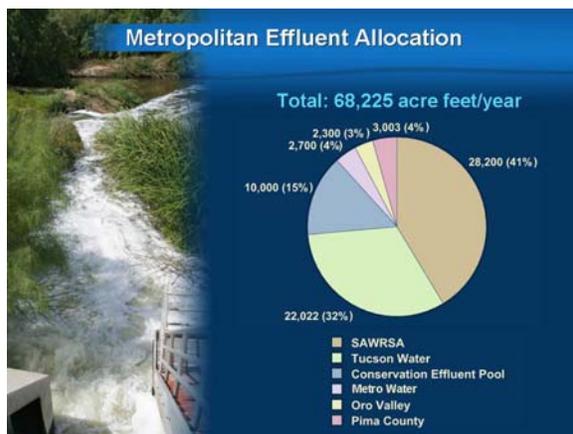
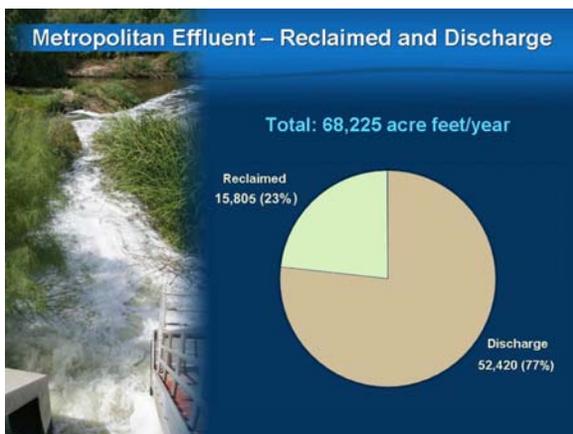
Reclaimed Water System of Tucson Water. Ina Road, currently, is solely discharging into the Santa Cruz River; and Randolph Park, located not too far from here, is also solely tapped into the Tucson Water Reclaimed Facility System.

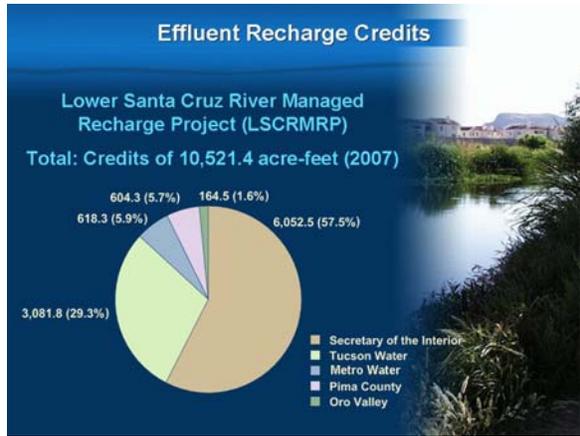


To quickly break down the contribution of our smaller facilities, this chart has both their effluent discharge and, at the bottom in light blue, what the primary type of effluent discharge is. We have the range of surface discharge - percolation, evaporation - and some reuse and reclaimed water use on a few of the facilities. But, it's a very small part when we talk about where

are the available effluent sources within our system.

When we look at the metropolitan area only, Roger Road, Ina Road, and Randolph, we can see that 23% is currently going to the reclaim system and the remainder is going to surface discharge,...





and that portion of surface discharge is already allocated through this formula, and I won't spend too much time on it. Chris will also go through a similar display, but we can show that the largest contribution is the dedication to

the Southern Arizona Water Right Settlement Act and other players in our effluent pool.

This is also an example of some water rights coming from a managed recharge project that we have on the lower Santa Cruz, showing, again, the proportional distribution; and, again, the reclaimed water rights will be discussed by Chris also.

County Water Rights

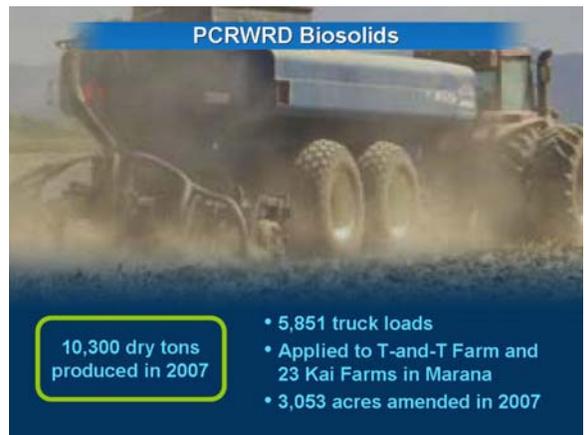
Type	# Rights	Acre-feet in 2006
Surface Water	45	59,764
Type 1 Non-Irrigation	12	2,493
Type 2 Non-Irrigation	18	986

Primary uses are environmental and ranching

We can't leave the topic of wastewater rights until we also show that we do have Type I, Type II, and surface water rights within Pima County, primarily conveyed through the purchase of property; and this water currently is used for environmental in-stream uses, riparian habitat, and ranching.

Last but not least, how can we not talk about biosolids when we talk about wastewater? We are talking about resources. At this point for our resources, we do pay to have them disposed of by land application, but we are constantly looking at what the viability is of using these biosolids as compost material and to gain some revenue from it. With that, we go back to Chris.

MR. AVERY: It's one thing to talk about effluent entitlements and the - and the rights to effluent as a resource, and another thing to talk about how it's actually used in the Tucson region today. And I - I'd like to show you a



breakdown of how - one of the questions we got two weeks ago was a question of how the effluent allocations work as a consequence of the 1979 IGA. And I hope - I hope that you'll bear with me a little bit. I know this graphic is complicated and it's made even more complicated by my diction at times, but I think we can through and show you comprehensively how effluent's allocated in the Tucson region from the Roger, Ina Road, and Randolph Metropolitan Treatment Plants.

So, let's start with an assumption that there's approximately 68,000 to 200 (sic) acre-feet a year that are discharged from the - those plants. The first cut of allocation of effluent is to the Secretary of the Interior under the Southern Arizona Water Right Settlement Act, which was an Act that settled the Water Rights Claims of the Tohono O'odham Nation to - to the re- - to water in the region. And this obligation is held by the Secretary of the Interior in trust for the - for the Nation and is to be used beneficially to provide a water supply for the Tribe in times of drought or shortage.

The remainder is approximately 40,000 acre-feet; of that, the City and the County reached an agreement in the year 2000 that allocates as much as 10,000 acre-feet of this water for use for conservation of riparian habitat restoration purposes. Although the - the pool of water was initially established for habitat mitigation plans under Section 7 in anticipation of - of the listing of the Pygmy Owl - and some of that's changed over time - so the current usage on the conservation effluent pool is currently zero. But, if the conservation effluent pool were to be used, there would be a remainder of 30,000 acre-feet available for use. Today, there's about 40,000 acre-feet of effluent that remains after the conservation effluent pool and SAWRSA cuts.

Of that, the 1979 IGA between the City of Tucson and Pima County splits the remainder on a 90/10 basis. So, of the 40,000 acre-feet that are available today, the County has rights to 4,000 acre-feet of water, and the City of Tucson, and other water providers, have rights to about 36,000 acre-feet of that effluent; that's further divided up today in the following three ways: Oro Valley has an effluent agreement with the City of Tucson that delivers the approximate share of effluent to Oro Valley that Oro Valley delivers wastewater to those Metropolitan Treatment Plants; and the same arrangement has been reached between the City of Tucson and the Metropolitan Domestic Water Improvement District. So, today, that results in an allocation of 31,000 acre-feet a year to Tucson, 23,000 acre-feet a year to Oro Valley, and 2,700 acre-feet a year to Metro.

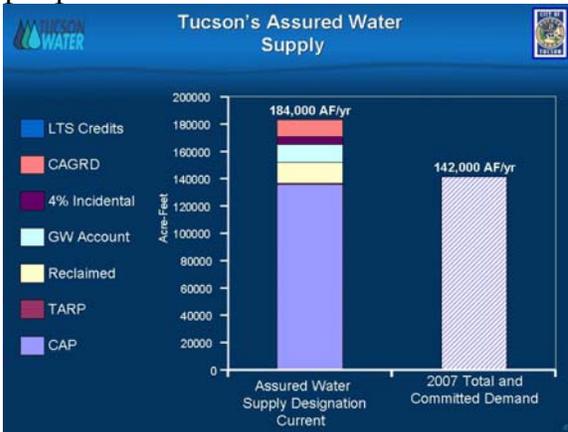
We've all cooperated together on a managed recharge project in the Santa Cruz River, and that further complicates the accounting a little bit, but I'll take you through that. So, Tucson's remaining effluent of either 23,300 acre-feet, or 31,000 acre-feet, we use about 13,000 acre-feet currently in the reclaim now.



Now, remember, the vision for the future of the CAWCD Service Area is that as much as 30% of effluent generated in the area will be reused for reclaimed water. Well, of Tucson's 30,000 acre-feet of supply, or - or 40,000 acre-feet of supply, Tucson currently delivers about 30% to its customers in the form of reclaimed water, so we're 40 years ahead of the game. That leaves 18,000 acre-feet that

flow into the managed recharge project.

The way the recharge project works is half the water that makes it to the aquifer is left in the aquifer as a cut to the aquifer and the water provider holds the remaining 50%, minus evapo-transpiration losses. So, this is how the project worked as recently as last year. Ten thousand acre-feet of that 18,000 acre-feet were recharged; that was split in half; 5,000 acre-feet in credits; 5,000 acre-feet to the aquifer; and about 1,500 acre-feet were lost to evapo-transpiration; that leaves 5,500 acre-feet. Now, remember, this 5,500 acre-feet is less than Tucson's obligation under the conservation effluent pool. So, in essence, the entire volume of water that's available to the City of Tucson today is used in one purpose of another, or reserved for use for a specific purpose.

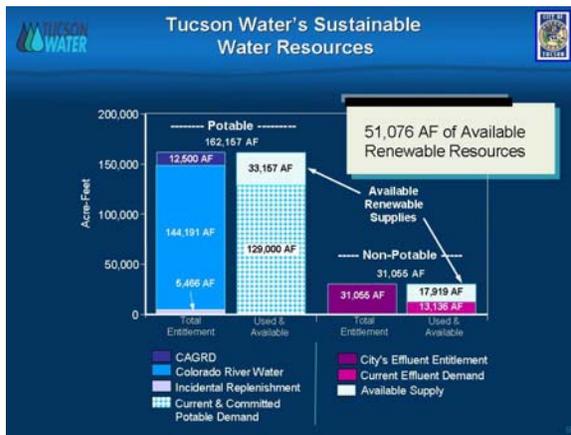


This is the way all of those resources stack up to meet Tucson Water's current Assured Water Supply filing with the State of Arizona, and this is a fairly complex process, but I'd like to take you through it a little bit quickly and show you how it works.

Basically, the bulk of Tucson Water's supply for Assured Water Supply purposes is this

Colorado River Water allocation. Other renewable sources of supply are sort of found here in bits and pieces. There's a 4% incidental recharge credit here and CAGR D membership. In addition, there's some groundwater accounting and supplies here that make a total portfolio of 184,000 acre-feet a year of Assured Water Supply water that's currently available to the City of Tucson, and has been accepted by the Department of Water Resources as part of its 100-year Assured Water Supply. And the way the Department counts future demands, it counts a current total delivery demand, as well as future anticipated demands over a

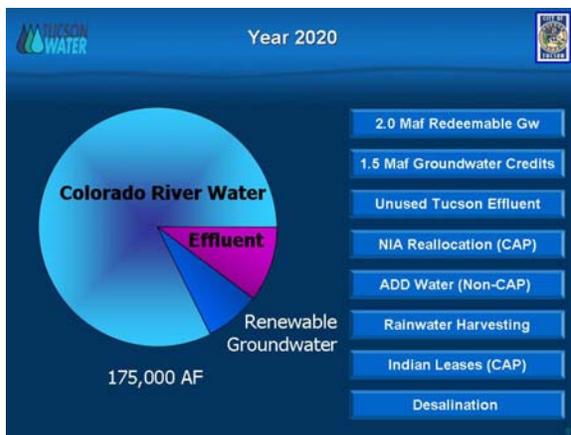
ten-year period. And so for Assured Water Supply accounting purposes, that total is 142,000 acre-feet a year.



One recent way that we were asked by the City of Tucson Mayor and Council to account for water is on some sort of sustainable basis. And I've spent a lot of time trying to avoid the definition of "sustainable," especially given the context of this Committee. But, what we're talking about here, in terms of the information we've provided to the Mayor and Council, is what are the renewable supplies that are currently

available to the City of Tucson? And the way those stack up is as follows: There's about 5,500 acre-feet of incidental recharge credits. We talked a little bit about those two weeks ago. A Colorado River allocation, and Central Arizona Groundwater Replenishment District Membership. That stacks up against our current deliveries in the following way on the potable side: We currently delivered about 129,000 acre-feet. Those numbers, depending on - on what year you're counting - this is a future look - and that leaves about 33,000 acre-feet a year available of sustainable supply to the City.

In addition, the effluent entitlement's about 31,000 acre-feet. We currently use about 13,000 acre-feet, and that leaves about that 18,000 acre-feet that are also available for future supply, and leaves a total of about 50,000 acre-feet of available renewable resources to the City.



Let's go - let's go forward to the year 2020. We talked about this pie chart a little bit in the last week's presentation. In the year 2020, we expect to deliver about 175,000 acre-feet of water to our customers, and we'll hold firm with that demographic, at least for a while- until we try to figure out the cost of the relatively flat usage in our service area over the last five years. The way we -

we predict that those supplies will be delivered: Again, majority Colorado River Water, some small slice of renewable groundwater; it's primarily based on incidental recharge, and the CAGRDR membership, and increasing reliance on effluent.

And, in addition to those supplies, the City will also have a remaining portfolio of supplies that may or may not be available to it, and I've tried to list these supplies in order of surety, if you will. So, we know that we got 2 million acre-feet of redeemable groundwater accounts, and we expect that our 1.7 million-acre-foot groundwater credits will be reduced by about 200,000 acre-feet of pumping between now and 2020.

In addition, we will have an unused effluent supply and - and, if discharges from the area's wastewater treatment plants increase over time, that supply available to Tucson will increase proportionately, as well as to the other water providers. And one of the reasons for that is that the SAWSRA obligation of 28,200 acre-feet is fixed. So, although, it - it forms a majority, or a substantial component of Tucson's effluent supplies, the Tucson region's effluent supplies today, its proportionate share will diminish over time as more water's discharged from Pima County's Wastewater Treatment Plants.

In addition, the Central Arizona Project, at some point in the future, is going to have to allocate non-Indian agricultural water; and - and we expect that the region as a whole, and Tucson Water in particular, will - will play a part in that reallocation. And one of - one of the benefits of having Recharge and Recovery is that non-Indian agricultural supplies are not likely to be protected from shortage, but in times of normal flows on the Colorado River, or in times of surplus, those Recharge and Recovery Projects can put that water to use.

In addition, the - the Central Arizona Water Conservation District has started the ADD water process; Larry Dozier talked about that a little bit two weeks ago, and we expect to participate in that process. During yesterday's presentation, the estimate was that that may be as much as 350,000 acre-feet of water available to the three-county service area.

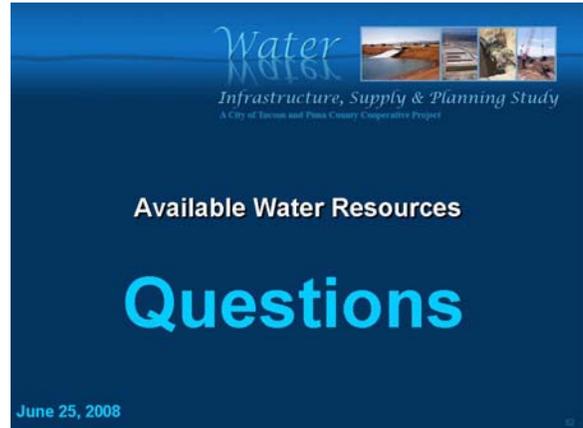
One other additional source of supply that's available to the community as a whole, if not exactly to Tucson Water in the traditional sense have - having a source of supply that's owned by the water utility and delivered to customers, is rainwater harvesting.

In addition to that there are Indian leases. One final component of supply that a lot of folks who are interested in future water resources challenges like to talk about is desalinization, and that can take a lot of different forms; it doesn't necessarily have to take the form of nuclear power to electric plants in the Gulf of Mexico; it can be used even to remediate locate supplies, or brackish groundwater supplies that might not otherwise be available for use.

And one of the things I'd like you to think about as we move forward to try to meet these challenges in the future is that chart that we put up here a while ago and talks about the economic return that municipal and industrial users get from water.

So, in addition to having a diverse portfolio of supplies, in addition to being about 40 years ahead of the curve on - on the resources that Tucson Water has, we also have a vibrant and robust economy in the City of Tucson that

makes very efficient use of the water resources that we deliver and that produces large economic returns from that water. Those large economic returns allow us to be innovative, creative in solving the water resources challenges of the future, and we hope that we'll be able to take you forward on that journey and to understand what those challenges are, both from a supply, energy and water quality and infrastructure perspective as we move forward through this process. Thank you very much.



CHAIRMAN JIM BARRY: Are you going to take questions now, yes?

MR. WIEDUWILT: Sure.

CHAIRMAN JIM BARRY: Questions? Yeah.

CHRIS BRUX: My name is Chris Brux (ph.) Where you talk about the -

MR. AVERY: Great name.

CHRIS BRUX: - the available groundwater credits that - that will - the City will have access to -

MR. AVERY: Yeah.

CHRIS BRUX: - associated with ag land that's been purchased -

MR. AVERY: Yeah.

CHRIS BRUX: - could you explain briefly how those credits come about and - and what the significance is of those credits? You mentioned they become available in 2025?

MR. AVERY: Yeah. I can do it, but I can't do it briefly; it's a really complicated question. But, the - the simple answer is that the - the City of Tucson, as a consequence of purchasing large volumes of - of large acreage of cotton farms and fields in Avra Valley beginning in the mid-1970s, obtained some groundwater credits as a consequence of, basically, retiring that former agricultural use. And the sum total of those credits, depending on how they're accounted for - and it's extremely complicated, and I won't even try to get into it here - but, the idea is that if Tucson Water manages its resources wisely over the next 18 or so years and uses Colorado River Water for Recharge and Recovery, we - we will have an account of groundwater credits that are available to us in 2025 of approximately 2 million acre-feet. And those numbers can change depending on how much water's pumped between now and then. But, it's, essentially, a credit for retiring farm fields in Avra Valley that would otherwise have pumped water from the 1970s until today, and into the future.

UNIDENTIFIED FEMALE SPEAKER: (Inaudible; not speaking into a microphone.) Hi. I'm - I'm interested in the effluent and the reclaimed

concept that you talked about and tying it together with last week's or two week's ago presentation, and seeing that Pima County is upgrading its system to deal with the different grades and, like, there's Type A, A+, B. Can you address that why Pima County is going up to the highest grade possible?

MR. WIEDUWILT: I think I can partially address that. We operate under regulatory constraints where our water quality has to meet State regulations and federal regulations under the Clean Water Act. The two major upgrades we're doing at the Roger Road Plant and the Ina Road Plant are regulatory-driven. We are moving toward an A+ delivery system, which is the cleanest possible water, and its nitrogen removal is the foundation of what we're being asked to do for those two treatment plants.

We have also outlying facilities that started out with a B level water quality, because the uses were primarily percolation and evaporation. As we see opportunities to move that water into reclaimed systems, A+ is the standard that we'd like to seek there, and two of our smaller plants that serve water to developers are providing A+ water. So, we respond to the needs of people that can use the reclaimed water, and where we don't have that need and we don't have a regulatory requirement, it's much more beneficial from a cost standpoint not to do those expensive upgrades and to continue just to recharge that water into the aquifer.

NANCY FREEMAN: Nancy Freeman. What is the grade of water that's being put on the golf courses and the schools and parks?

MR. AVERY: I can answer that question on a general basis. There's an exception at Silverbell Golf Course, they use effluent directly from the Pima County Wastewater Treatment Plant. But, for the rest of the system that's served by Tucson Water's Reclaim System, we deliver what's called "A+ water," and that means it's water that meets the highest standards for turbidity (ph.) or clarity, but which has some additional nitrate in it.

NANCY FREEMAN: A+ water has additional nitrates in it?

MR. AVERY: We deliver A - we - I'm sorry - we deliver Class A water to our customers and - and that water has - meets the turbidity standards, but has some slight excess nitrate depending on the time of year and the way we operate our recharge facilities. My

NANCY FREEMAN: Thank you.

MR. AVERY: - my bad.

CAROL HELLER: Hi, I'm Carol Heller. I'd like to ask about the biosolids. What kind of crops are - is - is this - is this used upon? And what prevents the runoff from getting into surface water or into groundwater? What kind of contaminants are in the biosolids?

MR. WIEDUWILT: I think we owe you probably a lot more detailed explanation than what I can provide now, and that was one of the questions that's on our to-be-answered list. So, let me assure you we'll answer the questions about the pollutants that we sample for our biosolids and what

measures are in place to keep any contamination from happening. So, I'm going to refer those questions to a more technical staff. I can tell you that we are supplying a Class B biosolid; it's land-applied to 24 farms in the Marana area; it's non-food source, primarily cotton, agricultural use, and it's all regulated and permitted by the State, so there are quite a number of chemical tests that are done on the biosolids before it's delivered, and all land-applied, I believe, within 48 hours is a requirement.

MARGOT GARCIA: Margot Garcia. I wonder if you could comment on the impact of the Court case last week saying that Marana owns all its own wastewater now on some of the slides and projections that you've put forward today?

MR. WIEDUWILT: I apologize, but I'm going to have to defer comment; that case is still in litigation; there's still a lot of issues that need to be resolved, so I'm going to have to defer comment until we get that resolved from the Court side. Sorry.

COLETTE ALTAFFER: Colette Altaffer. Just a few questions. We are treating a certain amount of water for TCE contamination. We pull it out of the ground, we treat it, and then we deliver it to homes. Is that water part of our Assured Water Supply?

MR. AVERY: It is at the moment. Let me show you where it is. The - the TARP account is - is right here, and it's this little sliver of water right - right there on the graph, and that - those - those Tucson Airport Remediation Project accounts will diminish in time as the plume starts to become remediated and will eventually disappear as an important component of our Assured Water Supply. But, for now, they do form a component of Assured Water Supply, and - and they also form an important part of containing the plume and remediating the chemical that's in the groundwater.

And I guess I'd like to point out just - just for fun that, in the 15 years that that project has operated, there has been no exceedance of the - of the water quality standards; in fact, there's been no detection of any TCE in the water that's been produced by that facility.

COLETTE ALTAFFER: Second question: You showed some graphs early on indicating the subsidence; in some cases, we were shown actually an increase in water level.

MR. AVERY: Yeah.

COLETTE ALTAFFER: What was the baseline point on those things? Did we start from when we first started counting subsidence? Have we lost, say, 200 feet before we began counting these numbers?

MR. AVERY: The answer to that question is - is that we don't have precise measurements of the amount of subsidence that occurred prior to 1987 when the United States Geological Survey installed the current baseline monitoring stations.

I think - I can confidently say, though, that the - the period of time during which subsidence was measured in Luke Air Force Base is comparable; it's about 30 years instead of 20 years; and the amount of groundwater declines, they're also comparable on the neighborhood of 300 feet.

And so I would expect - and - and - and I'm not a geophysicist - but, I would expect that these subsidence numbers, instead of looking at them as absolute numbers, if they're looked at as - as numbers based on a 20-year snapshot, they still - they may not be perfect, but they do show that the Tucson aquifer, which is - which is - is robust and productive, does suffer from fewer subsidence effects than some aquifers elsewhere in the State.

COLETTE ALTAFFER: And then, finally, the facility that we have in Avra Valley where we're banking water, is that considered part of the Water Banking Facility Program and - yes or no - and -

MR. AVERY: Yes.

COLETTE ALTAFFER: - it is. And do we know how much water we've actually banked and how much we have down there?

MR. AVERY: ADWR can - showed those numbers earlier in their presentation this evening. I'd like to point out, though, that there are two facilities that are important: One is our facilities in Avra Valley, and the other is that Pima Mine Road Facility that's located down near the new Desert Diamond Casino, actually, and - and that's responsible for the - actually, it's responsible for this plume of - of - of - I should not use the word "plume," right? Is responsible for this mound of - of - of groundwater in the area; that's a consequence of the Pima Mine Road.

RON PROCTOR: I'm Ron - Ron Proctor. At least a couple of your graphs have shown that the Colorado River Water supply is a major component of - of, say, of Assured Water. What would - I don't know if you can go back to that graph of the reservoir there.

MR. AVERY: Yeah.

RON PROCTOR: At what point would the water need to drop before there would be major repercussions to Tucson's water supply?

MR. AVERY: Nobody really knows the answer to that question. I can tell you one absolute number, and that is if the water drops below the dead pool in Lake Mead where the water can't get out, then you got serious repercussions.

But, the - the shortage-sharing criteria are - are an adaptive management tool, and what they - what they do is keep water in Lake Mead that would otherwise be discharged to meet the region's obligations. And I think that the example of the recent shortage-shar- - sharing agreement shows that if Lake Mead elevations were to drop dramatically that the Seven Basin States would be able to come together and figure out how to deal with that issue.

And I - I think it's also important to remember that, in anticipation of - of variability on the Colorado River, the Water Bank has put water into the

Tucson AMA. Tucson Water has put storage credits into the Tucson AMA. We've built Recharge and Recovery Facilities, and we still have some small supply or, you know, it's - it's an important resource, we don't want to waste it, but we still do have access to groundwater supplies if things were to get really bad on the Colorado River. That's not to say that things are perfect in the Tucson region if something goes wrong with Lake Mead, but it does suggest that we're positioned as well as anyone who relies on Colorado River Water for a major source of supply to withstand the kind of variations that appear in Colorado River supplies as a result of tree-ring dating and other methods.

RON PROCTOR: Can I just follow that up -

MR. AVERY: Yeah.

RON PROCTOR: - with -

MR. AVERY: Sure.

RON PROCTOR: How much - how many years of bank is in - is there currently, I guess, in the - in the Col- - what's been banked by the Colorado River for Tucson?

MR. AVERY: If I recall - if I recall, it's about 600,000 acre-feet in Tucson. Is that . . .

UNIDENTIFIED MALE SPEAKER: (Inaudible; not speaking into a microphone.)

Ken Seasholes: It's about 300,000; it's a lit- - or 350,000 -

MR. AVERY: Yeah.

Ken Seasholes: - currently.

UNIDENTIFIED MALE SPEAKER: And how many years (inaudible; not speaking into a microphone)?

Ken Seasholes: The number of years would depend on how much of a cut-back there is. Even in a shortage, even if we get down into this pool of firm supplies, you would still be delivering portions of those supplies. So, the - the amount of it you have banked away is really representative of filling the gap. The amount that we're targeting for this AMA, for the Water Banking Authority, represents what the projections were for 100 years' worth of shortages, and the shortages get more frequent in the future, and that number's about 800,000 acre-feet.

MR. AVERY: I guess, from my perspective - and I don't know the answers to all of these questions on Colorado River shortage and drought - but, I do think it's important to say that there are a lot - that - that a lot of thought has been given to the problem, not just since 1999, but from the very inception of the Central Arizona Project, and that - that there are a lot of really bright people who are trying to figure out this issue, even as we move forward, and that Recharge and Recovery operations give you a way to attenuate the year-to-year, you know, even a couple-year-to-couple-year effects of those shortages by not being reliant on water being actually in the canal as your source of supply.

NANCY FREEMAN: Nancy Freeman. I just interviewed John Mawhinney, so I have the 2.8 million acre-feet from the Water Banking Authority on my mind, so the 800,000 would be Tucson's share?

Ken Seasholes: The Water Banking Authority is storing water for multiple purposes, including for interstate purposes, and they've stored quite a bit of that water in the Pinal AMA. They've not stored as much in the Tucson AMA; like you said, about 350,000.

The - I would reiterate what Chris has said generally about the way the Tucson area - and Tucson Water in particular - is positioned to handle the variability of the supply. There are multiple strategies being put in place, both by the individual utilities, CAP itself, and the Basin States to address the - the variability; the Water Banking Authority is one piece of that; to try to store as much of this water we have available now for later use. We've got - we have a ways to go in terms of meeting as much as we'd like to have in the ground, but we do have a large reservoir of supply available to be able to mit- - to mitigate it in that short term.

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations, and Questions & Answers with Presenters) excerpts of the City County Water & Wastewater Study Oversight Committee Meeting held on June 25, 2008.

Transcription completed: August 26, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF JULY 9, 2008

List of Presenters:

1. *Chris Avery: Interim Deputy Director of Tucson Water: Potable Water and Reclaimed Water Delivery Systems and System Conditions*
2. *Eric Wieduwilt, Acting Deputy Director of Pima County Regional Wastewater Reclamation Department: Wastewater Delivery System and System Conditions*

Presenter #1

**Chris Avery, Interim Deputy Director Tucson Water
Potable Water and Reclaimed Water
Delivery Systems and System Conditions**

MR AVERY: I've been asked to respond to two questions from previous presentations at this time. The first question is about the story of the MUM, which is the Metropolitan Utilities Management Group that began in the mid 1970s and effectively terminated about the time that the 1979 IGA was entered into between the City and the County and also to talk a little about the history of 1979 IGA. MUM was an initial cooperative effort between Pima County and the City of Tucson for basically joint operations of water and wastewater, operations that existed at the time. In early 1970s, the Pima County Hydro Treatment Plant facility was in the development stages and most of the wastewater that was being treated in the region was being treated by the City of Tucson at the Roger Road Plant.

The director of MUM was the director of Tucson Water at the time who was Frank Brooks and there was a Board of Directors at MUM that was comprised of citizens from the community including some citizens as well as politicians. The Board and the MUM process seemed to work well for a while, until toward the end of the process seemed to break down based on some disputes about where water would be provided and whether the County had the authority to provide water, to tell the City where it could and how it could provide water, because there was no statutory authority at the time for the County to be in the water business. The MUM process was effectively ended by the 1979 IGA between the City of Tucson and Pima County and that IGA, which I'll talk about now, gave the Roger Road wastewater treatment plant, and essentially the City's entire sewage system, to Pima County and the City obtained in return a share

of the effluent from all of Pima County's wastewater treatment plants.

The 1979 IGA, this is probably the linchpin of water and wastewater management in this region at this time, was entered into between the City and the County in the summer of 1979 largely as a consequence of fresher, and there may be other factors here that other folks think are important and at this point I'm not here to give you a factual answer, I'm going to give you what I think is going to be more of an opinion than a factual answer, and that is that it's my opinion that the primary driving force for the combination of the water and wastewater systems was pressure from the EPA and from the EPA funding process which essentially identified and wanted one agency in order to obtain federal funding for wastewater projects so it's my opinion, and there may be other factors that were important and that were important to people at the time for a consolidation, but it seems in retrospect that the primary guiding force was the federal funding and the apparent belief and probably the reality that the EPA wanted a joint operation, a joint wastewater operation in the region and that it was only going to fund one single entity.

Anyway, whatever the reasons were, there were probably more than just one, by the summer of 1979 the City and the County entered into the 1979 Intergovernmental Agreement and that agreement was a landmark agreement in several ways. One of the factors of that agreement was that the City's entire wastewater operation was transferred, including employees and you can imagine how difficult that must have been, was transferred to Pima County. So Pima County became the sole wastewater operation in the region and in return for transferring the investment and sewer operations to Pima County, the City obtained essentially the rights to all of the effluent that was produced by the Pima County wastewater treatment plants. There was, at that time, a division between non-metropolitan facilities and those that generate the outlying facilities that we have talked about up until this point, and the metropolitan facilities which are and were the Randolph Wastewater Treatment Plant, Roger Road Plant, and Ina Road Plant. After the City obtained all of the effluent by virtue of the 1979 IGA, it granted 10 percent of the effluent back to Pima County so that's the other source of the 90/10 split. The City, at that point, was also . . .

-----BLANK AUDIO-----

. . . to settle pending Tohono O'odham Nation litigation. In addition to that the City and the County granted each other reciprocal rights-of-way and easements so that those reciprocal rights-of-way and easements allowed the City of

Tucson's water systems to be installed in any Pima County right-of-way outside the City of Tucson and allowed the County to install wastewater equipment and infrastructure in the City of Tucson's right-of-way property inside the City of Tucson. After the 1979 IGAs and right-of-entries that followed in 1982, there was not much that happened for the next decade or so and in 1995 the Randolph Wastewater Treatment Plant was taken off line as a consequence of the reconstruction of the new golf course you see out the back window, and that in addition to some other pressures lead to a lawsuit that the City of Tucson filed against Pima County in 1999 alleging some violations of the 1979 IGA. That lawsuit was settled by the City of Tucson and Pima County in the spring of 2000 and that settlement, in addition to setting up some definitions of metropolitan and non-metropolitan facilities, also got the effect of creating the federal conservation effort that you see here.

Most recently the City and County have amended the 1979 IGAs and the 1982 license agreements to provide some additional clarity about how the cost of water and wastewater should be paid for in those respected right-of-ways and up until now there are some current proposals that are going back and forth between the City of Tucson and Pima County about how to further refine the 1979 IGAs to take care of some current issues.

QUESTION: Chris, could you further explain a little about the concept of the conservation effluent pool and what is intended for the use of that 10,000?

ANSWER: Sure, the conservation effluent pool came out of the settlement discussions from the 1999 lawsuit between the City and the County and one of the primary issues that was affecting the region at that time was the designation of the cactus ferruginous pigmy owl as an endangered species and so the conservation effluent pool was established as a way for parties in the region first to obtain water that might be necessary to conduct habitat mitigation under a Section 10 permit with the US Department of Fish and Wildlife Service. Tina, correct me if I'm wrong here because I know you know more about this than I do, but the whole point of the conservation effluent pool was to establish water that would be available if municipalities or other entities in the region needed it to comply with the Section 10 permitting under the endangered species act. The effluent pool, or conservation effluent pool is, if the City and County have leftover water after the Section 10 permitting was established, then the City and the County could agree that or designate particular projects as riparian projects and use conservation effluent pool water for those particular projects.

One of the really important things about the conservation effluent pool agreement in the 2000 IGA between the City and the County was that it also adopted a relay rate for environmental purposes and that rate has been used by the City and the County to move water around in other respects not necessarily the conservation effluent pool water but the relay rate for effluent under the conservation effluent pool agreement was a way to get that water to projects through the reclaimed systems at lesser costs and is being paid by golf course use and other consumers of the reclaimed system and essentially what it does through a very complicated formula is it takes out the capital repayment costs of the effluent and reclaimed system and the treatment process and asks users to pay only for the operation and maintenance cost on the systems. At this point the conservation effluent pool water or environmental rate for effluent is about \$300 an acre foot and the price that is paid by most users on the reclaimed system is about \$710 an acre foot. So from that math you can see that in terms of reclaimed water that borrowed debt or capital repayment obligations for reclaimed is about \$400 an acre foot and the operations and maintenance costs is about \$300 an acre foot.

QUESTION (unintelligible):

ANSWER: Well, the Indian Tribes in Arizona and across the west have substantial rights to water...

-----INTERRUPTION FROM GOLF COURSE INTERCOM-----

... but it's based on a 1909 lawsuit that was accepted by the United States Supreme Court that recognized that the Indian Tribes were created, with, as part of their treaties with the United States, the tribes also obtained a reserve right for water that was necessary to supply the reservation and in the case of the Tohono O'odham tribe there is some history of agricultural use in the area prior to their creation of supply and prior to the treaties that they signed with the United States. So, they had substantial claims to water in the region and its no secret that groundwater pumping from the Sahuarita area, as well as the Tucson area, dried up the Santa Cruz River by the 1940s or so. So, the Tohono O'odham nation had substantial claims to water in the region and the fact that they had substantial claims to water in the region is illustrated by the fact that the Gila River Indian community, the Salt River Pimas and other tribes that were similarly situated in this area, only resolved their claims as of about 2006, 2007 for substantial CAP water rights. So, the fact that in Tucson we were able, and, I'm going to take a little diversion here and credit Morris Udall for this but I think that Morris Udall deserves a lot of the credit for helping to implement a settlement between entities in the Tucson region and the Tohono

O'odham nation in 1983, which was, you know, 25 years before some of the other tribes in Arizona settled their cases. In fact, the San Carlos Apache Tribe has still not settled its reserve rights claim. So, there were substantial claims to water and the 28,200 acre feet of effluent was a way of settling those substantial claims and there are still some provisions and settlement agreements that allow Tucson Water some priorities in terms of obtaining rights to CAP water that the tribes, the Tohono O'odham Nation obtained in settlement should they decide to release it or otherwise put it to use outside the reservation. So, it's a difficult case but I can say from a legal perspective that, without commenting exactly on their case, that their claims were substantial.

QUESTION: (unintelligible):

ANSWER: Without making it too complicated, the 28,200, we talked a little about shortages and we talked a little bit about what happens along the Colorado River in those times two weeks ago, the 28,200 acre feet of effluent that was given to the tribe and was held in trust by the Secretary of the Interior to be used for firming the CAP operation for those times. So, the use of that water is for assuring that those tribes have access to their allocations during the time of shortages on the Colorado River.



QUESTION: I just have a question about the chart here. What is the significance of the larger number in parenthesis?

ANSWER: The larger number in parenthesis is if the conservation pool is used then you have the smaller number, there's 30,000 acre feet left. If the conservation effluent pool is not used, then you have the larger number in parenthesis, the

40,000 acre feet that's available. The conservation effluent pool of water is a year to year allocation, it's basically a use it or lose it allocation that will build up over time. Currently it's not being used so the larger numbers are what's actually in effect at this time.

QUESTION: So are you telling us the conservation pool currently being zero that, there is currently no effluent being used for conservation purposes?

ANSWER: Well, what I'm saying is that there is a pool of water that has been established for that purpose and there is some use on the reclaimed system, for example, the linear parks

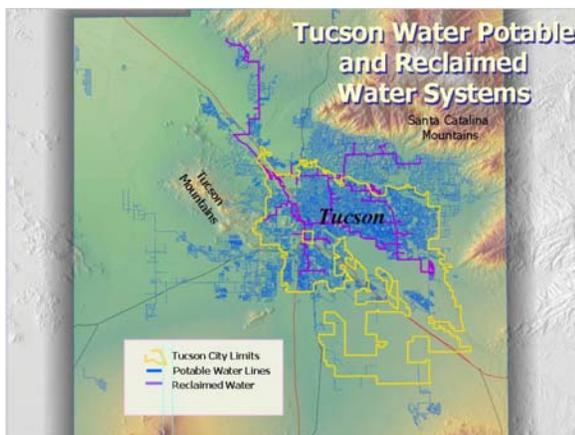
along the Santa Cruz and Rillito were almost all on the reclaimed system. That's not designated as conservation effluent pool water and one of the reasons for that is that the initial designation for conservation effluent pool was based on obtaining the Section 10 permit, it's a long history, but basically the cactus ferruginous pygmy owl was D-listed although there were some Section 10 permit processes that were started. It is my understanding that to this date no one has obtained a Section 10 permit yet from the Fish and Wildlife Service as a consequence of that process and I know that the City of Tucson has some applications pending. The County has a conservation plan that has some Section 10 permit processes in it and I know that the Town of Marana is also working on a Section 10 permit process. If the outcome of those processes is to obtain some of this water for riparian that would be available, otherwise the City and County will have to agree on riparian projects, designate them mutually, in other words, the City and County each have a veto vote on what a riparian project is or is not, and they'll have to agree on what is a riparian project and its water use.

QUESTION: I'm looking at this intergovernmental agreement and you're talking about modification and we've invited all kinds of entities (unintelligible).

ANSWER: I'd like to point out really quickly that after the 2000 IGA the City of Tucson entered into some subsequent agreements with the Metropolitan Domestic Water Improvement District and Oro Valley that transferred effluent rights based on the 1979-2000 IGA respectively and are shown up on the screen here. So, there have been some modifications as a consequence of those agreements to transfer effluent out to other water providers.

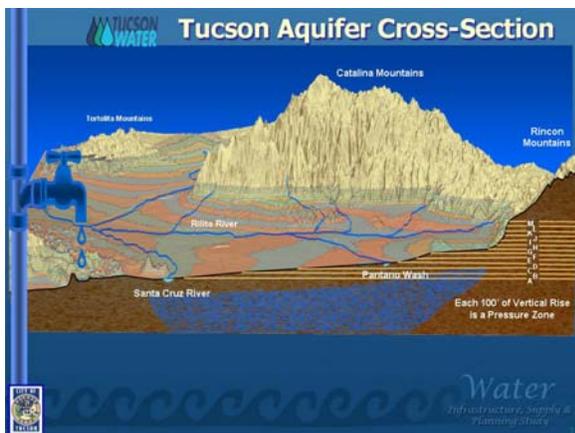


CHRIS AVERY CONTINUES:
 Two weeks ago we talked about our customers, we talked about the water resources that are available to the City of Tucson and to Pima County and this morning it's a privilege to talk about the infrastructure that connects our water resources to our customers.



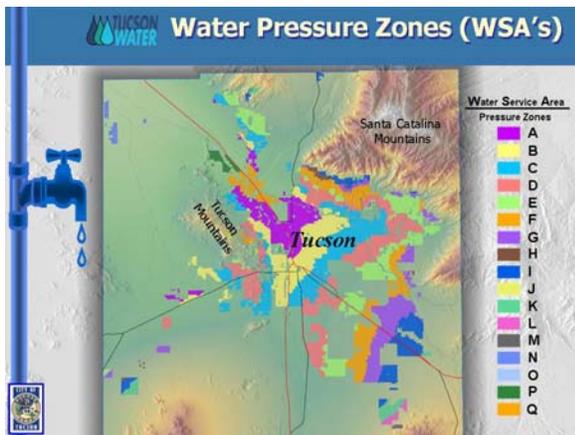
Lets start with this slide that you've seen now a couple of different times. This is the Tucson Water's service area. These blue lines are Tucson's water pipes. These purple lines are Tucson's water reclaimed system. The recharge facilities are located generally out in Avra Valley and south of Tucson and we are going to talk today about the potable water and reclaimed water infrastructure that delivers the

resources that Tucson has available to its customers.

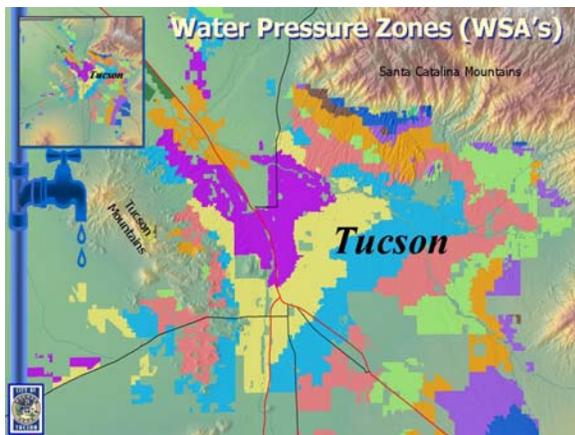


Let's go back to this one. This is a three-dimensional view of the Tucson basin and the cross section is essentially along 22nd Street. As you can see the Tucson basin is relatively flat in the middle, it starts getting pretty steep around the sides. This is some exaggeration, and this is Tumamoc Hill and the original Tucson water system that started back in the 1880s, was

located primarily along the Santa Cruz River within this general area and this is called the A Zone. Each 100 foot of vertical rise in the Tucson basin creates about 50 pounds of water pressure difference so as it moves through the basin, Tucson Water in fact operates about 25 different water systems that are connected to each other.



This is a plan view of what those separate water systems look like distributed throughout the basin. I guess one thing I'd like to note is that these pressure zones are also generally used by other water providers in the area, Oro Valley, Metro, and they generally follow Tucson Water's elevation and pressure differences. The pressure difference means that at the bottom of one of Tucson's water pressure zones you are still going to get pressure that's within the recommended engineering specifications and at the top you'll get water that also meets those specifications without exceeding them. If we were to break the system up into larger sections to make it less complicated we would end up with places in town where it would be very difficult to take a shower and places in town where pipes



would continue to burst with the pressure. As you can see generally the system stays relatively flat and then it starts to get a little more complex as we get more toward edges of town and there are still some areas where Tucson Water actually reacts to local conditions based on the topography.



Ok, let's talk about the potable water infrastructure now for just a second. Basically, the potable water assets that are available to the City at this point consist of the storage and recovery project in Avra Valley, transfers through the Hayden-Udall treatment plant up to the Clearwell reservoir and delivered to the City through a series of large diameter pipelines in the

Tucson region as well as the existing well fields that were developed essentially from the beginning of Tucson Water's existence and that continue even today as an important back up

supply for the City. Those well fields are essentially located here on this map. The central well field that was the original source of supply for Tucson Water's customers, as the resource began to be depleted in the central well field, Tucson also developed some well fields on the south side as well as the Santa Cruz well field and Avra Valley well field originally as independent sources of supply and then the recently developed CAVSARP well field as a recovery well field for the recharge operations that are out in Avra Valley.



Now, as you can see by the total number of these well fields that are prevalent - let me interrupt for a minute - as a consequence of the TCE contamination on the south side here we also operate the TARP facility, the Tucson Airport Remediation Project. That consists of nine wells with a total capacity of 6.5 million gallons a day and the water from those wells is pumped to the

Tucson Airport Remediation Project treatment plant located along the freeway down near I-19 and Irvington where the water is basically stripped and cleaned and used for potable purposes. The total number of wells in the well fields is about 216 wells depending on whether the recent one just got equipped or not and the total capacity of those wells, if the were all operational, is 212 million gallons a day. Another thing that I would like to show you here is that in recent years the department has been able to start taking advantage of some continuity to scale.

You can see that in the central well field we have 120 wells with a total capacity of about 90 million gallons a day. In CAVSARP, 33 wells have a capacity of 70 million gallons a day. Most wells are large diameter high-capacity wells that are drilled very deeply and have essentially duplicated the entire capacity of the central well field in some respects with about a quarter of the wells. The number of 212 million gallons a day assumes that all of the wells are in operational condition at one time. That's really never the case given how many wells there are in Tucson. The fact that some of the wells in the central well field are located in close proximity to the Broadway Landfill and that other wells are located along some sensitive riparian areas along the Tanque Verde Wash so, at this point, generally our well field capacity is somewhere around 170 million gallons a day, depending on which wells are in service

and out of service and if we were to go ahead and rehabilitate and get every well working and operational, that would be 212 million gallons a day. In addition to the central well field, we also have some isolated wells and generally those wells are serving very small amounts of water to customers that are located fairly remote from the Tucson Water central service area. Those areas include the Diamond Bell area on the southwest side of town, what we call our W Zone customers, west of Marana, the town of Catalina. The well field in the Corona de Tucson area, as a result of recent development pressure down in the Santa Rita valley area, there has been an agreement reached between Tucson Water and developers to extend the pipeline along Houghton Road up to the central distribution system. So, when that pipeline is complete this system here will cease pumping groundwater and start to be part of Tucson Water's integrated system and be pumping renewable supplies.



In addition to the well fields that access Tucson water, its groundwater resources, we have the recharge facilities that are used to put Tucson's Colorado River allocation to use. There are three recharge facilities at this time but the first one that was constructed by Tucson Water in partnership with the Central Arizona Water Conservation District is down at Pima Mine

Road. We showed that mound of water at the Pima Mine Road facility two weeks ago and you can see that it's located in relatively close proximity to the Santa Cruz well field. The next recharge facility that Tucson Water constructed was the CAVSARP recharge facility in Avra Valley and that recharge facility has 318 acres of basins, 33 recovery wells. Just last May, basically two months ago, Tucson Water opened the first recharge facility at the SAVSARP recharge basin located about five miles south of the central Avra Valley storage project, and when those basins are complete there will be 220 acres that will be permitted for recharge at about 60,000 acre feet a year. The total recharge capacity that is permitted for Tucson Water at this point is about 170,000 acre feet a year.

We are seeing higher rates of recharge from the CAVSARP basins than was originally anticipated under our current conditions and we're also seeing what we would consider to be highly productive results from our new recharge basins in SAVSARP. There's an allocation pending to increase the recharge

capacity of the CAVSARP facility to 100,000 acre feet a year. If the SAVSARP facility continues to operate at the slightly higher recharge rates that we're seeing in practice today, that facility might also increase substantially and we think its reasonable to assume that without constructing any new recharge basins that the City of Tucson will have the ability to recharge as much as 200,000 acre feet of water a year in its existing facilities and that's about one and a half times our current Colorado River allocation and that's about one and a half times our annual demand for Tucson at this time. As you can see from the SAVSARP facility and Pima Mine Road facilities that we still don't have as much recharge capacity as we do at CAVSARP and that's because we haven't constructed the well fields and distribution pipelines to bring the water back to Tucson yet. But we will talk about those future facilities in two weeks when we talk about future infrastructure.



Once the water from the recharge facilities or from the well fields is distributed into Tucson Water's distribution system it next goes to storage reservoirs where it's allocated for storage before it goes out to customers. Tucson Water has about 37 storage reservoirs and the capacity of those reservoirs is 296 million gallons, that's about twice Tucson Water's peak day

deliveries. So, what that means is that we have about two days of storage in our reservoirs on a peak day. In addition to the reservoirs, we have 145 boosters. The boosters are basically what allow us to ship water uphill either from reservoirs to higher reservoirs, or from well fields to recharge facilities to reservoirs where it's stored and distributed to our customers. Many of our booster facilities are located next to reservoirs so you can see here, and here, and other places. There are some booster facilities that are located outside the reservoir, but generally the reservoirs and boosters go together to store the water and then you're going to be able to take the water out the reservoir and lift it up and out to some other place where it should go. Once the water is put into the system, it's distributed out to customers through what we commonly think of as Tucson Water's distribution structure of pipelines.

Tucson Water has about 4,500 miles of pipeline in its system. Of that pipeline, we consider 400 miles of it to be large diameter or what we call transmission veins. You can think

of those as the arteries and then the other remaining small 12 inches in diameter you can think of as the capillary distribution veins and you can see that the ratio of large diameter veins to smaller diameter veins is about one in ten. So, run of the mill distribution is about 4,100 miles on a large scale. Really important, really expensive pipelines are about 400 miles. We have about 90,000 valves on the system. Valves are the operation and maintenance crew's best friend. They allow us to get in to work on an isolated part of the system and they're helpful and they're very costly but they're a very important compliment to the system. They allow us to work on the system, they allow us to shut off the water in an emergency, they allow us to be flexible in ways that we probably wouldn't be able to do if the valves weren't working properly.



This is actually my neighborhood. It's located near Tucson Boulevard and Broadway and as the water in my neighborhood essentially comes from a reservoir that's located down near 22nd Street and Craycroft in the V Zone and it probably flows on most days through a large diameter pipeline in 22nd Street. From there it hits a 12-inch main and then an 8-inch main going up

Tucson Boulevard and comes into the neighborhood through a series of 4-inch and 6-inch mains and you can also see all of the fire hydrants and the valves in this system that are located in this area. In addition to the physical infrastructure, Tucson Water and any modern water utility also has what I like to think of as electronic infrastructure that's equally important in operating, maintaining, and just running the utility and one of the ways to think of this is that through modern technology and remote telemetry, Tucson Water from central location, can control, depending on how well the system is working and whether all the valves are open and not stuck and whether all of the radio transmitters are actually working, we can essentially control the system from one central location and move water throughout the system on a remote basis rather than sending field crews out into the areas exercising valves or turning pumps on or off on a manual basis. That electronic infrastructure is very costly but it allows the system to be run more quickly and more responsibly and able to deal with situations on more of an immediate basis.



One of the most important functions of the control room operations at Tucson Water operating at the Tucson Water Airport Mediation Plant, is a fairly complex system and the parameters of that system have to be monitored continuously to ensure that all of the systems are operating and that there's no possible contamination to the water that's coming into the City

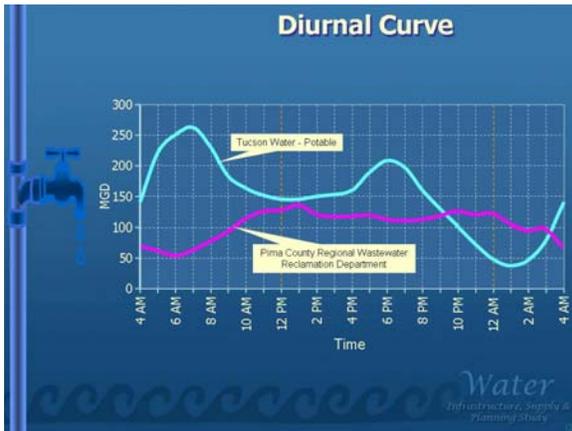
of Tucson. There are some other places where Tucson Water is able to operate facilities in order to bring in water in order to meet Drinking Water Quality of Standards, and that's all possible through this electronic infrastructure that really wasn't in place 20 or 30 years ago. This is a graph that shows Tucson Water's daily demand on an annual scale so you can see in the wintertime Tucson Water's distribution system runs at a relatively low rate and peaks in the summer and then falls off again in the winter. This large blue graph is essentially an average of the maximum daily demand over the period between 2003 and 2007 and should show us the variation that we see in the system. This is the average of those maps during those previous four years and again you can see that you have about 98 to 99 million gallons of water per clear day and goes up to 150 to 160 million gallons a day and then back down again.



Two weeks ago we talked about the fact that Tucson Water's deliveries on an annual volume metric basis have remained essentially flat over the last four years even though the number of customers has increased. This is what our water delivery look like in 2007. You can see that there are relatively few places where deliveries in 2007 were above average and a lot of the

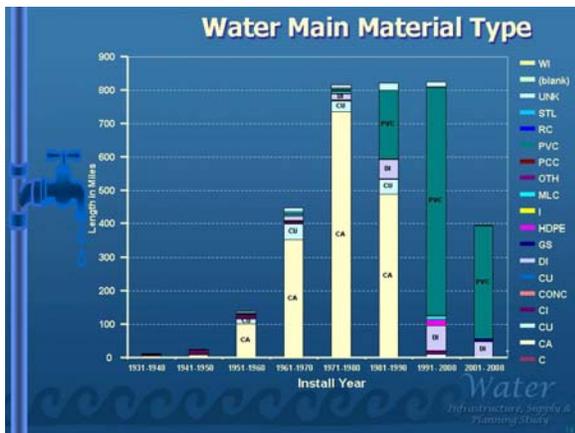
places where the deliveries in 2007 were below average and this is this year and as you can see that there are a lot of places where Tucson Water deliveries are at average or below. There are not too many places where they are above. There are some interesting things going on on this chart that would be interesting to point out. This is that nice cold front that came

through during the Memorial Day weekend and you can see a dramatic decline in water as the temperatures go from 103 to 70 in one day, and this is the recent monsoon activity, this is last Sunday. This is the daily diurnal curve and this is the actually the diurnal curve on one of Tucson Water's peak days so you can see that on a peak day Tucson Water's deliveries are in the neighborhood of 150 million gallons a day when everyone, all of Tucson Water's customers, start to use water in the morning. We actually have to pump 250 million gallons a day to keep up with that morning demand and then there's another small peak in the afternoon and evening.



Essentially what this means is that during a peak day Tucson Water's reservoirs are draining during the morning, they drain again mid-evening, and we use the night time lull in demand to refill our reservoirs and start over again the next day. Let me just go back to this slide. One of the, the points that I think we need to understand and what I'm talking about Tucson's Water

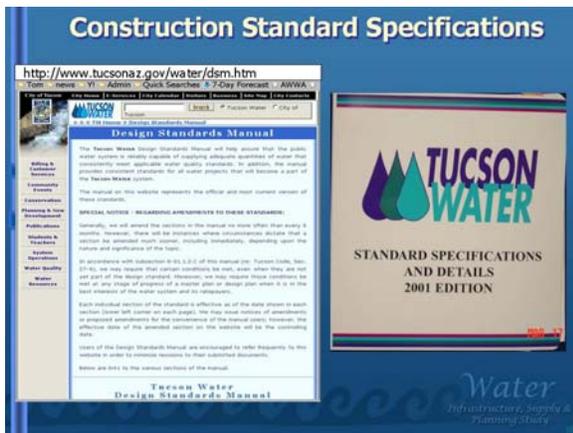
infrastructure is that basically all of Tucson Water's infrastructure is sized and planned in order to meet this peak demand period and so it's those three weeks or so in June that cause the large scale infrastructure investments to be made, pipelines to be sized, reservoirs to be constructed, etc. And generally what Tucson Water tries to do is do a general maintenance and repair work during the off season or shoulder months and have systems ready to go again in the summer time. This is the graph of Pima County's diurnal flows into the wastewater treatment plants and you can see that their peaks fall. Tucson Water delivery peaks fall every few hours and their sewer shed essentially attenuates some of but not all the peaks in the diurnal demand.



OK, let's talk about water mains and what we have in the ground at this point. This is a fairly complex graph and you have to have three or more advanced engineering degrees than I have just to understand it but essentially what it shows is the miles of main that were constructed in the Tucson Water system, the decades during which they were constructed, and the

materials that were used. So you can see, this is - about a month ago we talked about pre-war and post-war boom in Tucson, you can see that boom right here.

This is 1930, we constructed not very many mains between 1930-1940, not a whole lot between 1940-1950. In the beginnings of the 1950s and the 1960s we started to install a lot of pipe. You can also see that the kind of pipe that the Tucson Water has installed over the years has changed through time. So, beginning in the 1930s and 1940s a lot of the pipe that was used at that time was cast iron. Beginning in the 1950s a pipe-type called cement asbestos became dominant. In the 1980s and 1990s we started to use more ductile iron pipe in the system and PVC started to become the material of choice. One of the complicating factors in the Tucson Water maintenance operations is that we have so many different kinds of pipe in our system from so many years and so we start in two weeks to talk about future infrastructure needs. One of the things to keep in mind is that it is sort of the general rule of thumb that most large scale public infrastructure has a useful life of about 50 years and that's not an exact number. A lot of it depends on installation, a lot of it depends on local conditions when pipes were installed and where they were installed.



But you can see that these post-war boom years are starting to come up on 50 years old, just like the baby boomers are. Tucson Water's installation of new pipes is largely dictated by a set of standard and custom specifications. Most specifications are largely driven by experience such as what materials will work, what installations work. Once the

pipe is in the ground and accepted by Tucson Water, there isn't a lot we can do in order to make sure that we can access it and fix it so we learn from experience and have adopted a design standards manual. A lot of the specifications in the design standards manual are driven by departments and we talked about that a little bit a couple of months ago.



Why is all this stuff important? Because, we have to have folks go out and fix it, maintain it and keep the system operational. One of the things that changed over the last couple years with maintenance operations is that in addition to having the truck full of generators and welders and cranes and other equipment, Tucson Water's field crews are now using laptops and asset

management computer programs in order to keep track of maintenance activities. This again links with the importance of electronic infrastructure as well as physical infrastructure as we move forward.



One of the things that we have with maintenance is that during the summer monsoon season, we have a lot of floods in the area that tend to wash up pipes and so we have our crews busy. This however isn't a monsoon, this is a pipe break. This is a pipe break on a 96-inch main that happened in the spring of 1999 coming from Clearwell reservoir down to Tucson Water's service area.



Luckily for Tucson Water, this break happened about one-half hour after some school children were waiting up here for the bus and it happened in February. It didn't happen during Tucson Water's peak demand season. One of the reasons for this large-scale break is that this is a 6-foot diameter pipe with a 6-foot diameter valve. The casting on this pipe is about 6 to 8-inches

thick so, when it was closed in order to try and stop this leak, it broke and this is the hole that resulted in the pipe as a consequence of that pressure.



This is what a more ordinary day to day leak on the water system looks like. Here is a spectacular geyser. This is more, the kind of leaks that folks aren't going to notice but this is actually the most common situation that Tucson Water crews encounter. This is a leak and it has to be fixed just like the other leaks and they happen fairly regularly in Tucson

Water's systems and we have a whole series of operation maintenance crews whose job it is to go out there and isolate the system, repair the leaks and put the system back into service.



One of the consequences of the 96-inch main break in 1999 was that Tucson Water became a lot more active in trying to diagnose areas of weakness in those large scale and large diameter pipes before they happen. And it is interesting to see the evolution of the technology just in the last decade or so. One of the first ways that Tucson Water crews began to detect leaks was

through actual physical sound. I don't know how well you can see this picture but essentially sounding was a system where you essentially walk through the pipes and pound them with a stick and listen to the sound and the sound of the concrete steel vibrating would tell experienced crews what was going on with the structural integrity of the pipe. In addition, we were also using some field currents and other methods to try and detect issues in the pipes before the weakness became so severe that they led to leaks. These days, things are getting a little more sophisticated than just merely walking through pipes and beating on them with sticks. We are using electromagnetic surveys, we are using some solar-powered equipment that runs through the pipes, and holding pipe phones to the pipes and sounding them that way.

One of the things we are doing with new pipes is installing basically fiber optic cables and acoustic monitoring devices and those electronic systems deliver a signal to the Tucson Water Operations Room.



I am told that the sound of the water hitting one of the pipes essentially makes a pinging sound and once a certain number of pings are detected in a certain place on the pipeline, then Tucson Water crews generally go out and investigate and try to see what happened. And sometimes we find that folks have played mischief with our pipes.



This is a damaged, this is a pipeline of 66-inch diameter, a piece of transition main. You can see how large this pipeline is by this photograph here and our best guess is that someone with a backhoe, that didn't call for a blue stake, heard a large cracking noise and quickly buried the pipe and disappeared and once the corrosion set in, the reinforcing rods in the pipe started to break and Tucson Water

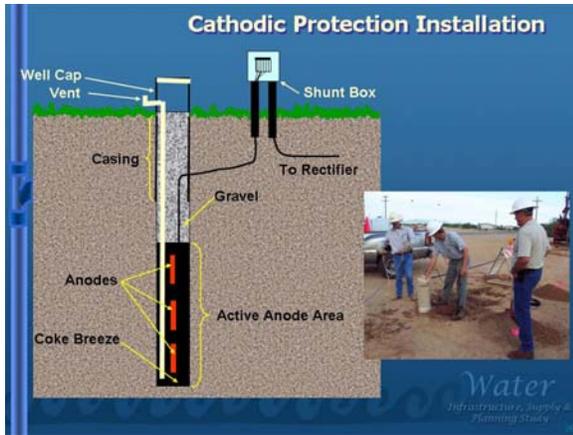
was able to detect the area of weakness in the pipe and go and fix it.

So you can see, the repair being done down here and the recoating of the pipe. I don't know if we're the only water utility in the region that has backhoe mischief as a major cause of ... one of the things that happens with backhoe mischief is that if the pipe is hit with a backhoe, if there is no immediate spewing of water that flies up in the air, that hole gets covered and then a couple of years later the corrosion starts to set in. It's a consequence of that original breach and then we've got an issue .



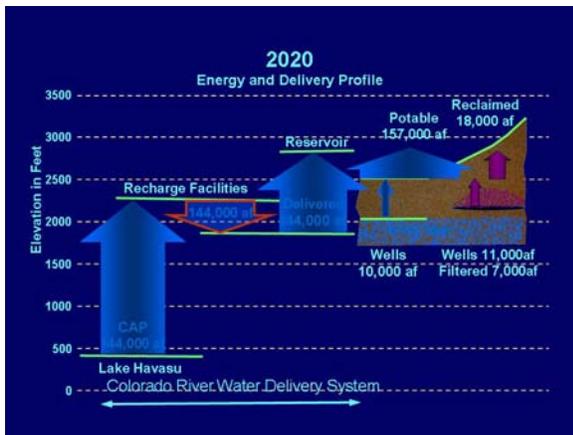
Here are some more photos that just show corrosion and one of the things that happens when you put pipes in soil is that metals are dissimilar. Some metals attract electrons and some metals are more than happy to send electrons to the other metals so you get greedy brass taking electrons from steel and you get corrosion. It also happens when the concrete exteriors of some of

our large diameter pipes are cracked and then corrosion is able to come in and attack the wires.



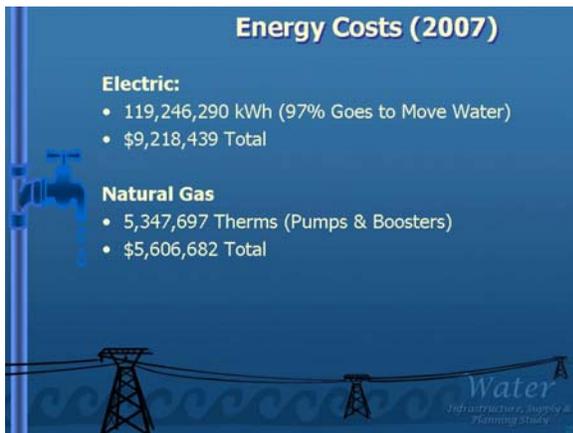
One of the ways that we try to attack this problem is to use what is called cathodic and anodic protection and essentially what you're doing is setting up a current that goes through the pipe, and through the steel in the pipe and then you set up a sacrificial anode and the sacrificial anode, this is an example of what happens in the well installation, using current

and sacrificial anodes so that the corrosion occurs on discreet pieces of metal that you can check and maintain rather than on the pipe. Here is the photograph of installation. I think this is about 40 pound sacrificial anode that is going to be installed on the top of one of Tucson Water's large diameter pipes.



Let's talk a little about energy. This is the graph we showed about a month ago. This is a 20-20 and you can see how much energy Tucson Water will be using. Basically when you lift water from one elevation to another, it takes energy and the 20-20, there is going to be a substantial energy component as we move forward from CAP as well as water that we've delivered within our

own system. Essentially today we are upgrading relatively small scale lifts here and in this area from our groundwater wells up to our surface of the water and through boosters and up to reservoirs. This is how it looks.



In 2007, we used 120 kilowatt hours of electricity, five million therms of natural gas. The total cost for both of those electrical sources was somewhere in the neighborhood of 14 million dollars.



Current PV Solar Systems

- **Thornsdale Reclaim Reservoir**
 - kWh/year: 119,000
 - Total Cost: \$574,110 (COT solar fund and rebate financed)
- **Hayden & Udall**
 - kWh/year: 65,000
 - Cost: \$366,550 (COT solar fund and rebate financed)
- **Small Data Acquisition (off grid)**
 - kWh/year: 80
 - Cost: \$500 (COT solar fund financed)

Water Infrastructure, Supply & Planning Studies

One of the things that we are trying to do is to become more energy independent and that is in the case of Tucson Water largely taken of the guys who have solar projects. We have some small scale solar projects that we are currently filing. This is the roof of the Thornsdale Reservoir located on the northwest side. It generates about 120,000 kilowatts hours per year and it is funded through the City of Tucson's solar funded rebates.

Future PV Solar Projects



East Africa - Solar-cooled vaccine delivery (photo courtesy of Shell Solar)

Water Infrastructure, Supply & Planning Studies

This is a solar bridge located out at the Hayden-Udall treatment plant. This is one of the more interesting uses of solar electricity. In this case, just to send data to our control center and that prevents the cost of installing _____ to the small scale location. The reason I have to show this is because it is such a cool picture and essentially this is a camel

that is using solar-heated refrigeration systems to deliver vaccines in Africa. So the applications in solar are interesting and we are trying to be involved in that.



Future PV Solar Projects

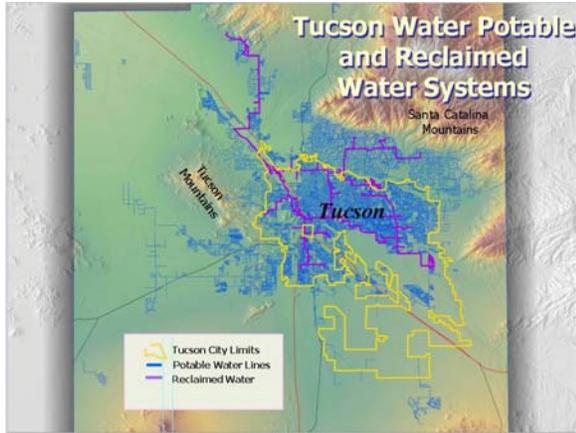
- **Sweetwater Reclaim Plant**
 - Yearly AC kWh: 198,000
 - Total Cost: \$750,000 (CREB financed)
- **Hayden Udall Plant**
 - Yearly AC kWh: 257,400
 - Total Cost: \$975,000 (CREB financed)
 - CAVSARP operations
 - Published Request for Proposals (RFP)
 - Yearly AC kWh: from 1,940 to 9700
 - Total Cost: \$6,000,000 to \$30,000,000 (Private Developer financed & operated)

Water Infrastructure, Supply & Planning Studies

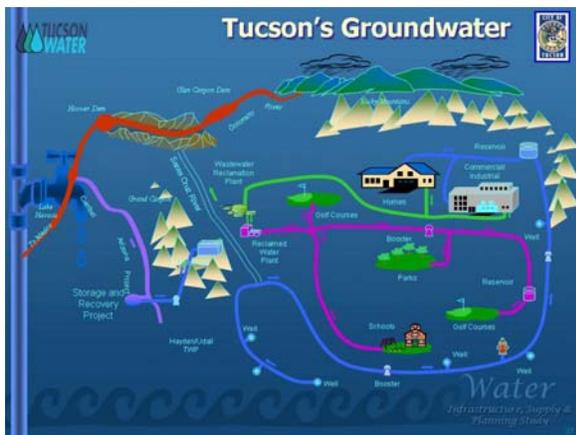
Some of our future solar projects, we are planning to install some solar panels at the Sweetwater Reclaimed Plant which is the reclaimed reservoir and increase the size of the facility at Hayden-Udall. Both of those facilities are funded through clean renewable energy bonds and I'll get on my high horse here and say that there is some thought that those bonds might

disappear as a consequence of federal funding. They are important, they allow basically interest free loans to develop solar energy and we are using them in Tucson Water to develop relatively, in terms of our overall demand, relatively small scale projects. The larger scale project is CAVSARP. We have

just put in a request for proposal for a 1 to 5 megawatt facility out at CAVSARP. We estimate that the total cost of that facility will be somewhere between \$6 million and \$30 million dollars. That will be private developer financed.



Let's talk a little about the reclaimed system now.



This is the graph that basically the cartoon character of the reclaimed system delivers water from the wastewater treatment plant through the reclaimed system to our customers. I'd like to give you just a little primer on effluent classifications. Basically, as wastewater is treated it goes through a variety of different processes. All of the water in the Tucson area that today is

essentially secondary treatment and that requires biological and total solids removal and disinfections. At that point from the Roger Road Treatment Plant, the Silverbell Golf Course takes Class B effluent and uses it to irrigate the golf course. One of the things that we tried to show here is how much the costs change when you try to treat effluent to higher-quality standards. In order to take that Class B effluent from Roger Road and deliver it to Tucson Water's reclaim system, which is also a use for open access irrigations of schools and parks, the effluent still has to be treated. to receive the treatment which is essentially filtration and that allows open access for use on school yards, golf courses, fire protection and residential irrigation.



process works.

In order to _____ the effluent, which is substantially more expensive than simple filtration, you would either get Class B effluent or Class A plus effluent and that can be used for more uses than Class A or Class B effluent. So what Tucson Water's reclaimed system does, at this time, is turn Class B effluent into Class A effluent. Let's talk a little about how that



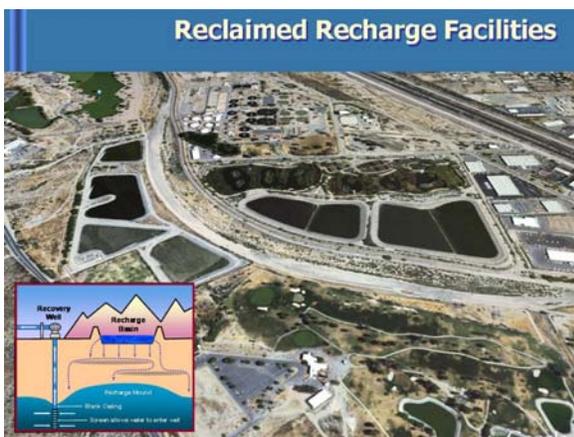
reclaimed sites.

Basically, in order to use reclaimed water, in addition to the infrastructure issues, there are a variety of regulatory issues involved. Reclaimed water can't just be used willy nilly in a system like global water. It has specific regulations, signage requirements, usage requirements, backflow requirements, etc. and this is an example of basically a sign that Tucson Water requires its customers to post on the



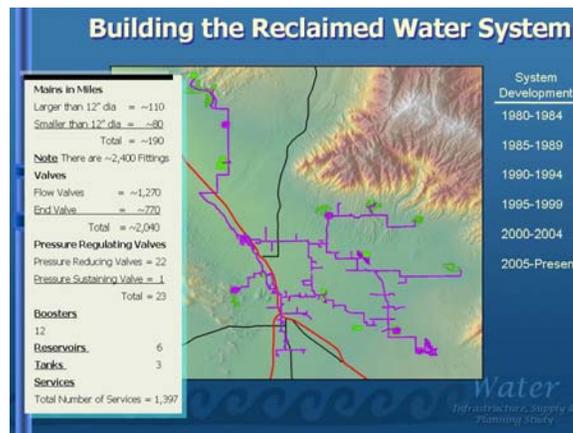
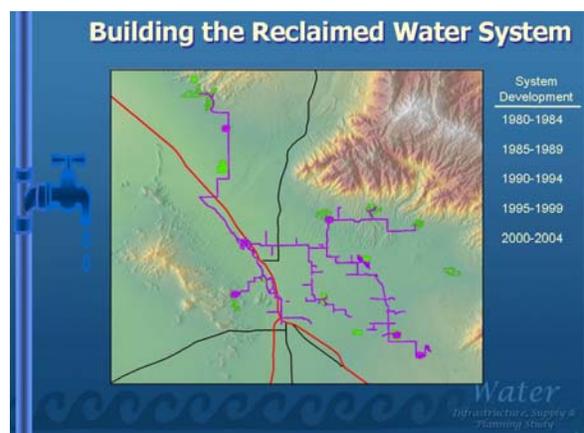
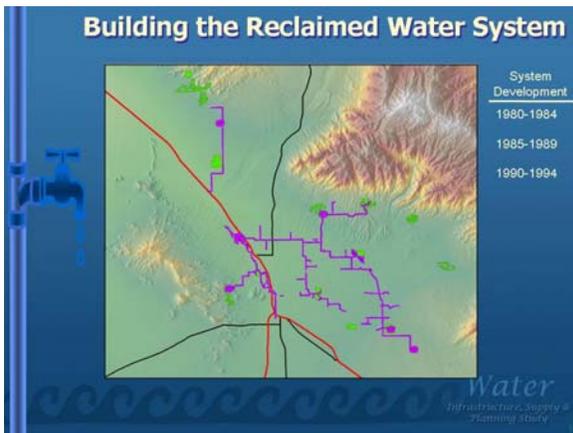
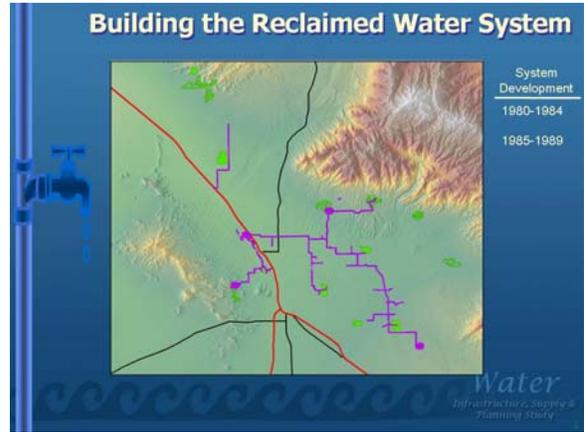
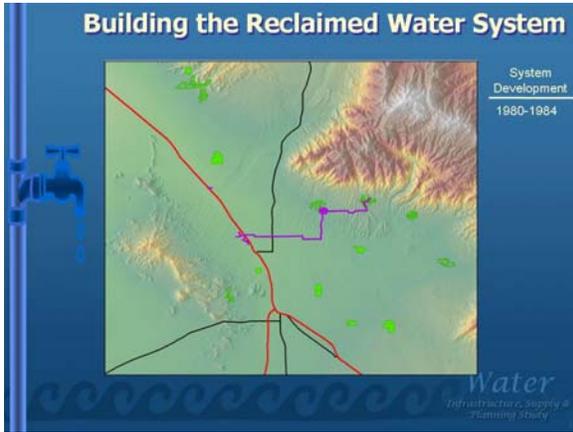
The reclaimed water treatment plant is located next door to the Roger Road Treatment plant. The original filtration facility is located here and it's essentially a 10 million gallon a day pool filter. These are the large diameter sand filtration vessels that treat the Class B reclaimed water, and turns it into Class A reclaimed water, that we can deliver to our customers. The capacity of this plant is permitted at 10 million gallons a day so once Tucson Water begins delivery of reclaimed water to it's customers, it knew that it would have to find a secondary source of treatment and that secondary source of treatment is recharge and recovery. Long before Tucson Water was using recharge and

recovery as a method of using its Colorado River allocation, it used recharge and recovery as a method of producing reclaimed water from Class B effluent. These facilities here at Roger Road, this is the Roger Road Treatment plant, Tucson Water's reclaimed plant, and the Sweetwater plant, and associated recharge facilities. These facilities were permitted starting in 1984-1985 essentially upon the completion of the filtration plant, Tucson Water began permitting recharge and recovery and Class B effluent is delivered directly to the recharge basins where it flows through an aquifer for treatment, down to the local aquifer, and is pumped up through a series of recovery wells and delivered into the reclaimed system.



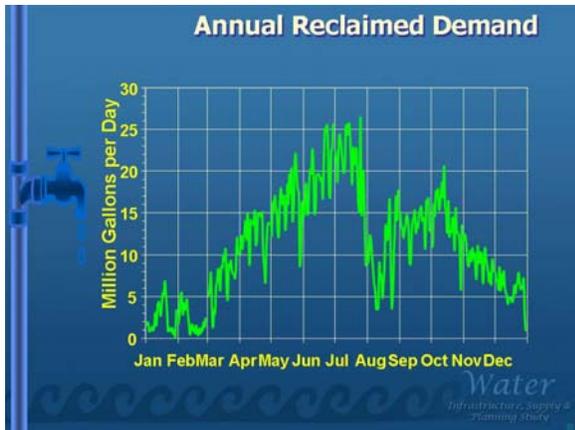
Tucson Water uses its recharge operations in the reclaimed system as a way of meeting peak summer demand. So, the recharge facilities are operated on a relatively costly basis. There is a surplus of water that builds up during the wintertime and during the summer increasing amounts of water are pumped and delivered to Tucson Water's customers to meet golf course irrigation needs.

_____ in the beginning as well as the Starr Pass Golf Course on the southwest side and then began to progress more to the courses that were eventually going to be built at Dove Mountain. Beginning between 2000 - let's go back here, you can see that the system was originally constructed essentially just to serve these golf courses and other users. Beginning, just recently, between 2000 and 2004 we were finally able to start moving the system so that if there was an issue, some place out in the system, for example, here, the water could be, this part of the system could be valved off and isolated and water could still be distributed out to customers through a redundant or loop system.



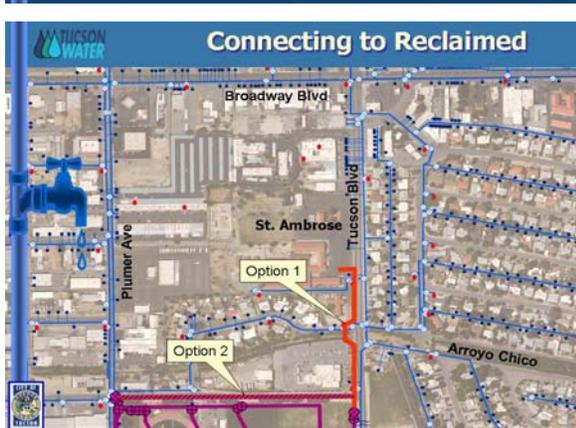
And here is a recent addition to the reclaim system that shows in a smaller scale, more additional moving and some small-scale extensions. As of today, Tucson Water delivers water to 18 of the 21 golf courses that are located within its service area. There are two golf courses, Rolling Hills and El Dorado Golf Courses, that have groundwater wells that existed prior to 1980 so they have grandfathered water rights under the Groundwater Management Act. There is a Tucson Estates golf course located

on the far southwest side in this general area here, located far away from a reclaimed system that is still a Tucson Water customer. In addition, in recent years we've been able to provide water to Pima County's former Arthur Pack Golf Course and also to deliver water into the Town of Oro Valley where it's used to supply golf courses in the Town of Oro Valley that also used to be on groundwater. Pima County's Arthur Pack Golf Course was on secondary effluent for a while, and it's now on the reclaimed system also.



I'd also like to highlight the long extension that goes out to the Forty-Niners Golf Course. That was a relatively expensive extension that it took a golf course, that was located in a shallow riparian in the Tanque Verde Wash and took that golf course off of groundwater and put it on the reclaimed system. The reclaimed system has about 190 miles worth of mains. Again as

opposed to the global water distribution system which is relatively small diameter pipelines, the reclaimed system is about half large diameter pipelines and half smaller pipelines. It has a relatively small number of reservoirs and a relatively small storage capacity and that's because we ask golf courses to use their lakes as storage to attenuate some of those daily fluctuations in the system. This is annual reclaimed demand and you can see that opposed to the potable demand curve, the reclaimed system is much more peaked. It's much more variable, almost no demand during the wintertime and demands are, as you know, five to six times the winter demands in the summer. This is a graph from 2000, what is it? Is this the average? This is an average demand. Actually this year we reached a new peak on the reclaimed system about 31.6 million gallons a day. In addition to the primary customers of the reclaimed system that are golf courses, Tucson Water's reclaimed system is also being extended out to serve parks. About 66% of the City of Tucson parks are on the reclaimed system. And you can see some are isolated areas for example, "A" Mountain is not on the reclaimed system, but there's not a lot of water use up there either.



And in addition to the parks, the reclaimed system is also becoming extended to more and more schools. It's not always easy to extend the reclaimed system to new customers. One of the things that we try to do is look at customers that are within a half-mile of the existing system because it becomes expensive to extend large-scale diameter transmission mains for relatively small uses. In fact, let's go back to my neighborhood. The reclaimed system is currently available at this is the University of Arizona Complex on South Tucson Blvd, this is the track field, soccer field, some general fields, and Howenstine School. St. Ambrose School is located about 1,000 feet north of those facilities, and recently we've investigated the possibility of bringing in reclaimed water from another school. St. Ambrose School uses probably less than ten acre feet...

-----BLANK

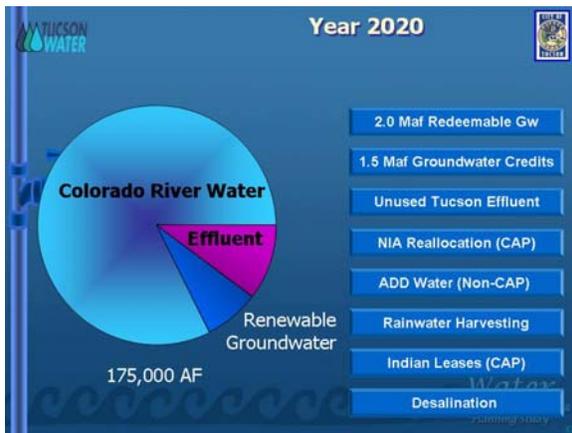
AUDIO-----

... Because this pipeline crosses the Arroyo Chico wash, which is in itself about \$50,000 cost, the cost of getting water from the existing reclaimed system to St. Ambrose school is about \$250,000. So, basically for \$1,000 dollars in water savings you are investing about \$250,000 dollars worth of infrastructure.

About 1/5 of the cost is the _____ about another 1/5 of the cost is pavement replacing, and about 1/5 of the cost...

-----BLANK AUDIO-----

... We do this on a more or less continuous basis to try to ensure that we can add additional customers every year. Now, the agreement with the TUSD where we use the difference in cost between reclaimed water and global water and finance the changes that need to be made on the individual sprinkler systems to use reclaimed water. What that means though is that as we move forward in time, we will be able to attract new customers on to the reclaimed system. But, those customers would probably be on a relatively small scale because most of the golf courses in the area are probably on the reclaimed system and will have to take advantage of opportunities as they arise. So, let's go to the year 2020. In the year 2020, we've seen this pie chart before. We are going to use a lot of Colorado River Water, groundwater supply and effluent. The infrastructure that Tucson Water has today, the well fields, the recharge facilities, the basins, the pipelines and the reclaimed system, will allow us to meet these demands in the future. In addition, the additional capacity of the water scale of the recharge basins and the large diameters of the pipelines that we installed will also allow us to use some of the water supplies that we don't anticipate needing by 2020 by groundwater credits, unused effluent, and perhaps some other sources supply that may come down the CAP canal. So, the infrastructure that Tucson Water has today is relatively robust. It's large scale and it directly accesses all of Tucson Water's resources, Colorado River Water, effluent, and groundwater. Thank you very much.



QUESTION: (unintelligible)

ANSWER: Well that's a great question. You actually hit on what we are just starting to see as a relatively interesting phenomena down in Pima Mine Road and that is that this mound of groundwater that has been recharged in the Pima Mine Road over the last decade is now, we think, starting to

move toward the Santa Cruz well field. The original concept of Pima Mine Road would be that it would be a storage-only facility. But, we are starting to see some preliminary indications of groundwater quality changes from the water that we recover from the Santa Cruz well field that would indicate that perhaps water from Pima Mine Road is coming into the Santa Cruz well field. But that's a good thing. That means that we are starting to recharge an existing well field and we are not necessarily going to have to build additional recovery infrastructure in order to recover it. So, one of the things that's happened, particularly in the case of the Avra Valley well field, that well field was originally designed as an extraction-only well field. But, because of the location of SAVSARP, we know that the wells that are located out here will be pumping Colorado River water in the future.

QUESTION: You mentioned the Green Valley area, are you going to have interactions with either your storage or your pumping?

ANSWER: I think the answer is yes. This is more of a prediction than a fact. So let's be clear about that. But, I think that there are some discussions that are beginning between the City of Tucson and the other water providers. There is some discussion that has been going on for a very long time about how to use the existing infrastructure that we have in the region in order to prevent groundwater pumping elsewhere. One of the ways we've been able to do that is on the reclaimed system where the Town of Oro Valley is getting water from the reclaimed system that's replacing groundwater pumping that they were otherwise using for their golf courses. We think that there will be more possibilities for doing that in the future.

COMMENT: I understand that it gets more acute in the future but thank you.

QUESTION: Could you just physically explain what you meant by "reservoirs"?

ANSWER: Yes, reservoirs, you know any of you who have driven through the Midwest have seen the large storage space, you know large storage tank sitting up on generally three poles 100 feet or so in the air. That is a reservoir and that is how those water utilities in Kansas are developing their water pressure is by lifting water 100 feet up into the air and then dropping it back down to their customers. In Tucson, our topography allows us to essentially do that by sitting reservoirs at the correct elevation and then delivering water downhill to our customers. So, reservoirs are essentially huge storage tanks located above our future customers and use that pressure drop between the reservoir and the customer in order to build water pressure.

QUESTION: Those great big tanks?

ANSWER: In the Tucson area most reservoirs are either on the ground or halfway, the reservoir might be 20 feet deep, 10 feet above the ground, and 10 feet below the ground.

QUESTION: (unintelligible)

ANSWER: Yeah, again, the important thing about the reservoirs is not necessarily whether it is above ground, below the ground, it's what elevation they are, it's which elevation they are located so that you can deliver water downhill to your customers.

QUESTION: Is there backup to be able to supplement an area if for some reason storage in that settlement is depleting faster than other areas?

ANSWER: Mark, I can answer that question for most of the system and say yes. As we get out toward the edges of the system it becomes harder and harder to have redundant supplies. But the fact is that with all the elevation changes in topography and boosters, and the network of pipelines that connects the system, we think that we are redundant in most places. There may be, there are some places out near the edges of the Catalina Foothills out near the edges of the Rincon Mountains and so with isolated systems, where we are redundant. Jim, you said you had two questions.

QUESTION: On the daily demand curve, I understand going up in June but then it comes down in August and September and goes back up again and that is also what you show for reclaimed? I just don't understand.

ANSWER: Ok, well, I think there are two reasons for that. First of all, we have a nice Indian summer in Tucson so generally September and October can be fairly warm and fairly dry, so people are starting to irrigate their lawns again. And another thing that the phenomenon really shows up on the reclaimed system is over-seeding. The golf courses have a secondary demand period in September and October when they change their Bermuda Grass to Winter Rye and put a lot of water on those golf courses for a couple of weeks in order to establish the grass and based on my experience in the _____ in October and November, and I think that happens on the residential side as well.

QUESTION: (unintelligible)

ANSWER: John, I'm going to let Pima County really address that question.

QUESTION: I'd probably known that but I thought I'd get some new information (laughter).

ANSWER: I think they need to answer the question. I know that we are working together with Pima County and with the City on looking at what the future demands are going to be down

here on the Southeast side and what we call the Houghton Road Corridor, Houghton Road Planning area, and there may be some opportunities that come forward.

QUESTION: The Clearwell Reservoir, that's the one in the Tucson Mountains correct?

ANSWER: Yes.

QUESTION: And that's a significant part of the reservoir system. Is that right?

ANSWER: It's significant for a couple of reasons, but there are two reasons why Clearwell is important. Let's go back there. This is the Clearwell Reservoir located in the Tucson Mountains. There are a couple reasons why Clearwell is a really important facility for us. First of all, _____ but it's at high elevation. It's essentially, I think at 2,900 feet and so from Clearwell Reservoir we can serve almost all of the Tucson area. Basically, out here on the pressure zone map you can serve from Clearwell Reservoir- go ahead and show them. From Clearwell Reservoir 2,900 feet up you can essentially serve all the way out into Tucson. So you are basically able from Clearwater Reservoir, to serve water out into the Tucson Water system all the way out to essentially this orange boundary. The other thing that is great about Clearwell is that the width from Hayden-Udall treatment plant to Clearwell Reservoir is paid by Central Arizona Water Conservation District as part of the CAP allocation and that was part of the deal that was struck a long time ago to bring water into Tucson. So, the water is lifted uphill to Clearwell Reservoir and from there we can serve a great majority of the Tucson Water area through gravity storage once the water gets there.

QUESTION: Does the name Clearwell have any significance or is that just what it's called?

ANSWER: It does have some significance. The reason it is called Clearwell Reservoir is because it is a potable water reservoir on the CAP system, it's not CAP water. So there is, I don't know all the terminology, but there is the Snyder Hill pumping station and four bays that are located down in the Hayden-Udall treatment plant and it pumps up to the Clearwell Reservoir for which is really, it's the Tucson Water's facility but is essentially, from my understanding, the only point on the CAP Canal or the CAP facility where there is potable water being distributed that is not CAP water.

QUESTION: When there is a problem with the Clearwater Facility is there another pipe that can get that water into the system?

ANSWER: Do you mean the Clearwell Reservoir or the Clearwater Facility?

QUESTION: I'm sorry, the Clearwell Reservoir and the associated pipelines, where the 96-inch main broke. How did you reroute the water?

ANSWER: When the 96-inch vein broke we have a 42-inch pipeline that comes in from Avra Valley. In addition, we have got, depending on how many wells are on or off, we've got about 90 million gallons of capacity in the central well field. So, you know, its not a perfect solution and on a peak day there is definitely going to be some issues but the central well field itself, the south side wells, and the 42-inch line out in Avra Valley can in combination meet Tucson Water's demands most of the time. When you get into the peak days, you know, essentially we're running the system on a pretty close to maximum capacity but if we are in April or September or any of those periods, then there is good coverage. One of the future infrastructure projects that we are going to talk about in two weeks is a way to first build storage and recovery facilities from SAVSARP that connect in, and second to build a third pipeline in from Avra Valley that would be redundant so that if anything happens on any one of those three pipelines, we have the capacity to use the other two pipelines to deliver water.

QUESTION: When you were talking about building a water system, I'm getting the perception that a lot of that system was driven by water needed for golf courses. So, two questions: Is that perception accurate, are we paying for that infrastructure to be installed, and is there any kind of comparison about golf courses within this region and their uses and demands for groundwater and effluent versus other uses?

ANSWER: I can answer your first question, you are exactly correct, the reclaimed systems was driven by golf courses. Those large _____ points at the end of the reclaimed system allowed us to construct it in the first place. Without those large-scale customers it would have been economically infeasible to build a reclaimed system to deliver water just to a school or just to a park because the infrastructure costs are so high and constructing that 10 million gallon a day treatment plant and constructing 42-inch diameter pipelines to extend throughout that system. So, it is absolutely correct that the first customers on the reclaimed system were golf courses and then we catch as catch can with parks and schools and other reclaimed users and take advantage of their proximity to the reclaimed system in order to make those connections economically feasible. In terms of golf courses and their use of effluent and groundwater compared to other places, I don't know the answer to that question. I do know that ADWR, Jeff, is Jeff here? He can help me out. ADWR

has some standards for golf course usage, and especially when they're on groundwater, that they can't exceed certain quotas.

STAFF ANSWERING PART OF QUESTION: Approximately half of the golf courses in Tucson are on groundwater and about half of those have grandfathered groundwater rights because they were using water between 75 to 80, half of them. The other half of the golf courses using groundwater are being served by municipal providers that don't have a reclaimed system.

QUESTION CONTINUES: Well, what I'd like to see at a future meeting is the actual numbers or total number of golf courses within this region and what their actual use and demand is in terms of their use versus all the other uses. I think that would help give me a much clearer picture of what the demand really is and the necessity of that demand versus cost providing the infrastructure. And that is the other part of my question, who pays for the infrastructure for that delivery? Because, I guess I don't see how golf courses really contribute to the outgoing supply at all. So, I would like to see some of those statistics in terms of that use and those demands versus other demands within the region. Not just on a per golf course basis but all of them combined.

CHAIRMAN: Let me interrupt that last question. It's coming on a quarter to nine. We do have another presentation to make. I know there are some other questions out in the audience. So let's try to go through them. Marcelino?

QUESTION: Yes, one question in regard to consistency of water quality in the system. Is the water quality, the make up of the water consistent, just in the example of the Clearwater Facility and 42-inch well. Would there be a difference or reduction, on a different PA?

ANSWER: The water quality in the Tucson Water System is fairly consistent, especially the Colorado River recharge facility is rainwater, water on a relatively large scale and that water mixes in reservoirs and is delivered throughout the system at a fairly uniform rate. So, that as a general rule, customers in central Tucson are getting water that is approximately the same quality. There are some slight variations in some areas of Tucson that are served only by wells and remain being served only by wells and there are some variations in quality. Isolated systems that are also on their own independent well fields, but in all cases the water that we serve meets the regulatory standards and again the fact that there is a large system, a lot of reservoirs, a lot of opportunity for mixing means that the water quality we deliver is fairly consistent throughout the Tucson region.

QUESTION: My understanding is La Paloma and Ventana Canyon as well as Starr Pass receives subsidized water and I'd

like that to become public, and I'd like also to know if Dove Mountain received that same tax benefit? I'm also interested in the agreement.

ANSWER: Very quickly the answer is that if we can go to the reclaimed system cycle, the answer is that Dove Mountain, Starr Pass, and La Paloma golf courses receive water under a contract that they entered into with the City of Tucson in 1983. At that time there was a rate established and that rate was indexed against the commercial rate that Tucson Water would adopt over the years. So, as the commercial rate increased, that initial rate that was established by contract with Ventana, La Paloma, and subsequently Starr Pass also increases. After that, those contracts were entered into, the City and as the reclaimed system matured, the City developed a reclaimed rate. That reclaimed rate is independent from the contract made for Ventana Canyon, La Paloma, and Starr Pass and at this time the difference is that the reclaimed rate for La Paloma and Ventana Canyon and ...

-----BLANK AUDIO-----

...expenses on the reclaim system were higher. As the reclaim system matured, as it acquired more customers, it has become more independent and today the amount of that subsidy is about 5%. The courses in Dove Mountain today, the standard reclaimed rate, and while that rate was more subsidized in the past, in 2000 and 2001, the amount of "subsidy" for that rate today is a lot less than 5%.

QUESTION: One more point, I'm interested in the agreement between the developers because you did not mention any names, regarding extending the pipeline to Corona de Tucson and I'd like to see that agreement, _____ agreement or what kind of agreement was made?

ANSWER: That agreement is a matter of public record. It's available on the City of Tucson's website and I'll make sure that the link to that agreement is posted to the City _____.

QUESTION: Quick, Quick, right or wrong? I got a _____ If you have a new golf course, you must used reclaimed water, is that right?

ANSWER: That is certainly true in the City of Tucson.

QUESTION: Can I get one clarification? First you said that 18 to 21 golf courses are on reclaimed in Tucson, then she said that half were? I think she is referring to the Metro Area?

ANSWER: Yes, I'm referring to courses in the City.

(Previous person who confused the current speaker) I was referring to the Tucson AMA.

(Current speaker): The AMA?

(Previous speaker): The AMA, yes.

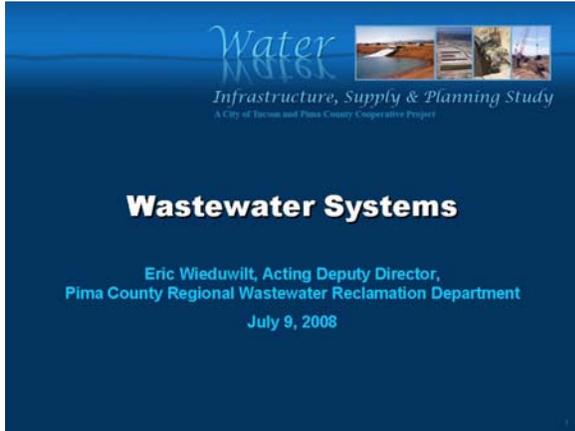
(Current speaker): Ok. Great.

The AMA's are a much larger area than the service area.

CHAIRMAN: It is now ten till nine and we still have 45 minutes worth of presentation to go. If there is anything we have not processed submit any questions that we will get back to if we don't do it today. Let's take a five minute break so you can ask questions directly if you like, then we'll get started again. Thank you. Good job Chris.

Presenter #2

**Eric Wieduwilt, Acting Deputy Director of Pima County
Regional Wastewater Reclamation Department:
Wastewater Delivery System and System Conditions**



MR. WIEDUWILT: There is good news and bad news. The bad news is that we are only halfway done this morning. The good news is that we get to talk about wastewater now.



We have framed this morning's topic on five key issues that we think are take home points. One is that our wastewater system is shaped by the history of geography and climate in a unique area. Both the temperature and the terrain dictate how our sewer system has been constructed and how it operates. We have a complex system that is dependent on new technologies and energy to

run the pumps, very similar to Tucson Water's elements. Our treatment facilities are expensive to build and expensive to maintain and operate. It takes a lot of dollars to keep them rehabilitated and up to date. I'll use the analogy later on, the treatment plants are like battleships and you will see that a lot of what we do is very similar to what Navy crews do to keep the battleship operating out in high seas. We are constantly dealing with quantity issues, new development, physical hydrologic capacities with pipes in the plants, as well as the water quality issues. It relates to the regulatory framework, both Tucson Water and Pima County Wastewater have highly regulated requirements. Because of that, we have to be constantly aware of upcoming regulations and what we have to do to adjust our facilities that meet those requirements.

Challenges for the Wastewater System

-  Aging infrastructure
 - Ina Road WRF – initial facility built in 1970s
 - Roger Road WRF – initial facility built in 1950s
-  Increasing regulatory standards
-  Growth and expansion

Next thing we will focus on are the aging infrastructure. If you're involved at all with utilities you will know that every organization in the United States keeps saying that our infrastructure is aging. Most of it was built in the 60s and 70s, and are past its useful life, half a trillion dollars for roads, streets, water, and sewers. You are going to hear

the same story from us. You've heard it from Tucson Water. We all are going to have to look at what it is going to take to invest into our existing infrastructure to keep it functioning properly. Regulations never stop. We are looking at more, better standards, better water quality standards, it relates to cost, growth and expansion as well.

Regional Wastewater Reclamation Department

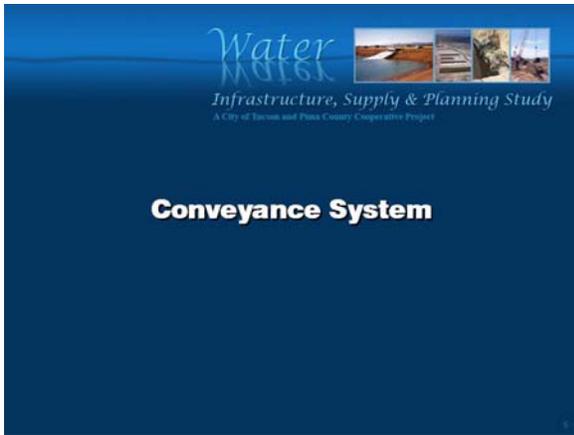
- Second largest wastewater system in Arizona
- 700-square-mile service area
- 260,000 customers
- 580 employees
- Conveyance
 - 3,400 miles of pipe
 - 73,000 manholes and cleanouts
 - 31 lift stations
- Treatment
 - 11 wastewater reclamation facilities
 - 70+ million gallons of wastewater per day

Public Health is the Mission



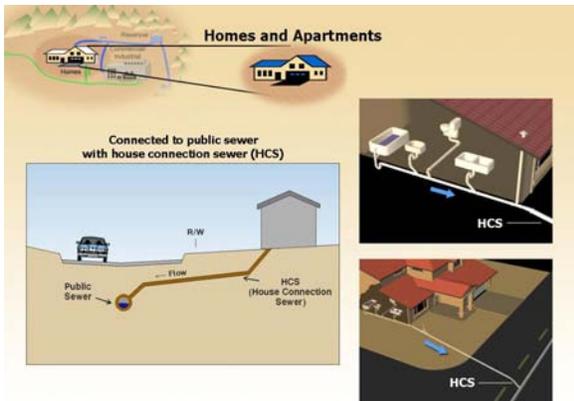
Let me introduce Pima County Regional Wastewater Management Department. Our mission is public health. We are very fortunate to be in a society where raw sewage is not running down the streets and you can look at what we do here as something that we all as a community are able to help do. Proper infrastructure, water and wastewater, keeps our health and

safety of our kids and of our society. We are the second largest wastewater facility in the state, second only to our nice neighbors to the north in the City of Phoenix -- 700 square mile service area, a quarter of a million customers, 3,400 miles of conveyance pipe, 73,000 plus manholes and going on down the list, 11 treatment facilities, 3 of them in the metro area, the remaining in the sub-regional areas outside the metropolitan area.



Let's talk for a minute about the two parts, we'll talk about the Conveyance System first, that's the pipes and manholes that are out in our community. The second part will be the treatment plants and we are going to go through a virtual tour of our major treatment facilities at the very end. Hopefully, this will show you enough about what these plants look like on the ground so

that you could get a good idea of their function and operability.



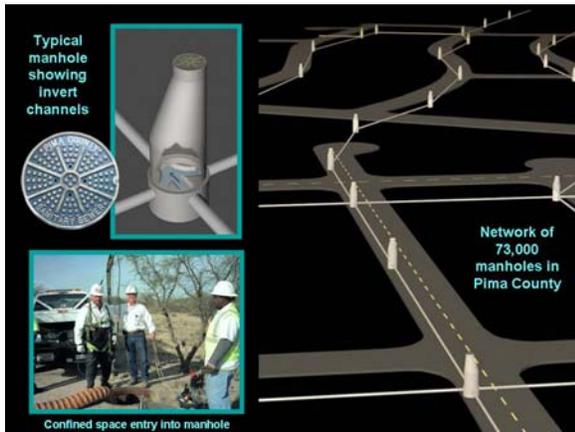
The Conveyance System, this slide may look familiar. This is a slide we showed in, I believe, the first presentation. It shows our homes and that we all have house connections, and sewers, public and private lines that go out to a public main, most of the time in right-of-way, sometimes in alleys and easements.



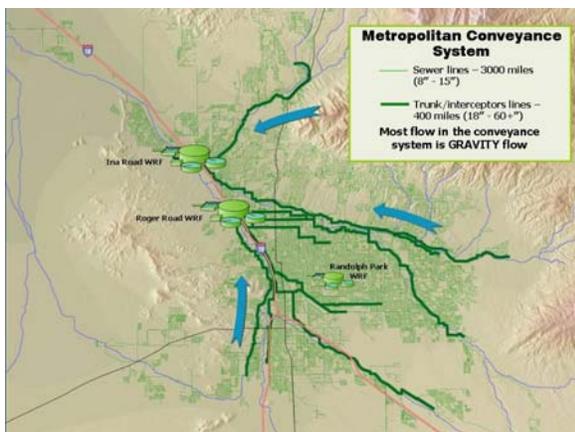
The green lines are the public sewers. This is a rapid new development. The red dots are manholes. Manholes are spaced on an average of 300 feet down every sewer line and you can see the sewer doesn't always follow the street. It's a gravity-driven system for the most part, so the developer, when they design these are looking for an area that can drain hydraulically, so we do have to fight the challenges of

accessing our sewer lines outside of the right-of-way. The little green dashes are the house connection sewers. Regulations changed a couple of years ago that required us to have to do blue stake or be able to identify the private lots and public right-of-way and we are starting that effort by

putting them on our maps so our field crews can see where the pipe lines are.

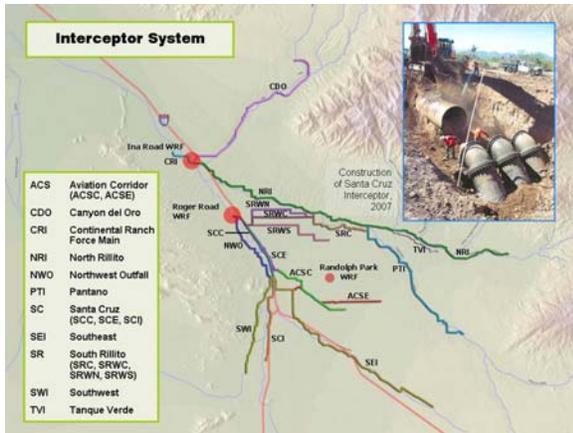


A little fancy schematic of the inside of the manhole, these are our maintenance ports. Manholes are the way we get into the public sewer system. It is an infrastructure that is out of sight out of mind. This is how we check to see how it is operating. Any entry requires confined space so there is a lot of risk to the employees. It is a hazardous environment in there -- gases. We do not know what people dump upstream. So, all of our workers that do entries have to be very cautious of what the air quality is in there as well as the wastewater itself.

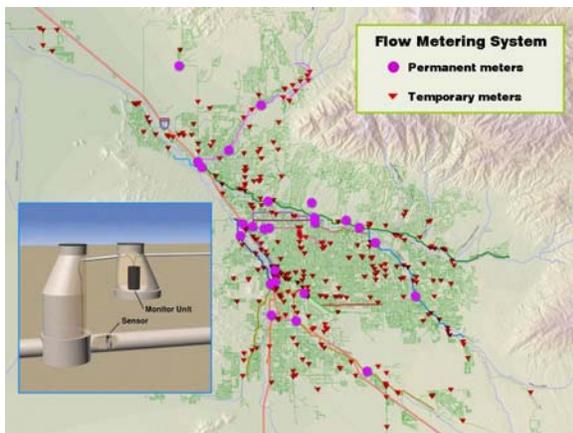


So looking at the bigger picture, this is just the metropolitan area, the light green lines in these areas are the smaller diameter sewers. It is about 3,000 miles of 8-inch to 15-inch diameter pipe. It's primarily 8-inches that would serve residential neighborhoods and the darker green lines are what we call our trunk sewers or interceptors, the larger diameter

pipes that collect the small feeders that run into our major treatment plants. I have mentioned that most flow is gravity. We are very fortunate to have mountains around the town with big plains and have enough elevation fall to allow the systems to be operated by gravity. Communities in Florida, where you have very flatlands, end up with thousands of pump stations to service an area the size of ours. We are lucky we have only 31. Our interceptor system is the backbone of our sewer network. We have gotten to where we need to give them acronyms or names to be able to talk about the interceptors. When you start describing the large pipe along I-10 on the left side of the railroad track, it gets a little difficult for us to communicate.

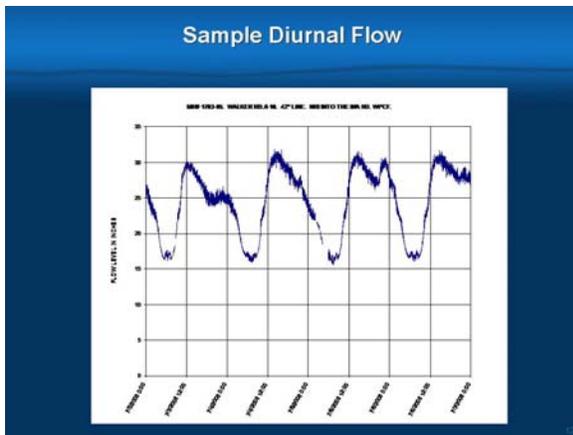


So, every interceptor is named and that name is referenced for all of our maintenance activities and discussions of capacity constraints. The picture on the right is the current construction on the Santa Cruz Interceptor expansion. It is going into the siphon box. So, it's going underneath our river. We have to go through three different pipes up the line but, you can see the diameter size of our interceptors compared to the workers.



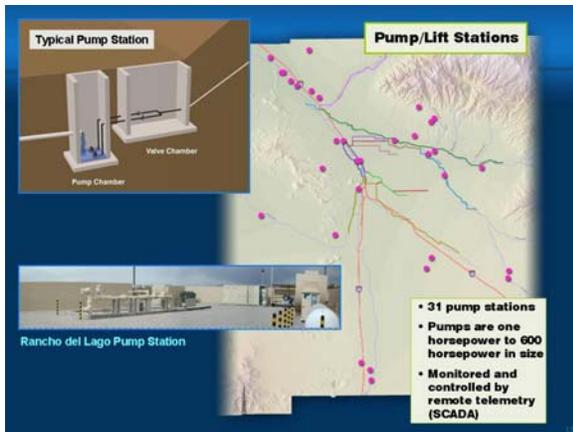
In order for us to feel the pulse of the system, because it's gravity, we need to monitor the flow. We have permanent meter sites that are connected by a SCADA system to a local control room, and we are constantly monitoring the flow. SCADA is Supervisory Control and Data Acquisition. Chris talked about electronic or remote monitoring and SCADA is the terminology that

has the wireless signal information back and forth between these elements. The picture on the left is a sample of what a monitoring site looks like. There is a little caliper sensor that fits inside the sewer pipe. All the electronic signals go to the small vault chamber and then usually to an antenna that transfers it to our central system. We have temporary meters also. With 3,400 miles of sewer, we can't be monitoring in every reach so we have meters that we move around. As new development requests come in, we need to see what the existing capacity of the system is so we go place a meter for a couple weeks to get an idea of the flow and move forward. We have just completed a calibration of a hydraulic model for our interceptor system and we will be moving to calibrate a model of the entire sewer system in the next couple years. Once that calibration is done we will be able to use a model for the technical placement of a lot of meters.



Chris showed you a sample of a diurnal. Tucson Water's flow and ours is quite similar and also varied as you can see the peaks come in the early morning, very big peaks, and another little small peak in the afternoon and a big drop at night. You can see the different days and there's unique characteristics with each day so we can't predict 100% what it is going to look like the next

day. Saturdays and Sundays are different than the weekdays. Superbowl Sunday is much different than any other day. It is also good to point out that this is because it's gravity, there is no off button. If something happens in the sewer system it takes a while to get people mobilized, pumps in place to start pumping the water around to another location than it could gravitate against. That is something that you should really have an understanding of, that you can't just turn off the pump to stop the water from flowing. They'd have to call all the residents and ask them to stop flushing to be able to have any impact.



We do have 31 pump stations. Most of them are small but these are variants in the system that require the wastewater to be lifted back up over a ridge and dumped into the gravity system and flow. Usually a wet well pump chamber into a valved vault that we call force main, that's our pressure lines, small diameter, it goes and discharges into another gravity manhole.

Our largest pump station is the 600 horse power Continental Ranch Regional Pump Station. It was developed in Continental Ranch, uploaded to a large pump station that sends that wastewater to Ina Road. The rest of ours are much smaller than that serving single developments primarily.

The picture on the left here is the Rancho del Lago Pump Station and we have modified our design, without them pumping above ground to keep from having the workers do confined space entries into the valve boxes. Again, the SCADA word, all of our pump stations are connected by SCADA, an operator at two of our facilities can watch the screen and monitor the level of

the operation of the pumps continuously and there's alarm triggers also, so you reduce the windshield time of operators that we have to have at every plant, with every pump station everyday.



Here is a picture of a typical pump station, the developer put in a community. It was on the side of the hill so all the gravity flow is to the north. This is far East Speedway and there was not a gravity sewer for them to connect to at this point, so they had to install a pump station and the force main goes all the way back up the street and discharges at the top of the

development. Some of the problems with pump stations is odor. Because we have a long force main, the oxygen gets eaten up and starts getting septic. The odor occurs at the discharge manhole so we have a lot of standards in place to try to address the odor problems at the pump stations.



Now we will talk about the Conveyance Division staff. Staff at our Conveyance Division work out of our Richey yard operations facility. They do the preventative scheduled maintenance. They do the pump station maintenance, odor control, and roach control. 108 employees.



They were fortunate to recently receive three ISO Certifications. The only municipal organization in the United States to have all three, one on safety, one on quality, and one on environmental.

Water
 Infrastructure, Supply & Planning Study
 A City of Tucson and Pima County Cooperative Project

Conveyance System Programs

Preventive Maintenance Program

- Area Rodding Program
 - 73,000+ sewer line reaches
 - All lines 15" and under are cleaned at least once every five years
 - Rodder trucks insert industrial "plumber's snake" into lines to cut tree roots, break up debris and clear blockages



One of fifteen rodder trucks

We operate several preventive maintenance programs. The primary concern is to keep the wastewater in the pipes and not flowing out on the streets, so they are called Sanitary Sewer Overflows. We will go over some statistics about that later, but all of our maintenance activities are directed at keeping the water in the pipes. One of the primary maintenance activities we have is what is called Area Rodding Program for 3,400 miles we want to get every pipe at least once every 5 years and run the rod through it just to make sure there is no grease or blockages building up at the roots. The picture on the right is our rodder that is the workhorse of the collection system. It is just like a sewer snake, a plumber sewer snake, except the coil is in the back grid and the

very front is an 8-inch saw instead of a little 4 or 2-inch saw that you would usually rent from a store.

Scheduled Maintenance Program

- Scheduled response to problem areas identified by crews and televising of sewers
 - Root growth, grease, debris that could cause sanitary sewer overflows
- Maintenance cycles vary from three months to 48 months



One of six combination vacuum/pressure trucks



Roots removed from sewer

In addition to the rodder truck, we operate combo units, these are pressure cleaning and vacuum trucks. The picture on the lower left here. The reason we are going to these now is that they do a better job of cleaning. They have a pressure hose that shoots down the pipe then washes the pipe moving debris back toward the manhole they're operating out of and then a large

snorkel vacuum that sucks the debris out of the manhole and puts it into a debris body in the back. The problem with the rodders is that they bring the debris to the manhole and they either have to use long shovels or do manned entries. So, this technology reduces the wear and tear on our workers, reduces the risk of confined space entry, but has its own challenges given that if you look at the size of that vehicle it's like driving a

cement truck around. We have to really pay much more attention to the access to manholes, where developers put sewer lines in easements, overgrowing easements, makes it harder to get to and it also requires a commercial drivers license for those operators. For areas where we know we have root intrusions or grease downstream from certain restaurants, we do that reach or several reaches upon what we call scheduled maintenance. We define periods 3 months to 48 months to go back and keep that line clean and keep anything from building up and blocking it.

Emergency Response Plan
Contain, Remediate, and Mitigate

- Sanitary Sewer Overflow (SSO) Response Program
 - Rapid response to overflows caused by blockages and pipe breaks
 - Primary causes are roots, grease and vandalism
 - SSOs are reported as Clean Water Act exceedances – beginning with one drop




Year	SSOs
1999	245
2000	238
2001	199
2002	193
2003	128
2004	126
2005	78
2006	100
2007	93

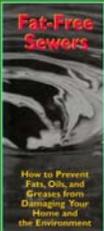
Of course as I said, you do all this to prevent sanitary sewer overflows. We are not perfect so we do have them occur. We have an emergency response plan that's a very high priority that we get out there immediately, we contain the spill, and we remediate it and we mitigate it. We also have to report it. Any discharge outside of the conveyance system is in violation or exceedance of

the Clean Water Act. The guys on the left here are cleaning up a spill caused by a root blockage, and they're picking up the debris that the pipe blocked up. Primary causes are roots, trees and vandalism. On the chart, on the right you see that we had a concerted effort in reducing our sanitary sewer overflows. What we are having a hard time doing is controlling vandalism. Youths pop open the manholes, put in bowling balls, tree trunks, mattresses, you name it. We've had some landscape crews decide to dump their debris into our manholes instead of taking it to a landfill. So when we can identify when it has occurred, we have a detective who's out there trying to find the culprit and we will prosecute them. Because some of the overflows are also caused by grease, we have very pro-active educational programs for the public.

Fats, Oils and Grease Program

- Educational program
- Periodic grease collections/Greycycle



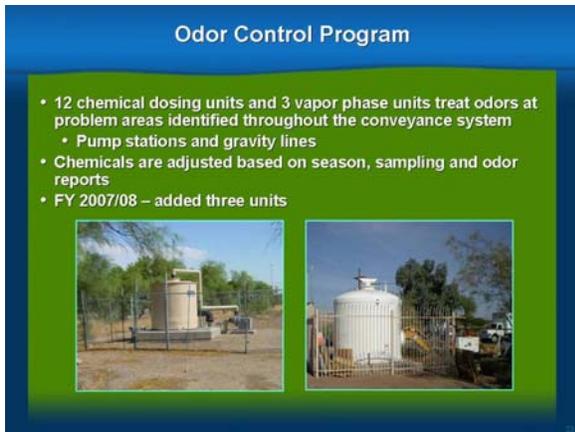


Fats, oils and greases are a big cause of blockages and so we want to stop that by developing brochures, "Are You Committing Sewercide?" creative slogans like that. We also hand out white spatulas at any County event that you can use at home and which remind you not to put grease in the sewer.



We have several programs that are just to serve the public and our workers from a health perspective. One is our famous roach program. The cockroach of concern is the American Cockroach. We all have samples to carry around with us and we've also been trained to separate and identify the American Cockroach from the Russian Cockroach from the German Brown, so the American

Cockroach is the only one that lives in the public sewer but they also live in wet damp areas around peoples houses so we have started an improvement program the last three years to coat every man hole with a latex based pesticide. If you're a little squeamish don't look at this picture but those dots are cockroaches. That's the before picture and in the after picture they're all gone. So we think that the program, if properly used, has a two-year guarantee that will come back and re-spray anything that's seen, so, I think we're moving in the right direction, to rid the sewers of American Cockroaches.



Near and dear to everybody's heart is the odor that comes out of wastewater. We talked about force main discharges, but there's also odor sources in any part of the system. There's turbulence that's generated or a very, very slow moving wastewater occurs that becomes septic. So we have 12 chemical dosing units, three vapor phase units. Pictures on the bottom, the one on the

left is one we installed last year, developed by Dr. Bohn from the University of Arizona, is called a Bohn Bio Filter and the one on the right is another vendor's paper-based treatment called solvent treatment, so we try different manufacturers looking for the right applications.

Asset Management Program

- Computerized Maintenance Management System (CMMS)
 - Manages all conveyance system assets and maintenance activities
 - 1.5 million historical records



CMMS database

All the work I talked about gets inputted into a computerized maintenance management program. The collection system has been operating since 1985 so we have 1.5 million historical records. All new reaches are added to the system and the maintenance we do is recorded so we will have a long history of maintenance that we can develop our programs from, be able to zero in on areas that

need special attention. We've also moved to mobilize laptop systems. Upper right hand we have an operator with an authorized laptop so that he can pick up work orders in the truck, go out and complete the work orders, and electronically upload them. We used to have to do a hand-entry; it took a lot of staff.

Conveyance Condition Assessment

- Sanitary Sewer Inventory and Inspection Program (SSIIP) – completed in 2007
- GPS location and condition data for 60,000 manholes
 - Program continuing to collect data for new and outlying manholes



Let's move from the maintenance side and we'll talk about condition assessment now. Starting out with manholes condition assessments. We just completed last year a 60,000 manhole inspection and inventory program. Through this effort we were able to categorize all the defects of 60,000 manholes as well as to get their GPS position and invert elevation, which was

critical to develop our hydraulic model. We needed to develop consistent data to be able to build a model from and this program gave us that information.



(1-6) Eroded manhole, corroded brick manhole, illegal connection, Africanized honeybee colony, daily report, vandalized manhole

Of course we found some interesting things out there in the field, the normal corroded exposed manholes, number three here with a unique un-permitted tap. Someone put a PVC pipe in the top of the manhole for a sewer connection, and we did find out that the Africanized bee loves to live in the sewers. The little pick holes in our manhole covers are just the perfect size

for them to come in and our workers are trained to identify potential beehives in the manholes by the bees coming in and out of the pick hole and this is actually a fairly small hive we found. We've seen some two to three-feet long within the manholes. The picture on the lower right is a vandalized manhole people just dumped debris in.

Conveyance Condition Assessment

- Closed-circuit Television Program (CCTV)
 - All large diameter pipes have been inspected and are on scheduled inspection intervals
 - 189 miles of pipe televised in FY 2007/08
- Pipeline Assessment Condition Program (PACP)
 - RWRD requires PACP-certified operators
 - International standards for defect codes
 - Grades/evaluation
 - Graded from 1 (very good) to 5 (needs immediate attention)



As I mentioned, our system is out of sight, out of mind. Through the manholes we can use closed circuit television or CCTV to do our inspection. That's our primary mode, it's our visual inspection tool and we've got five in-house trucks that work on responding to maintenance calls from an operator who thinks something is wrong with the pipe. The worker will go out there and

visually inspect it or also some of them we have on repeated visual inspections. For our large diameter sewage pipes, after the Speedway sinkhole, we've put on three to five year repeated visual inspection. We learned our lesson at Speedway that if you wait too long, bad things happen. So, these concrete pipes need to be inspected every 5 years until we can rehabilitate them. All of our operators are certified. They use a pipeline assessment condition program so we're using a national standard to identify our defects. All the defects are accumulated into a point score and each reach gets a grade. Grade 1 means is in excellent condition and grade 5 means you better put it in for repair and rehabilitation immediately.

Now, I'll touch on Speedway very quickly. September 2002 we had a large interceptor main collapse on Speedway near the Arizona School for the Deaf and Blind. That was an eye opener for us. We had visual inspections of our interceptors, we were doing rehabilitation, and we were reading of other municipalities in this nation, with collapses and we thought, "We're on top of it". Well, this was a sign that we weren't on top of it as quickly as we should have been. So from that incident we accelerated our visual inspection, we accelerated our rehabilitation programs. So now we think we're ahead of the ball in keeping the movement in that manner but until that happens, the effort isn't put forward.



Some good pictures of root growth, concrete corrosion in the upper right, tuberculation, liner failures, all these are defects that we find within our small diameter and large diameter pipe.

Conveyance Rehabilitation
FY 2006/07 and 2007/08

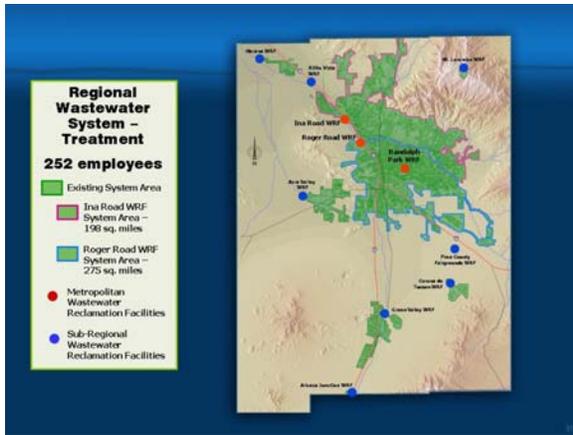
- \$6.4 million spent for rehabilitation of sewer pipe and manholes

We spent \$6.5 million in the last two years for rehabilitation projects. We expect to continue to spend \$3-5 million every year to keep ahead of that hurdle that's deteriorating infrastructure.

Water
Infrastructure, Supply & Planning Study
A City of Tucson and Pima County Cooperative Project

Treatment System

Moving now to the wastewater treatment system.



This map should also be familiar. There are the 3 metropolitan area facilities as well as our outlying facilities in blue, with 252 employees, in our Wastewater Treatment Division.

Operations

- 73 operators with Grade 1 to Grade 4 state certifications
 - Ina Road WRF, Roger Road WRF, and Sub-Regional Facilities each have 24 operators (1 for lagoons)
- Supervisory Control and Data Acquisition (SCADA) – remote telemetry
 - SCADA Control Center monitors SCADA information at all sites
 - New and improved SCADA systems are being installed
 - SCADA employees – 10 for Treatment and 10 for Conveyance

The images show the SCADA control room environment, a worker operating a computer terminal, and a large SCADA monitoring screen displaying a map of the system.

The Ina Road plant, with 73 operators, is scaled larger for remote control telemetry. The Roger Road Facility is an older facility, a lot of that is done by manual operation.

Maintenance

- Roger Road WRF – 18 employees
- Ina Road WRF – 19 employees
- Sub-regional Facilities – 9 employees
- Electrical, mechanical and specialty crafts
- Multiple journeyman skill sets – pipe fitters, pump repair specialists

The images show maintenance workers performing tasks: one on a large pipe structure, one next to a large circular tank, one working on a piece of machinery, and one sitting at a desk with a computer.

A number of employees just focus on maintenance and this is where the analogy of the battleship comes in. We've got operation staff and maintenance staff constantly working to keep this facility operating and they're all journeymen, pipe fitters, welders, and electricians.

Corrosion Control Program

- Painters are industrial coating specialists
- Preventive Maintenance Program includes cleaning and painting to prevent corrosion
- Odor control also helps capture corrosive gases



Murals painted by staff as part of corrosion control efforts

And then corrosion protection. We've got an artist out at our Ina Road facility and when you drop by you'll see blue geckos painted on the side of our buildings. The best part is that it keeps the surfaces from corroding.

Odor Control Program

- System-wide Odor Control Plan developed short-term, interim and long-term solutions to odor problems
- All short-term projects have been completed with substantial reductions in odors
- Approximately \$7 million spent on projects in FY 2007/08
- Long-term solutions are integrated into the Regional Optimization Master Plan – \$39 million



Ina Road WRF – Centrifuge scrubber

And of course the treatment facilities have odor control. The big focus the last couple of years, \$7 million dollars spent at the Roger Road facility and some at the Ina Road facility to address odor problems and we have budgeted \$39 million going to the next five years to those two facilities as we build new treatment plants.

Odor Control Program – Roger Road WRF



Primary clarifiers weir trough covers



Installation of scrubbers for headworks and clarifiers



Tent over headworks



Headworks compactors

Some pictures of the Roger Road improvements. Coverings of the primary clarifiers, weirs, HTVE covers, a big tent over the headworks, you can see that from the highway.



Just to show you some quick statistics, the larger cylinder is the measured odor prior to our improvements and the yellow are the odor measurements afterward.



Again, a couple of other facilities. This is the primary clarifiers, the before and the after. So we think the \$7 million dollars is well spent but there's a lot more work to do.

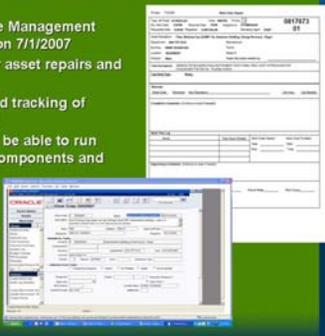
Support Programs

- Industrial Wastewater Control
- State-certified laboratory
- Compliance and Regulatory Affairs Office
- In-house training center

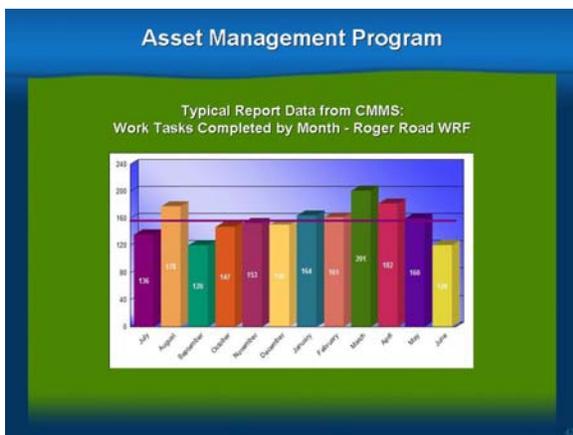
To support these programs we have a state certified laboratory, an industrial waste program to go out to the industrial dischargers to make sure they don't put something into the sewer that's not treatable, and an in-house training center for all of the certified operators. Both Tucson Water and Pima County Wastewater require certified operators in their facilities, so we've got a training center and of course compliance.

Asset Management Program

- Computerized Maintenance Management System (CMMS) went live on 7/1/2007
- Better tracking of costs for asset repairs and operating costs for plants
- Increase in productivity and tracking of backlogged work requests
- After two years of use, will be able to run analysis to show trouble components and systems
- Concentrate efforts and funds on trouble spots and improved plant performance



The treatment facilities also have maintenance management systems that started in 2007 and they're up and running full speed using that facility at the Roger Road plant as an example to get the work orders that they're generating.



Treatment System Rehabilitation FY 2006/07 and 2007/08

- Rehabilitation projects for Roger Road WRF
 - Spent to date – \$12,800,000
 - 9 odor control projects – \$6.1 M
 - 6 solids processing projects – \$2.5 M
 - 18 general rehabilitation projects – \$3.1 M
 - 2 aeration projects – \$1.1 M



As far as treatment rehabilitation, we spent \$12 million dollars at the Roger Road facility. That was the oldest plant. It started in 1951. It needed some infrastructure improvements. That's also the plant that will go away in 2015 when we build the new facility right next to it.

Treatment System Rehabilitation FY 2006/07 and 2007/08

- Rehabilitation projects for Ina Road WRF & Sub-regional Facilities
 - Awarded to date – \$7,800,000
 - 6 Ina safety projects – \$2.1 M
 - 28 general Ina rehabilitation projects – \$4.1 M
 - 7 Sub-regional Facilities projects – \$1.6 M

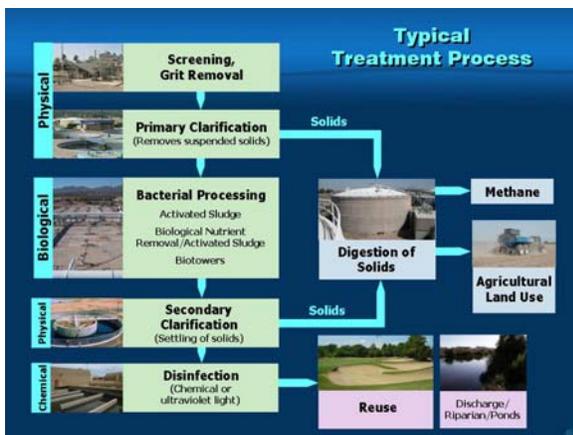


At the Ina Road facility and at the sub-regional facilities, we've committed \$7.8 million dollars this year, awarded to date to do repairs there.

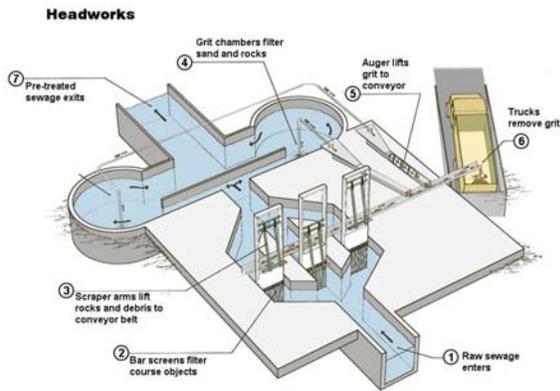


Treatment System Processes

I'm going to walk you through the typical treatment process: Wastewater comes in and it needs screening and grit removal there's stuff in that water. Primary clarification. There's a bacteria process, Tucson Water and water treatment systems are primarily chemical-related. They add chemicals to improve their water quality. On the wastewater side we rely on bugs, and it's a bunch of different bugs - bacteria - from all different types of sources. So you have to accommodate one bacteria strain in one process, then get another one growing in a second process that is inseparable or comingled. After all the digestion is done, there's secondary clarification and disinfection. All the solvents go to further digestion and then out to disposal. We'll go through these rather quickly.



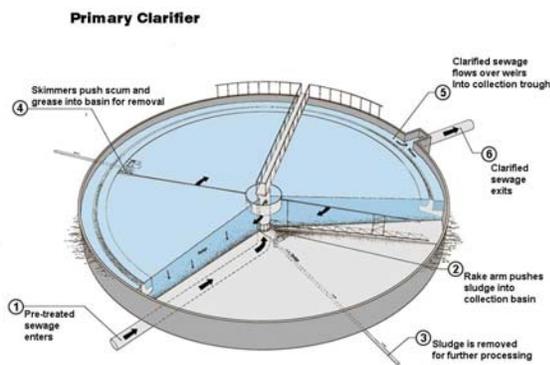
Headworks odor control, odor generators, this is where it enters, wastewater comes in.



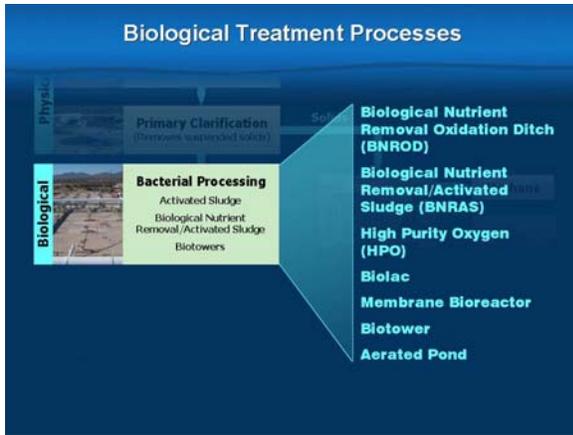
Large things are removed with the bar screens. Grit and sand are removed at vortex removers and then it goes on to treatment process.



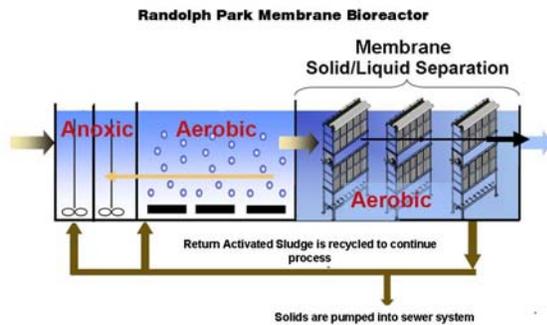
Primary Clarification. There's circular clarifiers on the lower left. Rectangular and covered on the upper right at Ina so you can't really see the process at Ina Road.



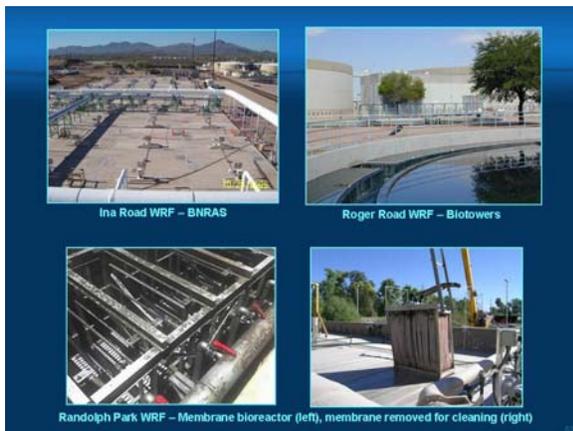
Those are both ways to allow wastewater to come in, travel across this passage so the solids can settle down.



On the right there are a number of biological processes that we use that are at our 11 wastewater facilities. It goes the gamut of oxidation ditches to bio-towers to aerated ponds. All, basically bacterial processes using an activated sludge.



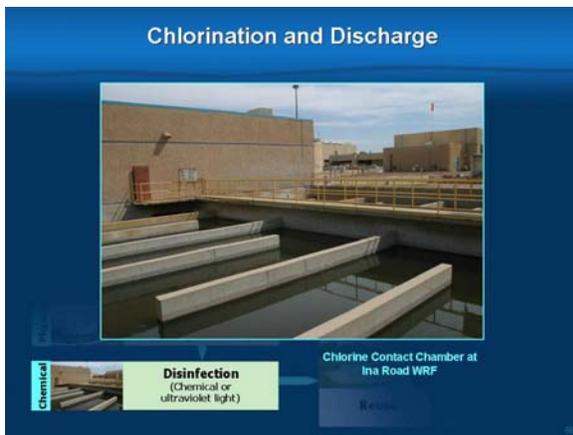
Our most state of the art facility at Randolph Park uses both the activated sludge and some physical membrane cartridges that do a further job of cleaning the wastewater. It's an additional filter.



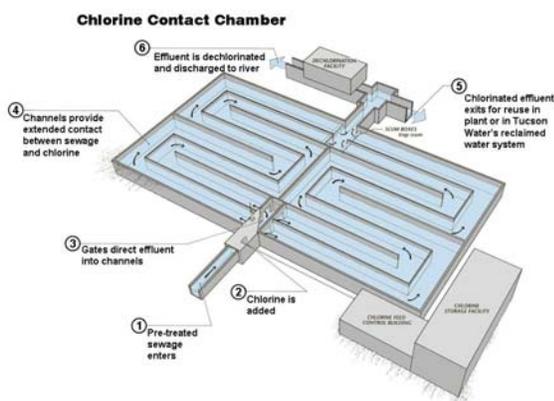
Different pictures, there's a picture of a membrane cartridge unit pulled out at Randolph, bio-towers at Roger Road, 30 feet tall towers that are plastic media inside, water is trickled through it and the biomass it grows on takes care of the digestion.



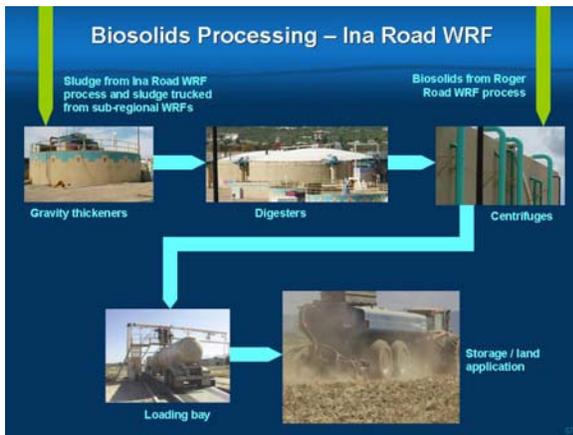
To the sub-regional facilities, oxidation ditches are primarily used there, sort of race track type lakes where the water is pushed up and around, and inside that wastewater there is bacteria growing there that's eating away the particles. Similar type of facility at Corona, that's Avra Valley and Biolac. The Marana facility is a pond that has air injection. It's just a big pond.



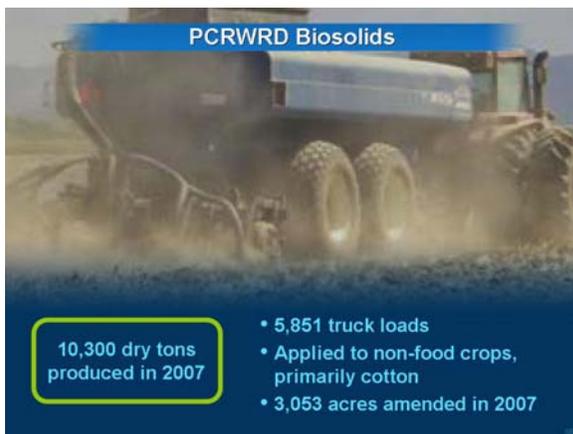
Finally, chlorination and discharge. For us to discharge along the surface we require it to be chlorinated so it's a long, serpentine path.



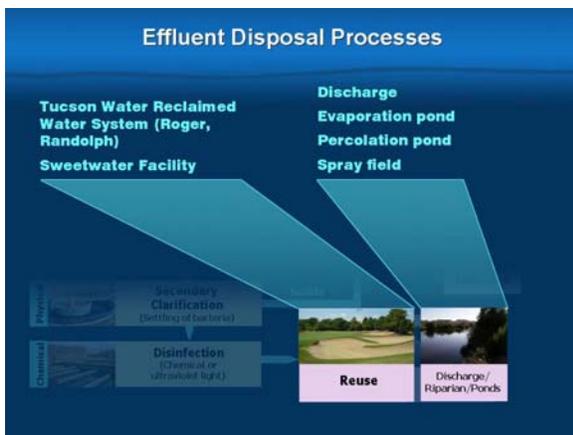
This is the time for the chlorine to come into contact with wastewater and then a de-chlorination facility for discharging to the river and Tucson Water's reclaimed system.



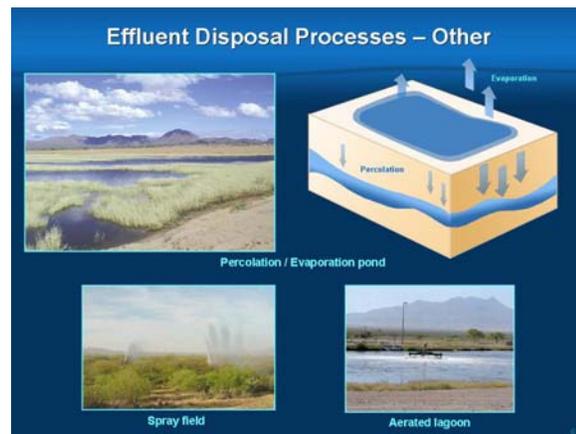
Bio-solids go through thickening, anaerobic digestion which generates methane for co-generation...



...and then land application, and we've seen all that in the discussion before.

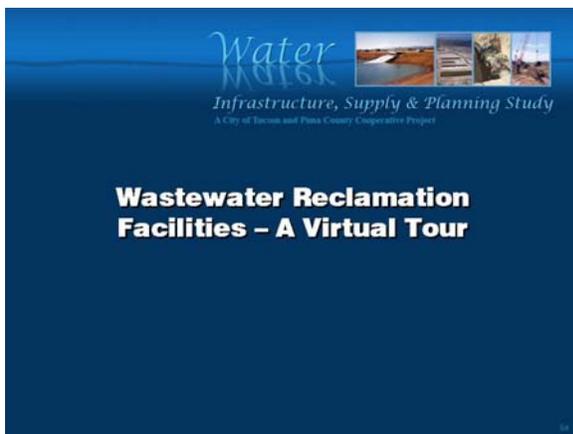


So then of course the final disposal either discharging, going to a pond, spray field, or reclaimed water system. There are some pretty pictures of ponds and then a spray field on the lower left at the Avra Valley facility.





Not to belabor the point, but we talked about that we're operating under three different Clean Water Act departments: Aquifer Protection, Arizona Pollutant Discharge Elimination System and there's the Reclaimed Water Standards and we talked about Class A before.



We'll just go through three or four of the main treatment plants and we'll repeat and show you where the processes are that we just discussed.



Ina Road. Remember this one was built in the 70s; that's an aerial view. Most of this plant is covered so if you went out there all you would see is a lot of concrete slabs, it's not that exciting. Ted Walker Sports Park right here, I-10, and then Ina Road to the south, to the north of the plant. North is to the bottom.



There's the headworks over on the far corner, lots of odor control there, chemicals, scrubbers, the headworks.



Two different process trains at Ina Road. The first one is a high purity oxygen, it uses oxygen to aerate the bacteria and it was state of the art when it was constructed, it's now obsolete and we are removing the high purity oxygen process. The second train is a 12.5 MGD train. This is a brand new one we just turned on this year and that one runs on activated sludge and as you can see both processes are covered, nothing to see.



Some of the unique odor control devices, lots of pipe, and then...



...a co-generation plant at Ina, when it was originally constructed the methane generated from the 25-inch HPO plant was used to co-generate the powered facility. They used about 33% methane, 66% natural gas to power that train.



And then bio-solids digestion, and then trucked out for land application.



You've seen this picture before. This shows you the Tucson Water reclaimed plant right there and we'll go through what wastewater does in this facility.



The headworks with a nice tent that you can see off of I-10 and at night it's lit up.



Primary clarifiers, you can tell by the colors, they're green and everything else is dark blue that means it's a little dirtier. So we've got the primary clarifiers and you can see the odor control units. We just covered the part that generates the odor and sucks it up and puts it in to a carbon unit.



Bio-towers, state of the art when they were constructed in the mid 80s. They are now obsolete and at the end of their useful life.



Force main bio-solids digestion, and then all the sludge from Roger Road gets pumped through a force main up to Ina.



wastewater.

Randolph Park is the newest facility which Chris talked to you a little bit about. When they came on line a couple of years ago we had to construct a force main from an interceptor on the Aviation Corridor because we increased the capacity by 3 MGD. There wasn't enough wastewater in the existing system around 22nd and Alvernon, so we had to come up 3 miles away to get additional



There's the pump station right off of Aviation Corridor that pumps it up to the plant here.



We used the existing foot print of the old plant with updated technology...

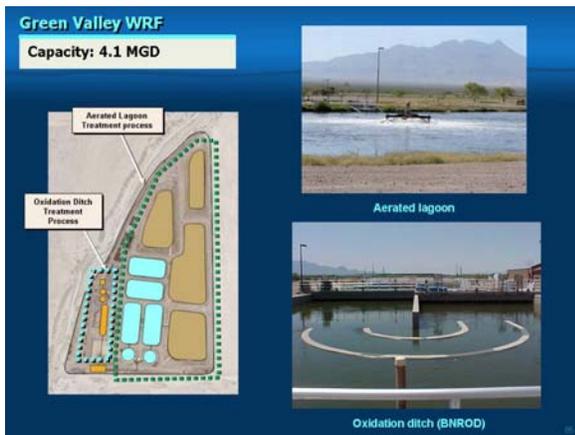


...and again, it's all covered, you can't see much, different basins.



Tucson Water's reclaimed system discharge goes one-way, and all the sludge and solids go back to the interceptor and are discharged. That's one of the challenges of a reclaimed scalping plant, which this is, that you can pull out the water and send it to a reclaimed system but the residual solids have to get dumped back into the sewer system, which doesn't help that

operation much. You have got to have enough flow and enough scour to keep it moving to the plant and not cause problems downstream.



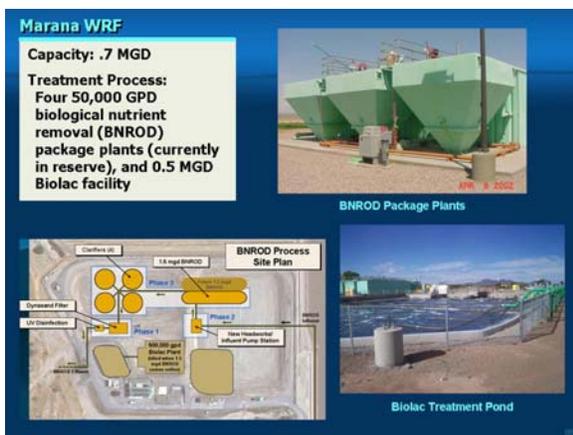
Quickly, the Green Valley plant, oxidation ditch,...



...Avra Valley, one oxidation ditch right now, we're constructing two operating at 4 MGD.



Corona just completed this expansion of 1 MGD.



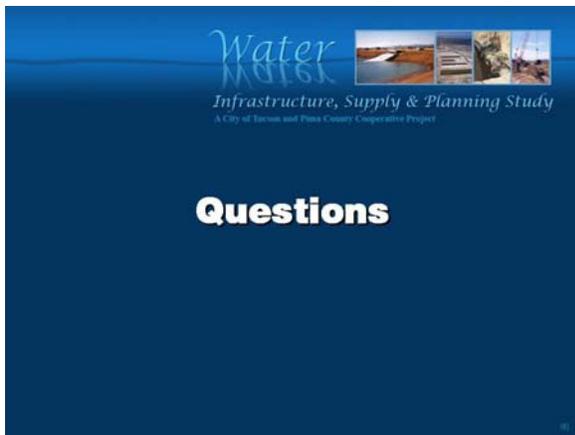
Marana started with small package plants to put in the Biolac and the plan is to increase it to a one and a half million gallon per day oxidation ditch.



Some of our lagoons, and of course our facility on Mount Lemmon, hidden in a little building that looks like a log cabin. That completes the whirlwind tour of Pima County Wastewater.

CHAIRMAN: I'm going to ask the committee to reserve your questions and give the audience a couple minutes but its (inaudible) and we've been here a

long time.



QUESTION: You started off by talking about aging infrastructure and so we really have two challenges. One, replacing our existing system to serve existing residents and expanding the system to accommodate growth. Given the fact that material cost trends and energy cost trends are making the per capita cost of all infrastructures more and more

expensive each day. How wise is it to conceptualize future infrastructure configurations as large central operations where as John mentioned the idea of pumping water all the way out to Vail and then pumping or, effluent all the way out to Vail golf course and then pumping it all the way back aren't we going to be reaching the limits of economies of scale and have to look at more decentralized solutions?

ANSWER: I think you've hit it on the head that it becomes a financial analysis, that even in the nation the EPA has moved from centralized or decentralized back to centralized, we go on these cycles and it becomes sometimes cost prohibitive to continue to have long, long interceptors where a remote reclaimed plant or small treatment plant could be constructed. You're absolutely right and we do take that into account in every area that we're expanding to. Is it better to connect it to the existing infrastructure? What's the augmentation that has to be done all the way downstream to the main treatment plant? Or is it cost beneficial to put in a small plant? What we found though, right now, is that it's still more beneficial to use the existing infrastructure going to the large treatment facilities than to place a small plant that has a marginal amount of flow. The cost to construct and operate those facilities are not yet as economical as operating our larger facilities and the collection system, but it's going to be a continual debate in comparison.

QUESTION: For future reference it would be helpful to see a graph of your grade A, grade 5, grade 4, grade 3. You were talking about grading the pipelines and I'm curious to see how many are grade 5 and wearing out so if you could provide that in print that would be helpful and then also how do you, do you have to flush the system with potable water? The City has been looking at that issue regarding its gray water use and when I heard you speak about the Randolph Park treatment and the sludge, I was thinking, ah-ha!, I bet they have to flush that with potable water. If so, how much and what's that schedule?

How much potable water are we losing? And the rest, I'll submit in writing.

ANSWER: Ok, but I can respond that all grade 5s are repaired immediately, so right now, we have zero grade 5s on our list and that's not to say tomorrow one won't show up. So it's a dynamic list and we do have a GIS map of all of our defects from the 4s or 3s that are all scheduled for rehabilitation.

QUESTION: Ok, well let's see that as part of the show here as well as, we need to know, the whole community needs to know this question, which is, how much potable water does Pima County use to flush out the system and what's the schedule of that and where? You know, we need a very concrete particular on that question.

ANSWER: And let me quickly answer that. At our treatment facilities, we use the processed water so we don't use potable water from any treatment plants to clean and operate those systems. In the collection system, we're currently using potable water but we are in discussions with Tucson Water to try to convert those to using reclaimed water. We realize that's an area of improvement we can make and we are in deep dialogue with addressing that issue.

QUESTION: Right, and that's what we need. We need that dialogue to happen right here in transparency. So that's what I'm asking you for, is to provide us with the quantities and open that discussion to the here and now. Thank you.

QUESTION: Yes, I'm Donna Branch-Gilby. I'm a resident and co-developer of Milagro Co-housing. We face the same situation of the photo that you showed of the development that was on the slope and they had to pump their wastewater uphill with a pump station but we, we thought we wanted to use that water ourselves that, that recycled water, so we got permission to build our own subsurface wetland system and now we have the benefit of that water of course it's only 28 homes but as we battled our way through the system to get the permit for it we eventually found someone who said "thank you" because we really don't need any additional burden on the sewage treatment system and "thank you" for establishing your own. So, I'm wondering is there any effort being done to work with a particular developer that are in a situation where they would be having to pump or where its, its out on the fringe of the service area to actually develop their own subsurface wetland system which is working very well for us. It requires minimum amount of maintenance and really benefits the vegetation in our whole community.

ANSWER: I'll start by saying that I believe it's a philosophical discussion and that if all the wastewater stays on site there will be no effluent for reclaimed water. So, as we keep it there, is it really going to recharge the aquifer or is

it just used to create a wetland? So you have to look for, what's the beneficial use and then at other levels the regulatory level. I think as you push the responsibility to private homeowners and small communities to maintain their systems, historically we found that that's a risk. That if they have a change of ownership in their homeowners association, and they don't put the money into maintaining these systems, they could then start impacting the public health for those people in the community so it's a great point for discussion. I think it's something we'll have to bring up in the next couple sessions. What is the best scenario to balance them?

QUESTION: If there is some major change in the kinds of technology, more on the, more on the order of what Donna is talking about, is the County obligated to produce 68,000 acre feet a year of wastewater for reclamation or is that simply the designed goal?

ANSWER: I do not believe we are obligated to deliver anything except the amount of effluent discharge by agreement; it's divided by percentages.

QUESTION: Ok, so a decrease, if there was one, would impact and it would be split with that 90/10?

ANSWER: That's right, and we're already seeing that by reduced water use and wastewater discharge by the homeowners throughout the community. Like low flow toilets, low flow shower heads, that's reducing our discharge as well.

CHAIRMAN: I'm going to ask the audience that if you have questions, you got forms that you can fill out and give to me and let me give the committee a chance. John?

QUESTION: Very quickly, grease, you went into the transportation system but it really raises hell at your treatment plant, does it not?

ANSWER: It also does, yes.

QUESTION FROM MEMBER: Ok, in low flow we've gone a while for a low flow because of low gravity, a low gravity system in some areas that's where you're having problems so that has to be coordinated with the City too now doesn't it, your low flow toilet system?

ANSWER: Yes, it does. We believe there are some problems with going lower flow because the main system in the sewer system may not operate properly in the neighborhoods, so, we still have a lot of research and work to do on that but there is a potential negative impact if we reduce flow.

QUESTION: And, and finally gray water, you are encouraging people to use it but there's a process to go through with County clearance and the City should love it if people water their plants with gray water, is that right? Where are we?

ANSWER: Pima County Regional Wastewater Reclamation still feels there's more study that needs to be done before we can support a full gray water implementation everywhere. I think there are areas where it would work well and areas where it will negatively impact communities.

MEMBER: Yeah, that's logical, but ok, thank you.

QUESTION: If you can identify (unintelligible).

ANSWER: There are some landfills in the area, also some other local industrial facilities that do generate odors. We do monitor them and for the most part they are in compliance, but sometimes the odors are also coming from areas that we have no control over and just general discharges. Septic dumping stations at RV Parks could generate odors. Because odors are very unique, you can't go right to the source. They sort of waft around until somebody smells them and you don't really know where the source is when you smell them.

QUESTION: I pulled up a Pima County map guide a while ago and my particular house showed a private sewer line that then appeared to connect to the County sewer line. What does that mean and how many miles of private line is out there and what does it mean in terms of maintenance and responsibility and that kind of thing?

ANSWER: Good question. There are a number of commercial developments or even private developments that don't want the public, Pima County to maintain and operate their system so they have designed their facility to have a private sewer system in which case, we the County, have no responsibility to operate, maintain or monitor it and its wholly the homeowners association's responsibility to keep it clean and upgraded and maintained, so there's a number of them, they are designated on that the County's MapGuide site as private, and we try to encourage them to come into the County system because we feel that we have better resources to manage it, but some of the newer communities and the gated communities don't want maintenance people in and out. They're the ones that want private streets and private sewers.

QUESTION: But that's private sewers coming in that eventually connect to the public treatment?

ANSWER: That's correct, they'll connect to a public manhole.

CHAIRMAN: Anybody else on the committee? Ok Eric, thanks you very much, very well done. We have 10 minutes left so lets do the Call to the Audience. I know you all have a lot to do. You can submit it in writing and then we'll do it next week or...

QUESTION: Yes, when is the next meeting?

ANSWER: The next meeting is in two weeks.

AUDIENCE: Ok, I'd like to submit this letter from the neighborhood infill coalition and give it to you, Mr. Chair, for the record, as well as Melody so she can put it online and then I'd like the opportunity to read it in full at our next meeting.

CHAIRMAN: Ok, we'll do that. Anybody else for the Call to the Audience? Ok, do I hear a motion to adjourn? Thank you all for coming.

Meeting Adjourned.

TRANSCRIPT OF JULY 23, 2008

List of Presenters:

1. Chris Avery, Tucson Water: National and State Infrastructure Issues/Tucson Water Capital Improvement Program
2. Eric Wieduwilt, Pima County Regional Wastewater Reclamation Department: National and State Infrastructure Issues/PCRWRD Capital Improvement Program
3. Michael Gritzuk, Pima County Regional Wastewater Reclamation Department: National and State Infrastructure Issues/Regional Optimization Master Plan

Presenter #1

CHRIS AVERY, INTERIM DEPUTY DIRECTOR FOR TUCSON WATER: NATIONAL AND STATE INFRASTRUCTURE ISSUES/TUCSON WATER CAPITAL IMPROVEMENT PROGRAM

Water
Infrastructure,
Supply & Planning
Study

Planned New Infrastructure

Chris Avery, Acting Deputy Director, Tucson Water
Eric Wieduwilt, Acting Deputy Director, Pima County
Regional Wastewater Reclamation Department

July 23, 2008

A City of Tucson
and Pima County
Cooperative Project

The slide features a blue background with a white header containing the text 'Water Infrastructure, Supply & Planning Study'. Below the header is a row of four small images: a dam, a water treatment facility, a water tower, and a water pipe. The main title 'Planned New Infrastructure' is in large blue letters. Below the title is the names of the speakers, Chris Avery and Eric Wieduwilt, and the date 'July 23, 2008'. At the bottom right, there are logos for 'A City of Tucson and Pima County Cooperative Project'.

MR. AVERY: Good evening. We've been asked to address the Committee about National and State Infrastructure Issues, as well as the local water and wastewater infrastructure needs in Pima County. And I think to understand the nature of the infrastructure needs that we have in Pima County, it's important, first, I think to

look at a national and regional scale.

Cost of Aging Infrastructure

Nessie Curve Analyses of Individual Utilities

For these 20 Utilities over the next 30 years:

- Infrastructure could cost \$10,000 per Household
- Current Revenue will fall short by \$550 to \$2,300 per household

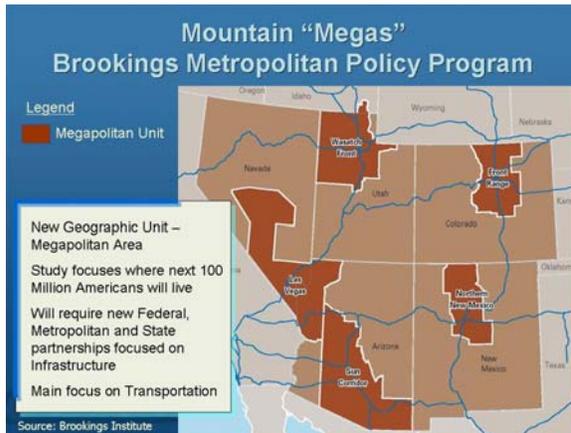
Source: AWWA 2001

The slide has a blue background. At the top left is a photograph of a large pipe being installed. To the right is a map of the United States with blue dots indicating the locations of 20 utilities. Below the map is another photograph of a large pipe break. A text box on the left contains the title 'Cost of Aging Infrastructure' and the text 'Nessie Curve Analyses of Individual Utilities'. Below this is a list of two bullet points: 'Infrastructure could cost \$10,000 per Household' and 'Current Revenue will fall short by \$550 to \$2,300 per household'. At the bottom left, it says 'Source: AWWA 2001'.

In 2001, the American Water Works Association published a study of 20 different water utilities around the country and found infrastructure needs for all of these utilities. The photograph at the top left is our 96-inch main break from 1999. The photograph at bottom right is a main break in the Chicago area in

the - in the middle of winter, which is another difficult issue.

The AWWA study found that in these 20 utilities over the next 30 years infrastructure costs could reach, in constant 2001 dollars, about \$10,000 per household over that period of time. And that, depending on the financial state of the respective utility, that current revenue could fall short by between \$550 to \$2,300 per household; essentially, you know, between 5% and 25% shortfalls in revenue that are needed - that is needed for infrastructure improvements.



If you read today's *Citizen*, there's an article in there about this study. The Brookings Institute out of Washington, D.C. just published a study on the mountain megapolitan areas, basically identifying five megapolitan areas in the inter-mountain west, all of which have their respective needs for infrastructure.

And one of the major components of the Brookings' study was to look at the fact that the infrastructure needs in these five megapolitan areas, Salt Lake City, essentially, Denver, Las Vegas, Phoenix, Tucson, Prescott, and the Albuquerque/Santa Fe area, are so extensive that they will probably require some new sort of private State and Federal partnerships in order to build the infrastructure that's needed for these areas. One of the primary focuses of this study is transportation infrastructure, but it also mentions the need - that all of these areas have a similar need for water and wastewater infrastructure and resource over the next 20 years.

Total Arizona Infrastructure Needs 2008 - 2032

Energy

- \$74 to \$86.5 Billion

Telecommunication

- Broadband Connections \$1 to \$2 Billion
- Fiber Optic additional \$23 Billion

Transportation

- Road/Highway \$198.8 to 257 Billion
- Transit \$35.8 Billion
- Railways \$5.9 Billion
- Airways \$12.1 Billion

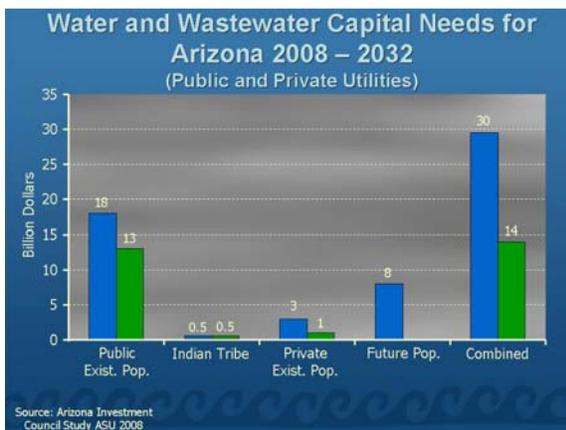
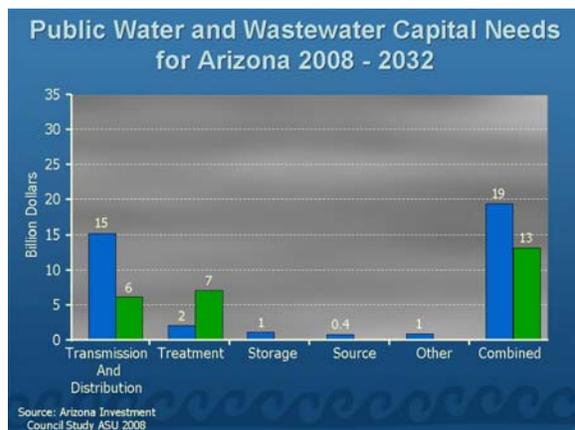
Water/Wastewater \$109 Billion

Source: Arizona Investment Council Study ASU 2008

Just this year, the W. B. Carrey School of Business at Arizona State published a study looking at infrastructure needs in Arizona, and identified, essentially, three or four areas of infrastructure need for the State, so it's not a complete look, but it looks, basically, at energy, telecommunications, transportation, water and

wastewater. And, depending on the - the scenarios and the outcomes of this study, the study identifies somewhere between \$400 billion and \$475 billion worth of infrastructure needs just in Arizona between now and 2032; of this, transportation is by far the largest component, somewhere between \$200 billion and \$257 billion worth of transportation improvement. And you can see the bulk of those improvements are needed in - in roads and highway, with smaller components in mass transit, railways and - and airports.

So, let's look a little bit about how the W. P. (sic) Carrey Study looked at water and wastewater infrastructure for the State. This is a graph that, essentially, shows the total capital needs for water and wastewater in the State of Arizona between now and 2032. The bulk of the new infrastructure needed is in public utilities to serve existing population. About \$18 billion in water infrastructure, and about \$13 billion in wastewater infrastructure just in Arizona. Some smaller component to meet Indian tribal needs, relatively small investments for



private water companies to meet the needs of their customers and - and \$8 billion allocation for future population needs. You can see that this future population allocation is divided all in water, but the study makes clear that there's some division between future water needs and future wastewater needs. And that adds up to a total of \$44 billion worth of infrastructure needs just in Arizona for water and wastewater infrastructure over the next 25 years or so, in terms of capital improvement. The - the rest of the \$109 billion figure that's mentioned in the study is O&M funding.

UNIDENTIFIED MALE SPEAKER: What - what are the green versus blue bars?

MR. AVERY: The green bars are wastewater infrastructure - we're trying to keep our color coding - and the blue bars are water infrastructure.

This is the way it breaks out just for public utilities and for existing customers, so this just separates out private water companies and wastewater companies, and separates out future growth.

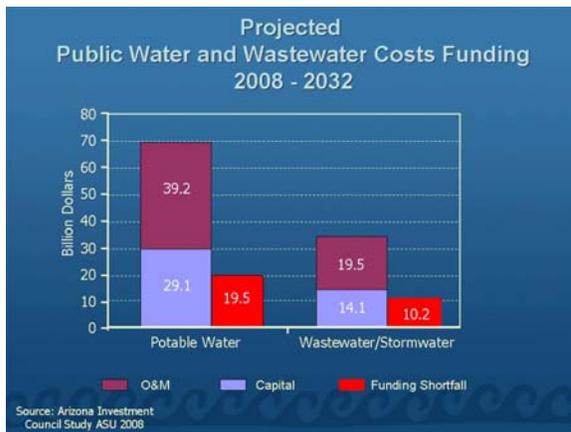
Again, you see there's some severe needs for water and wastewater infrastructure over the next 25 years; much of it in transmission and distribution on the water side and needs for treatment and production capacity on the wastewater side, and you'll - you'll see some of those same figures start to duplicate themselves as we talk about our needs here in Pima County.

One of the interesting things that this W. B. Carrey Study did was look specifically at shortfalls in funding. So, on the side - on the left side of these bar charts there's, basically, the water and wastewater component broken out by O&M - which is up here in the maroon color - and capital needs - which we've already talked about - in blue and, basically, the funding shortfalls that are identified going forward in order to meet the needs of water and wastewater infrastructure in the State. And, essentially, of the \$109 billion in water and wastewater infrastructure needs, they've identified about \$30 billion worth of shortfall. So, statewide, the shortfall's about 30%.

So, as we move forward to try to address our needs in Pima County, I think it's important to remember that much of this country - not - not just of Arizona - but, much of the rest of the country was built after World War II, and a lot of the water, wastewater transportation, airports, and energy infrastructure is starting to reach

the end of that 50-year life cycle that we've been talking about for the last few weeks.

This number can vary; there's a lot of different ways to slice it. There's a recent study that came out from the EPA that estimated a \$534 billion funding gap over the next 11 years nationwide. It's - it's hard to compare apples to apples in many of these cases because there - the studies range in scope and they cover different areas in different time periods. But, the essential message is the same between the AWWA study, the Brookings study, the W. B. Carrey and the Morrison Institute study on megapolitan corridors that you'll be talking about in a few weeks, and that is: There is a funding shortfall; that funding shortfall is significant; it may be 20%; it may be 10%; it may be 30%, but it's identified and it's out there.



What we'd like to do today is talk about our funding basically in a five-year block between now and 2013.

UNIDENTIFIED MALE

SPEAKER: Chris (inaudible; not speaking into a microphone) in the shortfall, is it more - where are the - where are these billions that currently - evidently

somewhere - where are they being held right now or - where are they exactly to come from, basically?

MR. AVERY: Basically, what the - more - the W. B. Carrey Study did is look at the overall rate structures for the identified utilities. They looked at Flagstaff, Sierra Vista, the valley - basically, the tri-county area - Maricopa, Pinal, and Pima County - and looked at the rate structures of the existing utilities, including CAP and, basically, added those numbers together with some projection of future rate increases and future CIP budgets, and so that aggregate total of - between necessary funding and available funding is what ends up with this shortfall.



So, let's talk about Tucson Water for a minute. This is the graphic that we've been looking at now for a while; it, basically, breaks up the infrastructure in the area to Colorado River Storage and Recovery, our main Distribution System that's primarily founded on our pre-existing groundwater Distribution System, the

wastewater system that collects water and delivers it to Pima County Wastewater Treatment Plants and the Reclaim System. And what we've tried to do today is break our CIP on the basis of future infrastructure needs, and - and tried to clump them together as best we can on a resource basis.



So, the - the primary chunk of the CIP over the next five years for Tucson Water is related to Colorado River Storage and Recovery, and we talked two weeks ago about the existing Recharge Basins and capacity at CAVSARP and SAVSARP. The bulk of the funding over the next five years is related to developing the SAVSARP

Wellfield and increasing our transmission and distribution capacity in order to actually bring the water that's recharged into the Tucson Water Distribution System and distribute it out to customers.

And one of the main components of that is the SAVSARP recovered water main which will be a large diameter pipeline to bring water from SAVSARP the Hay Needle Treatment Plant where water can be treated and delivered over the mountain to the Clear Well Storage Reservoir. The construction of the SAVSARP Wellfield, as well as a future Avra Valley augmentation main that will give the City redundancy in its ability to bring water in from these increasingly important Storage and Recovery Facilities in Avra Valley to the Distribution System.

Ground Water Resource



As for a groundwater resource, there's relatively no money at all in the capital budget in order to make increasing use of our groundwater resource over the years; that doesn't mean that we won't spend a small amount of money on rehabilitating wells and, perhaps, re-equipping and redrilling some wells, but

that amount of funding is - is so small that it doesn't really show up as a significant component of our CIP. Remember, we've talked about the fact that Tucson has used its groundwater resource for a long time, and that going forward groundwater becomes a decreasing important part of our portfolio, and that's reflected in the CIP.

Reclaimed System



The next component is Reclaimed Water. Reclaimed forms about 11% of our Five-Year CIP. You might recall from our resource discussion that our reclaim deliveries are about 8% of our total, so that number more or less corresponds. Generally, as we talked about two weeks ago, we just established a new Peak Day

Demand on our Reclaim System this summer, and that Peak Day Demand is close to the ability of our existing facilities to serve our customers. So, the next components of our Reclaim System are to construct a set of boosters here near the reclaim reservoir at Roger Road that will allow us to deliver additional Peak Day supplies and, in some sense, a redundant ability to provide supplies out into the Distribution System. And then a set of new recharge basins that'll be located here, adjacent to the Roger Road Facility that will allow us to increase the amount of water that we put into the ground and pump out every year and deliver to the Reclaim System. There's also a significant component of - of this budget that 's for a new treatment on - in the Reclaim System if it's needed in order to meet Pima County's needs for the ROMP Project.

Integrated Wellfields & Isolated Systems



All right. What we've tried to do is identify then those components of the CIP budget that are based on serving existing customers versus those components of the CIP budget that are needed to serve new customers on Tucson Water System over the next five years, and those needs are relatively modest. One of the major components

of that is, basically, drilling that large Wellfield at SAVSARP. Some component of that Wellfield is needed to serve existing customers with the water that's recharged from CAVSARP and SAVSARP; and some component of that Wellfield will be needed to serve additional new customers.

Reservoirs, System Storage



In addition, as we talked about two weeks ago, we try to keep two days' worth of peak demand in our reservoirs in order to meet our customers' needs for water. And as our amount of water that we deliver to our customers increases over time, we'll need to increase our storage capacity in the system in order to

accommodate that two-day peak demand figure; and, in the CIP, we've identified about \$30 million in reservoir improvements and additions in order to meet that need.

Development & Growth – Stair Step Res. In SE Tucson



In addition to those components, one of the significant components in - in Tucson Water's Five-Year CIP is what we're calling, essentially, a stair-step reservoir system on the southeast side, and that would consist of relatively large-scale transmission mains in more or less a zig-zag fashion south of

Interstate 10 that would connect a high-water storage, also

located south of the interstate, that would allow to feed water north and, to some extent, west in order to meet the needs of new growth along the State land on the Houghton Road Corridor and elsewhere in this area, largely on the southeast side of Tucson; and that component is \$33.9 million, \$34 million.

MEMBER JOHN CARLSON: Now, is this over five years or is it 25 years that you've

MR. AVERY: That's over five year - that's a five-year slice.

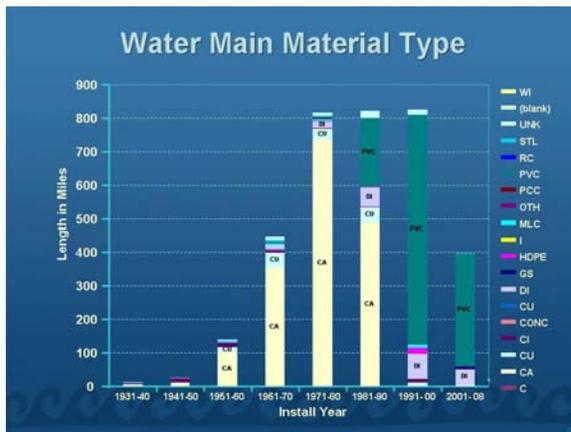
MEMBER JOHN CARLSON: Yeah, 'cause your figure up there always said '08 to '32 and that's 25 years, so -

MR. AVERY: Yeah.

MEMBER JOHN CARLSON: - I got confused.

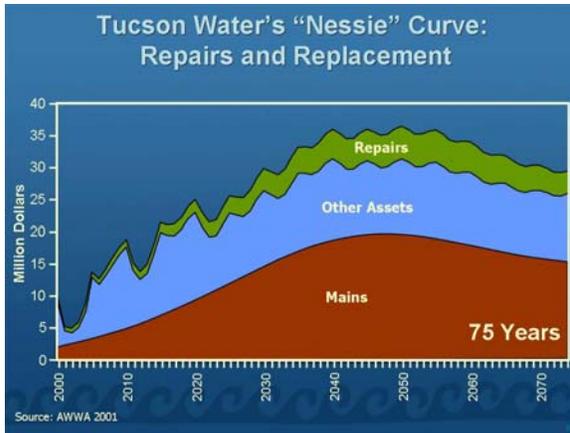
MR. AVERY: Yeah, that - the - the W. B. Carrey Study had 2008 to 2032 and that was, essentially, a 25-year slice, and that's their - their figures are looking at - at 25-year studies. Some other studies look at ten-year slices. We do - CIP and - and Pima County also does CIP in five-year increments.

So, that, essentially, ends the discussion on new infrastructure that's needed either to meet the needs of our existing customers and to connect them with the resources that we have, or new infrastructure that's needed to meet the new - the needs of new customers and connect them with those resources.



But, one of the major components of Tucson Water's CIP is the need to replace and repair the infrastructure that we already have. And two weeks ago we talked about this graph which is, essentially, a graph that shows the miles of pipes that were installed in Tucson Water's System, and the material that was

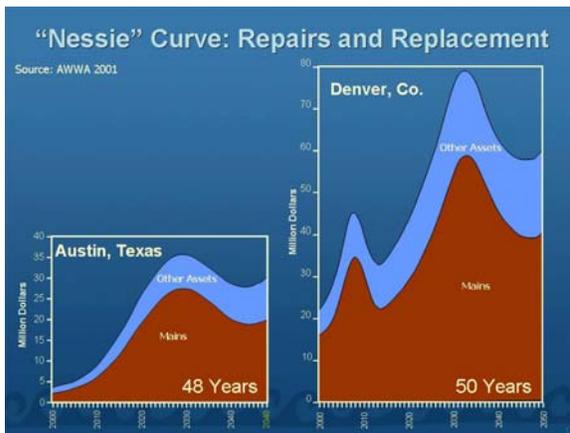
used to build them - and there's a lot of - of very small slices of this graph that I don't want to talk about too much - but, essentially, the large pieces of this graph are the cement, asbestos pipe that dominated the Tucson Water Distribution System from the post-war period up until the mid-'80s, early '90s, and the PVC material that's been the dominant material used in our system since then.



And when you take a look at the expected life span of our materials, and the age at which those materials were installed in Tucson Water's System - and, again, we're talking about existing Distribution System more or less needed to serve existing customers - you end up with a diagram that looks like this. And this is

called a "NESI Curve" and it comes from the 2001 AWWA Study, and it's named for its resemblance to some mythical slices of the Loch Ness Monster, and it looks like Tucson's version of the Loch Ness Monster was based on some sort of stegosaurus, or something. But, essentially, what it does is relate, sort of, if you want to be really imaginative, it relates back and forth to the materials and the age of the - of the assets of our system, and as those - as those materials and assets wear out, they need to be replaced according to a schedule.

This particular NESI Curve for Tucson looks at a 75-year pattern, so our CIP is about here, and we'll talk a little bit about that later. If you look at the NESI



Curves for other utilities on essentially the same scale - this is Austin, Texas, on the left, and Denver, Colorado, on the right. This is - this is a 75-year slice; this is a 50-year slice. So, we've tried to compress it in order to give you a visual effect. But, essentially, the Austin curve is very

similar to the Tucson curve; our curve might do a little bit more of this, and it's a lot more jagged; they're a little more smooth in Austin than we are. And, in Denver, you've got a big curve; larger system. Denver has a significantly higher peak day than the City of Tucson does; and they've got a big bill coming in about 30 years.

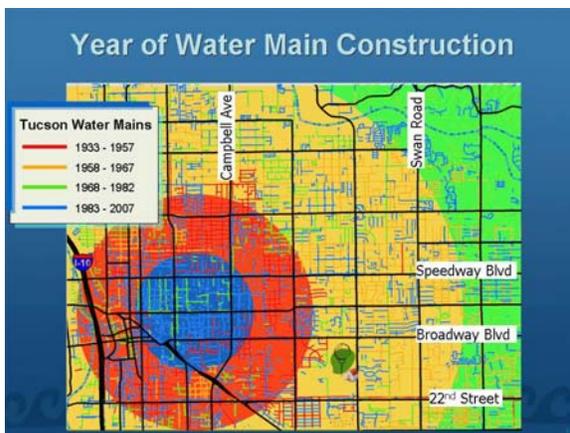
One thing to mention about this - this study - and I've mentioned it before - I'll reemphasize that point as we move forward - that these dollars for the AWWA Study

are in constant 2001 dollars. So, the - the NESI Curves would be exaggerated even more if inflation were part of the - of the study; and it, essentially, means that these water utilities, just like Tucson, face the same issue of aging infrastructure and how to replace it.

So, how are we going to try to attack that problem in Tucson? Well, one way is to try to take advantage of any of the Regional Transportation Authority projects. It's a lot easier to replace infrastructure in concert with road construction; it saves a little bit on utility replacement and it saves a little bit on paving, and it allows you opportunities to get in and use trenches that are already available in the roadways and disrupt your customers one single time, rather than coming back later and rebuilding the infrastructure from the very start.



This is a map of some of the proposed - I think all of the proposed RTA projects - Mr. Sullivan would be able to tell me if I missed an intersection here or there - in the Tucson area; and, in some ways, that map resembles our needs for infrastructure.



And, basically, the Tucson Water System was constructed in kind of a series of concentric rings, starting with the early downtown area of Tucson, and then expanding through the pre-war and post-war years, and then out in the boom period of '60s. This is kind of an overly-simple representation of what the

real data looks like. But, essentially, Tucson Water has spent a significant amount of money during the past ten or 15 years replacing infrastructure in the inner City; cast-iron mains that have been rehabilitated; older mains that have been replaced entirely. This is where we are today at Randolph, and you can we 're right at the - at the

verge - the part of the City that was built in the 1950s and '60s. This is what the real data looks like. And, if you squint hard enough and are under enough hallucinogenic substances, you can see - but, basically, you've got the inner City, you've got this sort of 1930s to 1950s post-war ring of subdivisions that were constructed in the City of Tucson, and then 19- - the 1950s and '60s period where you had large-scale infrastructure projects and really rapid expansion and growth in the Tucson area.

One thing to point out with this graph - and I'd like you to think about when Pima County's doing its presentation - is that many of these assets that were installed for the first time were also wastewater assets that were installed during - when these same subdivisions were being built.

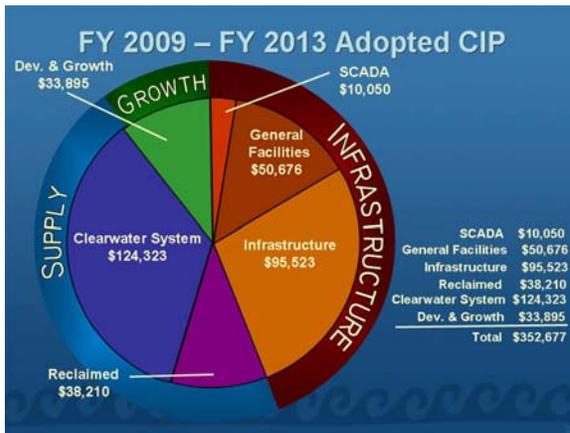
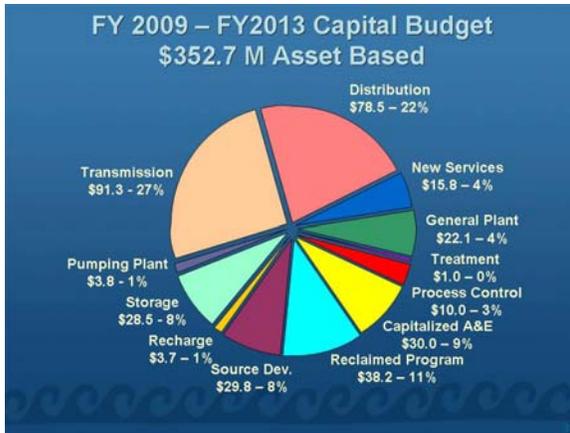


So, how does new - new infrastructure get constructed? And one of the ways that it happens primarily in Tucson Water System is that developers pay for it when they build new subdivisions. So, the infrastructure that we just saw in this graph was largely constructed piece-by-piece by

developers. You can see, you know, Colonia Solona - where's Poet's Corner? As those subdivisions were built, and that's still happening today.

At - in - in fiscal year 2007, Tucson Water reviewed about 150 master plans for new infrastructure in its Service Area; it installed about 3,300 new meters. Again, we're talking about - a month ago we talked about how many new customers have come on to Tucson Water System over the past few years while our demand has stayed relatively flat. Those new customers show up here in new meter installations.

And developers pay for about \$10 million a year of new infrastructure that doesn't necessarily show up in Tucson Water's CIP, but is a significant component of our asset base and our budget. And, in 50 or 60 years, or whenever this infrastructure starts to reach the end of its useful life, it will be the utility's obligation to repair it or replace it.



So, let's talk a little bit about how we pay for it. In addition to the \$10 million a year or so that developers install for - for Tucson Water System, we spend about \$70 million

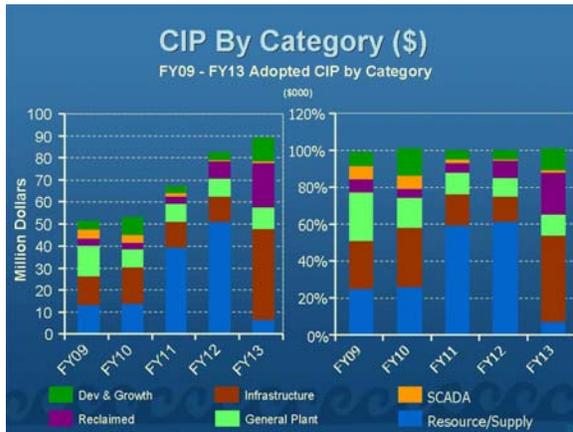
a year on our - on our CIP Program, and this is broken out on a - on an asset-based basis. Some of the interesting parts here - or some infrastructure that we haven't talked about yet - this is general plant; that's basically office space and buildings. Again, Tucson Water's Administrative Offices, our - our plant facilities, our maintenance facilities, et cetera, are as much of Tucson Water's infrastructure piece as just water and boosters and pumps

and reservoirs.

This slice here is - capitalized A and E - is essentially Staff time and overhead that's necessary in order to administer review and put together the capital budget for the Department, and those expenses average about \$6 million a year.

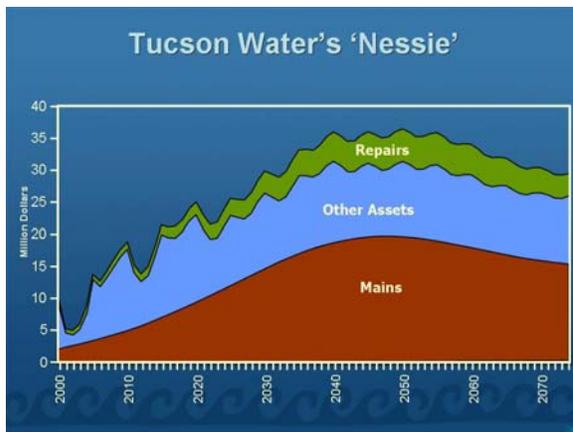
Here's the 11% for the Reclaim Program. Here's some more source development, transmission lines and distribution. One - we've tried to aggregate this by sort of rough categories in order to get a more complete picture of the way the CIP works, and this is one way to do it. If you think about our resources in terms of new supply, you can see that the new supply picture is dominated by the Clearwater Project and by the needed improvements in the Reclaim System. Some component of development and growth that's related to those stair-step reservoirs on the southeast side and, perhaps, you know, some component of the Clearwater System, it's hard to identify exactly which wells are needed for new growth, which diameter of pipeline is needed for new growth; if you're going to install a five-foot diameter pipeline to meet existing demands, and a six-foot diameter pipeline to meet new growth, what - how do you allocate

those costs? And then the bulk of the - of the CIP is on general facilities and infrastructure.

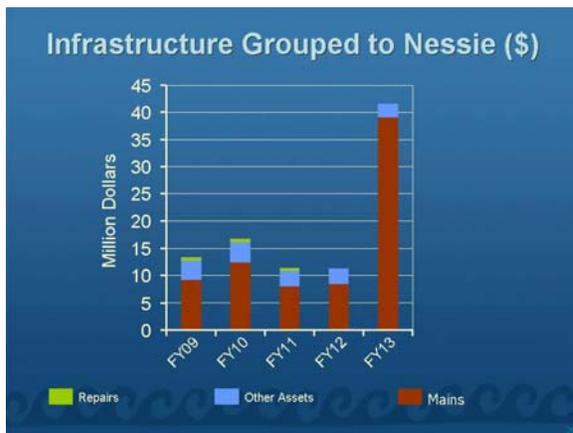


This is another way to look at it by category over the next five years. You can see that Tucson Water is spending a significant amount of its CIP over the next five years in making those Recharge and Recovery Facilities operational and delivering wet water from the Wellfields and

Tucson Water's customers. So, this is by number of dollars per year, and this is by percentage; again, you can see a large percentage of Tucson's CIP over the next four years goes toward putting Colorado River Water to use.

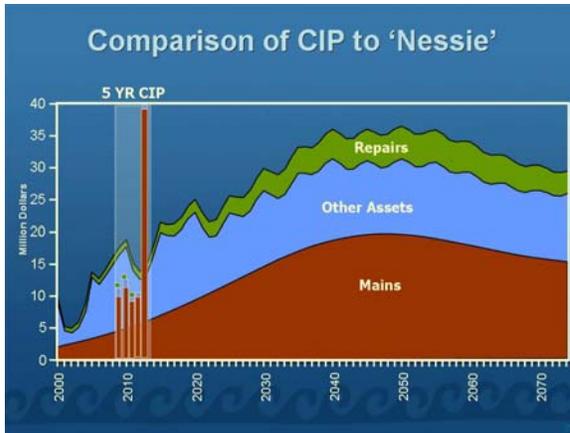


Let's go back to the NESI Curve and look how we stack up in terms of actual expenditures. And one way to look at that is to take that portion of the NESI Curve - basically about in here - that's related to our Five-Year CIP. And, when you - when you - when you try to break out Tucson Water's expenditures, in



terms of the categories that are identified in that NESI Curve, this is what you end up with: About ten to \$15 million a year over the next four years, and then a large jump in fiscal year 2013 as we finish the CAVSARP and SAVSARP Projects, those large diameter pipelines that are necessary to bring water to Tucson Water's Service Area, and we can

start addressing some infrastructure needs.

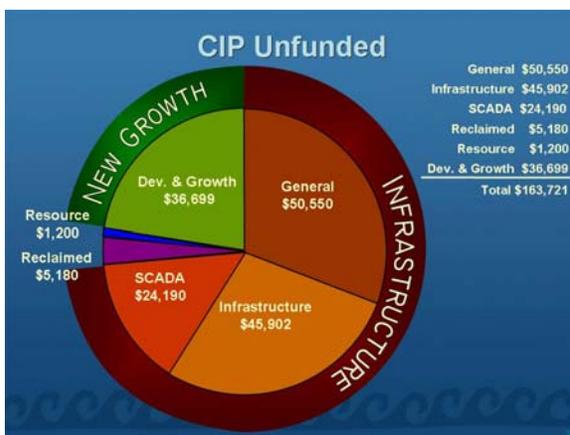


And this is how those CIP budgets stack up on the NESI Curve. and this diagram looks pretty good, especially this part of it - it's not exactly correctly, and I'd like to explain to you why. First of all, the Five-Year CIP is done in terms of constant dollars. The NESI Curve is done in -

in terms of constant 2001 dollars. So, if you were to project the NESI Curve out with the inflationary factor, the NESI Curve would probably, you know, end up being a little bit more this way.

The other thing to remember is that a substantial component of the infrastructure needs for Tucson Water are related to the RTA Projects, and it is true that some of the RTA Projects are associated with aging infrastructure that would otherwise need to be replaced by the utility. It's also true that some of the RTA Projects will require us to replace infrastructure that's not at the end of its useful life and that could otherwise - those monies could otherwise be spent on critical infrastructure, rather than infrastructure that needs to be relocated as part of a road reconstruction project.

But, moving forward. Tucson Water has a large CIP; it has relatively large rate increases that are going to be asked of its ratepayers over the next five years in order to pay for that CIP, and that CIP is, essentially, dominated by Colorado River Resource and Recovery for the next four years; after which point, we begin to address our infrastructure needs.

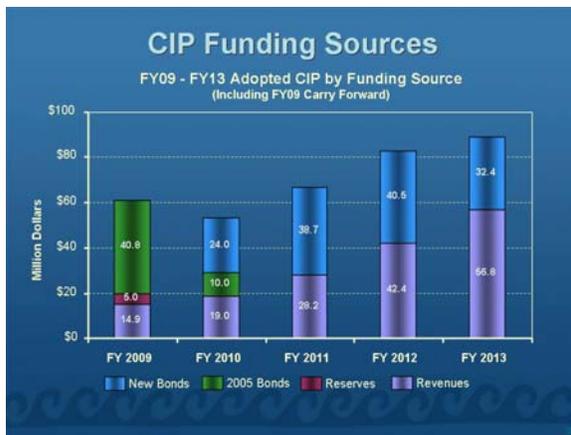


One of the things that the CIP doesn't do is fund everything it needs to. This is a general map of some of the unfunded needs in the CIP. These are projects that are identified by Tucson Water Staff that didn't make it into the CIP priorities. Again, you can see that we've done a relatively good job of

taking care of our resource needs over the next four to five years.

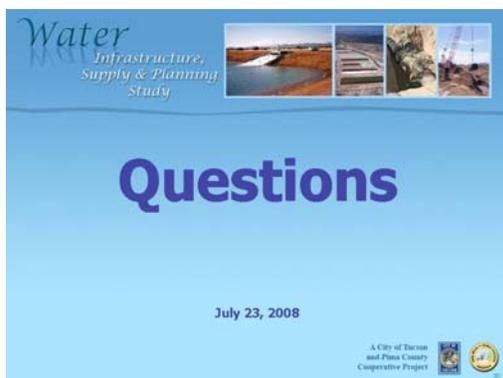
We have a large need to upgrade our SCADA; that's, basically, the electronic instrumentation in Tucson Water's System, and some unfunded development in growth needs, as well as a large component of, basically, general plant, you know, office facilities, maintenance facilities, storage yards, et cetera.

And you can see, in some way from this unfunded infrastructure needs that we're spending a large amount of money again on Colorado River resource; on putting those renewable assets and supplies to use; and we're taking some money to - in order to do that, that might otherwise be spent in other areas.



Going forward for Tucson Water, though - and you're going to hear a lot about this in two weeks - the most critical need for Tucson Water, in addition to managing the CIP, is managing the funding for the CIP. And, if you look at the CIP going forward over the next five years, this is how we're going to pay for

next year's CIP: About \$15 million next year in revenues; about \$5 million out of reserves; and about \$40 million out of our last bond authorization. We'll be going to the voters of the fall of 2009 for a new bond authorization; and, without that bond authorization, our CIP goes down into the magenta. And these 20 - beginning \$24 to \$40 million a year in CIP needs that are - that will be funded by bonds - that were anticipated will be funded by bonds will not be able to be funded without that bond authorization going forward in 2009.



If there are any questions, I'd be happy to entertain them now.

CHAIRMAN JIM BARRY: Bonnie?

MEMBER BONNIE POULOS: Chris, one of the questions we hear over and over again is if a lot of the Capital Improvement Program is dependent on revenues, and the community decides to conserve to a much greater extent than they already do, then what do you do? Do you raise rates even steeper to pay for the water to make up for the revenues that you're not getting from conservation, or what is the scenario if there is a community-wide effort to actually conserve water on a grand scale?

MR. AVERY: Well, we're - we're - we are seeing, as we discussed a month ago, we are seeing that the amount of water that we're delivering is remaining relatively flat, and that's already happening. So, conservation is already happening. We're already accommodating it in our budget.

One of the ways we're accommodating it on the short-term is by dipping into some reserves. The other way we're accommodating it is by looking carefully at our expenses and at our capital budget and, as we move forward, we'll continue that process.

We think that - that this year, you know, at the end of fiscal year '08, which just ended July 1st, that we will have some small shortfall in revenues, but that we'll be able to offset that small shortfall in revenues by reduced expenses. And some of those reduced expenses are directly related to the water that we're not serving our customers. There's some significant savings, for example, in terms of electricity.

But, going forward, we think we'll be able to put together a budget. We think we'll be able to fund it with a combination of revenue and bonds, and be able to - to progress. The fact is that in - in any large utility there's a certain amount of inescapable costs that are going to be incurred, whether you serve a small amount of customers, or a large amount of customers, and then there are costs that are variable depending on exactly how many customers come in or don't.

And one of the points I guess I'd like to make is that it's important for us to understand exactly what's going on in terms of conservation, and in terms of what's going on in terms of community demand for water, because that starts to inform our CIP. We talked a month ago about our - and - and also two weeks ago - about our Peak Day Demand and how we have to size our infrastructure in order to meet that Peak Day Demand. If our Peak Day Demands don't increase as fast as we anticipate, then the CIP that

's necessary to meet those Peak Day Demands also may become delayed. So, we think we're in pretty good shape with respect to that equation, and we keep balancing it year to year.

MEMBER BONNIE POULOS: Has there been any thought to restructuring how water bills are collected from the community in terms of splitting out infrastructure costs in a water bill as a flat amount per water user versus water rates for the amount of water that you consume? It seems to me that part of the problem with public perception is: Why should I conserve if all I'm doing is promoting more growth? And so it seems to me by looking at the financial structure of how you fund that, that might be one of the ways that you can balance that equation.

CHAIRMAN JIM BARRY: Bonnie can I make suggestion that you hold that and bring it up at the next meeting? 'Cause that's the - finances is the - is the topic for the next time. Very good questions, though.

Rob, I saw your hand.

MEMBER ROB KULAKOFSKY: Yeah. In the CIP, \$33.9 million is budgeted for, like, major alliance to go to the southeast side -

MR. AVERY: Yeah.

MEMBER ROB KULAKOFSKY: - for growth; that's a lot; that's, like, 9% of the CIP. Will that be recouped from developers and impact fees proportional to the capacity that their development will use, or is that just something that ratepayers are going to have to pay to support the development community?

MR. AVERY: I - I think the answer to that question is that we don't know exactly, and the reason that we don't know exactly is that the - the rules for how developers pay for infrastructure are still in the midst of a shift. When infrastructure was installed in the 1930s and '40s and '50s, and probably even up to the '70s and '80s, Tucson Water installed infrastructure at developers' requests. I went through a neighborhood I used to live in and was looking at some records and found Tucson Water installing the mains in advance of development in the 1920s. So. that was the model that was pursued for a long time in water and wastewater.

Recently, Tucson Water be- - began requiring developers, and wastewater also - and I don't know exactly what their timing is - but, we began to require developers to install the smaller-scale transmission mains, generally larger - or smaller than 12 inches, eight-inch mains, six-inch mains, smaller-scale distribution infrastructure,

and deed that infrastructure over to Tucson Water, and that's a significant component of that - \$10 million a year - in infrastructure that's currently deeded over.

I would say over the last ten years, you've started to see a shift where larger-scale pieces of infrastructure are now being built by developers. For the first time - in fact, we just received a bid opening on this project last week - we have a reservoir up in the Tangerine and Thornydale area that's going to be funded - essentially, a majority of the funding for that reservoir will be assessed on a - against the developers in the area on a - on a per-unit connection basis.

So, you're starting to see a trend from an era when the utilities paid for all of the infrastructure, to a trend where utilities are - are breaking even larger-scale infrastructure down in discreet pieces and asking developers to pay for it.

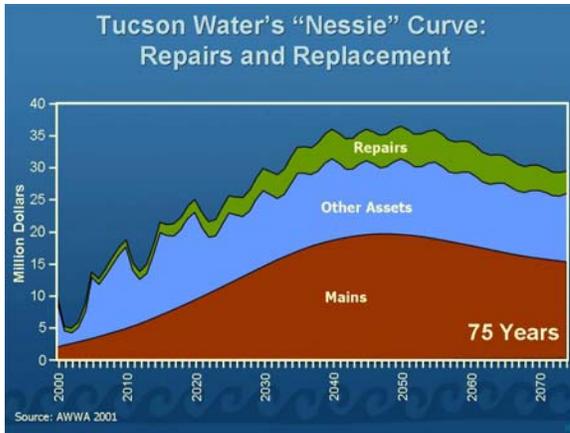
Going forward to 2013, which is when a lot of that southeast area growth starts to happen, it's hard for me to predict exactly what the rate structure will look like; whether, by that time, the Council will have issued direction to start a development impact fee and use those revenues to pay for this kind of growth or not.

But, one of the things that is interesting when you look at the CIP is that this is a relatively large individual component, but in terms of the overall CIP, the funds that you can point to directly and say, "That's the part of the CIP that's devoted to new growth exclusively" is relatively small; it's probably not exactly 10% if you try to thin-slice the CAVSARP and SAVSARP improvements, but it's not - it's not 50% either.

So, the - the question of how to pay for that going forward is a continuing question that the community answers, and - and it seems to me that the community continues to answer that question by asking developers to make larger and larger contributions toward the costs of new growth.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: Chris, again, I'm - you've got the four-year look at - and you guys should be pretty accurate at that - I give you credit for that maybe - your NESI is 70 years; another thing up there's 25 years; but nowhere do you mention what kind of increase in population and usage, and then your one slip of the tongue when you said, "Oh, we'll pay for it with bonds" and you had the revenue shortage. Well, bonds make a need for increased revenue in the future, so -



MR. AVERY: Mr. Carlson, I would like to point that the NESI Curve is just based on replacing existing infrastructure. When - so, when you look at the AWWA Study, and when you look at those - those NESI Curves and those replacement costs that are faced not only by us, but other utilities throughout the country,

you're not looking at replacing new growth, you're looking at existing infrastructure.

MEMBER JOHN CARLSON: That's zero population growth then?

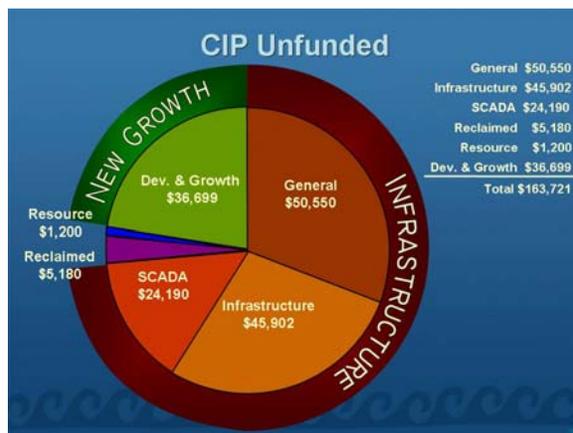
MR. AVERY: You're - yeah, the NESI Curve, for example, you know, it may be that - it may be that in 2070, you're finally starting to replace some of the infrastructure that was built in 2000 and 2010 -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - but, for purposes of the NESI Curve, and purposes for the first 50 years of the NESI Curve, you're not talking about new infrastructure, you're talking about repairs and replacement of infrastructure that's already in the ground to serve existing customers.

MEMBER JOHN CARLSON: Okay. As long as that's understood.

CHAIRMAN JIM BARRY: Any other questions from the Committee? Audience have any questions? Bob?



ALTERNATE MEMBER BOB COOK: I'd like to discuss your pie chart because I think there's something misleading here. When you say infrastructure is only existing system, and then you describe components of infrastructure as being the - the build-out of the major Recharge Projects issues on the west side, the recharge

projects that will bring our - our pool allocations, CAP, into recharge . . . situation for access, and when you go back to the earlier presentations where you say that we're going to accommodate growth from the increased capacity of

our recharge basins, in fact, you've got new growth built into infrastructure. You can't just say that - that infrastructure is existing system when, in fact, you know, part of the reason for your Recharge Project is to increase the capacity of - of - of having the full allocation of CAP, because we're going to be relying more and more on that pool allocation of CAP.

MR. AVERY: Let me say that it's difficult to - we - we - what we've done, Bob, is tried to do a good job of breaking this out in terms of the cost of infrastructure for existing customers, and the cost of infrastructure for new customers. And to try to lump a - a - a part of our budget and a methodology in a way that it's not traditionally lumped.

But, I - I tried to make it clear when we talked about this - if you'll go forward to that - that source chart - I tried to make it clear when I talked about this, Bob, that some component of this Clearwater System is, in fact, the difference between what we currently serve today and what we plan on serving in the future. But, exactly how you - how you thin-slice that analysis isn't clear to me - even after thinking about it for a while - and that's because right now, today, our current deliveries in potable and reclaimed to our current customers are about 136,000 acre-feet a year. Our full Colorado River allocation is 144,000 acre-feet a year today, and our existing capacity from CAVSARP is about 70,000 acre-feet a year, depending on which wells are in service and which aren't. So, we have 50 million gallons of capacity at SAVSARP that we have to make up just to serve existing customers.

My question then is: How do you identify which of - of the wells is going to serve new customers and which not? Do you - do you multiply everything by 5/7 and say, 5/7 of the costs goes to serve existing customers, 2/7 of the costs goes to serve new customers? When you build a large-scale transmission main, as I talked about in my presentation, it's very difficult to say, five feet of that transmission main go to serve existing customers, the other one foot in extra diameter goes to serve addi- - extra customers. And I - I tried to make it very clear during my presentation that some component of this Clearwater System is going to serve new customers.

By the time we're done building the - the - the CAVSARP and SAVSARP Recovery, Recharge Projects, and the transmission lines associated with those projects, we - we will be able to serve our existing population plus new population. But, because of the economies of scale in

large-scale water infrastructure projects, it's really hard to split that out, and I - we've tried to do that. I'll - I'll try to make it as clear as possible that we're not trying to deceive anybody here. We are trying to lump something that isn't traditionally lumped this way, and - and try to - to present a picture of how - how this - this works together.

ALTERNATE MEMBER BOB COOK: Since - since we've passed the Smart Growth Amendments to General Planning in 2001, the community has demanded increasing transparency in the cost of growth and how we're budgeting for them. One way to do that is take the growth component and actually have a separate pie chart that gives you all those categories within that growth wedge, because that's, in fact, what we need to understand. We understand that growth is embedded in each of these components, because - because of what you just described. So, we need a better understanding - I - to make communities' decisions about we manage growth and how we fund growth so that we really have a true picture of what that growth -

MR. AVERY: And -

ALTERNATE MEMBER BOB COOK: - really is.

MR. AVERY: - and I - I agree with you in one respect. I want to point out, though, that it's not quite that easy. And one way to think about it is I-10. You know, I-10 was built in the 1950s; it had two lanes; there wasn't a frontage road; now we're building it with, you know, eight lanes, three lanes of frontage road on either side and a nice little sculpted concrete in the middle. What percentage of I-10 is new growth?

ALTERNATE MEMBER BOB COOK: But if it's a (inaudible; not speaking into a microphone) question, it's - it's (inaudible) medical issue, you just, you know, what component of - of infrastructure serves existing? What serves the growth component really?

CHAIRMAN JIM BARRY: Okay. I think - Chris, I think we've identified an issue that - that the Committee's probably going to want to look at further. I - I want to give other people a chance to - to ask questions. And if you are in the audience and you want to ask questions, please come up to the microphone so the - the cameras can - can catch you. If anybody wants to come up, please, come up. Yes, sir, come on up . . . and give us your name, please.

CLYDE STAGNER: My name is Clyde Stagner (ph.) I request that you, Tucson Water, determine the quality of the water that you are going to be distributing that would

go into all of this magnitude of spending. You are now working on the salt, gray water, the who, management for gray water, cites 141 maximum milligrams for liter for TDS. Your water average, the last month to everybody in this city was 377. You haven't come up with a TDS in milligrams per liter. You are distributing water which exceeds the MCLG for radon by the United States Protective Agency, as established by the National Academy of Sciences. Your - Tucson Water System is ignoring the radon. You are ignoring the potassium 40 with a 9 billion - your (inaudible) that's in the water. You are not measuring the radioactivity in the Colorado River.

In short, you don't know how much water you're going to be able to put out when things come down a few years from now, until you come up with some standards and pass some laws here in the Codes of the City of Tucson.

UNIDENTIFIED MALE SPEAKER: Let me ask: Is there a question (inaudible; not speaking into a microphone).

CHAIRMAN JIM BARRY: This is - it was kind of a Call to the Audience. The gentleman made a statement and we're going to record it, and I think it's an issue that we'll - we will address at a later meeting in - in detail. I - I can - Trace, you have a question you want to ask -

TRACE ENGLISH: Right.

CHAIRMAN JIM BARRY: - right? Okay.

TRACE ENGLISH: Thank you. My name's Trace English. Given the definition of infrastructure that you're using, can you provide us with a per-capita cost of the future infrastructure cost for repair and maintenance and replacement of the system that we currently have?

MR. AVERY: I - I think so. I mean, in - in terms of - if you - if you want to do rough math, we have about - now probably about 800,000 customers -

TRACE ENGLISH: Okay.

MR. AVERY: - and you got \$352 million in our CIP budget over the next five years to spread out over 800,000 customers, so I'm going to guess that's, you know, \$700 per - per household.

CHAIRMAN JIM BARRY: Anybody else in the audience that's going to ask a question now of water infrastructure? We have a Call to the Audience.

TRACE ENGLISH: I can -

MR. AVERY: Trace, I'm - I'm - I'm missing my math there. Let's do - let's do \$500 per - per customer, and about \$2,000 per household over the next five years.

UNIDENTIFIED MALE SPEAKER: I'd like to ask some questions. First concerns about waste; and second about do

we have more water than we know what to do with? This start off with a small, and I'll go to the big and I'll - stop me when you think I've gone through too many items.

CHAIRMAN JIM BARRY: Let me - let me interrupt a second. We - we do have Call to the Audience, and it sounds to me like you might want to be making a general statement about the study, rather than asking Chris a specific question about what he said about the Tucson Water CIP. If you have a general statement you want to make, then I'm going to ask you to wait until Call to the Audience. If you have a specific question, then please do it now.

UNIDENTIFIED MALE SPEAKER: Well, I was going to ask why they replaced water meters -

CHAIRMAN JIM BARRY: Okay.

UNIDENTIFIED MALE SPEAKER: - after one and a half years of use at -

CHAIRMAN JIM BARRY: Okay.

UNIDENTIFIED MALE SPEAKER: - a cost of -

CHAIRMAN JIM BARRY: All right.

UNIDENTIFIED MALE SPEAKER: - \$200.

CHAIRMAN JIM BARRY: Well, that - that's a - that's a specific question.

UNIDENTIFIED MALE SPEAKER: I have a house that I think had the same water meter since 1950 until 2005, then they logically replaced it; it was getting less accurate. Then, guess what? A year and a half later, they replaced it again; it makes no - that waste and poor judgment.

A second is: Why do we read water meters every month? Why can't we do it every other month and use half as many employees to read water meters? I believe the natural gas company does something like that where you can get it -

MR. AVERY: Well, I can tell you - I'll tell you why in one instance, and that's my own. I - I talked about this with my Staff today and my family's singlehanded attempts to try to balance Tucson Water's budget all on its own.

But, basically, we went on vacation and left the hose running and so . . . my wife and I still haven't settled responsibility for that, nor are we likely to in the future. But, I will say it was a \$672 water bill, and I'm glad that they billed it on a monthly basis and not on a bi-monthly basis.

UNIDENTIFIED MALE SPEAKER: Recharge.

MR. AVERY: So, in terms of conservation, we all know now that I do not practice what I preach, but there is a human error factor anytime an Avery is involved, so . . .

UNIDENTIFIED MALE SPEAKER: But, I still ask the question: Why can't it be read -

MR. AVERY: And one of the -

UNIDENTIFIED MALE SPEAKER: - every other month?

MR. AVERY: - reasons is - that's exactly one of the reasons is that we have some issues in terms of our customer base with making sure that we get bills out and totaled and - and to our customers so they can be paid. And we tend to find that when customers - we - we tend to find that it's easier to thin-slice those bills into monthly amounts and get 'em out, especially over the summertime, than it is to hit customers with large bills.

UNIDENTIFIED MALE SPEAKER: Well, that wasn't quite the question. Is - you send out an estimate for the one month. The next month you adjust it to what the actual water use is -

MR. AVERY: Yeah.

UNIDENTIFIED MALE SPEAKER: - so that you're only reading it every other month.

MR. AVERY: And that is a good question. As we start to adopt more automated meter reading, we may be able to incorporate new technology.

CHAIRMAN JIM BARRY: Sir, I - I want you to make sure, if you have other comments you want to make, please remember we do have the Call to the Audience. I don't want you to think I'm cutting you off. Yes, ma'am?

COLETTE ALTAFFER: Yes, Colette Altaffer. Just two questions. Early on, you were talking about building Recharge Basins for recharging of effluent. Is the purpose to recharge it and then, at some point in time, pull it back up out of the ground and just stick it into the Reclaimed Water System, or are we actually using that water at some point in time as potable water? And -

MR. AVERY: Okay.

COLETTE ALTAFFER: - two -

MR. AVERY: Let me stop you right there, 'cause -

COLETTE ALTAFFER: Oh.

MR. AVERY: - I don't want to get any further down this than we have to.

COLETTE ALTAFFER: Okay.

MR. AVERY: The - the Reclaim System operates based - and we - on two sources of supply: The first source of supply is a large bank of what are, essentially, pool filters that - that serve 10 million gallons a day of

demand on the Reclaim System; the other source of supply for the Reclaim System is an annual Storage and Recovery process that involves recharging reclaimed water, essentially, on a - more or less a steady-state basis, accumulating credits during the wintertime, and pumping those credits during the summer. We accumulate a small surplus in - in our storage account that way, but reclaimed water's produced and delivered, essentially, on annual Storage and Recovery, and this is a recharge of - of effluent simply to supply the Reclaim System and not for any long-term potable purposes.

COLETTE ALTAFFER: Okay. So, are we storing that underground?

MR. AVERY: Yeah. We, essentially, store it underground on an annual basis. We pump - the way ADWR allows us to operate our storage system is that we recharge a specific volume on an annual basis through our - our storage - our recovery - or, basically, through our Recharge Basins, and then we pump that water primarily during the summer to supply our customers' needs. And, depending on how - the demand might be variable, we - we run that system with a small surplus of credits in order to be as flexible as possible in meeting our customers' needs. But, it's fair to say that it's a put-and-take facility where, on an annual basis, more or less, all the water that we recharge is also recovered and delivered to our customers.

COLETTE ALTAFFER: Just out of curiosity, how do we keep it separate and keep it from migrating into the potable water that's in the ground?

MR. AVERY: Because the Camino Del Serro Landfill is just downstream of the Recharge and Recovery Facility, so we have to be very careful to make sure that we don't migrate excess water down into that area. And, essentially, what happens is we build up a small amount of water in the wintertime, and then we pump that amount of water through strategically-located wells in the summertime, and that results in, essentially, a cone of depression that keeps the water that's recharged in the general area.

* * * * *

(Recess taken.)

● * * * *

Presenter #2

ERIC WIEDUWILT, ACTING DEPUTY DIRECTOR FOR PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT: NATIONAL AND STATE INFRASTRUCTURE ISSUES/PCRWRD CAPITAL IMPROVEMENT PROGRAM



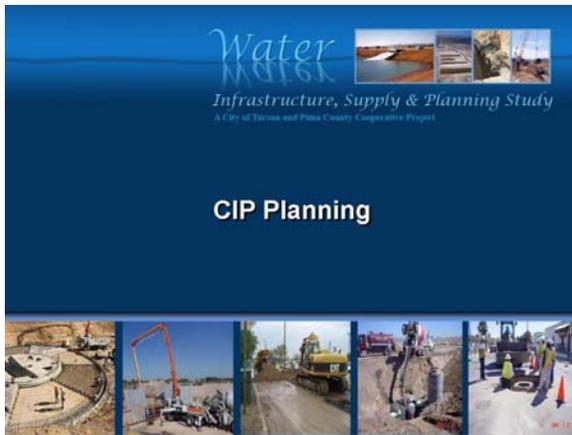
MR. WIEDUWILT: Good evening. As you know, there's always some good news and bad news; right? The bad news is we're halfway done. The good news is we get to talk about wastewater now.

The presentation today from Wastewater's standpoint is going to be in two parts: I'll do an

introduction with our planning and what we call our "Core, Capital Improve Program," and our Director, Mr. Mike Gritzuk, will be presenting the second half, which is focusing on our Regional Optimization Master Plan and what we have in store for the Metropolitan Area.

Just to respond to the question about potable water used for flushing, preventative maintenance. We use 4.8 million gallons a year, which is equivalent to about 60 households.

And, as you know, we are discussing with Tucson Water the use of reclaimed water. One of the biggest impediments we have now is that the Reclaimed System is not as far distributed as the area we need to maintain, so if we commit solely to reclaimed water, we'll have to drive many more miles to get to that water, and that's not efficient or energy-efficient, or even environmentally-friendly. So, it's a balancing act, but we are continuing that discussion.



Without any further ado . . . I'll start with what we call "CIP Planning." Tucson Water does it, we do it.



We look at a 20 to 30-year planning horizon, focusing on four key drivers; and, obviously, the first one is the regulatory world; trying to look ahead at the regulations coming from the EPA, from Arizona Department of Environmental Quality, and gearing toward building plants that might be suitable. One of the great

examples - and Mike will talk in a little bit more detail - is our look ahead that phosphorus may become an issue of concern. We're planning for that with the improvements we're doing right now.

Second driver, of course, is Asset Management. The Nassy Curve that Tucson Water showed, we're no different. We have to look ahead to keep the useful life of our infrastructure in place by either extending it or replacing it. From the Conveyance System, we talked of our visual inspection, monitoring every foot of pipe and analyzing whether it's in good enough quality to last another five to ten years, or needs immediate repair.

With treatment plants, it's a little different; that's also a visual, but it's - this pump is rusting and falling apart, we need a new one. And, when we expand for capacity, we're always retro-fitting the old facility, so it's almost like putting on a new suit.

Population. We'll talk a lot about that in the future but, obviously, when we look ahead to that 2030 horizon, we're doing it to look at population. Where is the capacity going to occur from the growth? And where do

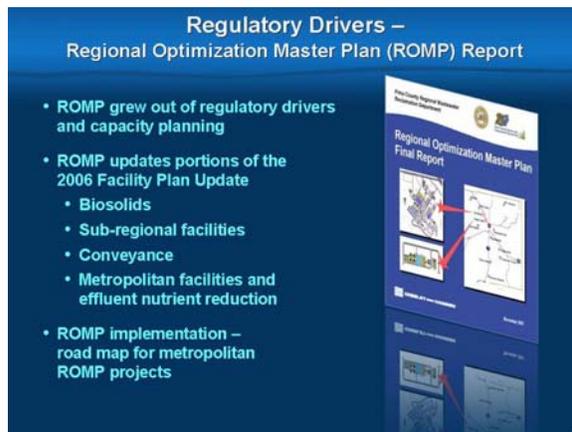
we have to look at our line infrastructure capacity and treatment plants?

Finally, being a good neighbor, both the aesthetics of the plants and the control of odor are key to everything we do.



The 2006 Metropolitan Facility Plan is our latest major plan; that outlines not only our look ahead to 2030, but also our Five-Year CIP, and this was a pretty significant activity. You saw the previous plans are at the top: 1978, 1990, and then this one. And, of course, through our Five-Year CIP and look

ahead, we also start to flush out where we need bond funding to complete those capital projects. This plan estimated \$1.4 billion through 2030, so Nessy Curve is here in our yard as well.



Part of that closer look at the regulatory environment moved us into a separate Master Plan called a "Regional Optimization Master Plan." We knew that when we did major upgrades at the Ina and Roger Facilities we'd have to address water quality issues, and this study was directed at additional

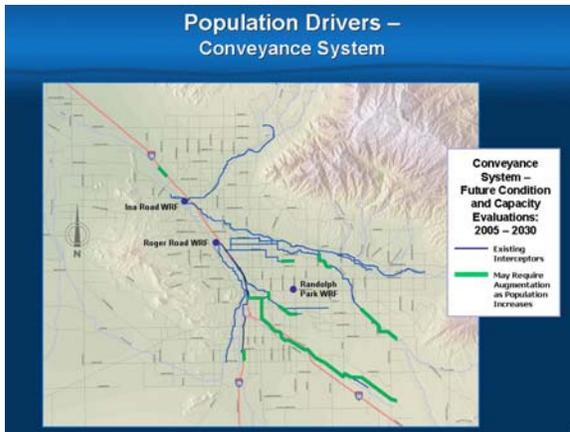
nutrient removal for the large plants, but we also took it as an opportunity to revisit our Biosolids Master Plan; what our sub-regional facilities are going to look like; what is the general treatment processes we want to move and standardize; and put some framework, so when we have to expand capacities, it's all been mapped out, and Mike will talk in a lot more detail about that.



When we talk about asset management, 25% of our pipe is over 50 years old. The Nussy Curve, that Tucson Water and Chris showed, was based on a replacement after a 50-year useful life, I'm assuming; that's what our infrastructure is, a 50-year useful life.

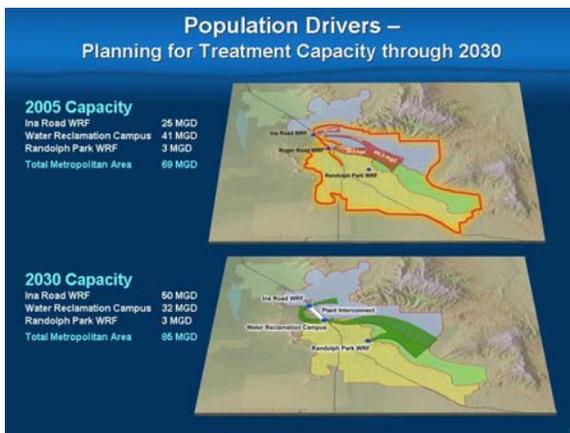
We've taken a different tack; that we have 100-year-old sewers that are still operating perfectly. So, we, instead chose to go in and visually inspect and replace when it needed it and let the stuff that's working fine just stay there. I mean, the clay pipe that was installed in the 1900s is great stuff; it won't erode or decay for the most part but, of course, root intrusions, and odd other defects, would require us to repair it.

We've taken a different tack; that we have



Population Drivers. I told you we looked ahead to 2030 with our population model, and it shows the areas in green are interceptor systems that if growth occurs where we're projecting it to, would require some type of augmentation. This is a planning tool for us to look ahead, know where the

impacts might be, and spend a little more time monitoring this as additional population comes up.



For the treatment plants, it's about the same exercise. This is an example of what we did for the Metropolitan Area. But, right now, we are approaching capacity at the Roger Road Facility. We are in the design phases of an interconnect to transfer a lot of that capacity that is occurring in the south side

of town and moving it to the Ina Facility where we have a free 12-1/2 MGD capacity right now.

The 12-1/2 was planned prior to the Pygmy Owl we told you the story of. We thought all the growth was going to occur in the northwest. The Pygmy Owl came, stopped growth there, moved it the other way. We had to do some quick reactions. And these are the things that you can't project or plan very well for. These facility plans are sort of hazy crystal balls; nothing's completely shiny. But, in addition to addressing capacity or expanding Ina Road to 50 MGD and a new Reclamation Plant, but I won't steal the thunder from Mike too much.

Good Neighbor Drivers – System-wide Odor Control Plan



<p>Interim odor control projects completed by June 2008</p> <p>Achieved noticeable reduction of odors</p> <p>Funded with 2004 Bonds and System Development Funds</p>	<p>Odor control at Ina Road WRF and new Water Reclamation Campus will be incorporated into ROMP</p> <p>\$40 M requested in 2009 Bond Authorization</p>
--	--

And we talked about odor control to a great extent two weeks ago, and I'll only say that we've got \$40 million in our 2009 bond request to address odor control at these facilities.

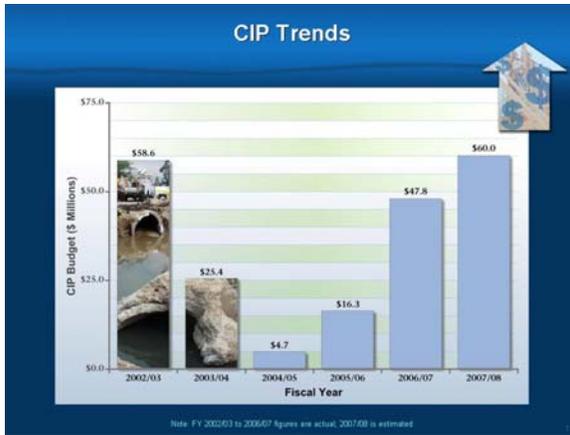
Water Infrastructure, Supply & Planning Study
A City of Tucson and Pima County Cooperative Project



Core 5-Year CIP – Fiscal Years 2008/09 to 2012/13



Let's move into our Five-Year Core CIP. I'll define "Core" as being all those improvements that need to be in addition to ROMP, and you'll hear about the magnitude of ROMP in a minute.

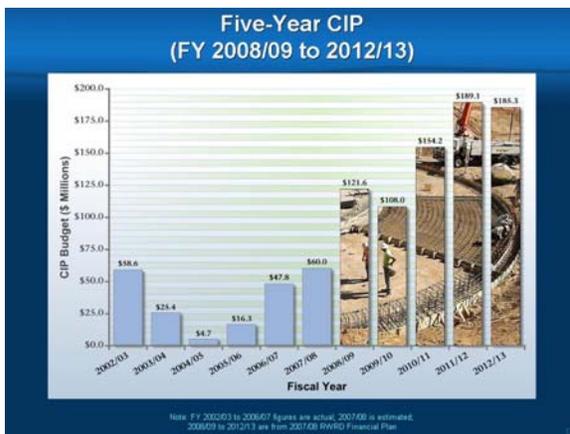


To back up to see where we are. This is the previous six fiscal years, including the current fiscal year that just ended, June 30th, where we are estimating a \$60 million expenditure.

Now, I think this is pretty unique for our utility. We had the Speedway sinkhole in 2002 and, concurrent to that, we

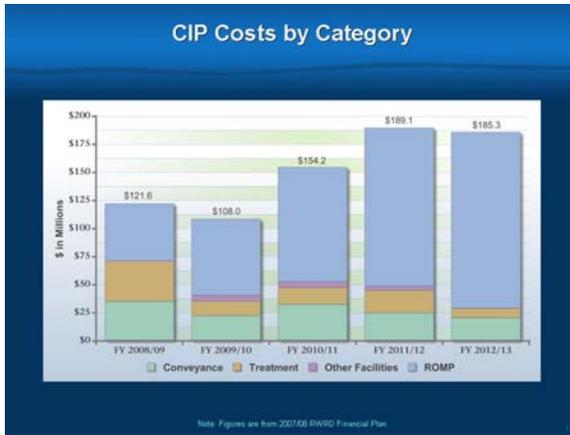
were doing a Randolph Park Facility and an Ina Road expansion, and what we learned was that: When things go wrong and you don't plan for it, or plan well enough, it puts us in a pretty dramatic fiscal solution or fiscal problem. So, in 2004/2005, we hardly spent anything on capital projects, because we had a financial house to improve and correct.

Now, the advantage of going through this curve as we think we're approaching capital improvements smarter, we're increasing the amount of retention that we have available for emergencies, and being a lot more proactive on addressing problems before they occur.



Looking ahead to our next five years, we have a large increase. A dominant portion of that is the ROMP, but I'll show you how much is still maintaining the existing system, other than the two facilities. Also to point out that this process taxes our infrastructure, our resources, as well as our processes, going from

\$4.7 up to \$60 million in three years with internal staff to begin with and now, also, pulling in some external to help has been quite a learning experience, but it looks like we'll be able to make that top curve.



This is dividing that Five-Year CIP into the blue, which is ROMP funding; yellow is treatment; and green is conveyance. And I think the point to come across that after you see Mike's slide show of the magnitude of ROMP, we still have a lot of infrastructure that needs to be taken care of through this period, and

all the effort can't go to the two new plant upgrades; that we've got to take care of other places as well.

The large chunk of green - I mentioned we carryover a chunk of money to put toward rehabilitation - and that's the large conveyance portion going there. Our treatment plants, most of them, have been expanded due to capacity, and I told you when we do a capacity upgrade, we're usually building a new plant, or repairing the old stuff, so the infrastructure needs for rehabilitation are not that high.



Some examples of the treatment upgrades in the Core. We're currently in construction for Avra Valley - and I showed these to you two weeks ago, so they mostly should not be a surprise.

For Marana, we have to look ahead. Will we need an additional expansion there? Green Valley and Roger Road rehabilitation. The sad thing is that we have a lot more rehab work that needs to get done on a plant that's not going to be around much longer, but we have to do it now to have it operational through that 2015 period.



Conveyance Projects. Total \$41 million for the miscellaneous rehab repair; that list is always changing, but we have a bucket of money to pull from to take care of those.

Santa Cruz Interceptor. Another enlargement in a large-diameter pipe to put in more capacity and take it off the northwest outfall which is a line that is nearing capacity now.

Park and Eighteenth. That was a small segment in the green line that I showed you earlier, so we're addressing pieces as we see a need.

And Prince and I-10 also improving some infrastructure concurrent with an ADOT enlargement of that area. So, trying to spend our money when it's being ripped up by somebody else.



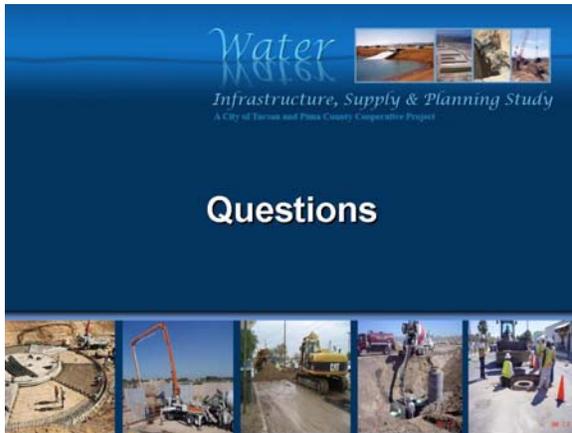
Coming around to the funding part - and we'll spend a lot more time in two weeks talking about the bonding - but, I thought it was important to put that our proposed 2009 bond request that we're asking for, totaling \$565 million, has a \$445 million component for ROMP, but we do have additional other capital

projects that are funded out of that.



Of course, looking ahead, this is sort of the scary part. We see a large hump right now that we have to spend and put our resources to, to address ROMP, and Mike will talk about that large blue one, but we expect that there's going to be ROMP II in the future, and probably a III and a IV,

as we go through the cycles of needing advance treatment for water quality and some more significant investment and rehabilitation.



So, with that lead-in, I'm going to move right to questions and, if it's anything to do with ROMP, we'll wait till Mr. Gritzuk gives his presentation and answer it then.

CHAIRMAN JIM

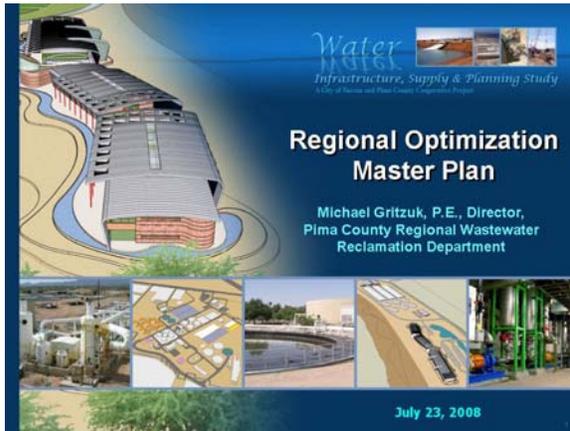
BARRY: Committee, any questions? Audience, any questions?

Michael, you're up. You all know Mike Gritzuk, who's the head of Regional Wastewater Reclamation? Yeah, it says it on the slide. You didn't need me.

* * * * *

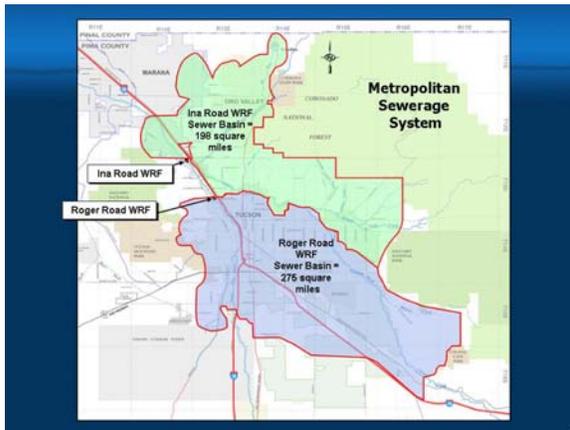
Presenter #3

MIKE GRITZUK, DIRECTOR FOR PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT: NATIONAL AND STATE INFRASTRUCTURE ISSUES/PCRWRD REGIONAL OPTIMIZATION MASTER PLAN



MR. GRITZUK: Good evening. I'm going to give you some detail of the ROMP Program, the Regional Optimization Master Plan, and want to stress that the initiation of this Master Plan was regulatory-driven, but as we started to develop what was required in the regulatory program, we just added a lot of other ingredients to this

program, such as rehabilitation, modernization, and planning for growth. So, let's go into this.



The primary focus of ROMP is primarily the two Metropolitan Regional Facilities: Ina Road and Roger Road. And this is Roger Road and you see the Service Area of Roger Road is rather large, 275 square miles of Service Area for Roger; and for Ina Road, the Service Area is about 198 square miles, so in total

somewhat short of about 500 square miles of Service Areas to be served by these two major facilities.

Current Challenges/Threats

- Regulatory requirement to reduce nitrogen/ammonia concentration in effluent discharged to the Santa Cruz River
- Maintain AZPDES and APP compliance during massive upgrade construction
- Have process upgrades on line to meet regulatory deadlines of 2014/2015
- Serve population growth needs
- Fund the program via substantial rate increases

What are the challenges that we envisioned when we started to put together this program? Top of the list, of course, was the regulatory requirements to reduce nutrients in the form of nitrogen and ammonia in the effluent that we discharge to the Santa Cruz

River; that was a driving force. But then, with a massive program like this, as I'll describe, we also have to maintain our existing facilities to make sure that they're in compliance while we're actually beating these facilities up. So, that's another major challenge that we had to address in the development of this program.

Everything had to be completed by regulatory time dates, 2014 for one facility; 2015 for the other. I'll get into that. We also have to serve population growth needs in this program. And last, but not least, fund a program somehow; and the way it will be funded, in reality, is with substantial rate increases, wastewater rate increases, as we move ahead with the program.

**Regional Optimization Master Plan
Scope of Work**

- ✓ Develop the optimal treatment process and plan to comply with regulatory requirements to reduce total nitrogen concentrations in discharged effluent
- ✓ Master plan foreseeable future regulatory requirements
- ✓ Determine the long-term capacity needs of the County



Ina Road WRF Headworks

So, the scope of work that we've developed for the program is as follows: Develop the optimal treatment process and plan to comply with regulatory requirements to reduce total nitrogen concentrations in that discharged effluent. In this process, we had to select a treatment process that would meet this

requirement, and that the process also, in the event of increasing regulations or new regulations, would be easily adaptable to new requirements.

So, that leads into the second item: Master Plan Foreseeable Future Regulatory Requirements, and put as much of that master planning in this program. And let me give you a couple of examples: DEQ, Arizona Department of Environmental Quality, just completed something that they call the "Triennial Review Process," and they're coming up with new regulations, proposed regulations. One of the proposals is to ratchet down on ammonia concentrations. So, we think we're there with this program.

Another future regulation that we know is on the horizon, but we just don't know when it's going to kick in, is to reduce phosphorus concentrations in the effluent that we discharge. With the process that we've chosen, we think that we can comply with that regulation. We're planning for it when it happens.

On the sludge side, the biosolids, the solids that we have in our process, right now we have a Class B

sludge that can be used for certain purposes and cannot be used for other purposes. On the horizon, we see that we will be required to upgrade our solids to something called "Class A" which has more reuse potentials. So, we're looking at that as a horizon that may happen, and we're planning for that.

And then, even into the distant future, what is becoming kind of popular now is the discussion of pharmaceutical waste products and personal care products, and a lot of these products, of course, wind up in the wastewater stream, and what do we do with those? Will there be future regulations about that? And we feel that there will be. So, how could we plan for that eventuality today? So, this was the crystal ball that we were looking in, in this process.

Determine the long term capacity needs of the County as it relates to these two facilities; in fact, in everything that we're designing in the ROMP Program, we're designing to the year 2030. What are our needs at that point in time? So, both of these facilities will accommodate growth up to the year 2030; after which, certain expansions have to happen.

Regional Optimization Master Plan
Scope of Services

- ✓ Develop long-term plan for the treatment, handling and reuse of system bio-solids and bio-gas
- ✓ Develop a detailed implementation schedule to meet regulatory implementation deadlines
- ✓ Develop a financial plan to support the system's regulatory and other needs for the next fifteen years



To continue, determine a long-term plan for the treatment, handling and reuse of system biosolids and bio-gas. These are byproducts of wastewater treatment and, traditionally, the sludge that was generated in the wastewater treatment process was a waste product and it was disposed of as a waste.

What we do today is that the sludge that we generate, which is Class B, as I indicated, is used for farming operations. We have a contractor that takes it in a semi-dry fashion and delivers it to properties where it's used for growth of crops.

More importantly, the bio-gas that we have in a digestion process, primarily methane gas, is currently used at Ina in our co-generation facility. We generate electricity through the use of this as a fuel. And we will concentrate all of our solids in the future at Ina, so we'll have more bio-gas there and we'll have more bio-gas to run the power generators that we have at that plant, so

we'll fully utilize the bio-gas that's generated in this plant.

The last two items: Develop a detailed implementation schedule - and the schedule is how to roll out this program over a 15-year period of time - but, more importantly, in a nine-year period of time, which is the regulatory portions of this program, and I'll go into that.

And last, but certainly not least, is to develop a financial plan to support the system's regulatory and other needs for the next 15 years. What this is meaning to say is that we have to develop a financial plan not only for the ROMP Program, but also for all of the other financial needs that we have in our department, as Eric had described.

Eric indicated that the facility plan that we have shows a need of \$1.4 billion, and that is 2006 cost estimates, but that program will be built over the next 20, 25 years; and of the overall CIP needs in our department, \$1.4 billion, about half of that is ROMP.

Regulatory Implementation Requirements to Reduce Total Nitrogen Concentrations		
	Ina Road WRF	Roger Road WRF
<ul style="list-style-type: none"> ✓ Complete initial engineering study ✓ Recommendation for upgrading treatment plants ✓ Submit recommended plan letter to ADEQ 	February 1, 2007	January 30, 2007
<ul style="list-style-type: none"> ✓ Award contract for construction 	December 31, 2010	January 30, 2011
<ul style="list-style-type: none"> ✓ Treatment of effluent to non-toxic nitrogen levels 	January 30, 2014	January 30, 2015

This is the schedule that we are required to adhere to, and you see one for Ina Road, one for Roger Road, and they're almost the same except for the last item. For both Ina and Roger, in early 2007, we had to present: What is our plan to comply with these regulations? So, we have conceptually developed the

plan at that time.

We went to our Board of Supervisors and presented the plan to the Board of Supervisors with the cost impacts of this regulatory requirement. We've got their endorsement, conceptual endorsement, of the plan. And then we went to ADEQ and presented the plan to them in early 2007, and they accepted the plan; in fact, they gave us quite a lot of compliments on how we've developed the plan. So, we met the first regulatory dates for Ina and Roger.

The next dates are actual award of the construction contracts for these upgrades at both of the facilities. We have to award the contract for Ina at the end of December, at the end of 2010, and then shortly thereafter, a couple months thereafter, for the Roger Road facility.

And then, finally, the most important compliance date here is that these facilities have to be online operating, running, and in compliance with the new regulatory requirements by January 30, 2014, at Ina and, a year later, 2015, at the Roger Road facility. So, these are the driving forces of the ROMP Program.

By the way, if you have any questions as I go along, by all means just chime in if you have anything that you'd like to ask me.



The slide titled "ROMP Plan at a Glance" features a blue background with a white rounded rectangle containing a list of six items, each preceded by a checkmark. Below the list are two aerial photographs: the left one shows an industrial facility with circular tanks and is labeled "Expanded Ina Road WRF"; the right one shows a large rectangular facility with a winding path and is labeled "32 mgd Water Reclamation Campus".

- ✓ Expand Ina Road WRF to 50 mgd
- ✓ Construct new 32 mgd Water Reclamation Campus (in vicinity of existing Roger Road WRF)
- ✓ Plant Interconnect – 28 mgd average, 72 mgd peak flow
- ✓ Good neighbor facilities
- ✓ Decommission existing 41 mgd Roger Road WRF
- ✓ Meet growth needs to year 2030

The ROMP Plan at a Glance. One is a Plant Interconnect which, basically, interconnects the Service Areas of Roger and Ina. The intent here is to convey flow from the Roger Road Service Area up to Ina where we have additional capacity, as Eric indicated in his presentation, and that is an up-front construction

project, because we're approaching capacity at Roger.

Expand the Ina Road facility to 50 million gallons per day. I'll get into more detail on that. Construct a new 32 million-gallon-per-day Water Reclamation Campus in the vicinity of the existing Roger Road Facility. To have good neighbor facilities. And we want to stress here that everything that we do in our programs now, good neighbor is a high priority of ours, and good neighbor has various components to it. One, these facilities have to be architecturally-pleasing to our neighbors. They cannot have huge sounds, sirens going off and, of course, odor control.

Odor control also is a major priority item with us. We've gone a long way in some recent improvements, and improvements will continue. As Eric indicated, in the ROMP Program, \$40 million in that program is for odor control at Ina and Roger.

And then, finally, when the new Campus is online, decommission the existing 41 MGD Roger Road Facility, retire it, give it a gold watch and say, "Job well done" for the last 50, 60 years that that plant has been in operation, and then meet the growth needs to the year 2030. So, that's it at a glance.

ROMP Cost Estimate
(2006 dollars)

Ina Road WRF Upgrade/Expansion	\$243,900,000
Electrical Upgrades	\$35,000,000
Plant Interconnect	\$22,300,000
Water Reclamation Campus	\$211,000,000
Roger Road WRF Demolition	\$23,800,000
Total Estimated Cost	\$536,000,000*

* Cost estimate includes design costs, UV disinfection and 5% contingency.

The cost estimate for ROMP. I want to go down to the bottom line here, and notice total cost of \$536 million, but let me stress a couple of points here. These cost estimates are in 2006 dollars, and here we are in 2008 already, and we haven't put a shovel in the ground on this program yet, but we will very shortly. So, the

asterisk there indicates that these cost estimates include design costs, a disinfection method that we're trying to avoid because of the high cost, and a 5% contingency, maybe stressing the contingency here.

Construction costs in recent years have been much more inflationary than 5%, and we're hoping that there's some leveling off with this inflation that we're experiencing in these costs; maybe 5% will do it; maybe it won't do it.

Some of the major components are the Ina Road Facility you see at \$244 million there, but then a lot of this next component, this \$35 million, which is our electrical upgrades are at Ina itself. So, if you add about another \$25 to \$30 million, the Ina Road Project in the overall ROMP Program is the largest component and is the most complex component.

The Plant Interconnect I mentioned, about \$22 million; the new Water Reclamation Campus, about \$211 million; but then to this \$211, you probably should add the demolition costs of the existing facility, so you see, in combination, that's about \$230 million as well; it's a very large component; and, again, stressing, these are cost estimates that are 2006 cost estimates, they're old.

50 MGD Ina Road Water Reclamation Facility

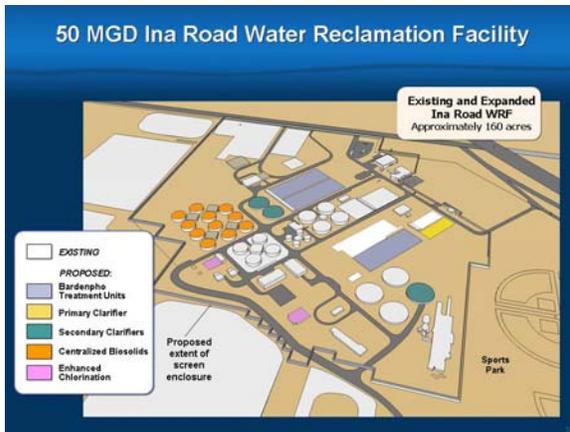
- Expand treatment capacity to 50 mgd
 - Convert existing processes to Bardenpho process
 - Additional 12.5 mgd expansion
- Centralized biosolids processing and handling
 - Reduces overall cost
 - Provides for co-generation bio-gas utilization at one location
 - Provides one point of distribution of final product



Some more detail. The expansion of the Ina Road Facility, as we indicated, to a capacity of 50 million gallons per day. Also in this program is the conversion of the existing processes that we have at Ina Road. We have a high-purity oxygen process. We also have a biological

nutrient removal process that does not meet the current requirements. So, both of these existing processes have to be upgraded to this new process that we're calling "Bardenpho," and that is in combination, 37-1/2 million gallons per day. And then, on top of that, an additional 12-1/2 million-gallon-day expansion with a Bardenpho process. So, the whole facility, the 50 million gallons per day, will all operate as one process when it's all done.

In addition, we will centralize all of our biosolids processing at Ina. In looking at the costs of doing biosolids at the new Campus versus and then doing biosolids at Ina, the costs estimates indicated to centralize that operation at one facility - and that will be at Ina - and then provide for co-generation of the bio-gas, and then it also provides for one point distribution of the final product, whether it's Class B or Class A, or something else. So, that's the plan for Ina, a massive, very complex expansion and upgrade program, and I should say it also includes a lot of rehabilitation. Ina is a newer facility than Roger, but there's also a need for a lot of rehab, and all of that will happen in this program.



An aerial view. This is Ina again and we have about 160 acres of property over there. This is kind of the outline of the property that we have and, color-wise, anything that's in color here are new facilities. What is not in color or white indicates existing facilities, but don't be misled by existing

facilities, almost everything that you see in white there will go through some type of upgrade and rehab, even though it's existing in nature.

And I also should point out that there is a sports park adjacent to Ina Road that all of you are aware of, and there was some early rumor out there that we were going to expand Ina into the sports park; that's not so. This entire expansion program is within the property that we own, so the sports park will remain over there.

32 MGD Water Reclamation Campus

- 32 mgd Bardenpho treatment train
- PCRWRD Central Laboratory Facility
- Showcase for cultural and biological resources
- Environmental enhancements partnered with City of Tucson
- Economic development
- Solar power project



The Water Reclamation Campus, it's a 32-million-gallon-per-day Bardenpho Treatment Train; that'll also house our Central Laboratory Facility. I'll talk about this in a little bit. We intended for it to be a showcase for cultural and biological resources, particularly in the setting that it will

have along the banks of the Santa Cruz River, and it will lend itself to environmental enhancements partnered with the City of Tucson, parks development, cultural resources, and many other features that we hope to partner with the City.

In addition, there's hope that there could be some economic development around this new Water Campus, and I'll go into that in a little bit. And then, finally, a new ingredient, a solar-power plant, and let me describe that: The County has a Sustainability Program which has recently been launched and is getting to be quite popular. One of the goals in the Sustainability Program is sustainability in power and green power. So, we have a project that will shortly go out in advertisement for a solar-power plant that will be located between the existing Roger Road Facility and the new Water Reclamation Campus, in between both of those facilities, and this will be solar power. And, once that facility is up and running, it will provide power to the existing Roger Road Facility. When the new Water Campus is constructed and operational and Roger Road will be decommissioned, we'll take that electrical cord, unplug it from Roger Road and just plug it into the new Water Campus. Isn't that nice? So, it's not a dream; that project is being developed and very shortly it'll be advertised for a consortium to come in and build it.



nature.

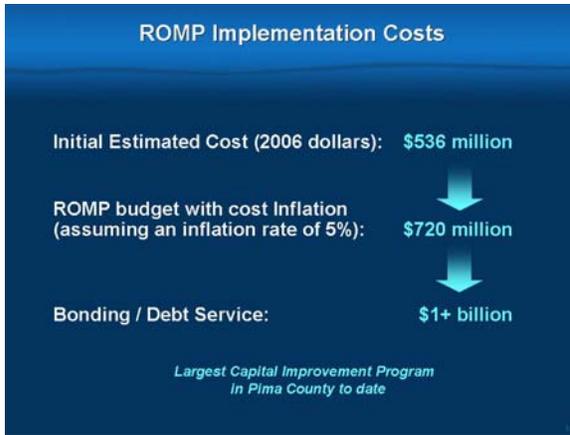
An aerial view just to stress that the facility will be built along the banks of the Santa Cruz River. The site is a very scenic site. We want this to be in a campus-type setting. And, as I indicated, there will be other projects surrounding this facility in the environmental theme type of



benefit from it. And notice they also said, "recycled" aluminum. I didn't understand what that meant, but I now understand that we can go out there and ask you, the community, to give us all of your empty soda cans and your empty beer cans and we could stockpile that and we could use it as recycled aluminum. There was a little humor in that, but you didn't get it, okay.

And to be stressed, also, is that everything that we do will be LEED-compatible. So, that's another major program that the County has endorsed and all of our facilities that will have some occupancy will go through the LEED review and will achieve the silver certification in the LEED program.

A more close-up look, and the only reason to show this slide is that our consultants are telling us that if you sway away from the traditional brick, mortar and steel, and use metal-type projects, like aluminum, you can incorporate solar-type panels in construction like this, get a solar energy



Now, to the bad news: Costs. I indicated that the initial cost estimate for the ROMP Program was \$536 million, and that was based upon planning-level cost estimates in 2006. We've since taken the program, we've divided it up into all of the various projects that need to be built in ROMP, also all of the consulting

services that need to be retained in both design, cultural resources, project management, construction inspection, and so forth, and we have taken that \$536 million, and we now have a ROMP budget of \$720 million.

Most of the difference between \$536 and \$720 is the inflation rate of 5%. We've inflated those costs up to the point of construction, assuming inflation at 5%, and we've come up with a budget of \$720 million.

MEMBER JOHN CARLSON: Mike, that's 5% per year?

MR. GRITZUK: Yes, yes. It doesn't stop there. If we had \$720 million in our bank account to build this program then, perhaps, we can build it for \$720 million. We don't have that kind of money in our bank account.

The way we will build this project is through the use of bond funds. And, as you know, when you use bonds, you have to pay them back, and you pay them back with interest; something called "debt service." So, when you factor in the bonding needs for a program like this, you are over a billion dollars by the time it's all said and done.

So, the accurate way is to look at this as a billion-dollar program, not a \$536-million program; also look at it as a regulated-forced-billion-dollar program. I need to point out one more thing: This is the largest capital improvement program in Pima County to date. Pima County has not seen anything like this in its history to the magnitude of the costs of this program and the complexity of it, and also the regulated schedule that's in this program.

Okay - yes, sir?

ALTERNATE MEMBER BOB COOK: I - I just wanted to stop right here and ask a couple questions -

MR. GRITZUK: Sure.

ALTERNATE MEMBER BOB COOK: - about the flexibility of the design. It's pretty obvious that this

is a showcase plan; there's no doubt about this is state-of-the-art, and it would be a wonderful thing if we could build this.

I'm looking at the - the areas of uncertainty: population growth, interest rates, and inflation of construction. And it seems to me that - that - that a - that a plan that addresses those three areas of uncertainty would - would develop a little more flexibility as these uncertainties become better understood. And let me just point out that the - that the inflation rate of construction is - is a - is a global financial phenomena, and it - and it - and it relates inversely to the value of the dollar, and - and also our Federal Reserve policy, which has been low interest rates. So, the value of the dollar has gone down because of our low interest rates, and that is now going to change. We see all indications that the Federal Reserve policy is going to be to raise interest rates to stem this - this - this dollar decline where we're buying on the world market the materials that we're going to building this thing with.

So, that 5% may be way low. That - that the - the population growth, some say that the housing crisis isn't going to actually work its way out of our economy until 2011. We're going to be going to - going to bid on this thing in an area of great uncertainty about really what the population actually is going to be between 2010 and - and 2030. How can we adjust this plan going out, you know, if we've already locked it in, in 2010 and everything changes? I mean, it seems like we got - we put all our - our - our eggs in one nest? I mean, we're - we're putting everything into this one plan and if - if any of these variables changes, I - I just see big problems.

MR. GRITZUK: All right. Let's take that in pieces. You said that inflation is there, but you really can't predict how much it will be. But, I think you said that 5% may be low? Is that what you said?

ALTERNATE MEMBER BOB COOK: Yeah, yeah. I mean -

MR. GRITZUK: Okay.

ALTERNATE MEMBER BOB COOK: - if you look at construction costs -

MR. GRITZUK: Yeah.

ALTERNATE MEMBER BOB COOK: - between 2002 and 2007 -

MR. GRITZUK: Yeah. So -

ALTERNATE MEMBER BOB COOK: - you - you see a lot more than 5% a year.

MR. GRITZUK: Yeah. So, if we're wrong in that projection, that billion dollars will get even higher; right?

ALTERNATE MEMBER BOB COOK: Right.

MR. GRITZUK: Okay. Keep in mind that we have no choice but to move ahead with this program because it's regulated, and if we argued that, hey, there's so many uncertainties in this program to DEQ, it wouldn't mean anything to them; it's regulated; you got to do it.

All right. Now, yes, we could provide different growth in this program. We provided growth to the year 2030, and that's based upon PAG projections - not our projections and, presumably, these projections are the best available today, put together by people that know how to put together population projections. We don't do that. Someone else has done it.

However, there is a possibility in this program that if growth does not continue, and we see this in the next couple of years, we can take the 32 MGD Water Campus and probably build 3/4 of that plant, 24 MGD instead of 32. So, there's a flexibility -

ALTERNATE MEMBER BOB COOK: That's what I was sort of getting at -

MR. GRITZUK: - of (inaudible; speaking over one another).

ALTERNATE MEMBER BOB COOK: - there's a flexibility.

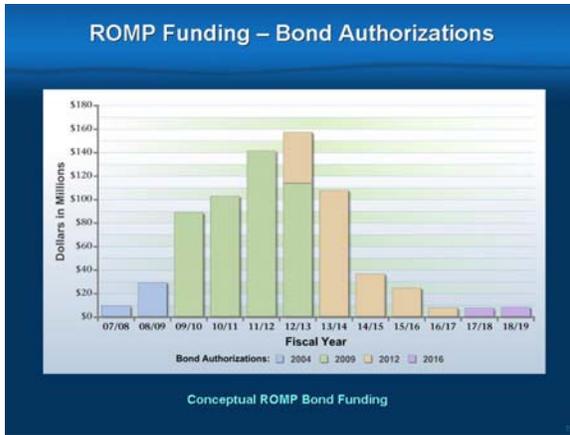
MR. GRITZUK: However, if you do that, and then you come back in the next five years or so and build that additional component, it'll probably cost you much more, so you have to weigh that.

ALTERNATE MEMBER BOB COOK: Yeah. Is there a way to - to create a more decentralized plan where - where, instead of having -

CHAIRMAN JIM BARRY: Bob, let me interrupt. Let's let him get - finish with his presentation, 'cause you've got a lot to talk about. So, Mike, finish your presentation -

MR. GRITZUK: Okay.

CHAIRMAN JIM BARRY: - and then we'll go to questions.

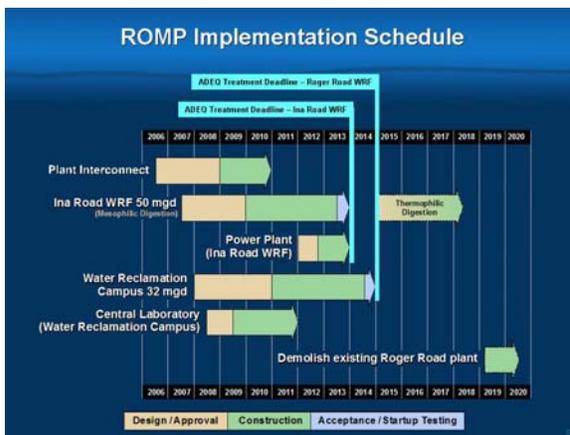


MR. GRITZUK: Okay. All right. How are we going to fund ROMP? And Eric got into this some - in a little way. Right now, all of that we're funding in ROMP is through the use of 2004 bond authorizations, and there's only very little money left in that 2004 bond authorization. The next component of funding ROMP is

with a bond issue that we hope to get voter approval for in 2009, and that's these components in green.

Now, Eric indicated that we have requested a 2009 bond authorization in the amount of \$565 million. Now, those who have a pen in the audience, if you add up \$90 million, \$105 million, \$140 million, and \$110 million, it doesn't add up to \$565 million; it adds to \$445 million. The reason I'm stressing this is that the bond request that we have, \$565 million, is for all of the CIP needs that we have in our Department for this short period of time; \$445 of that, which is on this bar graph, is for ROMP alone, \$445 out of \$565 million.

And then it doesn't stop there. As we continue to roll out this program, we envisioned that we need another bond issue in 2012, and then another one in 2016, towards the end here. But, if you feel that that's kind of going to bring us down here, that's a wrong assumption as well, because future regulations are going to start driving up something in that area. What it is, whether it's phosphorus, ammonia, Class A, pharmaceuticals, we don't know yet, but you know there's going to be something out there.



Here's our schedule, and I'll go through this more quickly. We indicated that the interconnect line is the most critical component of the ROMP Program because we're approaching capacity at Roger Road and we need to relieve that capacity, and the interconnect will do that by transferring that flow to Ina where we have

sufficient capacity.

Status-wise, the design contract has been let for this contract. We've also selected the contractor through a construction-manager-at-risk process; that design is in excess of 30% complete today, well on the way.

The next component is the Ina Road Facility, the most complex project of the ROMP Program; and here, too, we have let the design contract; that design is underway. We've also selected the contractor through a construction-manager-at-risk process; that contractor is aboard. And we've already received the first construction component proposal in that process where we're establishing a trailer park for all of the consultants, and so forth, that will be involved here, also to work on some of the cultural resources and other soil-type work at the plants. So, again, contract's let; project is on its way.

And the power plant which is at Ina, which is further out here, what we're looking for in here is some type type of a public/private partnership where maybe a private entity would come in and upgrade or build a new power plant through a public/private type of partnership arrangement.

And then the Water Campus. Recently, the consultants have selected a procurement method for this project, this Campus; it will be some form of a design-build project. We'll have that decision made very shortly, and we intend to move ahead as rapidly as we can with that project.

And the Central Lab, this is a necessity because of all of the compliance, sampling, and reporting we have to do, all of the monitoring we have to do. That new Central Laboratory will be located at the Water Campus.

And then, finally, way out in the program here, the demolition of the existing Roger Road Facility, which is about another \$23 million in itself. We pushed it out there because there isn't any urgency to demolish the facility, and we wanted to kind of spread out the costs of this program however we can, so that it's all not up front here, which could cause some real serious rate spikes. So, that's the way the program is laid out. Notice the compliance dates here for Ina Road, the beginning of 2014; and Roger Road, beginning of 2015. And Roger Road here, basically, is the new Water Campus.



Now, a dream: We will locate the New Campus along the banks of the Santa Cruz in an area around here, just north of the existing Roger Road Facility. And, as I said, somewhere in between the existing facility and new facility will be that solar-power plant that will be constructed.

But, in addition to that, there are plans by Tucson Water to expand their Reclaim Facilities, and this could be done in a very environmentally-pleasing way, and then our Natural Resources and Parks Department is talking about a regional sports complex of soccer fields, baseball diamonds. And then, finally, there's State-owned property alongside of I-10 that could be used for commercial development.

And all of this started with the presumption that the Roger Road Facility, with the odors that it was emitting, would go away and something else would come in and cause growth, economic development, environmental enhancement, and items like that. It's a dream, but studies have already been performed; for example, our Parks Department retained U of A, their Eller School to study this. They've submitted a very encouraging report that it can be done, and there are additional studies. We are being contacted now by national, international entities about the development of something like this around the new Water Campus.



That's the end of my presentation.

CHAIRMAN JIM

BARRY: Bruce?

MEMBER BRUCE

GUNGLER: Mike, from what - from what I got out of the presentation, Roger Road today's at

41-million-gallon-daily capacity, and the new Wastewater Reclamation

Campus is going to be 32-million-gallons-per-day, so that's a loss of nine million gallons per day capacity, and you're

adding 12.5 at Ina for a net gain of only 3.5 million gallons per day.

MR. GRITZUK: Right.

MEMBER BRUCE GUNGLE: Is that -

MR. GRITZUK: Yeah - and

MEMBER BRUCE GUNGLE: - going to adequately address our capacity issues?

MR. GRITZUK: - and the reason for that is our projection for capacity-to-growth needs in the year 2030 is 82 million gallons per day, and that also you have to add in there another three million gallons per day that we have in the Metropolitan Facilities -

MEMBER BRUCE GUNGLE: Yeah.

MR. GRITZUK: - there's the Randolph Park Plant, so it's 85 million gallons per day in the year 2030.

MEMBER BRUCE GUNGLE: Okay. So, the projection we're shooting for is 2030 -

MR. GRITZUK: Correct.

MEMBER BRUCE GUNGLE: - right across the top; not the (inaudible; not speaking into a microphone)?

MR. GRITZUK: Yes.

MEMBER BRUCE GUNGLE: All right.

CHAIRMAN JIM BARRY: Rob?

MEMBER ROB KULAKOFSKY: Yeah, a couple things that I think you need to make clear for - for members of the Committee and also for the audience, and that is the life span of the Water Reclamation Campus and the - the new facilities at Ina, as well as the consequences of not meeting the regulatory deadlines in 2014 and 2015.

MR. GRITZUK: Okay. Life span, you mean how long will these facilities last? Okay. That's a good point. In the construction of new facilities, it is no longer viewed as a 20, 30-year, 40-year type of facilities. These facilities are designed to last much longer, and the way they're designed is that, yes, there will be mechanical equipment change-out, there will be, certainly, instrumentation change-out, so all of that's taken into consideration, but the basic structures themselves are intended to last for 50, 60, 70 years, so, you no longer look at short life of the facility.

Let me also go back to pipe. Traditionally, large sewer pipes were reinforced concrete pipe, and they had a design life of 25 years, 35 years, thereabouts. The interconnect will have a design life, in the material that we use there, for 100 years.

As we rehab line today, the rehab techniques that we use are, basically, resins that line existing pipe.

When we rehab an old, reinforced concrete pipe that had a life of 25, 30 years, in the rehab process, that pipe will last another 100 years. So, this is the way we have to look at these facilities today. You design them for much longer life, understanding that instrumentation and so forth needs to be changed out.

The other point here, as far as compliance with the regulations, these facilities will be highly-automated. They'll be automated to such a point where they're fail-safe, in that if anything goes wrong, other equipment will kick in. If we see some sway in our compliance requirements, it will be detected and those adjustments oftentimes can be automatically made.

The stress I'm making is that, even though we have great operating and maintenance people, the way instrumentation has taken over in treatment plant process, it is state-of-the-art. I mean, these process controls are really fantastic, and that will be incorporated in this program. So, we are comfortable that, when we build these facilities, they will be in compliance. And the way we write our design contracts, our construction contracts with the schedules, there's a lot of penalty that the consultants may be encountering if they sway from the compliance state and from the quality requirements of this program.

MEMBER JOHN CARLSON: Mike, this his guy that takes your Class B refuse, do you pay him or he pays you? It becomes Class A, is it a saleable product?

MR. GRITZUK: No, we pay him. And if it goes to Class A, we will bid that out as Class A and we go to the marketplace with it.

Let me also mention that, yes, we do pay for the disposal of our solids, but we have one of the lowest, lowest sludge disposal rates in the nation, all right? For example, years ago, New York City used to barge its sludge 109 miles out to sea, and that became prohibited. Now they incinerate it, or something like that, at a very high cost.

You have California with their sludge disposal - and maybe some of you don't know this - a lot of the California sludge that's generated in California is hauled to Arizona for disposal at very high cost. So, today, with our Class B sludge, we have one of the lowest sludge disposal rates in the country; that doesn't mean we should stop there. We think that Class A is on the horizon; that should have some value; it should have higher value than the Class B. And will there be a break-even point? Well, we can dream.

CHAIRMAN JIM BARRY: Anybody else on the Committee, any questions? Audience, questions?

ALTERNATE MEMBER BOB COOK: Well, I'd like to -

CHAIRMAN JIM BARRY: Take the microphone, please, Bob.

ALTERNATE MEMBER BOB COOK: Yeah, I won't give a speech, I - I just - I'm very interested in this issue of - are there more decentralized and flexible plans because -

MR. GRITZUK: Okay.

ALTERNATE MEMBER BOB COOK: - because we're - what - what you're doing is - is saying that we're going to increase the capacity of our wastewater system and the quality of it, and the reliability of it, for an increment of 30% growth in this area, and we're going to have to decide that, as a community, that we're going to pay for this thing before that growth actually comes -

MR. GRITZUK: Yeah, but this -

ALTERNATE MEMBER BOB COOK: - and, at - at the same time, we have enormous demands in other infrastructure.

MR. GRITZUK: All right. But, could you pause for a moment -

ALTERNATIVE MEMBER BOB COOK: Yeah.

MR. GRITZUK: - and let me address that? In the ROMP Master Plan we also looked at the entire region, the entire Service Area, and we have 11 treatment facilities in our inventory, two of which are Ina Road and Roger Road. So, we've looked at all of these other facilities for what their future needs are, both from a quality point of view and a capacity point of view, and we are developing sub-regional plans for the outlying areas.

What I've just addressed here is just the Metropolitan Area. But, yes, it doesn't end there, there are sub-regional facilities that we have out there now, and all of them need to go through some degree of upgrade, or expansion, or abandonment. We still have several facilities that are just open lagoons, and those facilities need to be abandoned and that needs to be incorporated into these sub-regional areas. So, I feel that we have addressed that. And, in addition to the regional metropolitan facilities that I've described here, we have sub-regional areas and we've also addressed.

CHAIRMAN JIM BARRY: Okay. Who's next? And give your name, please.

GEORGE HUBBARD: I have the microphone, so I guess next, huh?

CHAIRMAN JIM BARRY: Yeah.

GEORGE HUBBARD: Yeah, I'm George Hubbard, and I just want to know: Is the sludge considered hazardous material?

MR. GRITZUK: No. And the reason it's not is that there's another federal requirement called "Industrial Pretreatment Program" where we have to regulate industrial discharges to our system to make sure that those industrial discharges do not cause any harm to our system, any harm to our employees, and any harm or to make the end product, the solids, unusable -

GEORGE HUBBARD: Thank you.

MR. GRITZUK: - so it's not a hazardous waste.

MACK HUDSON: My name is Mack Hudson and I'm wondering if your regulation is based on a bond issue and that doesn't pass, what do you do?

MR. GRITZUK: I retire. Because . . . I need to give you more of an answer, though. This is a regulated program, and I want to argue that this program will happen whether we have the funding for it with the way that we are proceeding, and if this fails and if we fail on these dates, the regulatory agency will come into the picture, they'll initiate litigation, we'll get into a Consent Order, or Consent Decree, and that will require us to move ahead and build these facilities. Unfortunately, when you get into that type of regulatory atmosphere, there are penalties that will be paid, you'll be paying much more for this program, and it's not the way to go. If you can do it, the way you're planning on your own dime, that's the most efficient way to get this program done. I've had programs on both sides of that fence; this is the better way to go.

And if we don't get the bond issue - the other part of your question - we have to come up with other funding mechanisms. There's something called "COPS," which is Certificate Of Participation type of funding, and we also have spoken to private sector funding, even though that's not planned, but that is an option that we should always keep out there, and short-term financing and, last resort, use cash. Cash is still good; it's still being used. However, if we use cash, watch out for your rate increases. The only answer to that is: "Wow".

CHAIRMAN JIM BARRY: Sir?

UNIDENTIFIED MALE SPEAKER: Question: I notice you had 14 soccer fields throughout there. If that's the case, do we need to tear down the historic Rillito Racetrack - -track for 15 soccer fields?

MR. GRITZUK: Talk to our Parks Department -

UNIDENTIFIED MALE SPEAKER: Okay. Number two -

MR. GRITZUK: - not my project.

UNIDENTIFIED MALE SPEAKER: Number two: You said you're going to recharge some water there at that -

MR. GRITZUK: Yeah.

UNIDENTIFIED MALE SPEAKER: - Roger Plant, is that for then repumping out from that effluent or what?

MR. GRITZUK: Chris, can you answer that one?

MR. AVERY: Yeah, it's the same answer I gave earlier; it's (inaudible; not speaking into a microphone) Recharge and Recovery (inaudible) supply.

UNIDENTIFIED MALE SPEAKER: Well, my only question is: What's the quality of the water that's going into the Santa Cruz River now? And what will be the quality - quality of the water that is being processed at that plant?

MR. GRITZUK: There are levels of treatment: Primary treatment, secondary treatment, tertiary treatment, advance wastewater treatment. These regulations bring us beyond tertiary treatment to advance wastewater treatment; that is the highest degree of treatment required in the wastewater industry today.

UNIDENTIFIED MALE SPEAKER: So, it'd be repumped for our use? Probably, I would presume.

MR. GRITZUK: Pardon me?

UNIDENTIFIED MALE SPEAKER: You're then repumping it out for commercial and home use?

MR. GRITZUK: Okay. At that quality - advance wastewater treatment - we feel that we will meet Class A+ quality of water, which is reclaimed water quality.

UNIDENTIFIED MALE SPEAKER: So, the old toilet-to-tap thing does prevail up -

MR. GRITZUK: We don't intend to drink it yet.

UNIDENTIFIED MALE SPEAKER: Yeah. The water that's Class B that goes down the Santa Cruz River, why don't you create a catch basin down there in Marana and let the farmers pump that water out for use on their farms, 'cause the nitrogen and the phosphorus that you identify is what you pay many bucks for at Home Depot to put on your plants to make 'em grow?

MR. GRITZUK: Yeah.

UNIDENTIFIED MALE SPEAKER: Now, if you use sludge on farms, why can't you use that water, too, and save a \$211 million water treatment plant?

MR. GRITZUK: There are various components to this answer: One is that you have to remove the nutrients because of the aquatic life that's created with this

discharge; that's one part; and that's why we, in fact, have to reduce the nutrient level. But, also, a lot of this water winds up in underlying aquifers and we have to reduce the nitrogen level in the effluent so that there's no nitrogen contamination of the groundwater. So, those are some of the requirements for this degree of effluent.

UNIDENTIFIED MALE SPEAKER: Okay. So -

CHAIRMAN JIM BARRY: All right. Sir -

MR. GRITZUK: So, it's not an option to leave all the nutrients in the effluent so the farmers downstream can pump it out and use it for irrigation purposes. If you like to argue that, join me in meetings with DEQ, see how far you get.

CHAIRMAN JIM BARRY: I'm going to ask you to relinquish the microphone so other people can ask questions, all right? Huh? Anybody else have another question? Okay. Bonnie?

MEMBER BONNIE POULOS: Okay. At some of the previous meetings - that's on? - we heard a discussion about the amount of water that agriculture uses in the State of Arizona, and from your presentation it seems like there's another side to that story, because agriculture is one of the primary users of the biosolids that are generated from the wastewater. So, when you're looking at the issue of agriculture and their impact, in terms of water use, it seems to me that we also need to balance that with the benefits that we get from being able to have them utilize the biosolids that are a product; is that accurate?

MR. GRITZUK: Yes. I can look at it that way, yes.

MEMBER BONNIE POULOS: Thank you.

CHAIRMAN JIM BARRY: All right. Let's - okay -

MR. GRITZUK: That was a statement; it wasn't a question.

MEMBER BONNIE POULOS: No, I just wanted to know if that was an -

MR. GRITZUK: Okay.

CHAIRMAN JIM BARRY: Okay.

MEMBER BONNIE POULOS: - accurate -

MR. GRITZUK: I think so.

MEMBER BONNIE POULOS: - reflection of the two discussions that we've had.

MR. GRITZUK: Yeah.

COLETTE ALTAFFER: Colette Altaffer. I just have one - one quick question. If we're removing nitrogen from the water, is it ending up in the biosolids? Is that where it's going?

MR. GRITZUK: Yes.

COLETTE ALTAFFER: If - if - that's our - so, when we put the biosolids on the fields, we have nitrogen going on the fields, which, you know, is a fertilizer, but if we have excess amounts of nitrogen, how are we preventing that from running off the fields and winding up back in the aquifer?

MR. GRITZUK: Same as if you use fertilizer out on those fields; it does - some of that percolates down into the groundwater levels.

By the way, when you compare the nutrient level of our solids to fertilizer, at best, this is a very mild fertilizer. In addition, because it is organic in nature, it does provide a soil-enhancement quality to farmland in addition to the nutrient value that it has.

CHAIRMAN JIM BARRY: All right. I'm going to do a Call to the Audience so that we get that done, give people a chance. Tracy?

TRACY WILLIAMS: Thank you, Mr. Chair, for acknowledging my birthday and everyone. I just want to say it's a pleasure to be here this evening, and I want to compliment all the Committee members for your due diligence and perseverance.

Tonight I want to speak to you about the process

-

CHAIRMAN JIM BARRY: Tracy, let me interrupt one second. Michael -

MR. GRITZUK: I'm done?

CHAIRMAN JIM BARRY: - thank you very much. You're done. Thank you.

TRACY WILLIAMS: Thanks, Mike.

CHAIRMAN JIM BARRY: You did a great job.

(Applause.)

CHAIRMAN JIM BARRY: Thank you. Tracy, go ahead.

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations, and Questions & Answers with Presenters) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on July 23, 2008.

Transcription completed: August 29, 2008.

DANIELLE L. KRASSOW-TISDALE

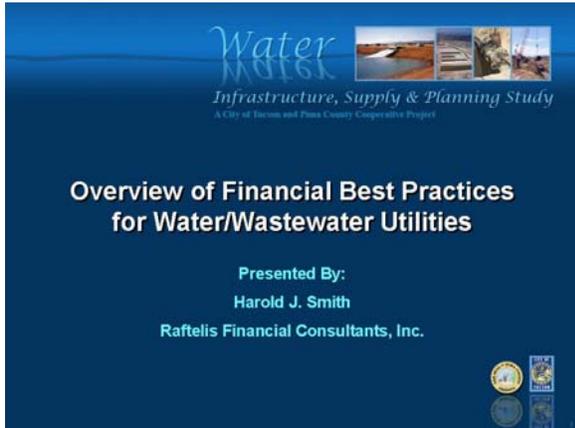
TRANSCRIPT OF AUGUST 13, 2008

List of Presenters:

- 1. Harold Smith, Raftelis Financial Consultants, Inc.: Overview of Financial Best Practices for Water/Wastewater Utilities*
- 2. David Cormier, Interim Finance Director, City of Tucson: Tucson Water Financial Planning*
- 3. Jeff Nichols, Deputy Director of Administrative and Financial Services Division, Pima County Regional Wastewater Reclamation Department: Pima County Regional Wastewater Reclamation Department Financial Planning*

MR. NICHOLS: Good morning, my name is Jeff Nichols. I am the Deputy Director of Finance and Administration for Pima County Wastewater Reclamation. The first person speaking this morning is Harold Smith. He's with Raftelis Consultants, Incorporated. They're a firm based out of Charlotte, and they've assisted us with our financial planning model going on the second year now. We're in the process of doing it again this year and they were the ones that put together our '07/'08 Financial Plan. So, Harold, if you would.

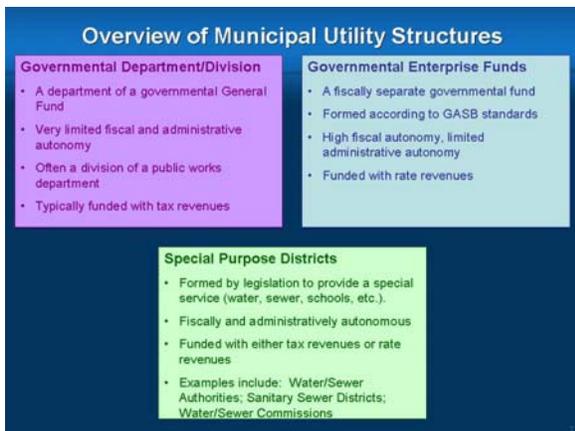
Presenter #1
HAROLD SMITH, RAFTELIS FINANCIAL CONSULTANTS, INC.:
OVERVIEW OF FINANCIAL BEST PRACTICES FOR
WATER/WASTEWATER UTILITIES



MR. SMITH: Hello. As Jeff said, I'm Harold Smith with Raftelis Financial Consultants. We do water and wastewater financial consulting across the United States. We've done a lot of work with Pima County Wastewater Reclamation Department in the past couple years; involved in the ROMP Project and developing financial plans.

But, like I said, we - we work for hundreds of utilities across the country and, as a result of that experience, we see firsthand what utilities are dealing with on a day-to-day basis, the challenges that they deal with, and we also see some of the things that they are doing to address these challenges; that, when they work, they become best practices, basically. And the word spreads that these are the things that we've done that will help you overcome these challenges, and the other utilities then jump onboard and try to do the same thing.

So, what I'm going to do today - what I was asked to do - is talk about some of the challenges utilities face, and a couple of the best practices. There's not a book out there that says, "Here's the best practices," but things we've seen that work for utilities in dealing with these challenges.



In starting out - just a little background about how we typically see utilities organized; they're really basically three different structures. There's one where they're a department of a municipal or a county government, in which case they are not their own separate business entity so to speak; they're part of the - like the Police Department and the Fire Department and the Water Department, and they're typically funded through the - the

municipality's or county's general fund. As a result, they don't have a whole lot of fiscal autonomy. The - the governing body of the municipality makes most of the big decisions about what they are going to do, and they're typically funded with tax revenues. We don't see as many of these as there were in the past; and, typically, they're for very small municipalities that don't have a huge service area.

The most common structure we see is the utility enterprise fund; and, basically, this is a separate fund; it's really almost an accounting construct where all of the revenues and expenses for a water utility are accounted for under a separate set of books. But, what it means is they operate really as a separate business entity from the government as a whole, and they have a high level of fiscal autonomy. Now, they aren't totally autonomous because, typically, the governing body of the municipality or county makes the decisions as far as what our rates are going to be, which drives your revenue stream. So, there is, on one side, how much they're spending tends to be somewhat autonomous, but how much they actually can collect to cover those costs is they're holding to somebody else on that account. And, in most cases, these are funded with rate revenues, so they set a water or sewer rate and that generates revenues they need to - to fund their activities.

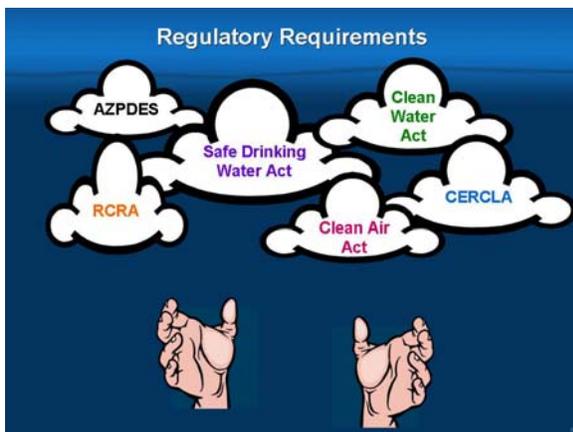
And then we also have Special Purpose Districts. These are things like Water Authorities . . . Sanitary Sewer Districts, Water Commissions; these are legislatively-created bodies that are created to form a specific purpose: water service, sewer service, school districts. And these are - well, they are fiscally and administratively autonomous, where that sometimes gets a little sketchy is in the creation of the board that - that - that runs these things. Sometimes they are appointed by members of the Board of Supervisors or the City Council, so there's a certain level of - of, you know - where they - they aren't quite as autonomous as you'd like them to be. But, in these cases, they're funded with either tax revenues, either they've been giving tax - given taxing authority as part of the legislation that created them, or they recover it through water and sewer rates. So, just a little background; that's how we see utilities organized across the country.



Now, all of these, regardless of how they're organized - I hope you've been watching the Olympics lately - I tried to do a little Olympic theme to my presentation - have different challenges that we see are fairly common across the country; that they have to deal with on a day-to-day basis. Sometimes individual challenges prevent more - present more of a problem than others. But,

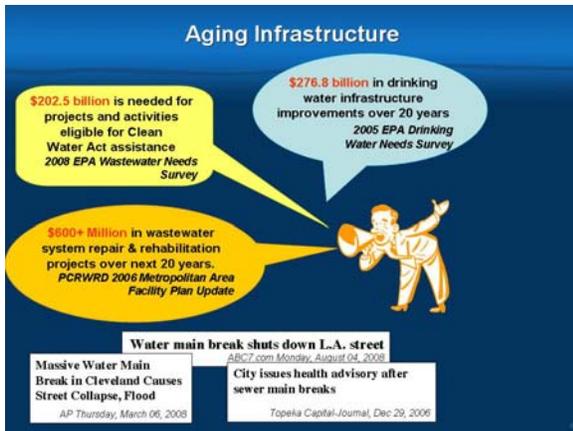
basically, what we're looking at regulatory requirements; the - the requirements that each utility has to meet in terms of water quality, effluent quality, air quality, that sort of thing, on a - on a day-to-day basis. They're - have challenges related to the local economies that relate to their customers' ability to pay for the service they're provided.

Aging Infrastructure. When you think that a lot of the infrastructure that was put in place across the country is getting to be nearly 100 years old today, it's starting to fall apart, and more and more utilities are faced with incredible cost in replacing or repairing that infrastructure. As anybody that's been involved in water and sewer in any county in any state across the country realizes, politics always play - is always a challenge that the utility has to recognize as they're making their plans for the future. And then limited resources, there's not - a lot of times, not enough water to serve the population, or anticipated population, of the service areas.



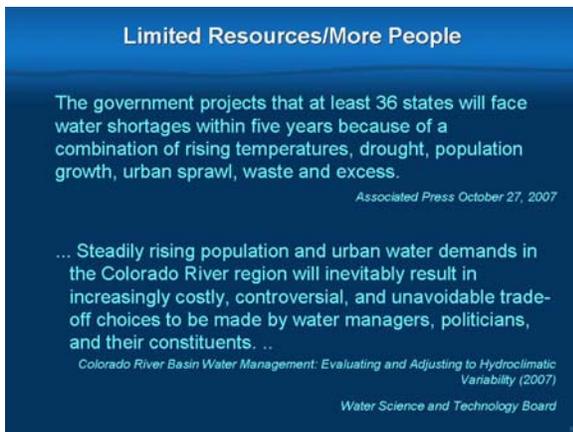
So, looking at each one of these. Back in the '70s when the Safe Drinking Water Act and the Clean Water Act were passed, that was really the beginning of the regulatory environment in the United States. And each day utilities are faced with the challenge of making sure they have the assets and the operating staff in place to meet those requirements. Now, the problem

is as - on a day-to-day basis they think they've got it figured out, but it's a moving target and they have difficulty in making sure that they're able to meet the challenges on a day-to-day basis.



Aging Infrastructure. As you can see, these are some projections that were produced by the EPA; \$202 billion needed for water projects over the next 20 years; \$277 billion in wastewater projects. Pima County, in their - the facility plan update, tentatively had over \$600 million earmarked for system repair and rehabilitation. Basically, the infrastructure is getting old and

falling apart and more money needs to be spent on that to keep it working on a day-to-day basis; otherwise, you run into problems like we see in these communities: water main break shuts down L.A. street, city issues health advisory after sewer main breaks. So, there is a lot of cost associated with this, but failing to do it results in other things that none of us want to deal with.



Limited resources and more people. These are just a couple of quotes I pulled off the internet looking around at various different news articles over the past year or so. "Projects that 36 states will face water shortages in the next five years" - that was from AP article in October, 2007. And then a little bit closer to home, the Colorado River Basin Water

Management Evaluating and Adjusting to Hydroclimatic Variability, a report done by the - some of you've probably seen this already - basically says that the Colorado River Water is not going to be sufficient to meet the growing population of the area that that - where that water is used. So, as we grow, our water demands grow and, unfortunately, water is a limited resource.

Local Economies

- Number of building permits in US is down 32% since June 2007.
- In the past 12 months, the national unemployment rate has risen by 1.0% to 5.7%.
- Unemployment rate in Tucson has risen from 3.5% in June 2007 to 4.8% in June 2008.

Sources: Bureau of Labor Statistics and National Home Builders Association

As the cost of providing water and sewer services increases, the ability of customers to pay for service is declining.

Local economies, some more statistics. I hate to be so pessimistic about this, but I - we see building permits are down, unemployment's up. Locally, unemployment has risen from 3-1/2% in June of 2007, to 4.8% in June of 2008. Basically, what this tell us is, as the cost of providing water and sewer services increases, the ability of customers to pay for it is

declining. As people lose their jobs, they aren't as - as capable of paying for the services you provide to them. And the decision-makers recognize it and they're less likely to give you the resources you need to properly operate your utility.

Politics



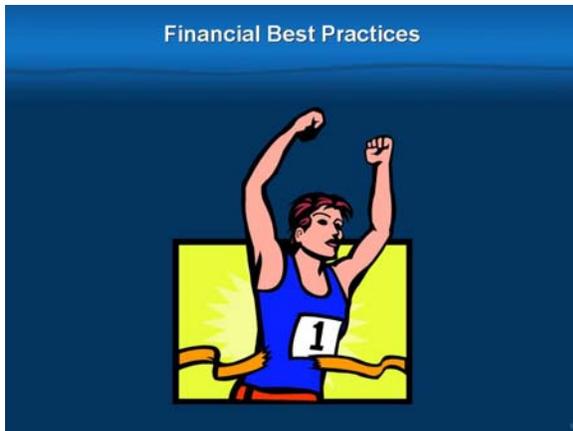
- Local leaders are resistant to increasing water and sewer rates to pay for rehabilitation, expansion and upgrades.
- Federal leaders reluctant to provide funding options for needed infrastructure improvements.
- Political subdivisions compete for available water resources.
- Competition among regulatory agencies for control of limited water resources.

Politics. Government decision-makers, City Councilors, Board of Supervisors, they don't want to raise rates because their constituents don't want their rates raised. The Federal Government is reluctant to provide funding. In the past, when the Clean Air Act, back in the '70s, was passed, there was a lot of money available from the Federal Government to pay for the

infrastructure needed to meet those new regulatory requirements. That money's not there - and people argue both ways, whether or not it's appropriate for the Federal Government to fund it - but, the fact of the matter is: that money's not there.

And then you have political subdivisions competing for water and - so that that - because they recognize that water is a necessity if they're going to meet their growth expectations, so you have different - you have neighbors fighting over the limited resource. And then you even have regulatory agencies fighting over who should dictate what is done with those limited resources.

And we do a lot of work in Rhode Island and right now they're going through a big process trying to decide - the Department of Environmental Health is fighting with the Division of Water Resources about who is it that should tell people how they can use these resources? So, politics plays a big part.



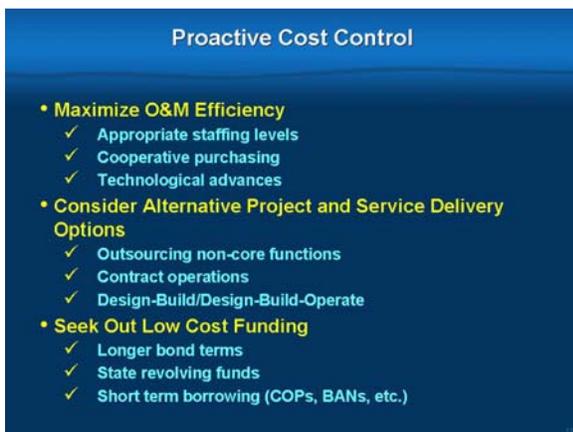
Now, as I said, I'd like to talk - the - the second half of my presentation will be about what utilities have done -

CHAIRMAN JIM BARRY:

Five minutes.



MR. SMITH: All righty. What utilities have done to meet these challenges. All right. Practice Proactive Cost control, Practice Sound Asset management, Maintain Adequate Reserve Fund Balances, and Establish and Maintain Appropriate Rates and Charges.



What do I mean by Cost Control? Obviously, this is a no-brainer. You want to reduce your costs, because that makes it cheaper to operate your utility. How do you go about doing it? These are some of the things we've seen utilities do across the country. Maximize O&M efficiency. Make sure you've got the right number of people, because labor is one of your largest utility costs.

So, having too many people on staff is meaning you're spending too much money.

Cooperative purchasing is something we've seen, particularly with respect to power and water treatment chemicals. Utilities within a region will pool their resources and get together and develop cooperative bar- - purchasing agreements with local utilities to reduce their costs.

And now, obviously, you want to take advantage of any technological advances that makes your process more efficient,

most cost-effective. Consider alternative project and service delivery options, out-sourcing non-core functions, things like janitorial services, landscape maintenance. And in - one big thing we see that's - people don't recognize, most utilities out-source the majority of their engineering work, so their design engineering work. They don't maintain a huge staff of design engineers, but they out-source that out because that is a more cost-effective way of doing that function.

Contract Operations. Many utilities have found that private companies whose core business is water and sewer utility operations are able to operate their facilities more cost-effectively. And then implementing alternative project delivery methods, such as Design-Build and Design-Build-Operate. We've seen utilities, say, reduce project costs by as much as 15 or 20% by going with an alternative project delivery method, such as a Design-Build, or a Design-Build-Operate.

Seek out Low-Cost Funding. Now, this is not simply just low-cost. What I mean by Cost Control is not only reducing your costs, but managing your costs so that it has a smaller impact on a day-to-day or year-to-year basis.

Longer-term bonds. While the overall payout for a longer-term bond is greater, you're able to spread your costs over a period of time that's more consistent with the life span of the asset you're funding. So, if you're building a water treatment plant that's going to last you 50 years, then you would probably want to use a 20- or 30-year bond to pay for that, because it aligns the cost, the recovery of costs, with the actual service the - the asset's providing.

Obviously, taking advantage of the State Revolving Funds; that's really, today, the only reliable source of federal assistance available to utilities is the State Revolving Funds that - the water infrastructure finance agency is the - the vehicle for that in Arizona. Typically, you can get funding at - as much as two or three percentage points lower than the market rate.

And then short-term borrowing is one of those long-term cost control mechanisms that I was talking about. Instead of spending cash on projects, you can fund those with short-term borrowings and spread the payback of that over a three to five-year period, as opposed to paying for it one lump sum in one year, so you're managing your costs.



Sound Asset Management. I don't know how many of you have heard asset manage- - this is kind of the buzz word in the industry over the past five years - but, basically, what it's doing is taking care of the facilities that are necessary for you to provide service. Now, this is a layout of how we have seen utilities do this effectively. Basically, what they do is they

determine what is the level of service that they and their customers expect them to provide? Obviously, it would great if we could provide service that guaranteed that absolutely every day you would turn on your water and it would come out and there would never be any problems, there would never be any main breaks, there would never be any sewer collapses, but the cost associated with that level of service is phenomenal.

So, what we have to do is establish realistic service standards that we and our customers can live with, and that becomes the basis of our Asset Management Program. We then manage our assets to achieve those service levels. And the way we do that is first of all we have to determine what our assets are and what condition they are in, so we know - and, as we do that, we got to determine what the consequences of failure of those assets. So, obviously, the failure of an eight-inch sewer main is far less consequential than failure of a 64-inch sewer main. So, we've got to determine - and that helps us prioritize our Asset Management Program and our capital repair and replacement program.

So, basically, what we have to do is establish the standards, determine our asset conditions, and prioritize our capital plan based on - that aligns our program with meeting our service standards. And then, obviously - I - I don't want to ignore predictive and preventative maintenance; this is maintenance that's done predictively and preventively, because it's been proven that that kind of maintenance is far more cost-effective than fixing something when it breaks.

Adequate Reserve Fund Balances

- Operating reserve fund
 - ✓ 45 days of O&M expenses (12.5% of annual O&M)
- Capital reserve fund
 - ✓ 50% of average annual capital costs
- Rate stabilization fund
 - ✓ 10% to 20% of annual revenues

Adequate Reserve Fund Balances. Now, this is one that we don't see many utilities really achieving these targets, but the fact that they have these targets in place align - positions them - puts them in a better financial position.

Operating a Reserve Fund. Basically, this is a Reserve Fund that's used to meet either unexpected O&M costs, or

it helps you in a situation when your water sales are down and, therefore, your revenue stream is smaller than expected. And we're seeing that happen more and more as utilities go to conservation rate structures which promotes conservation of water resources, and what that's really doing is telling their customers to buy less of their products, so their revenue streams are lower, and they sometimes get in the position where their revenues can't meet their expenses, so these Reserve Funds are used to - to cover the slack periods, and we look at 45 days of O&M expenses.

Capital Reserve Funds. These are used for those emergency situations that always come about, a large sewer main break or a water main break, a failure of a major component of a treatment plant. This allows you to fund that on a quick, readily-available basis, and it's much cheaper than going out and issuing bonds to fund a project that might not - that - that has to be done now.

And then we see many utilities using a Rate Stabilization Fund, where they have money set aside to use to offset the need for higher-than-usual rate increases. So, if cash needs require that you would increase your rates by 15% in one year, instead of doing that, you can have a 6% rate increase and draw down your Rate Stabilization Fund to meet the difference.

Appropriate Rates and Charges

- **Should Recover All Costs**
 - ✓ O&M
 - ✓ Pay as you go capital
 - ✓ Debt service
 - ✓ Indirect costs
- **Consistent With Utility's Pricing Objectives**
 - ✓ Revenue sufficiency
 - ✓ Conservation/demand management
 - ✓ Affordability
 - ✓ Growth pays for growth
 - ✓ Rate stability
 - ✓ Legality
- **Updated Annually**

I'm almost done. The last, and not least, is establishing appropriate rates and charges. This is how utilities pay for what they do, and they've got to be sufficient to meet their costs. So, they - the rates should recover all costs, including your operation and maintenance costs, your - what we call "pay-as-you-go capital costs," which is the - the minor

capital projects you do on a yearly basis, the Debt Service on the bonds you issue to fund your major capital projects, and also the indirect costs, the costs associated with the services that, say, the County or City Legal Department provides to the utility, or the services that the IT Department, the County or City IT Department provides in terms of the billing system to the utility, needs to recover all costs.

And the most important thing, it has to be consistent with the utility's pricing objectives. Before we do any rate study for a utility, we have them define what their - what are they trying to do? What is the most important thing to them with respect to rates? Obviously, revenue sufficiency is high on the list of most people. We've got to have enough revenues to cover our costs. But then you have other - conservation demand management has been very high on a lot of people's lists over the past couple years. We want a rate structure that promotes responsible water use, but we also want it to be affordable.

We recognize we have customers that are economically disadvantaged and we want to make sure that there's some way that we can ensure that they're capable of paying their fair share. So, they have to be consistent with your pricing objectives. And, most importantly, they have to be updated annually, and this is not saying that you have to have a rate increase every year, but you have to look at your rates every year and compare them to your anticipated costs and make sure that the revenues you're getting in are going to be sufficient to cover your costs; and, if they're not, you need to figure out a way to make that - those two come into alignment.



Now, any questions?

CHAIRMAN JIM BARRY:

Let me make a suggestion, please. It's - it's 8:15 and we want to be out of here by 9:00. Can - can we hold all questions until all three presentations are over? And can we forget our five-minute break and just go right into Tucson Water and then Wastewater and try to be done by 9:00? Okay. Thank you.

MR. SMITH: Thank you.

CHAIRMAN JIM BARRY: Thank you, Harold. Very Good. (Applause.)

CHAIRMAN JIM BARRY: Okay. The next presenter is David Cormier. David was Finance Chief for Tucson Water for 700 years, or a long time, and he's been trying to retire, but they brought him in as Interim Finance Director for the City of Tucson. And we allocated 35, but will you cut it back to 22?

MR. CORMIER: I'll - I'll do my best.

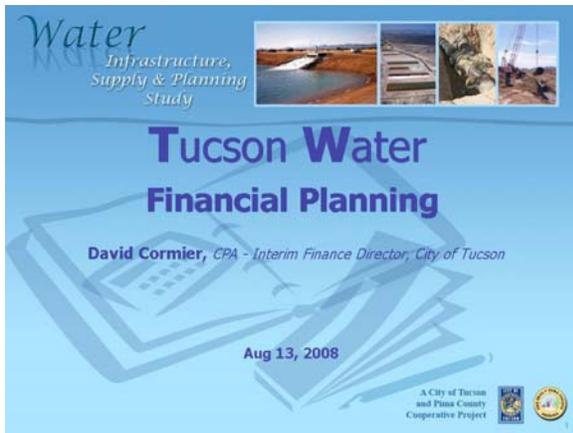
CHAIRMAN JIM BARRY: Okay. David is great at whizzing through this stuff.

MR. CORMIER: Yeah, I'll take -

CHAIRMAN JIM BARRY: Let me - let me say something: This is stuff that we can revisit, so we don't have to get it all done today. But, David, please . . .

Presenter #2

**DAVID CORMIER, INTERIM FINANCE DIRECTOR, CITY OF
TUCSON: TUCSON WATER FINANCIAL PLANNING**



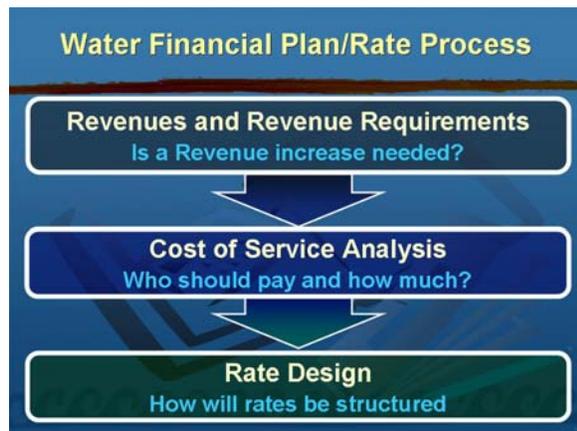
MR. CORMIER: All right. Good morning. Thank you for giving me the opportunity to share some information with you. I did want to start off by saying I will go through this relatively quickly. At best, I hope to give you a flavor of the Financial Plan process, the rate-making process that we go through; that'll enable you, I think, to ask some questions in the future.

Before I start, a little bit of information you may have heard numerous times at these meetings, but to just you a little bit of background on how Tucson Water operates in the financial world: It is a municipal-owned utility of the City. You just heard the - the various types of set-ups for water utilities. By a "municipally-owned utility," it means that all of the costs of doing business are to be provided for by revenues of that utility. It's a large utility. We have about 230,000 customer accounts, over 730 (sic) customers behind those meters. We serve customers within the City of Tucson and without - outside the City limits; about a third of customer base is in the County.

Mayor and Council serve as a sort of Board of Directors; they approve our Financial Plan; they set policies and they set rates. Two very important supporting pillars to that direction come from our Citizen Water Advisory Committee, a very active and very involved and very influential group of - of customers, 15 members appointed by Mayor and Council and the City Manager. And a less-important, but important nonetheless, Customer Rate Design Group, a group of folks that get together once a year representing different customer classes that provide input on Cost of Service and Rate Design.

And, finally, when Tucson Water considers a revenue increase, we have to follow State statutes, the State law tells

us what must be done in order to install or - or generate a rate increase.



We're calling this the Financial Plan or Rate Process. We're going to focus mostly on the Financial Plan. But, what is a Financial Plan? Very simply: It's how are we planning on covering our costs with our revenues? We have to make that work.

My co-workers in the room here from Tucson Water would say when we embark on the Financial Plan process we're saying, "What do we need to do in terms of increasing revenues to cover our needs?" We start out that way. By the time we end, we're pretty much saying, "How can we control costs to allow revenues to remain within an affordable level?" By "affordable" I mean what is deemed acceptable within the political environment, and what is affordable to our customers?

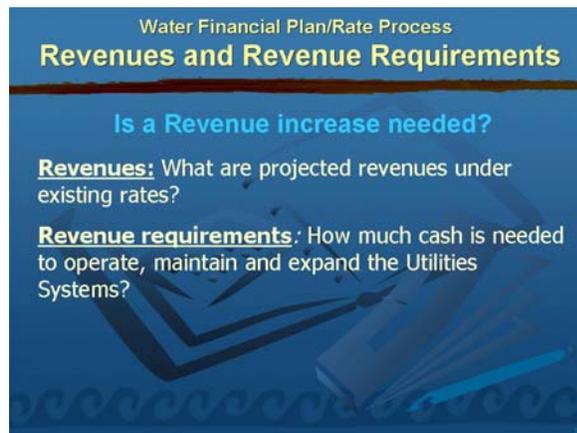
We have three main components to this process: The first, revenue and revenue requirements. The question is: Is a revenue increase needed? The second: Cost of service analysis. We look at that revenue increase and the underlying cost and we say, "Who should pay and how much?" And, finally, Rate Design. How will rates be structured?

The first phase is really the Financial Plan. The second is where we parse out the costs of doing business to our different customer classes. And, finally, we tell you how we're going to affect your pocketbook as an individual customer.

As I said, the first process is - is development of the Financial Plan. The first question is: What are our revenues? What are they projected to be under existing rights? And when we say "existing rights," we don't just mean what were they last year? We mean what do we think they will be in the next - during the period of the Financial Plan - which, by the way, is a six-year rolling plan - the year in which we're in and the five future years.

So, we look at revenues, we adjust them for increases in growth that we anticipate, we adjust them for newly-established fees. We also take into look (sic) what impact new programs might have on those revenues. For example, this year a new effort in conservation was imposed; hopefully, that program will be successful. What is the result of that

success? Decreased consumption; thereby, impacting revenues. So, all that is taken into consideration.



Water Financial Plan/Rate Process
Revenues and Revenue Requirements

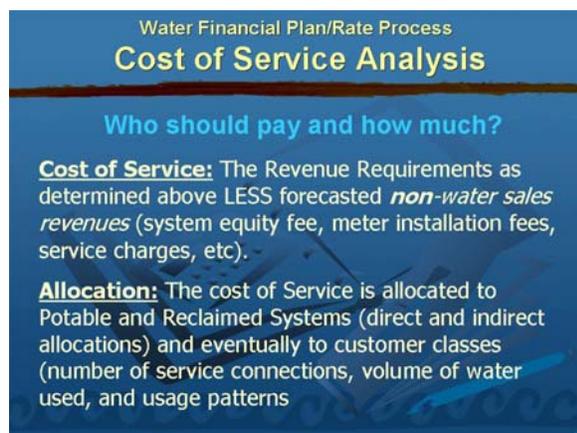
Is a Revenue increase needed?

Revenues: What are projected revenues under existing rates?

Revenue requirements: How much cash is needed to operate, maintain and expand the Utilities Systems?

When we talk about revenue requirements, we're talking about how much cash is needed to operate and maintain and expand the utilities systems, both our Reclaimed and our Potable System. Basically, the way I look at it, revenues are - are, basically, a projection of where we think we'll be in terms of cash in the door. Revenue requirements, typically, you think of those as budgets, the Capital Improvement

Budget, and the O&M Budget.



Water Financial Plan/Rate Process
Cost of Service Analysis

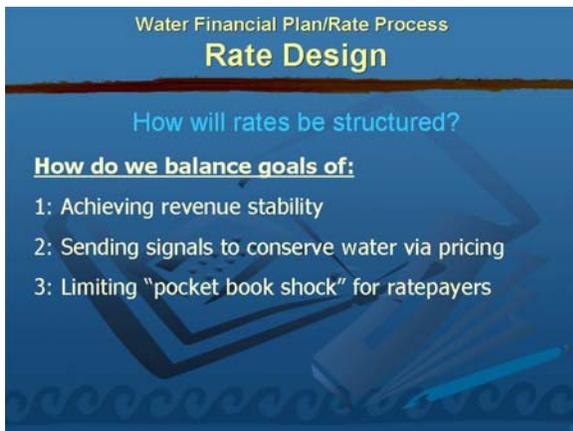
Who should pay and how much?

Cost of Service: The Revenue Requirements as determined above LESS forecasted *non-water sales revenues* (system equity fee, meter installation fees, service charges, etc).

Allocation: The cost of Service is allocated to Potable and Reclaimed Systems (direct and indirect allocations) and eventually to customer classes (number of service connections, volume of water used, and usage patterns)

Cost of Service Analysis. We boil it down to, basically, two sentences here: The cost of service is the revenue requirements or the cash needs determined in the Financial Plan itself, less non-water sales revenues. In other words, how much do we need to recover via water rates? That's what we're talking about when we're talking about a rate process.

We allocate those costs to first our Potable and our Reclaim System and then, eventually, to the various customer classes within our Potable System. Very simple, you can put it in two sentences; it's a very complicated process. People talk about Cost of Service as a science, as something very exact. Yes, you get absolute numbers out of it, but it's based on many, many assumptions; many, many allocations. For those few that are interested, we have multiple, multiple-page worksheets which, basically, do that allocation.



Rate Design. This is where most people finally get involved; this is where they - they see how we're going to impact their individual bill. As the prior speaker mentioned, there's some goals here. We want to, as a financial part of the utility, make sure that our revenue is somewhat stable. We also want to send signals to conserve via the pricing of water, and we want to

limit the pocketbook shock for ratepayers. Those do not always go in the same direction. What's the best way to achieve revenue stability? A flat monthly fee for every connection. That's very much against conservation. What's a good way to encourage conservation? Our inclining block for our residential customer, "The more you use, the more you pay per unit," very, very good for conservation; not the best for stability. So, we have to balance those and that's the role that both CWAC and the Rate Design Group play in making recommendations to Mayor and Council.



Couple financial policies of - you just heard some of the best goals, some of the benchmarks throughout the utility. We have two basic financial policies. I want to start with one, however, that's not on there, and that's how do we finance our Capital Improvement Program? Mayor and Council financial policy is that that will be done with a combination of revenue, bond

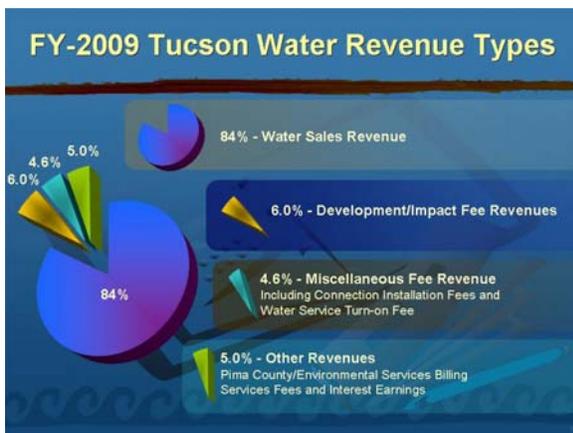
proceeds, and pay-as-you-go or - or revenues. What that, basically, forces us to do in a - in a good way is establish these other two reserve require- - or financial policies.

The first - or the second I'm going to talk about first - Debt Service Coverage. What is that? Debt Service is, basically, the payment on all of our revenue bond debt of principal and interest; it's very much the same as a mortgage payment you may have on your house. We make those payments annually.

The Debt Service Coverage is a bond covenant requirement. When we sell our bonds, we tell our bond holders

we're going to operate the utility in such a fashion that after we pay our operating expense in a given year, we're going to exceed what we owe them, in terms of principal and interest payment by 75%. So, we've got cash in, we've covered our O&M, we've now covered our Debt Service, there's still 75% left over. What do we do with that? Two things. One, we can allow that to go to reserves. I'll talk about that policy in a minute. But, most importantly, we use that excess to fund our Capital Program; that means, in a given year, we average about 60% funding of our CIP with bonds, and about 40% with the pay-as-you-go revenue.

Our Reserve requirement, our official policy adopted by Mayor and Council is 5% of our annual water sales, would be about \$10 million, or about \$5 million a year of - in the recent years when Financial Plans have been adopted. They've set a level of 10% - at least our goal is to get to a 10% reserve over the five-year period of the plan.



Here's a quick look at our Revenue Types; it's no surprise, water revenue sales, both potable and reclaimed are the big player there, 84%. Over the last four or five years, Developer Impact Fees have been becoming more important, about 6% of our revenues. We have a couple of Development Fees, the biggest is our System Equity Fee, which is a buy-in fee, you pay to buy into

the assets of the system; it is a backward-looking fee; it's updated every two years to pull into that inventory, additions to the system infrastructure.

We have a Water Resource Fee that was just implemented a bit over a year ago; that's to recover from our customers the costs that this utility has invested in buying the rights to Colorado River Water. And we have two small isolated System Development Fees which are hybrid fees, they're both a backward-looking and a future-looking fee.

We do know that we do need to expand our - our vision on Development Fees and, in the future, look at making our System Equity Fee, or the buy-in fee, a hybrid, looking to the future as well.

Miscellaneous fees, those are fees for various services, such as connections to the system, various billing fees, turn-on fees, about 4.6%, and then everything else, 5%. One of the biggest players there is our agreement with Pima

County and City of Tucson Environmental Services to utilize a combined billing system. We do a significant portion of Pima County's billing; it's a win/win for both the - the County and the City.

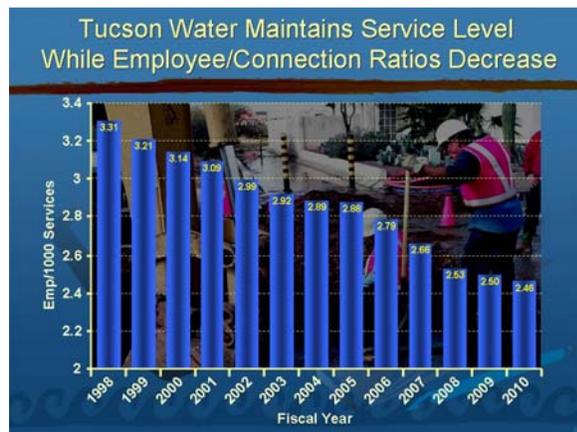
Improvements/Efficiencies

- **MMP – Predictive Maintenance**
- **Efficiency – More Services/fewer Employees**



Talked a bit about cost control, and I wanted to take a slight detour before we talk about our CIP and O&M. As mentioned, a focus on predictive maintenance is - is very important. Tucson Water actually started that effort back in 2000. We've been working aggressively over the last several years on a Maintenance Management Program which does exactly what Harold mentioned. As we look at - we created an inventory asset. We looked at process control. We looked at what type of maintenance needs to be done to ensure longevity of our assets. And also we looked at ways to depress this improvement using our resources to do more with less folks. Now, this is good and bad impact on the short-term Financial Plan.

Less employees, certainly, you have an immediate O&M benefit. MMP, what that does is put a dollar amount and an identification on the reinvestment in the systems that are needed; that means that, in the short-run, you very well may need to invest more in the system. So - but, nonetheless, it gives you more data on which to make decisions.



And, finally, just a quick chart here to show that Tucson Water over the last ten years has done what we think - more with fewer folks - this is just a chart showing service levels employ- - employees per 1,000 connections, and you'll see that that has steadily declined over the years from about 3.31 employees in 1998 to under 2.5 we predict we'll be in, in 2010.



CIP, again, this is similar to the slide you saw in the previous presentation; it is a challenge to balance all of these of - of various considerations. System needs, legal mandates, resources, both financial and staffing, as well as contractor availability.

I would also say another piece of this puzzle is the political landscape, both that in terms of financial

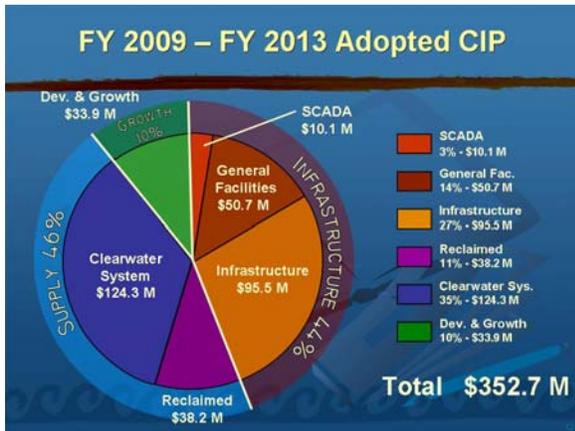
considerations, what is acceptable in terms of the impact on the customer and, also, consideration of treatment or source development, all of that comes into play in looking at a short- and long-term CIP.



Go through this very quick, since we're short on time. This is a high-level look at our CIP development process. This process is done every year. Our Financial Plan is a rolling activity. This actually starts in about May for a rate increase that may be implemented a year from the following May. We look at our projects. We categorize them. We have a team of Division

Administrators and Engineer Managers that look at those requests. The highest priority projects are selected.

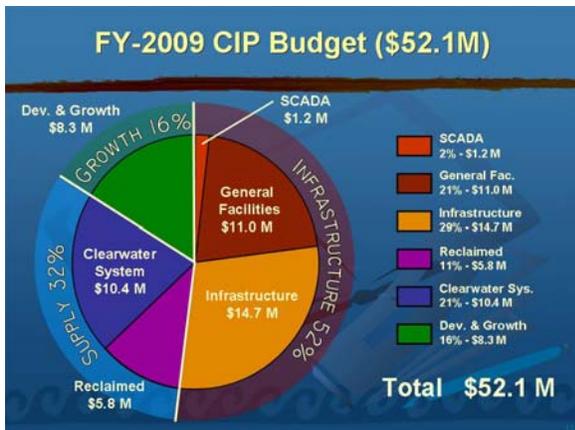
A Financial Plan. This is a first-guess Financial Plan because, again, the Financial Plan needs to look at the revenues, the CIP and the O&M, but we look at it, based on the information at a certain point in time. We evaluate affordability. What does that mean? How much is it going to cost in terms of an overall rate increase? We look at that. The - the decision- -decision-makers decide that percentage is acceptable or not. If it's not, we take the red arrow back and start over; that process in a typical Financial Plan process happens as many as ten times. You're looking at, basically, making ends meet. Finally, once you get a final Financial Plan together, it's presented to CWAC with much discussion and, finally, it goes on to Mayor and Council asking them for adoption.



A quick look at the CIP for the next five years. No surprise that the investment in infrastructure is the biggest - well, take that back - Clearwater System, no surprise there, that includes money infrastructure items that we would consider separately. Tucson Water has focused for the last ten years on purchasing, recharging, and using 100% of its CAP allocation. We

need to invest - continue to invest in that infrastructure to enable us to do that. For the five years, Clearwater remains the biggest component.

Infrastructure, that's everything else; that's the other transmission, distribution mains, boosters, reservoirs, and general facilities. We have a small sliver there in for growth, and that is strictly growth for system expansion into new areas. We do know that the Clearwater System, for example, is - a growth component to it as well, but we've chosen just to block it out in this manner for this presentation.

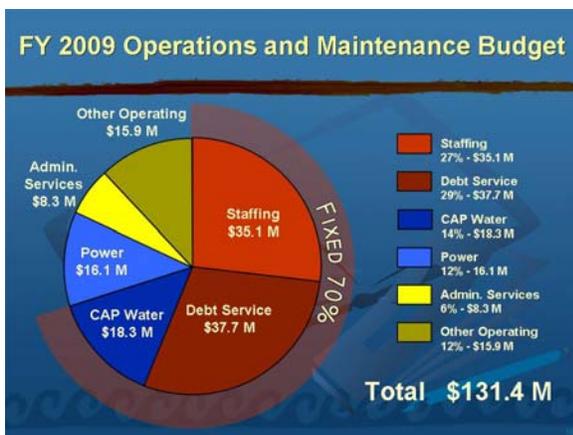


Another look - this is for fiscal year '09 - our - our total CIP of about \$52 million, a very similar outlook; perhaps, a little less investment in the Clearwater System for this year, expanded or - or - or invigorated investment in the following four years.



O&M, a very similar process, the various divisions put together, they're - they're budget models, they worked with targets that are set. The divisions used those targets to put together their requested budget. We have divisional reviews, departmental modifications, often many. Again, the Financial Plan is - is put together this time with the recommended CIP element, evaluate

affordability again, and back to a presentation to CWAC, and adopted by Mayor and Council. If Mayor and Council adopts the Financial Plan, we proceed to the next step, which is the Cost of Service analysis. You can't do Cost of Service until you know what costs you're allocating, and finally Rate Design.



A quick look at O&M; this is for fiscal year 2009. One thing that we often like to point out is: How fixed our costs are, at least how - how they're fixed in the period of 12 to 18 months. Staffing, limited availability to do a lot of staff reductions within a 12-month period, \$35 million of that total budget of \$131 million.

Debt Service, that's what I spoke about earlier, that's our mortgage payments, basically, \$37, \$38 million. CAP Water, we're considering that fixed. Why? Because it's the policy of the Department that we're going to take that water and recharge it, whether we need it to meet demand in a given year or not we want to keep that allocation, we want to purchase it and guarantee our hold, our legal hold on that water right into the future.

A variable cost is power. Certainly, it takes a lot of money, \$16 million, to move that water around our system, to pump it out of the ground to get it to a booster, to boost it up and to push it through our Distribution System.

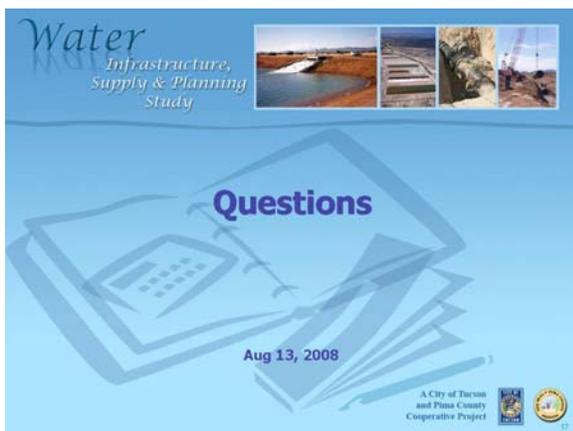
Admin Services, that's what this utility pays to the City of Tucson for all its support services, about \$8.3 million - and then everything else is relatively minor - \$60 million of that picture.



And consideration of time, here's another quick look at - at the O&M basically showing you'd strip out Debt Service and wages and salaries, about \$58.6 million is left, and then we've got 13 items that basically account for that remaining difference. Again, the big three elements there are CAP Water, power, and the administrative service charge.

Because my - my good friend, Mr. Barry, asked that I talk a little bit about the Financial Plan, let me take two minutes on that, it's in front of you. This is the Financial Plan that was approved by Mayor and Council; it was the Financial Plan that was ultimately used for Cost of Service and which generated the water rates that went into effect the first week in July.

Just quickly to tell you how it works. It's a cash flow, basically, focused Financial Plan. Line 1 shows our cash balances, our working capital balance, at the beginning of the year. Line - Line 14 shows the total requirements, and Line 15 shows where we think we'll be from a cash standpoint at the end of the year. It, basically breaks our cash requirements - our - our cash flow in terms of revenues - you'll see that summarized - on Line 6(a). On Line 14, again, it shows where we think we'll going to be spending all that money; and, finally, showing the projected ending balance. We show cash reserves ending this year at about 5% - or, excuse me - this year at about 6%. Again, our goals is to build to 10% if you look on Line 16 - or 15. You'll see at about \$18 million at the end of fiscal year 2013, which equates to what's shown on 16(b), about 10% of our annual revenues.

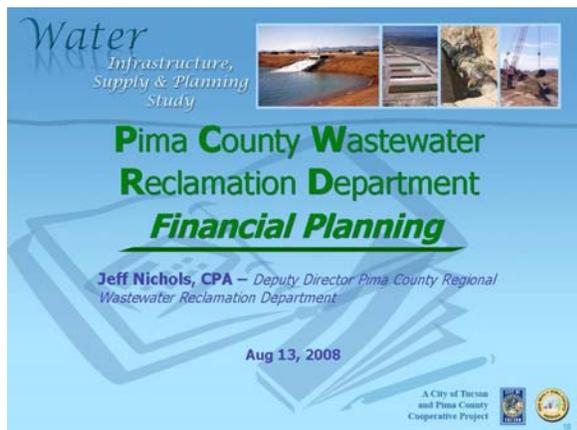


CHAIRMAN JIM BARRY: Thank you, David. We'll hold questions. Jeff Nichols - we'll going to hold questions, sir, please. No, we're going to hold it until all the presentations are over. Then - then you can talk. Thank you.

Jeff Nichols has already introduced himself from Pima County Wastewater.

Presenter #3

JEFF NICHOLS, DEPUTY DIRECTOR OF ADMINISTRATIVE AND FINANCIAL SERVICES DIVISION, PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT: PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT FINANCIAL PLANNING



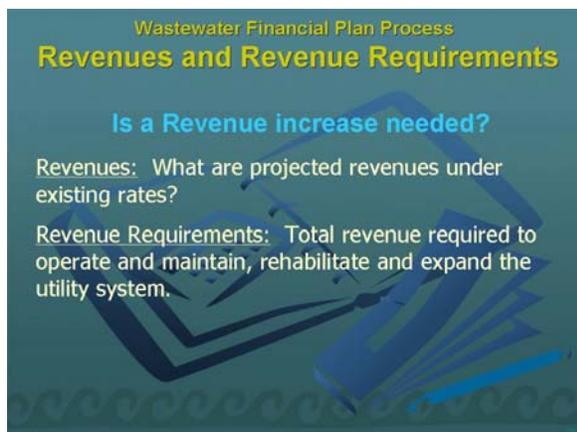
MR. NICHOLS: Yes, and to keep Jim happy, and after David's presentation - I'll just say, "Ditto," okay? But -

CHAIRMAN JIM BARRY:
Thank you, Jeff.



MR. NICHOLS: - but, truthfully, you'll see very similar processes between Pima County and the City of Tucson Water Department. When we show this first slide, we talk about revenues and revenue requirements. The first thing we do is calculate the revenues that would be produced under our current rate structures and we see how that looks; that's the first step. So, we don't

automatically assume a rate increase.



Stepping through these three a little bit more you'll see the revenue requirements: what our projected revenues are under the existing rates and then what the requirements are. And these are Cost of Service analyses. And when we say "required to operate and maintain," those are Conveyance and Treatment Systems. To rehabilitate, that would be along the line of capital

improvements to rehabilitate the existing systems, and to expand the utilities, which would be covered under connection fees to expand the utilities.

Wastewater Financial Plan Process
Cost of Service Analysis

Who should pay and how much?

Cost of Service: The revenue requirements as determined above less depreciation.

Allocation: The cost of service is allocated to wastewater system customers (current and future) based upon a ratio of existing and future wastewater system requirements.

The Cost of Service is the revenue requirements as determined above through that process, less depreciation. We do not recover depreciation; it's not in our rate structure; however, it is a cost. One thing that we have done recently is that we finally reached a point within Pima County where our Debt Service is fairly equal to our depreciation on an annual basis,

and what that's telling the people that read the statements is that we're investing as much in our infrastructure as it's deteriorating on an annual basis, and that's an important thing, to maintain your infrastructure.

For the allocation, the Cost of Service is allocated among Wastewater System customers, both current and future, and this gets to be what is sometimes referred to in the practice as "Inter-Generational Equity," and that's that those who benefit from the improvements are going to pay for them.

Also what we do in the wastewater business is we have two "strength of sewage factors." In the residential area, the ratio is 1.0, and we consider that our baseline, and then what we do is, through a laboratory process, we test certain customer classes out within the community for total suspended solids and biological oxygen demand, and those two elements pretty much determine the amount of money we're going to have to spend to treat that wastewater to meet our permit requirements for either discharge or reuse.

Wastewater Financial Plan Process
Rate Design

How will rates be structured?

Achieving revenue (rate) stability: Normalized and predictable rate increases are planned for allocated to the customer class responsible for them.

Meeting regulatory requirements: At minimum rates must be sufficient to allow department to meet permit requirements (CMOM, ISO, etc.).

Limiting "pocket book shock" for customers: To the extent possible, forecast operation and maintenance and capital infrastructure requirements to minimize significant rate increases.

So, under Rate Design, how will rates be structured? We talk about stability. We do want normalized and predictable rates.

I need to note in 2004, Pima County's Wastewater Reclamation Department was the lowest wastewater rate in the nation. Now, some people might think that's a really good thing; other people might say, "Well, maybe that's why we had an

instance like the Speedway sinkhole," you know, you can cut your costs and cut your costs and, eventually, it's going to come back to bite you.

At a minimum, we need to meet our regulatory requirements. We have permits to operate our Conveyance System, and that's under our CMOM and ISO, and we also have permits to operate each one of our treatment plants. So, at the very least, we need to meet our regulatory requirements on a daily basis.

As far as limiting pocketbook shock for the customers, we do that to the extent possible, and we do that through a planning process in our Financial Plan. We try and go out a number of years so that we can predict what the rate increases will be needed over time.

We also have a program we mirrored after Tucson Water's program - ours is called "SOS" - and it is a program for customers who are economically disadvantaged and may need help with their utility system. We go through a process and we have certain standards and, if they meet those standards, we can give them a discount on their utility rates, up to 75%. So, we do try and make it affordable for our whole community, even those that have difficulty at times.



In our financial policies, we have a Reserve Requirement; it was adopted by the Board just about a year and a half ago; and it requires us to maintain a balance of \$10 million in reserve. And, again, this would be able to be used to fund any unforeseen Operations and Maintenance expenses, if something should happen in the Conveyance System that you'd need

to immediately address or at a treatment plant, above and beyond our normal Operations and Maintenance costs.

We also have Debt Service Coverage Requirements, and those are in our bond indenture; basically, it's a 1.2 bond ratio coverage. If we even get close to that, though, the rating agencies are asking us what we intend to do. They like to see it greater than that; and, personally, I think I would, too.

Improvements/Efficiencies

- CMOM – Capacity, Management, Operations and Maintenance
- CMMS – Computerized Maintenance Management System
- ROMP – Regional Optimization Master Plan

Some of the improvements and efficiencies that we've made in the department over the years involve a very old plant. I think most people know that. I went by Roger Road this morning and I reported an odor emanating from the plant to the Deputy Director in charge of Treatment. But, we have been trying over the past four years and have made great strides. One of the

strides we've made is CMOM, that's Capacity Management Operations and Maintenance, a Preventative Maintenance Program in our Conveyance Area. And, basically, what we do is we go out and we televise the interceptor lines, the conveyance lines, and we determine, based on a national scale, what those lines' condition are. It's one through five - five means you need to replace as soon as you can, it's a possible failure; one means brand-new pipe, looks great, don't worry about it. We have addressed all the fives within our system. We're now working on the fours; and, of course, we do that as funding is available.

What we do find is that as pipes age and they start deteriorating, it's not a linear deterioration; it kind of increases exponentially when they start deteriorating. So, they can go from four to five very rapidly.

What we're doing at the treatment plants is called a "Computerized Maintenance Management System;" it ties into our new accounts payable system. We write work orders against assets and, hopefully, what this allows us to do is have our maintenance crews look on a week-to-week or month-to-month basis, so they can write out and kind of plan out what they're going to be doing at the plant prior to it failing. In some regards prior to this effort, we were on a reactive maintenance basis; basically, when something broke, we would go out there and fix it.

The department in the past had been criticized for its planning processes. And we've just got through an 18-month planning process called "ROMP" - it's Regional Optimization Master Plan - for our utility, and it basically paves the way over the next 10 to 15 years on everything that we need to do within our system.

Some of you may have heard we're expanding Ina Road significantly, and we're replacing the processes that are currently in place there as well. We're building a plant interconnect between Roger Road and Ina Road, and we're building a new Water Reclamation Campus at Roger Road; those are in the

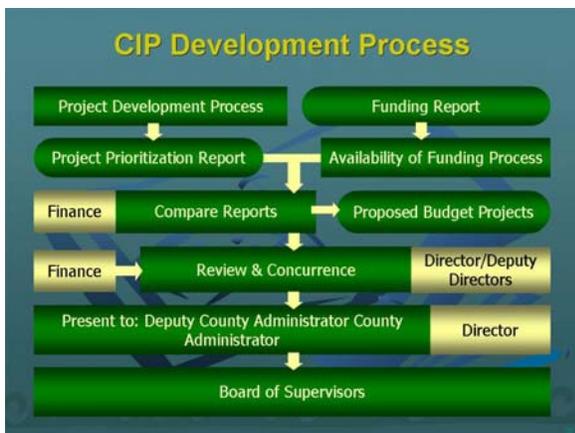
plans right now; that is what we refer to as the "ROMP" when we talk inside the Department.



The goal of the CIP development process, certainly, is best fit in its system needs, but we do, again, take a priority approach. We have a process that we go through, and the first being legal mandates; what projects are required by regulatory agencies, and then the second step we would look and say, "Okay, what are our current systems? What do we have to do to rehabilitate those?"

And the last equation would be expansion of the utility and what is needed there. What are we showing for population increases and where? Then we have to balance that with our resources, our financial and staffing resources, and contractor availability.

In the past, we've had difficulty getting contractors to bid on some of our projects. I need to say right now we're getting an excellent response related to our ROMP. We are getting what we consider to be the "A" Teams in both engineering and construction firms, and they are very interested in Pima County and the infrastructure needs within the County, and that is not only within our area of wastewater, but also within the RTA; I think they're getting good responses from those builders as well, for linear construction.



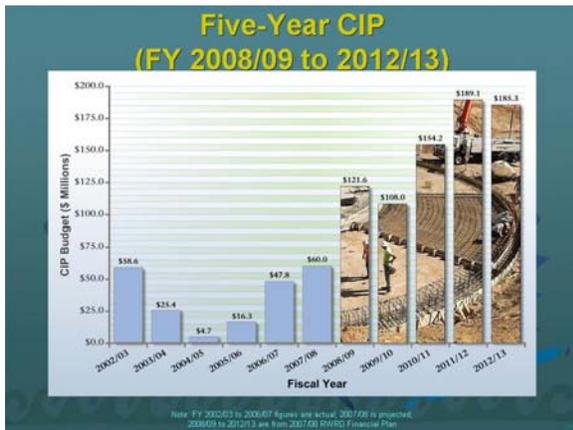
When we go through the CIP development process, what we do is we ask everyone. We don't base it on our resources - and the reason I point this out is we ask people to submit a project request for what is needed. Let's first find out what we need, and then we can prioritize those needs and fit them within our process. So, we take those needs, we match them with the

availability of the funding, and we do a comparative report, and we also have to include in that any Capital Improvement Project that we're going to be building. We have to carry over to the Operation and Maintenance side once we get it built; we have to operate it, so we have to know what those impacts are as well.

We do a review and concurrence. Our principal finance analyst, Diane Bracken, is really the backbone of this process, and she comes forward to the Deputies and the Director, and we review and concur on the rating process.

And, by the way, our rating process isn't done as a group. We have certain individuals that are assigned to this process, and they take the material and they go and they sit down at their desk alone. We're not looking for group think. What we're looking for is synergy within the thought processes, and it's different for an engineer and accountant. Trust me, I work with a lot of engineers.

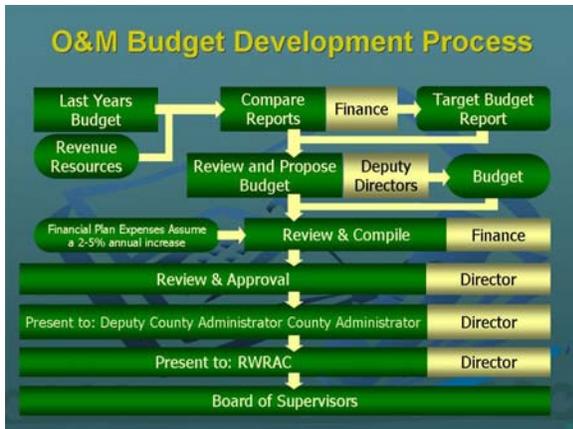
Then we present that to the Deputy County Administrator and the County Administrator, and the Director does that. At that point in time, it becomes the County Administrator's recommended budget and that would go forward to the Board of Supervisors for approval.



Here's our Capital Improvement Program. As you can see, this point in time here was right after the Speedway incident and, needless to say, the Department had - between that and this 3 MGD treatment plant here at Randolph - we had very little money to move forward with the Capital Program. We have since ramped up, and almost doubled, I believe, this '08/'09 budget.

Right now it shows \$121.6 on that slide - I believe that's been adjusted to \$117 million - but still a very significant figure.

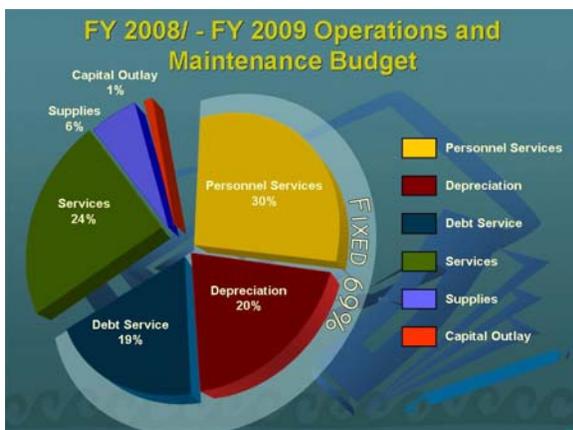
One thing I would like to point out. We've had significant rate increases recently, and what we're doing is we're ramping up our rate increases to pay for the pay-as-you-go capital portion of this program. And once those increases are in effect, and we hopefully receive bond authorization from the community, once we get done at the end of this process, which really ends about in 2015, our ROMP Program should be built out, what we're going to see is significant Debt Service requirements related to those bond issuances. But, hopefully, the rates will already be in place; it will just be instead of focusing them on the CIP, we'll focus them on the Debt Service requirements of the Department.



Here's our O&M budget development process. Above this line right here is really a divisional process. What we do is we give our Deputy Directors in each area target figures for their budget. They go out and they determine what their needs are. And, if they can't live within that target figure, what we require of them is to submit what we call "Supplemental Requests" within

the Department. If the Deputy Director of Treatment says, "I need more money because we just opened up the Avra Valley Plant and it went from 2 MGD to 4 MGD," then we address those needs at that time. And so when it gets down below that level, and we come down here, that's when it comes into my Department, and that's when we start looking at budget-to-actuals from prior years. We look for areas where maybe we can have trade-offs between the divisions. We work well together. If we need to take some funding from Treatment because they were funded at a level higher than we think they need to be, but we need to move it over to the Conveyance area, we do that.

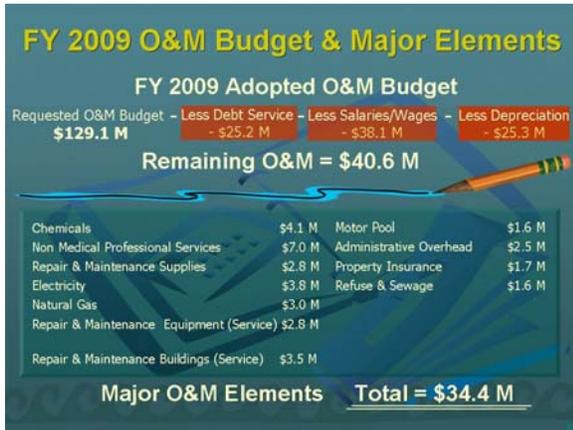
Again, we compile that budget, we forward it to the Director for his review and approval. He presents it to the County Administrator, and the only additional step in here, is then we take forward both that budget and our CIP budget and we take that to our Wastewater Advisory Committee, and we work with them, we explain our thought process, we explain the rationale for what we're asking for and we ask for their concurrence and recommendation in supporting that budget prior to it going to the Board of Supervisors for their consideration.



As you can tell, when you look at our budgets, if you line them up after this, side by side, we're very similar to Tucson Water, and it's not surprising to me. Most of our costs, our personnel services about \$38.1 million, depreciation's \$25 million, Debt Service is about \$25 million, are non-controllable costs in the short-term. Some are controllable for a number of years,

depreciation, which we have to budget for; it's based on the assets that you have and the life that you give them. So,

basically, it's a fixed cost and we're just told what we need to budget. In the services category, some of the large services we have are for chemicals and energy, repair and maintenance of building and grounds, repair and maintenance of the infrastructure, treatment and conveyance infrastructure.



There's some of the line items. When we take out our requested O&M budget, less our Debt Service and salaries and depreciation, basically, that's for our Operations and Maintenance, and those are the major categories. Some of the categories we didn't include, but office supplies and travel or training are very small, but they do add up when you take a look at them,

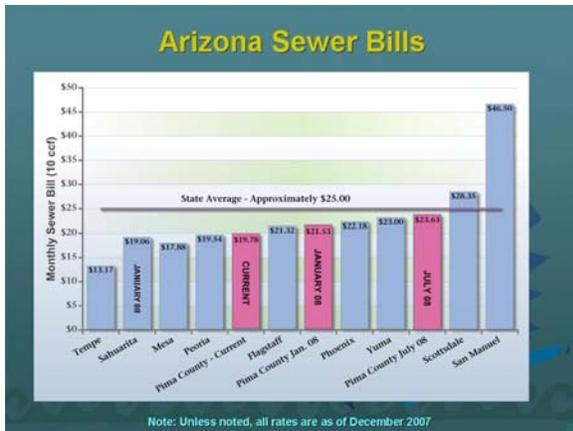
collectively.



Here's our revenue sources. Again, user fees being our biggest revenue source, and what we're forecasting for '08/'09 is about \$87.7 million. Connection fees we're forecasting at \$32.8 million. What I would like to point out is we also have to forecast our capital contributions; and what this is, is when developers build infrastructure within our system

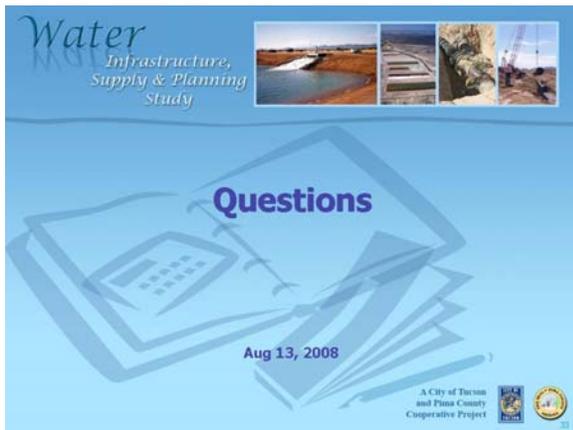
and they deed that infrastructure over to us, we accept that infrastructure and then we maintain it for life, but they are assets that are given to us, but they're in the ground; it's not money we can spend; and it's not really something you can sell on the open market.

So, the majority of our "other" is interest earnings on bonds, which is restricted. The interest earnings on bonds is restricted to those bond projects. The interest earning on just our available cash balance is somewhat less restricted and can be used in other areas besides specific bond projects.



Currently, what we're looking at is our current rate of approximately \$19.78 per month; these are all based on average use of 10 ccf per month. Your sewer bill is based on your water usage. In January of '08, it went up, and in July of '08, so we're at \$23.63; that's still below the state average.

One thing we are seeing is with the infrastructure needs nationwide, many utilities are increasing their rates drastically, not only wastewater, but water utilities as they address their infrastructure needs which have been ignored for quite some time.



And, Jim, that . . .

CHAIRMAN JIM BARRY:

Let me make a suggestion to the Committee, if you have questions, let's put 'em in writing and we'll - we'll get 'em answered and - and get 'em out. It is five to - to 9:00. Some people are gonna have to leave, but at least we will do the rest of the time for Call to the Audience, and if you have questions, you

can use that time to - to ask your question and we will also get it back to you in writing.

* * * * *

CALL TO THE AUDIENCE

CHAIRMAN JIM BARRY: This gentlemen had his - his cane up, so we'll go to him first.

CLYDE STAGNER: Well, the first thing I'm - the first question I would have is for the gentlemen that just spoke. Several months ago there was a -

UNIDENTIFIED MALE SPEAKER: Who is it?

CLYDE STAGNER: - an applaudatory article in the newspaper about the performance of the Wastewater Management, and it turned out that Wastewater Management paid that per- - that outfit a fee. Is that how our money is being spent?

MR. NICHOLS: I'm not sure which article you're referring to.

CLYDE STAGNER: It was in the *Arizona Daily Star* -

MR. NICHOLS: Okay.

CLYDE STAGNER: - and it was about -

CHAIRMAN JIM BARRY: Jeff, we'll get back to him on that.

CLYDE STAGNER: - a commendation by one of your contractors for your performance.

MR. NICHOLS: I believe, what you're referring to is our ISO Certification -

CLYDE STAGNER: Yes.

MR. NICHOLS: - and that's correct. In order to become ISO-certified, you do have to contract with someone to certify your program. We did the program internally, and we were the first utility in the United States to be certified in all three ISO standards.

CLYDE STAGNER: Yes -

MR. NICHOLS: The -

CLYDE STAGNER: - I -

MR. NICHOLS: - reason for the payment was you can't get certified without being reviewed by someone who is authorized to make those certifications.

CLYDE STAGNER: I would suggest that you go to Wikipedia on the internet and look up the reputation of that organization -

MR. NICHOLS: Okay.

CLYDE STAGNER: - internationally and nationally. Thank you, sir.

MR. NICHOLS: You're welcome.

CHAIRMAN JIM BARRY: Could - could you give us your name for the record?

CLYDE STAGER: My name is Clyde Stagner and I represent Social Security.

I have a comment I wish to make concerning the Citizens' Water Advisory Committee. It concerns the Discretionary Funds they recommend for the Mayor and the Council - and, incidentally, I admire those people for signing the document and taking accountability and responsibility for their actions which, in some government cases, we don't even see from the Directors of our Departments.

I have a recommendation and that is: Tucson Water's up the - going up to about 580 people. I'm going to give you my reasons why we should have, in this County, a Water Quality Department, hopefully, to include Pima County. The reason for calling for such a Department - here is an example from Las Vegas, and they have three wastewater treatment plants of 115 contaminants that they measure and they publish and make available to the public.

If you go the U.S. EPA Safe Water Drinking Information System under Enviro Facts, you will now find over 60 monitoring violations by the Tucson Water Department. In communications with them, there have been indications that their infrastructure is either lacking personnel or the equipment to do what 76% of the remaining water outfits are doing in the United States that have no water monitoring violations. Now, the Tucson AMA has come up with recommendations in 1999 and, again, in 2006 about the contaminants that should be measured in the CAP Water. Tucson Water is not measuring all of them.

In 1962, I walked into a quonset hut at a Nevada test site one night where there were two tables put together and the head was Livermore Radiation Laboratory on the design of nuclear weapons was conducting a meeting about the next morning's nuclear test. Where you're sitting there were representatives of the different agencies of the government. The U.S. weatherman stood up during that meeting and pleaded with them not to detonate the nuclear weapon the next morning because it would go over St. George, Utah. The next morning the weapon was detonated and it went. This data from Las Vegas does not include the effluent run-off which is going into Lake Mead from St. George, Utah, and other places along that route.

CHAIRMAN JIM BARRY: So, could - we - we do ask people to keep their comments to three minutes. Can you -

CLYDE STAGNER: Yes.

CHAIRMAN JIM BARRY: - wrap it up, please?

CLYDE STAGNER: I will end by end by recommending again that we have a Tucson Water Quality Department separate them from the operator. That Tucson Water is a great - and I

applaud at them for qual- - for quantity - let's take care of quality; to justify all of that. Thank you.

CHAIRMAN JIM BARRY: Thank you. I got a card here from James Braithwaite. Again, we try to keep it to three minutes, okay?

JAMES BRAITHWAITE: Yes, I'll keep it even shorter than that.

CHAIRMAN JIM BARRY: Excellent.

JAMES BRAITHWAITE: My name is Jim Braithwaite. I'm an Environmental Engineer. I live in midtown. I don't do any work in Arizona, so I think I'll - I may be the one to raise a sensitive issue.

I - I haven't seen on the Agendas or the list of topics any discussion - there was a question on June 25th, I believe, about - from the audience about indirect potable reuse of wastewater. I know it 's a very sensitive topic, and I don't expect any response. But, my California experience is that it takes five to ten years of public interaction, outreach, education before that kind of thing can be brought home, and I think that that ought to be placed in your report, at least as a place holder to get that process started.

You've got some excellent resources at the University of Arizona in Dr. Carruba and Kelly Reynolds who've done wonderful work, published on pathogen control. I'd like to see them make a presentation at one of these meetings about that issue.

And then, secondly, I'd like to associate myself with the comments of the previous gentlemen. I think what's known as emerging contaminants is something that we all ought to be focused on. We've been focused on suspended solids and BOD now for 30 years, 50 years, and there's a whole list of compounds that are in the wastewater and in the water that need to be tested and should be tested for. So, with that, I'll close.

CHAIRMAN JIM BARRY: Thank you, Jim.

Anybody else? Tracy?

TRACY WILLIAMS: Okay. I'm going to keep my comments short today. I'll give you my comments in writing, but I would also like to also ditto the past two speakers in the quality. I'm hearing a lot about quantity and, with sustainability, hopefully, we're going to discuss some of the contaminants that have been alluded to, such as pharmaceuticals and endocrine receptors, and other icky stuff that we want to know about.

CHAIRMAN JIM BARRY: Thank you, Tracy.

Anybody else? Yes, sir.

FRANK POSTILLION: Yes, I'm Frank Postillion with the Regional Flood Control District, and I just had a question for both the Wastewater - the Wastewater representative about the

Debt Service of about \$19 million a year. Does he expect that to go up with ROMP and similar to what's gone on with about \$30 million with the City Water because of the infrastructure improvements? And, if so, what will the resulting rate impacts be?

CHAIRMAN JIM BARRY: Okay. Frank, we'll get back to you in writing on that. Okay. Anybody else?

Anybody want to move for adjournment?

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of Presentation and Call to Audience excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on August 13, 2008.

Transcription completed: September 2, 2008.

DANIELLE L. KRASSOW-TISDALE

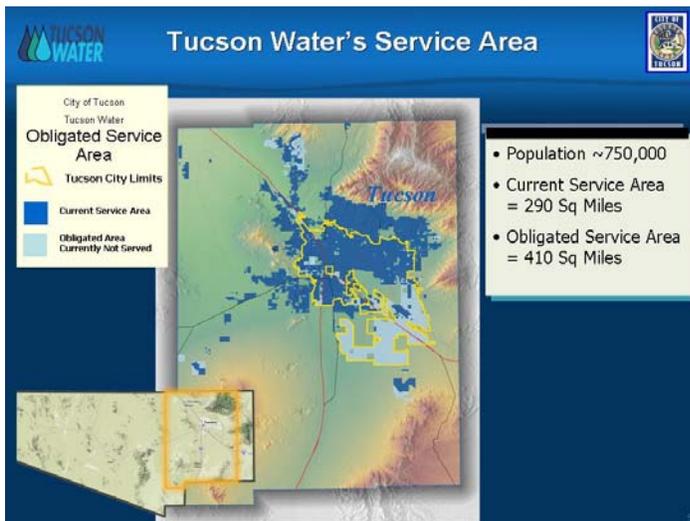
TRANSCRIPT OF AUGUST 27, 2008

List of Presenters:

1. Chris Avery: Recap and Overview of First Five Presentations
2. Sharon Megdal: Regional Water Planning Perspectives
3. Jonathan Mabry: The Ancient Oasis
4. Dave Taylor: Population Trends and Projections
5. Bob Cook: Population Projection Issues

PRESENTER #1

CHRIS AVERY, INTERIM DEPUTY DIRECTOR TUCSON WATER RECAP OF FIRST FIVE PRESENTATIONS



MR. AVERY: Good evening. I'm Chris Avery, and I'm the Interim Deputy Director of Tucson Water, and I'm also speaking on behalf of Eric Wieduwilt of Pima County Wastewater in this presentation tonight. What we wanted to talk to you about tonight was the fact that we're now in a transition period between the first five presentations and the next series of presentations that are coming to the Committee.



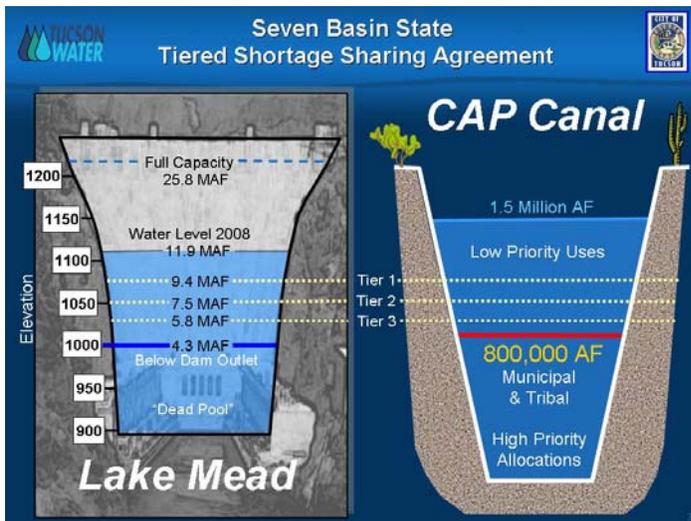
This is the Tucson Water Service Area and, roughly, the same Service Area that is currently served by Pima County and its Wastewater Treatment Plants; it's about 750,000 folks, and an area of 300 to 400 square miles. We've talked about this diagram extensively during the course of the presentations, and talked about the

customers that we share; the way our customers use water; the infrastructure that's necessary to convey water to customers; to collect water from customers; to treat it to the standards that are set for the State and Federal Government; and, also, the Reclaim System that collects water after it's been treated and delivers it out to other customers for reuse.

And, during the course of these proceedings, we've talked about all of the Regulatory Drivers - or, at least, some of the Regulatory Drivers, some of the financial issues and the most pressing infrastructure issues that face us as we move forward. In essence then, what we've tried to do is present you with a set of facts about our combined utilities; about the way they work; about the way they're financed; about their history and the way that they're put together. And that's only a small part of what we're asking the Committee to do and what the Committee's been asked to do in terms of its presentations.

And, going forward, you're going to be asked to combine those facts with some assumptions, or some variables, in order to come

up with a picture of how you, as a Committee, think the future is going to look.



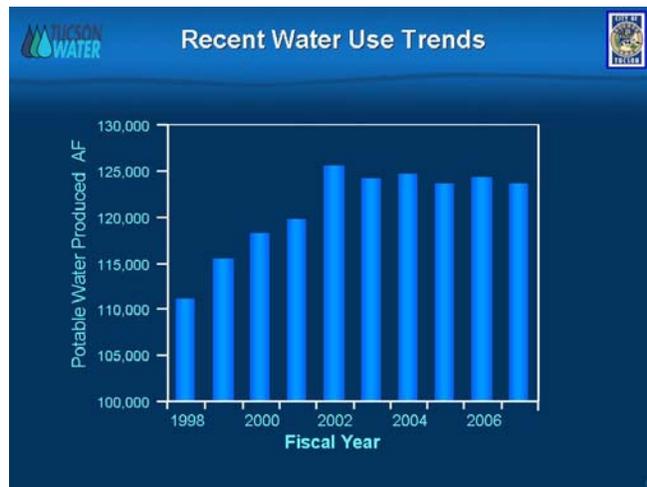
One way that that's done is illustrated by this slide that we've talked about a few weeks ago. This is a slide that, in some sense, is a fact. It's a graphical depiction of how the new Seven Basin States Shortage-Sharing Agreement allocates capacity out of Lake Mead

so that if the water level is a certain level, a certain shortage will occur. And one of the reasons that we included this graph in our initial presentation was to show that it's unlikely that a tier-three shortage will affect municipal and tribal allocations on the Colorado River.

But, the question of whether a shortage will actually occur, when it will occur, and what magnitude it will reach is a variable, and it's the kind of variable that you're going to be asked to consider as we move forward through this process. As a Water Department, as a Wastewater Department, we can, in some ways pass along information about those variables and, in some cases, in - in these next presentations, we'll have the opportunity to tell you why we think certain outcomes are, perhaps more likely than others, and tonight Eric is going to

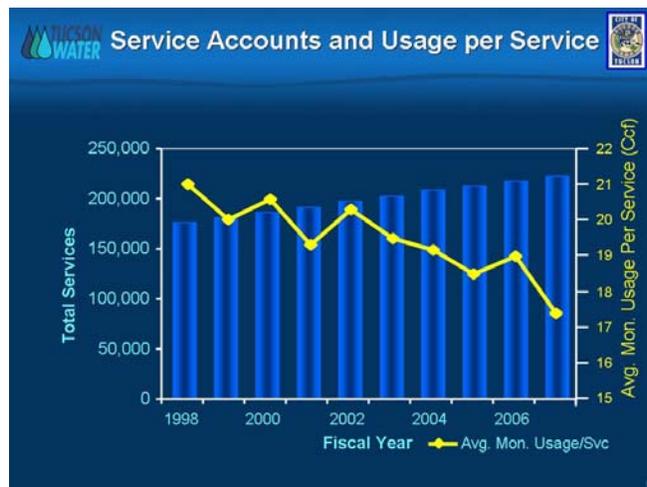
tell you why we rely on some versions of the future rather than others.

But, ultimately, we don't know. As - as a water lawyer and a temporary bureaucrat, it's impossible for me to stand up on this podium and tell you that a shortage on the Colorado River is going to occur on a certain date in the future and that, when that shortage occurs, certain things will happen. Those are the kinds of decisions that, as we move forward, you're going to be asked to consider as Committee members. And the information about those outcomes and scenarios are going to



be presented to you in order to make your independent decisions. So, as - as Lake Mead declines, we have an agreement that sets out what's going to happen, but we don't exactly when Lake Mead is going to decline, or whether it will at all.

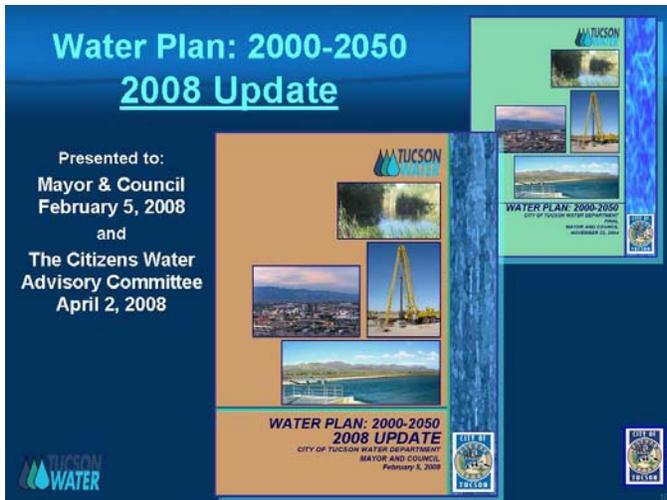
Here's another one.



This is a map - or a projection of - of Tucson Water's use during the previous ten years, and you can see that for the first five years Tucson Water's customer use followed a relatively constant pattern; that is, as we grew by a number of customers, usually between two and 3% a year, our water use also increased about two or 3% per year. But then, starting about five years ago, some interesting things started to happen.

So, as the amount of new services grew in Tucson Water's Service Area between 1998 and 2007, the

amount of water use declined dramatically. In fact, when we did a water plan in 2004, we expected water usage in the Tucson area to continue to grow by those relatively uniform increments that it had grown over the previous ten years, but it didn't. So, when Tucson Water did its 2008 plan update, it had to change the plan in order to accommodate what had really happened during those - during those years.

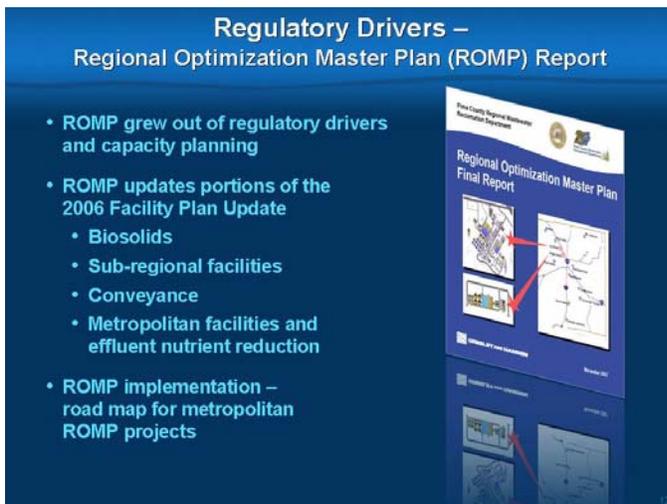


Tucson Water's primary Long-Range Planning Document is the Long-Range Plan; it was originated in 2004, and updated in 2008. And, as we move forward to this process, we're going to have the opportunity to talk to you at some length about Tucson Water's Plan and the outcome that it came - that - that came from it.



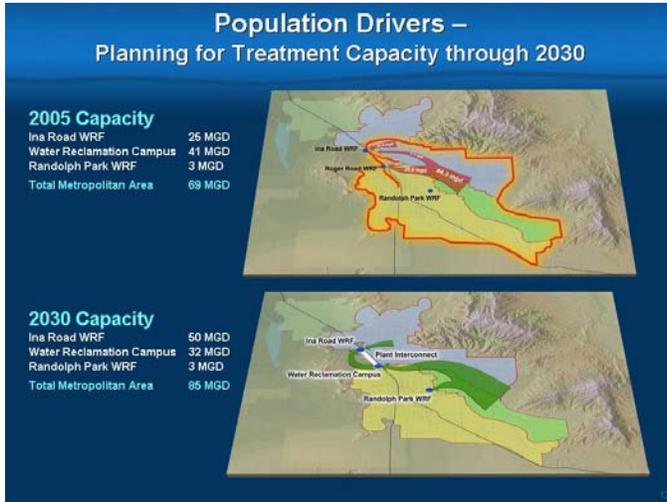
Tucson Water's Plan is largely water quantity-driven. The - the most pertinent question for Tucson Water moving forward is the amount of resource that will be available and, in some ways, the costs and the methods by which that resource can be brought to serve the growing community.

In many ways, the 2006 Metropolitan Facility Plan Update fulfills the same function for Pima County Wastewater. Pima County Wastewater is doing the same kinds of things in this plan; trying to determine population and flows, regulatory capacity, CIP costs, and capital improvement. In some cases for Pima County, the primary



driver is water quality issues, and particularly with respect to the ROMP Plan, which you heard about - about a few weeks ago.

The ROMP Plan, in particular, grew out of regulatory drivers and - and, in some secondary way, capacity planning, so that in the case of Pima County not only were they considering the amount of flows that were going into the Wastewater Treatment

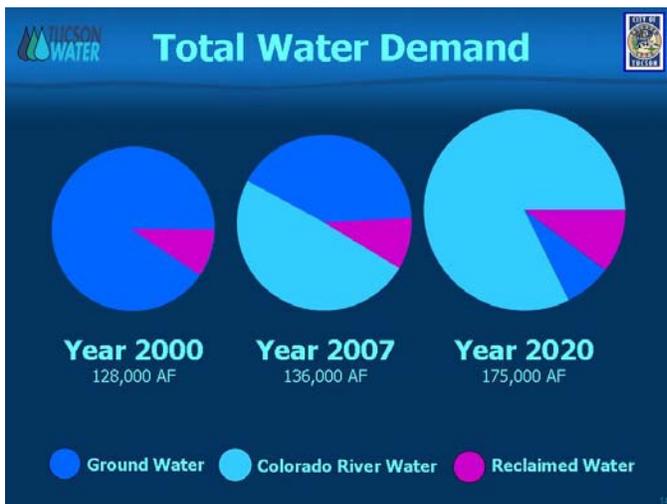


Plants - you can see in 2005 about 69 million gallons a day of treatment in 2030, they expect 85 million gallons a day of capacity - but, also, the regulatory environment in which they're forced to operate.

For us, it's total water demand. And, during the first presentation of Water Resources, we showed this graph and explained that, in the year 2000, we served 128,000 acre-feet.

In the year 2007, we served 136,000 acre-feet, and this is the mix. Those, in some ways, are facts. We know how much water we served during those years, and we know what the mixture of water resources that we served was during those years.

We also presented a graph for the year 2030 and explained that, in the year 2030, we expect to serve approximately 175,000 acre-feet, and that that 175,000 acre-feet will be comprised of a mixture - oops - of reclaimed water and replenishable groundwater, dominated by Colorado River Water. But the inside baseball is that this graph on the far right side is just an outcome of Tucson Water's planning process; it's the process of taking these knowns from year - the year 2000 and the



year 2007, along with some guesses and some estimates about population and water consumption in the future, in order to come up with an outcome for what we expect as Tucson Water managers will happen in the year 2020. And Pima County has done much the same thing with their ROMP Plans and the 2006 Facility Plan Update.

But, as we move forward now to these next presentations, you're going to hear about the variables. You're going to hear about population growth. You're going to hear about environmental needs for water, conservation and drought, and some of the things that we can't control; that we don't know exactly what the answers are. And so as we move forward, we -

we wish you luck in applying the same factors to those facts, the same variables to those facts that we've applied in making our decisions about long-range plans. We hope that you'll, in some way, see some of the inside baseball of these plans, some of the assumptions and variables, and recognize those assumptions for what they are. We also hope that the facts that we've presented have been useful to you.

And I would also like to personally say - I know that - that Jim Barry talked a little bit about this - but, on behalf of myself and Ed Curley, Eric Wieduwilt, all of the presenters from Pima County Wastewater and Tucson Water, there - there have been magnificent support from our Staff, respectively, that have helped us to collate this information, collect it, and provide it to you in some kind of comprehensible format, and I'd like to thank them for the efforts that they've put forward in the last couple of months. (Applause).

So - so, with that, we'd like to move forward and - and let you start considering a somewhat uncertain future, and hope that the presentations that we've made over the past - past five presentations are useful to you as you move forward into that future. Thank you very much.

CHAIRMAN JIM BARRY: Let me - if you wouldn't mind - do something. We've been given an absolutely invaluable set of facts and data, and I think 99% of it is not in dispute, and - and whatever we do is going to be largely dependent upon staff, and staff seldom gets noted, and are people here who I want to acknowledge.

From Tucson Water, we've got Sandy Elder, Dennis Rule, Ralph Marra, Michael McCasland, Michael Liberti, Dean Trammel, Wally Wilson, Karen Lamartina, Karen Dodson, Linda Smith, Reis Lindley, Belinda Oden, Mitch Bethesky. These people work on weekends, they work nights and they did a tremendous job providing information to us. And from Pima County Wastewater - well, let me step back a second - and we also have to acknowledge Nicole. Nicole Ewing Gavin and Sabrina Cotta from the City. From the County, we have Eric Wieduwilt, Melaney Seacat, Brenda Garcia, Ed Curley, Jan McDonald, Matt Matthewson, Rose Hilton, Susan Hunt, and Laura Fairbanks. And I want, again, just personalize that and - and ask you to thank those people for the - for the work they've done so far. (Applause.)

So, we are moving into - into another phase where - where I think there's incumbent on the Committee to be more active. It's going to be a period of time in which values and assumptions and perspectives and preferences are very important, and it's going to be a time when we have to draw these out of ourselves. We have to volunteer them. And so I hope that we

all become more active. We've been a very good audience. Now, I think we have to start earning our keep.

So, with that, we're going to move on to the presentations for tonight, and I think it's appropriate, since we are going into the process where population and - and how that's determined, values and whatnot, are going to become of paramount importance.

Remember at our very first meeting, Sharon Megdal got up and briefly described a report that she and a student, Aaron Lien were working on, which was interviewing a set of people who had stakes in the regional water process. And we've all seen the results of it - and I believe it's posted on the website. But, I've asked Sharon to come in to briefly describe issues that were substantive in the report and how the community of interest that she talked about breaks out on those substantive issues.

Sharon, please.

PRESENTER #2
SHARON MEGDAL, EXECUTIVE DIRECTOR, UA WATER RESOURCES
RESEARCH CENTER:
REGIONAL WATER PLANNING PERSPECTIVES

MS. MEGDAL: Thank you, Chairman Jim Barry and members of the Committee. It's nice to be here and I'll also note that you have me on a future Agenda but, Nicole or Melaney, I need to find out which week I'm supposed to come and what time, because I may have a conflict if you move me where it looks like you moved me.



But, I'll talk then about a study I did that's more quantity-based. This is really a summary of a study that I self-commissioned; nobody asked me to do it; perhaps, nobody wanted me to do it; but, I wanted to do it, and I had a great graduate student in the name of Aaron Lean with whom I'd worked on a study, a different study, where we'd done interviews. And so I call the "Perspective Studies - Study," but I also subtitled it, "The Hopes and Fear Study" or the "Hopes and Concerns."

Purpose of the Study

- Perspectives (hopes and concerns) for a regional water planning effort
- Study conceptualized prior to initiation of City-County effort.
- Short time frame for completion (Spring semester, 2008)
- Self-funded by the Water Resources Research Center using Technology Research Initiative Funds (TRIF) – Water Sustainability Program
- Co-authored by Aaron Lien, who graduated with a master's degree in planning in May 2008

region. And there have been efforts in the past for the City and County and the regional players to come together, and there seemed to be a renewed emphasis. And so we - we conceptualized this study and started it about the same time this group was - was getting its - its activities going. And we had a very short time frame for completion. My - my student, Aaron, graduated with a degree in planning in May, and so the whole thing was

Approach

- 43 interviews with 47 people
 - Local elected officials
 - Local jurisdiction managers
 - Business
 - Environmental
 - Water managers
 - Other
- No attribution to individuals
- Effort to capture all perspectives shared
- Report was distributed to all those interviewed before finalized.
- Many findings consistent with what's been discussed with this committee.

elicited more frankness, and - and so forth, in the discussions.

And so the breakdown - we don't provide the names and we don't provide very much information - what we do in this study - and isn't a very long one, so I encourage anybody who is interested to take a look at it - we divided them into six categories, elect- - elected officials - and note the word "local" there a couple times. We did not attempt to interview legislators. We didn't interview elected officials from outside our region, but we kept it to people right here in the region.

What we were hoping to do was talk to people about their perspectives on Long-Range Regional Water Planning. And we conceived of this study before this whole City/County process began, because we all know that there's a lot of debate and a lot of discussion and it will continue for a long time about the growth of the region and the water supplies of the region. And there have been efforts in the past for the City and County and the regional players to come together, and there seemed to be a renewed emphasis. And so we - we conceptualized this study and started it about the same time this group was - was getting its - its activities going. And we had a very short time frame for completion. My - my student, Aaron, graduated with a degree in planning in May, and so the whole thing was carried out in a very short period of time.

So, the approach was we conducted 43 interviews. Some of them included more than one person, so there were 47 people interviewed. I conducted every single one of the interviews, and Aaron was usually there quietly taking notes, both of us took notes. We promised people that they would be anonymous, hoping that that might help

We interviewed local jurisdiction managers. We interviewed representatives of the business community, environmental community water managers, and then "other," which was truly a hodge-podge of other interests that there was not enough representation from any one category to separate them out.

And in the report - even though it is relatively brief - we made every effort to capture their perspectives. Our - our process was to distribute the draft to the people interviewed to check for our accuracy, as well as kind of the - how comprehensive we were. And so we did get comments back: "Well you left out this really important perspective on so-and-so." We did have a few people that tried to give us new answers to the questions, and we did not add new information at that time. And many of the things we heard are - are totally consistent with what you have heard, as I saw reflected in - in - in your report to the Mayor and Council and - and Board of Supervisors.

So, I'm going to very quickly - and I'm going to keep this presentation brief deliberately, because I don't have a lot of time and a lot of it's written out in the report for you. But, everybody was sincerely - I really have to say "favorable" toward creation of a Long-Range Regional Plan, and particularly the idea of a common set of facts was very important - that was something that was reflected a bit in the October community conversation that many of us got together and co-sponsored - was let's try to get a common set of facts and, on those facts, develop a plan; and there were different visions, though, of what that plan might be.

And, in particular, I'd say if there was any category of individual where we saw the most uniformity - perhaps, not surprisingly - it was in the water manager category. They really were looking for a water augmentation plan. Where do we

get the water resources for the region to supply the - the increasing demands over time?

We asked the question about, "What should be on the table? Should things be off the table? And, actually, somewhat surprisingly, most people were uniform in answering, "Well, everything can be on the table, or maybe should be on the table, but let's not rush to make decisions

Findings

- Stakeholders from each category favored creation of a long-range regional plan based on a common set of facts.
 - Different visions of what the plan would be.
 - Water managers: Water augmentation plan
- Most stakeholders were not ready to take things off the table, although concerns were voiced about some items.
 - Retail water distribution systems
 - Local control and accountability

about some of the things that may be should be on the table," and, in particular, the things that - there was some hesitancy about or - or saying, "let's not rush," of course, retail Water Distribution Systems, "let's not rush to do anything about that."

And then, related to that, but not only related to Water Distribution Systems, was the whole question of local control over growth and land use decisions, and also accountability, in general. And additional findings - not surprisingly - and, again, you've had a lot of discussion about process - but, participation should be open and broad.

We asked a question about, "What role do you think" - we called them "super agencies" - some of the regional agencies like the Department of Water Resources or the Central Arizona Water Conservation District - "What role should they play?" Because, in the past, the Department of Water Resources, in particular, has been a lead agency in - in regional planning discussions here in the region, and the - the Central Arizona Project - as I think you've heard and - and will likely hear more - is looking at being a lead in finding new supplies. And it was interesting that the preponderance of the answers were

that, "They should be information sources. They should be a resource that we can go to and get information." But, there was general uniformity that they should not necessarily be at the table, but maybe around the table to answer questions and - and not necessarily lead the process.

And, also, just relating to the process that we talked about, people noted

that, perhaps, there might be the need, at some point, for objective facilitation, probably not by a water expert, and they cited things like the East Valley Water Forum and their success.

Education was really commented on by a lot of people and the importance of education. And this little bullet underneath, understanding the context is like my little bullet. I see one of my students back there. Anybody's who's taken my Arizona Water Policy class knows that I talk a lot about understanding the context in which decisions are being made and

Findings

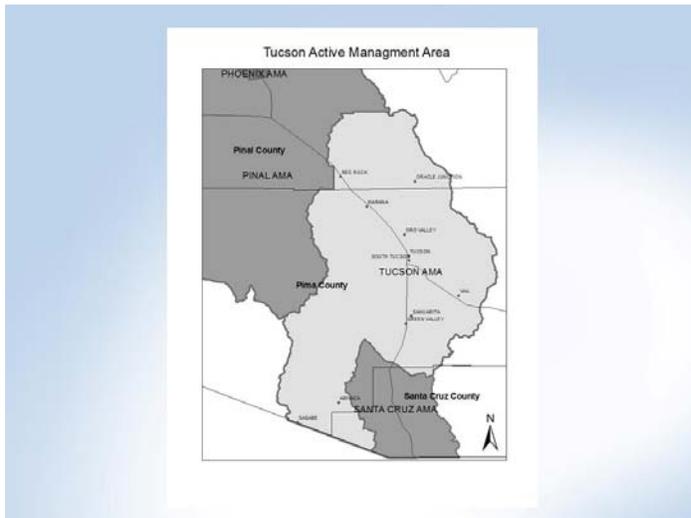
- Participation should be open and broad
 - Arizona Dept. of Water Resources and Central Arizona Project should assist
 - Objective facilitator may be needed
- Education is extremely important
 - Understanding the context
 - Common set of facts
- Ultimately, most believe the Tucson AMA should be the region of focus
 - Brings in players from outside the County
- Majority of interviewees did not favor the formation of a regional authority at this time.

policies are being formulated, and to understand the context takes a lot of effort and a lot of education; and, again, that issue of common set of facts.

We also asked a question about, "What region should be the region of focus?" Again, we weren't asking particularly related to this study, or any other particular study, but what should be the region? And most uniformly, with some exception, we heard that the Tucson Active Management Area should be the region of focus.

And I'm going to go forward and then back. I'm sure you've seen the diagram of the Tucson Active Management Area, but I thought I'd put it in there. I know this is going to be posted, but note in particular that the Tucson AMA, which is this light-shaded area, includes part of Pinal County. We didn't interview people from Pinal County. We didn't ask them what they thought about a region of focus being the AMA including the southern part of their county, but that's what people from here talked about.

And then we had a question in there that asked about, "What do you think about forming a Regional Water Authority?" because that's something that was discussed in the fall; it was



discussed after the election on - on the Prop 200 in - in November, and most of the interviewees did not favor the formation of a Regional Authority at this time. They thought it was premature to talk about forming anything when you didn't really know what you wanted done, and what - what the goal of something might be. And, of course, that makes utmost sense but, going into the

interviews, I didn't know what to expect as answers. Some - again, the water managers were, perhaps, the ones who thought, "Well, something needs to be done on this issue of - of finding additional water supplies," and had some ideas about maybe something that could be formed for that limited purpose.

So, just some observations and - and - and questions and, if you - you read the report, you'll see about 17, 18 pages of it are just really reporting on what people say, and then the last page is a little bit of the perspectives of - of the authors.

But, I interpreted the responses as indication that this region wants to self-determine its water future; it's not looking to the State and the Department of Water Resources; it's not looking to the CAP; of course, they're important players to this. But, people here really need to figure out this and - and determine where we're heading.

There were a number of questions about, you know, whether people will have the staying power to stay through this process. And you know from your own - from the City/County process, it's looked at as a many-year process, and will everybody have the staying power for that? Because it will take a while, most likely, for this - this region to develop a Water Plan.

And we did observe, I think, very sincere sense of willingness to cooperative, more than I've observed for a number of years in this region. And the question is, "Is the spirit of cooperation resilient? Is it robust? Will it carry us through some bumps in the road that might appear as we get to some of the tougher questions and issues?" And, in that regard, the

Some observations/questions

- Responses suggest the interviewees favor "water self-determination". Sincere desire to work at figuring things out locally.
- Will people have the staying power to see through the various stages of regional water planning?
- Is the spirit of cooperation as represented in the responses resilient to bumps in the road?
- The process will be very important.

process itself, I think, will be very important to that, and I know that's something, you know, this Committee is deliberating.

So, in summary, I think that what we see as, perhaps, a greater spirit of cooperation than has been observed in at least the many years that I've been working on regional water issues, and I think a

general - I - I didn't put it in the report, because we weren't really asking this question - but, general support for participation in the process that is ongoing by the City and the County, and looking forward to, perhaps, that broader inclusion, but understanding, I think, that it's going to take time to work through these issues.

So, with that, I would conclude. And I think you want to take questions after the next presentation; is that correct, Jim?

CHAIRMAN JIM BARRY: Are there any questions at this time? Mark?

MEMBER MARK STRATTON: Yeah, I just wanted to point out one thing. Your slide on the findings, it said the majority of the interviewees did not favor the formation. In your handout it says -

MS. MEGDAL: Well, yes, you know, I called here in a panic and - and that was because -

MEMBER MARK STRATTON: It was Marcelino that found it, not me.

MS. MEGDAL: Yes, I was - I was going over these slides before coming over here, and you can tell that I did not just cut-and-paste from my report, because in my report it very clearly says "did not," and I'm looking at the slide and the word "not" was missing. So, I called Jim and I got here before and I've asked Melaney to make sure that the version that's posted is this version on the computer. Thank you, Mark. I didn't know you had the slides. This is a very efficient organization here.

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: Sharon, you use a lot of terms like "most" or "feel" or "should," things like that. Does that imply that a majority of the respondees in each of those cases felt that way? It seems kind of subjective, so I'm just trying to get a handle on it.

MS. MEGDAL: Well, if you look at our report, in many instances, we list the question and then we go through, perhaps, a summary, and then we go to a breakdown where we list by those different six categories of stakeholders. And then, in certain cases, it's explicit and it says, "We're listing their perspectives in order of frequency of response." And so it's very hard to summarize 43 interviews in 15 pages, and so what we tried to do was a sense, but if you actually look at the report you'll see where there are some differences.

And I'll give you one example: One of the differences is on the Region of Focus. One person very strongly felt that the Region of Focus should be the three-county CAP area, and that's reflected in the report, but I couldn't get into all that, you know, detail in just a quick presentation.

And there was, like I said, it was the water managers where I think there was the most consistency of position with the focus on water supply augmentation. Elsewhere, even within categories, there tended to be some more difference of perspective.

MEMBER BRUCE GUNGLE: Thank you.

CHAIRMAN JIM BARRY: Anybody else? I just want to make one comment. You talk about agreement of the interviewees about the importance of agreement on a common set of facts and understanding the context, and - and this idea of common set of

facts is what I think Mayor and Council and the Board of Supervisors tasked us to do, and so if we can do that, then - then I think we will have made a contribution to whatever future regional dialogue comes along.

Sharon, thank you very much.

MS. MEGDAL: Thank you.

CHAIRMAN JIM BARRY: We appreciate it. And we will see you in a couple weeks. (Applause.)

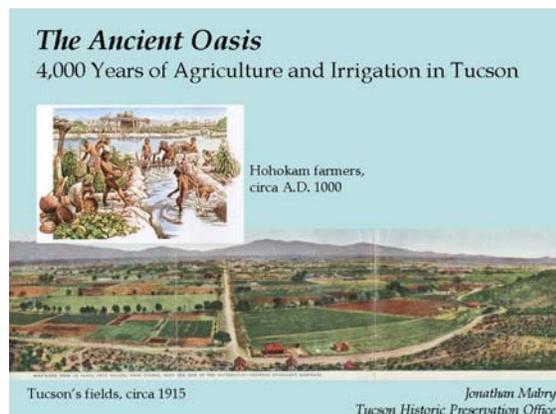
We've asked Jonathan Mabry, who is the Historic Preservation Officer to, in 25 minutes, review 4,000 years of Agriculture and Water Management in Tucson, and he's agreed to do that. But, this is - this is a perspective on what we're doing that is important to Marcelino and me and I think will be important to the Committee. We - life didn't start in 1940 or 1960, or whatnot. We - we - we really want to understand who we are and what we're doing and how we define sustainability in a longer-term perspective.

So, Jonathan, please. Thank you for being here.

PRESENTER #3

JONATHAN MABRY, HISTORIC PRESERVATION OFFICER, CITY OF TUCSON: THE ANCIENT OASIS: 4,000 YEARS OF AGRICULTURE AND WATER MANAGEMENT IN TUCSON

MR. MABRY: Thank you. I'm the City's Historic Preservation Officer, but that's a new job for me; recently started that. I've been an archaeologist working, digging in Tucson, and elsewhere in southern Arizona, for almost 20 years, and I have to tell you that archaeologists think in longer time spans than other people, and so I'd like to get you to think in longer time spans with this presentation.



Yeah, they told me at first the topic was - they - they wanted to start back with the first people in - in the Tucson area; that's 13,000 years ago, so it was going - I was going to have to cover - and they gave me ten minutes. So, I was going to have to cover, I figured, more than a millennium a minute, but I got

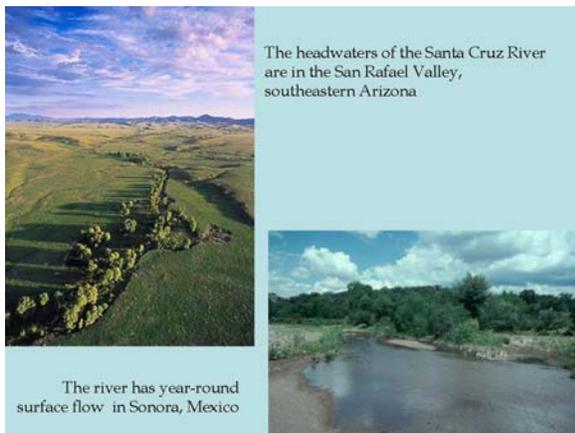
them to agree to shift the topic a little bit, and I was going to talk about the very long and interesting history of agriculture and water management in the Tucson area from this long-term perspective. So, I'm only going to go back 4,000

years and they did give me more time, so now it's about a century a second, so . . .

CHAIRMAN JIM BARRY: You're up to it, though, John.

MR. MABRY: I can do it. So, I want us to - to have an understanding that the reason that people have been living in the Santa Cruz River Valley and in the Tucson Basin is because of the water that was available. And we really have to talk about the surface water, not the ground water, and it's the Santa Cruz River; it's all about the river.

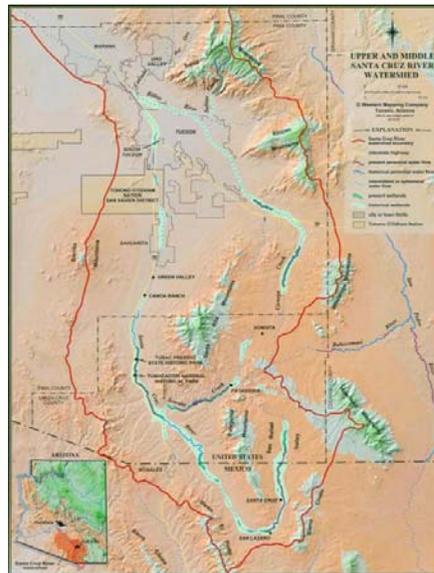
And most people don't know that the Santa Cruz River starts in the San Rafael Valley, this beautiful place here, and then it flows into Sonora, south into Sonora, loops around, and then flows back into Arizona just east of Nogales, and then



north through Tubac, Tumacacori, Green Valley, Sahuarita, Tucson, Marana and then, historically, it just kind of petered out into the desert.

And we know from studying the layers of the - the Santa Cruz floodplain that for about the last 6,000 years, it was never a continuous flow that entire length I just described; it was always a discontinuous

stream. And the red line that you see in this map is the watershed of the Santa Cruz River, and the light green that you can see along here and here's the head waters of the Santa Cruz, here's where it flows into Sonora, and then back past Nogales northward through Tucson - and all the light green that you see, historically,



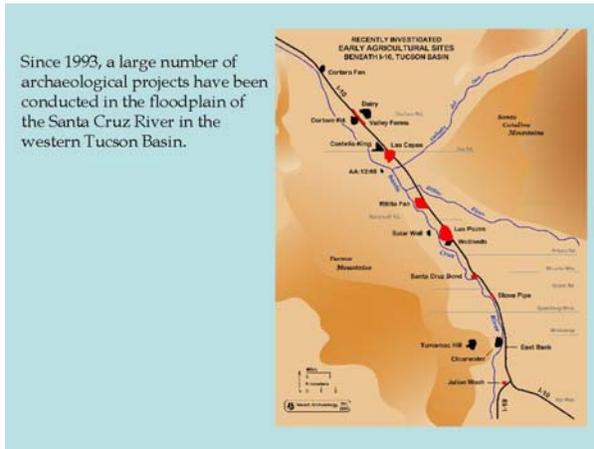
For the last 6,000 years the Santa Cruz River flowed discontinuously

Until the late 1800s there were extensive wetlands along the river course

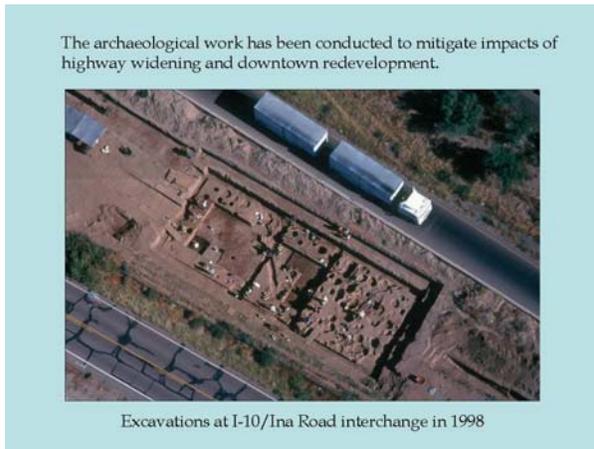
Today there are 120 miles of channels with perennial surface flows in the watershed

were wetlands. And it wasn't until the late 1800s that those disappeared, started disappearing, and they disappeared very rapidly, and now only the areas that are shown in dark green that you see here are still wetlands and the - the remaining surface flows are only the stretches that are shown in purple

here. But, there's still about 120 miles of year-round surface flow in the watershed.



Now, I'm going to - I'm going to start with the evidence of early farming and water management that archaeologists have found, and it's only been in the last 15 years or so that this has really come to light, and it all has to do with we weren't looking intensively in the floodplain until there were a series of construction projects along I-10, the Rio Nuevo Downtown redevelopment project that came up with funding to do archaeology. And there are laws



that require that archaeology is done in advance of these types of construction projects that are funded with tax money. So, it was a good 15 years to be an archaeologist in Tucson.

And we found a series of early farming village sites buried in the floodplain of the Santa Cruz River. And here's an excavation that I directed at the I-10 and Ina Road Interchange. And in this in

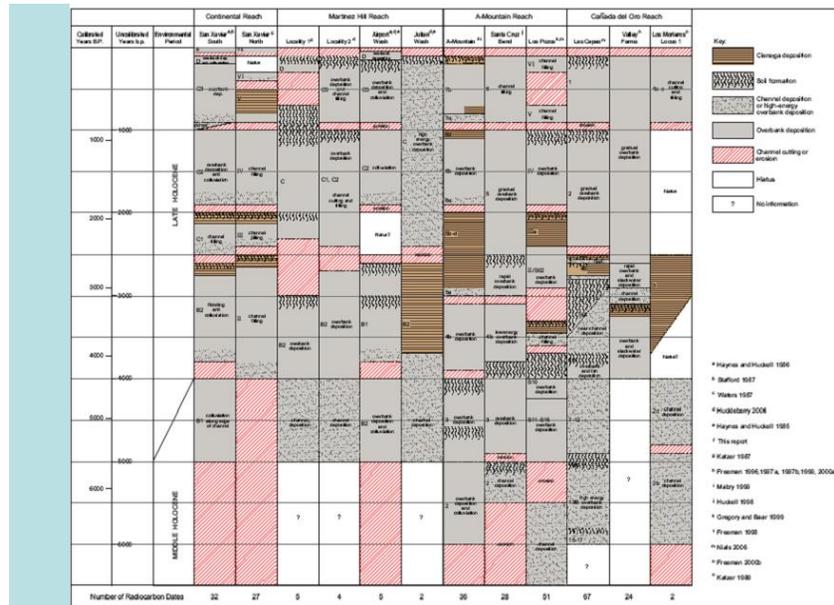
this small area, we excavated almost 500 pits and pithouses and human burials and other features, and in the bottom about - about ten feet down below the current ground surface we found this canal and it's about 3,200 years old, and we found a series of canals at this site and, with this excavation and some - some other excavations that were right around this time back in 1998, we discovered that the history of water management, of - of irrigated agriculture, goes back very far in the Sonoran Desert.

But, we were also having opportunities to look at the layers of the floodplain and learn about the history of the river, the history of the - the river and its floodplain, and we have been able to use radiocarbon dating to piece together a chronology of the river and the - and the floodplain history that is more detailed than for any other river in the southwest. So, for the last 6,000 years we have more than 300 radiocarbon dates that provide a time scale for this detailed understanding

of the history of the river and - and, of course, this will continue to be refined.

But, what I wanted to show you here is this scale that goes back - here's 6,000 years ago, here's today up at the top. The red intervals are periods of erosion; the gray periods are

periods of floodplain deposition; and the brown colors that you see are periods when there were extensive wetlands or cienegas in different stretches of the river floodplain. And we can see that there were six almost valley-wide cycles of channeled-down



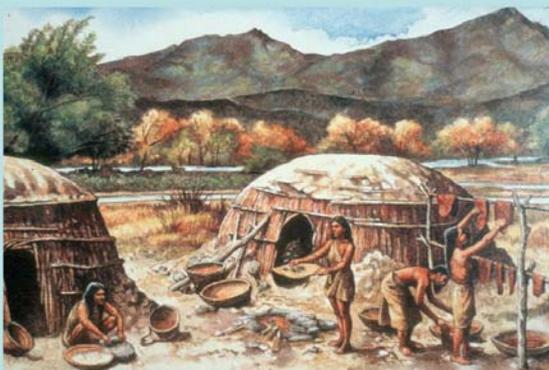
Layers of the Santa Cruz floodplain reveal 6 major cycles of channel cutting and filling over the last 6,000 years

cutting, and then filling back up again in the last 6,000 years.

And these excavations also uncovered a huge amount of information about a time and an early farming culture that developed along the Santa Cruz River, and other river valleys of southern Arizona and northern Sonora, that we didn't know much about before. And this is not the Hohokam, this is long before

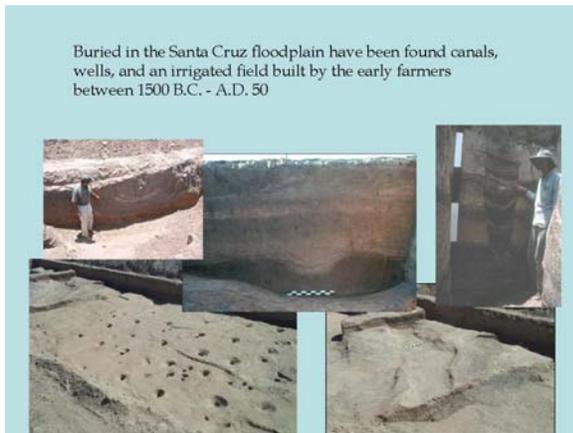
the Hohokam, and these people were the first farmers, the first villagers, the first pottery makers, the first canal builders, the first traders of the Sonoran Desert.

These recent archaeological discoveries in the Santa Cruz floodplain have revealed a n early farming village culture that flourished between 2100 B.C. and A.D. 50 (long before the Hohokam!)



in the layers. And the deepest, earliest village that we found remains of dates to about 4,100 years ago. And so when you see

- when you see 2,100 B.C., add another couple of thousand years and that'll - that'll tell you how long ago it was in - in years. So, this is - you might've heard people talk about or heard in the paper about how Tucson is - is more than 4,000 years old, well, this - this is how we know that.

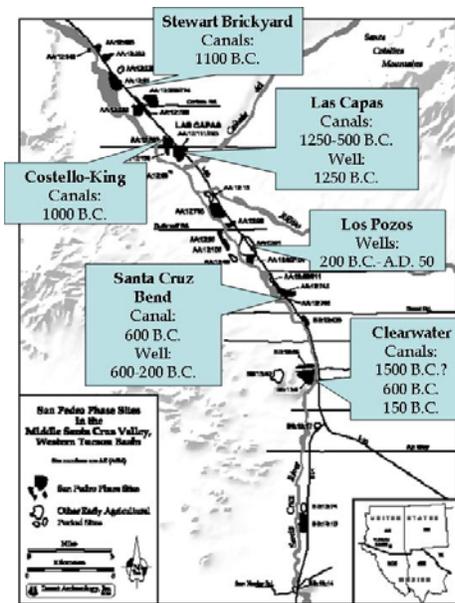


And I'm the archaeologist that worked on this project and it was very interesting - this is back in 2000 - and I find it fascinating that this fact has gotten into the public discourse. And I'll be at parties and I'll hear people saying, "Oh, did you know that Tucson is 4,000 years old?" And I say, "Oh, you don't say? That's interesting, you know." But, it - it fascinating and it makes Tucson, perhaps, the oldest, continuously inhabited place in the United States.

And at - at this location you'll see here we've got some modern housing and some - this is the cluster of pithouses that you see shown in blue here, and I've described this photo as - this is 20th Century housing and - this is 20th

Century A.D. housing, this is 20th Century B.C. housing next to each other. And, interestingly enough, we found the earliest pottery that's ever been found in the southwest at this site right here in Tucson.

And, of course, the other really fascinating features that archaeologists have been finding at these early farming sites buried in the floodplain are buried canals. And somebody asked me, "Well, what does that look like?" Well, here's what it looks like. You can see that the canals silted up when they constructed the canal and dumped the dirt onto the banks; it created these berms and, as they had to maintain the canal and dredge it out and clean it out, they kept piling that mud up on the banks and these berms built up. Canals that are not lined with cement, they silt up, floods fill them up, they - they're cleaned out again and again, and so you recognize them from the kinds of sediments that filled them up - that's me there - and this is a real interesting site. I spent a summer digging in



The early canals in the middle Santa Cruz Valley were contemporaneous with the earliest known examples in Mexico.

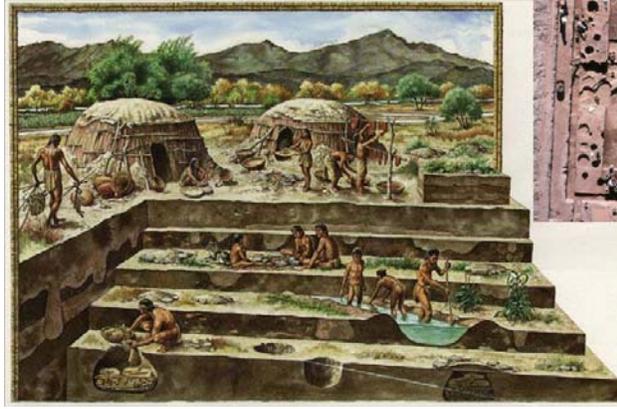
They were built 1,250-1,500 years before the earliest known canals in the Phoenix Basin.

the median of I-10 in Marana and that's not fun, but it was very interesting because we found a 3,100-year-old irrigated maize field in the median of the highway, and these are planting holds for maize plants that we found. This is a well. You see how that - that well feature there that's filled in?

So, this map just shows that at multiple sites now we've found evidence of very early water management, canals and wells both. The earliest canal that we've found so far is at that location at the base of "A" Mountain, and it dates to about 3,500 years ago. So, just to get it straight - 'cause I see these dates garbled all the time in the media. We've got evidence of agriculture in Tucson 4,100 years ago, and we have evidence of canals at 3,500 years ago. I won't be surprised if someday we find older canals than that, but - so, the evidence of agriculture's a little bit longer than the evidence of water control right now.

So, here's an artist's rendition of the layers of the floodplain and the different periods of occupation represented

Supported by irrigated agriculture, the Las Capas site in Marana was occupied almost continuously for 500 years (1250-750 B.C.)

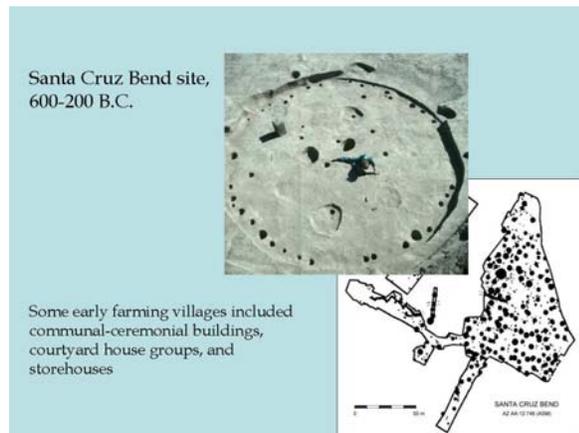
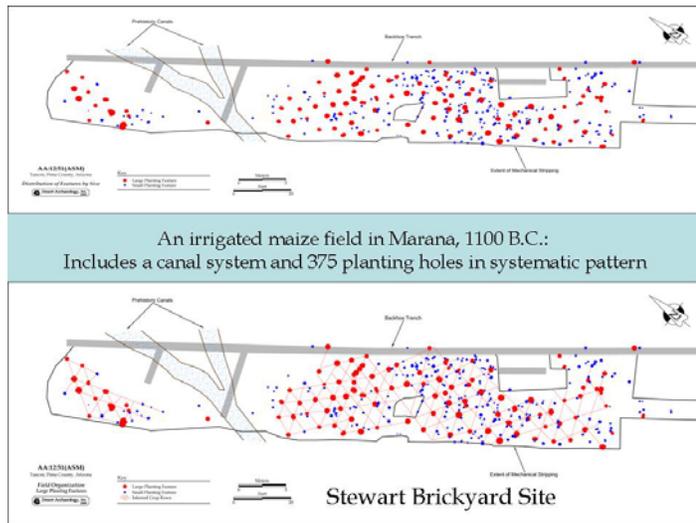


at that site up in Marana I - I showed you; this site here. And I always find it interesting that artists always portray the water in these earthen, unlined canals as looking like swimming pool water, you know, but it certainly was muddier than that.

So, this was a very long-occupied settlement, almost - well, about 500 years of continuous occupation; it was because of the water, the

reliable water supply just below the confluence of the two largest tributaries of the Santa Cruz River, the Rillito and the Canada del Oro; this was the sweet spot in the Tucson Basin if you wanted to be a farmer thousands of years ago.

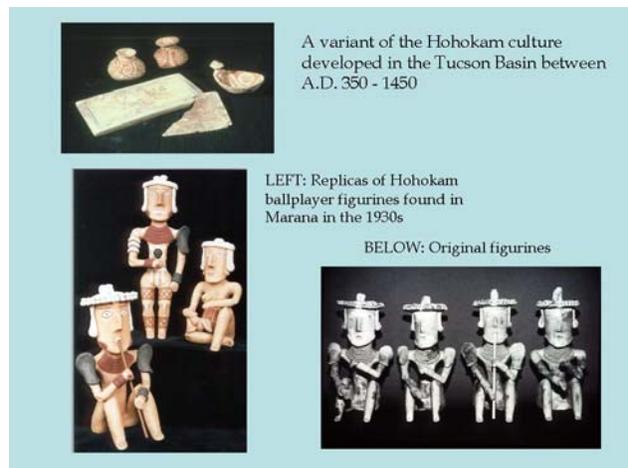
This is a map - a couple of maps of that agricultural field in the highway median that I was telling you about. Those planting holds were in a surprisingly regular pattern. I don't know if



you can see that or not, but they were very efficiently laid out. And there was a sheet of clay extending out over this field that could be traced back to these canals, and so that clay that covered this field was - had - had settled out of the muddy water from - from the irrigation canal.

And this early farming culture developed the - the level of social organization developed over time, and by about 2,500 years ago we find evidence of courtyard groups of houses and special types of architecture, like these very large - relatively large buildings that we think were for public meetings or ceremonies, and it indicates a level of organization above the household. So, multiple households were - were living together in these villages and were organized at - were integrated at a higher level than before.

And, of course, a lot of folks in southern Arizona have heard about the prehistoric Hohokam culture; this is the much-better known



prehistoric culture. We don't understand the connections between that earlier farming village culture and this later Hohokam culture that flourished in southern Arizona between about A.D. 350 and 1450.



The Tucson Hohokam lived in villages and hamlets above the floodplains, where they built large canals



The estimated Hohokam population of the Tucson Basin was 4,500-7,000 persons between A.D. 1000 - 1300

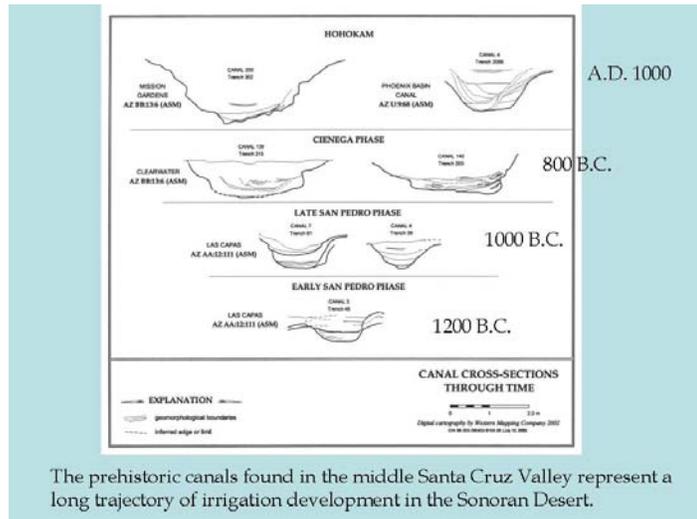


This is fascinating, the - these figurines were found in an agricultural field in Marana in the 1930s and - this is black-and-white photo - but, some full-color replicas were made for display and these - these are representing Hohokam ballplayers. They - they - they played this ball game in a large earthen ballfield. All of

the largest Hohokam village sites in the Tucson area have remains of these large ball courts that are very Mezo-American like.

So, the Hohokam lived in larger villages than the earlier culture. They built larger canals. This gives you an idea of - can you see the different colored sediment that fills that canal and how big that is? That's 1,000 years old. And so they were becoming better hydraulic engineers over time. And a canal this big could have diverted the entire early summer flow of the river. And here's a population estimate that between A.D. 1000 and 1300 there may have been 4,500 to 7,000 people in the entire Tucson Basin, so not a huge number.

But, if we compare these earlier and later canals through time, we can see that they were becoming better and better hydraulic engineers of bigger canals, larger capacities, better designed. We can see evidence that they were operating head-gates and controlling the flows very well in these canal systems, and it looks like a very long and continuous trajectory of irrigation technology development.



The prehistoric canals found in the middle Santa Cruz Valley represent a long trajectory of irrigation development in the Sonoran Desert.



1697

Father Eusebio Francisco Kino, in the company of Captain Cristóbal Bernal and Captain Juan Mateo Manje, traveled down the Santa Cruz Valley.

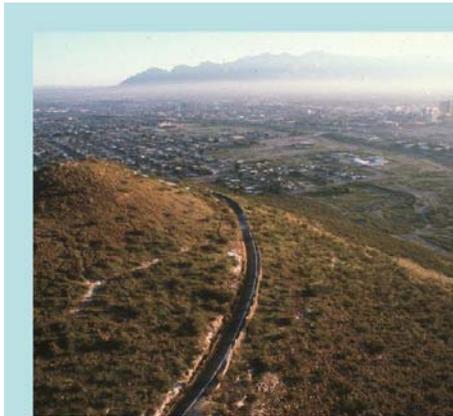
Their diaries mention several Sobaipuri villages and irrigated fields along the Santa Cruz River in the western Tucson Basin.

They estimated these villages had a total of 1,680 residents—the highest population density in southern Arizona at the time.

Now, when Father Kino and soldiers of the - of the Spanish Empire arrived in the Santa Cruz Valley in the 1690s, they kept diaries and they - they describe Sobaipuri, Pima, or O'Odham villages strung along the Santa Cruz River. And right in the Tucson area, at San Xavier and - and where Tucson is, they found the largest concentration of population, almost 1,700 people by their estimates,

and this was the largest concentration of population that they had seen in the Pimeria Alta, and these folks living in this - in these villages were using canals to - to irrigate their crops.

So, here's Tucson's birthplace. The - the village



Tucson's Birthplace

At the foot of the black volcanic hill known today as A-Mountain, was the Sobaipuri village of Schookshon ("below the black hill"), for which "Tucson" became the most common Spanish written form.

that Father Kino found at the base of "A" Mountain was called "Schookshon," which is where Tucson, Tucson gets its name, and it means "at the base of the Black Hill," and Father Kino, he referred to it as "San Cosme del Tucson."

This is a very early map that Father Kino drew and Tucson is located right here, and so you can

Father Kino renamed the village as "San Cosme del Tucson."

see that Tucson was part of a chain of native villages along the rivers of what is now Arizona and Sonora, the Pimeria Alta.

Father Kino was a transformative figure in the history of this part of the world for many reasons, and it's not just because he introduced Christianity, but - and established that chain

1697

Father Kino drew this map to illustrate the biography of his martyred fellow missionary, Father Saeta, killed in Caborca during the 1695 uprising of the Pimas.

The native village at Tucson is marked as San Cosme



Father Kino introduced wheat and cattle to the Santa Cruz Valley in the late 1690s

These and other Old World crops complemented the native summer crops and wild food resources of the O'odham



Irrigation was practiced at several places along the Santa Cruz River with reliable surface flows and high water tables

of missions that - that he's well known for. But, to the natives he was also transformative because he introduced cattle and wheat. All of the native crops have summer growing seasons, and the lean season, the hunger season, was when your stored corn ran out in late winter and early spring, and that early springtime is the lean season in terms of wild foods in the

Sonora Desert, even the animals are at their skinniest, and it's hard to sustain yourself even if you are hunting all those rabbits and deer.

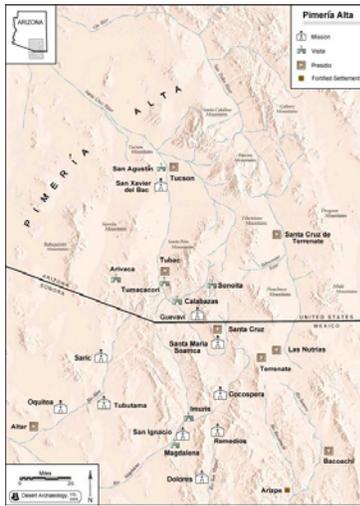
So, wheat is a winter crop and so it was a perfect complement to the native summer crops, and it gave them - they were able to double-crop for the first time in their irrigated fields, and so they weren't hungry any more. And, also, cattle was - was transformative and the Papago or the - what are now the Tohono-O'odham - became cattle herders and that became a very important part of their economy.

Well, we're talking - we're focused on - on the Tucson area, and this chart is just to show you that archaeologists have uncovered the remnants of the - of the Mission Visita that was at the base of "A" Mountain, the Visita of San Augustine, and you can see some computer renderings of what the recreated mission is going to look like, and these are based on - I - I describe it as we are reverse engineering this mission from historic photos and from archaeological remains, but it's going to be very authentic, and I'm very excited because construction is starting this fall. And this is a mission period native house foundation that you can see here.

So, let's not forget that the Mission of San Augustine and the Presidio of Tucson in the downtown area were part of chain of Spanish missions and presidios in the

The Mission Visita at Tucson	
	1752 After Pima revolt in 1751, Sobaipuris in middle Santa Cruz Valley resettled only at Bac and Tucson
	1757 Jesuit Father Bernhard Middendorf first resident priest - stayed only briefly
	1762 250 Sobaipuris from San Pedro Valley relocated to Tucson by Spanish military
	1771 First visita chapel built within defensive wall for Franciscan Father Francisco Garcés
	1782 Father Velderrain watched Apache attack on Tucson presidio from chapel roof
	1795-96 More than 200 Papagos resettle in Tucson
	1798 First chapel described as deteriorated; work probably began on second chapel
	1810 Second chapel and convento completed by this time

Pimeria Alta. And the Spanish had a policy of reduction, which means they wanted to bring the natives in out of the desert to the missions where they could be converted to Christianity and



1700s
Tucson was part of a chain of Spanish missions and presidios in the Pimeria Alta.

Several O'odham groups relocated or disappeared because of Old World diseases, displacement by Spanish colonists, depredations by Apaches, forced relocations by the Spanish military, and assimilation into related groups.

Shifting Composition of O'odham Tucson

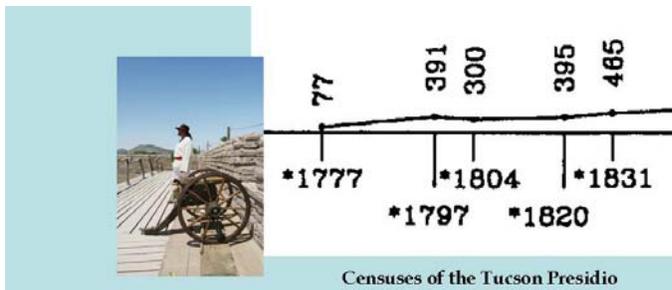
1752	156 Sobaipuris
1762	400 Sobaipuris
1797	211 Papagos, 78 Sobaipuris
1801	213 Papagos, 26 Sobaipuris, 7 Gileños

to work in the fields and support the mission, but that's where they were exposed to old world diseases, and that's where they became vulnerable to Apache attacks.

And if you read the - the records of these missions, it's very sad the - the number of deaths constantly outpacing the number of births and they had to keep - the missionaries had to keep

urging the - the Indians to come out of the desert to the mission to replace the ones that had died. And you can see that whole groups, whole ethnic groups, disappeared during this time, were - were completely displaced, relocated.

Well, when the garrison at Tubac was moved to Tucson and the Presidio of Tucson was established in 1775,



In 1775 the garrison of the presidio at Tubac was transferred to the location of downtown Tucson today, and the eastern floodplain of the river was irrigated by Spanish soldiers and settlers.

Increasing competition for water led to a 1776 agreement that guaranteed three-fourths for the O'odham village on the west side, and one-fourth for the presidio.

In the 1790s, the Indians' share was reduced to one-half.

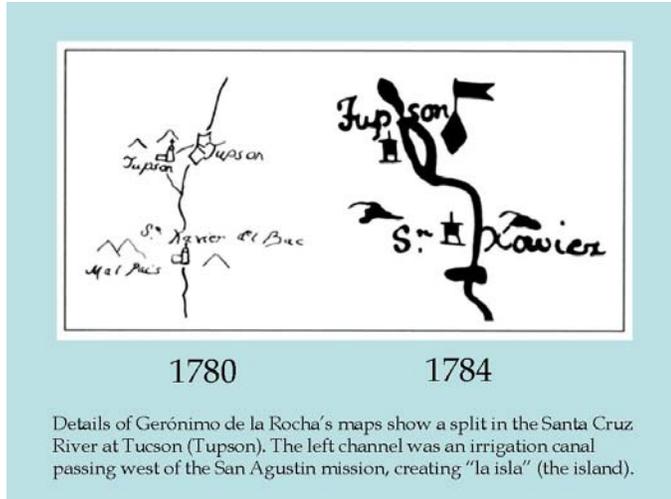
well, Spanish colonists also came, and so for the first time both sides of the river, where downtown Tucson is today, both sides of the river were irrigated and cultivated, and for the first time water sharing became an issue, and it led to a 1776 agreement that the native village on the west side would get three-fourths of the water, and the

Presidio on the east side would get one-fourth. Of course, they immediately broke that treaty and, eventually, by the 1790s, the - the Indian share was reduced to one-half.

In 1780 and 1784, a Geronimo de la Rocha was touring the Spanish Missions and Presidios to - to prepare reports, and he made maps on both trips of - of Tucson and San Xavier you can see here, and he described and showed on his maps that there was a very large canal that - west of the river channel that created "la isla," the island, the island, and he commented on how there

was a dam that impounded the water for - for that major canal, and a whole system of smaller canals.

Now, in 1854, the U.S. Boundary Commission came through Tucson as part - after - when they were negotiating the - the new border with Mexico and were surveying - and this drawing you see in the lower left was - the artist was sitting up on "A" Mountain, and he drew fields of Tucson and you can see



Details of Gerónimo de la Rocha's maps show a split in the Santa Cruz River at Tucson (Tupson). The left channel was an irrigation canal passing west of the San Agustín mission, creating "la isla" (the island).

the Catalina Mountains in the background, and here you can see the - the still-standing convento and chapel of the San Augustine Mission. And this is a later water color by another artist based on this earlier drawing, but you can see how bucolic Tucson was.

A Sonoran irrigation community

Tucson's fields, 1854

New settlers arrived after Mexico gained independence from Spain in 1821, and established the traditional Sonoran system of irrigated agriculture in Tucson

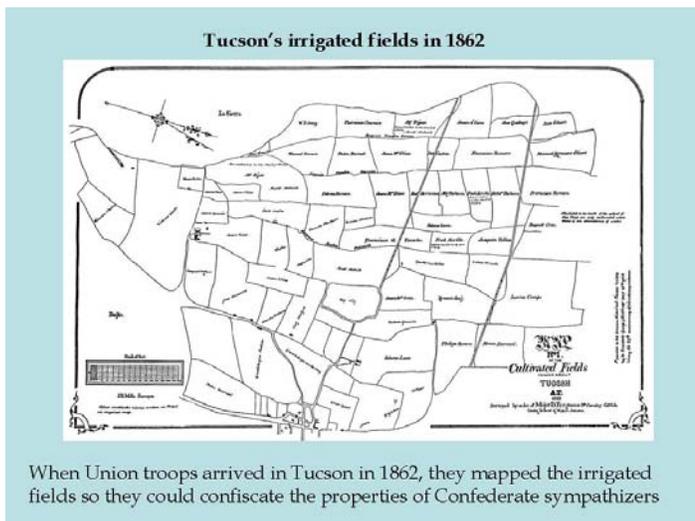
The main canals were maintained as common property by a *común de agua* (irrigation community), and an elected *zanjero* (overseer) supervised water distribution in turns

Water shortages were shared proportionally

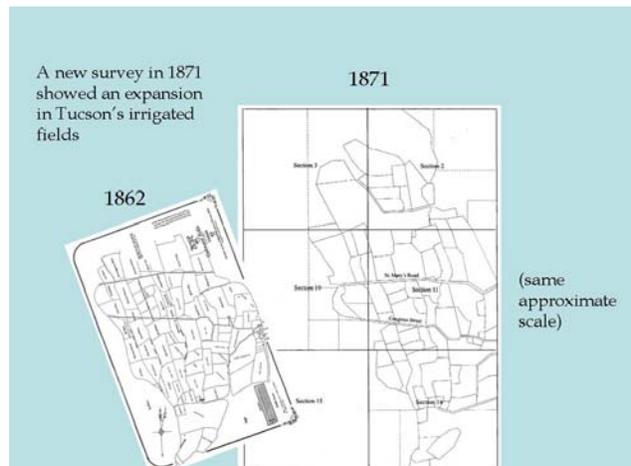
Now, this - it was, at that time, a traditional Sonoran irrigation community, and what I mean by that is - is all of the farmers using

the - the water source, using the main canal, shared that water and - and - and that main - those main canals were also common property, and they took their water shares in turns. And there was an elected official, an overseer, a *zanjero*, who supervised these water turns. And, when there were water shortages, they were shared proportionally by everybody.

So, when U.S. troops arrived in Tucson in 1865, the first thing they did was mapped all these fields, and we're glad they mapped all those fields -



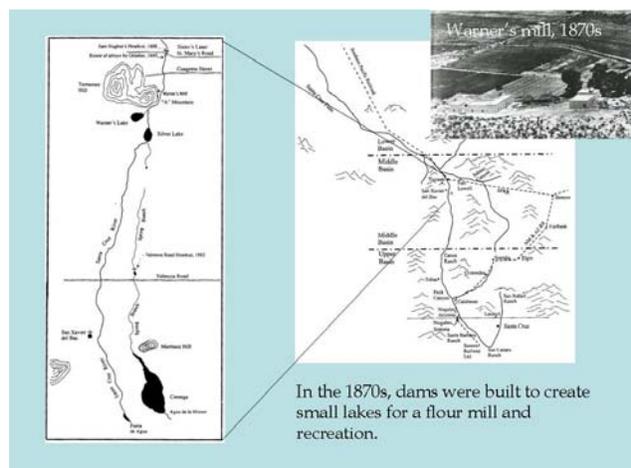
it's - it's the earliest map of Tucson - but, their motive was so they could identify properties owned by confederate



sympathizers so they could confiscate them.

And here's a map from 1871 that - and I tried to scale them about the same and tilt the earlier ones so they're about oriented the same - but, this is St. Mary's Road and Congress Street. St. Mary's Road and Congress Street you can see on both of them, and it looks like in the 1860s, the irrigated fields of Tucson had expanded.

By the 1870s Anglo-Americans who had arrived in Tucson had impounded the river at several locations to create lakes that would power mills for flour and, also, lakes for recreation. This is Warner's Mill that you can see here. This is a photograph, a famous photograph, of Tucson taken from the top of Sentinel Peak in 1880



just a few months after the railroad arrived and, in the background, you can actually see - here's the railroad in the background - and, if you look closely, there's two trains - there's one here and there's one here, and there's the smoke from the - the engine, and they're getting ready to pass each other.

But, when the railroad arrived, Tucson was still an irrigated oasis; it was an agrarian community still. The railroad would turn out to totally transform this place, but one of the big changes was these American entrepreneurs who wanted to speculate in land and water rights for their development schemes to make money and they ended up - because they took more than their share under the traditional system, the downstream traditional Mexican farmers didn't have enough water, and they challenged the - the Anglos in court - and we know how that turned out - the judge invoked U.S. Water Law and said that superseded any local customs, so water changed from becoming common property, a shared resource, to private property at that point along the Santa Cruz River, become commodified.



Tucson's agricultural fields, 1880

first time. They - on the train arrived all this dimensioned lumber. So, the construction changed from adobe to wooden structures, and there was a need for fire protection, and the growing population needed more water, and so Tucson's first Municipal Water System was built in 1882. And

And it was - this is a great example of the tragedy of the commons; if you know what that is, and I'll come back to that at the end.

Now, Tucson was growing and, with the railroad, came wooden buildings for the

1880s

Agriculture became a new focus for entrepreneurs

Increased water use by Sam Hughes, W.C. Davis, and Leopoldo Carrillo upstream of the traditional Mexican-American irrigation community led to a court challenge in 1884.

Western U.S. water law was determined to supersede local customs, ending traditional irrigated agriculture in Tucson.



LEFT: Chinese farmers rented fields from Leopoldo Carrillo and peddled produce in town



Tucson's first municipal water system was built in 1882, and expanded in 1907

A wooden flume was built in the bed of the river to carry well water to a 300,000 gallon wooden reservoir

A steam engine pumped water into a pipe constructed of riveted and tar-coated sheet steel, which carried the water 4½ miles north to town

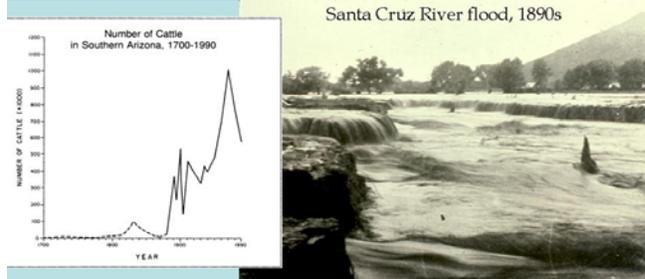
RIGHT:
Tucson's first water pipe recycled at Canoa Ranch



the - the pipe that carried it four-and-a-half miles north to Tucson was made out of three-foot-by-three-foot sheet metal riveted together and coated in tar. And I was at Canoa Ranch a few months ago, and I saw that that pipeline was recycled at some point in the - in the - probably the early 20th Century to make this fence, so . . .

The Santa Cruz River became the way we know it today; this - basically, a dry riverbed most of the time, 20 feet below the top of its banks in the late 1800s. And it's - there's several - there were several factors involved; having - at the scale of the watershed. First of all, the cattle industry had really overstocked the range, and you can see here that - how rapidly the number of cattle in southern Arizona increased in the 1870s and 1880s. And then there were a series of terrible drought years with huge losses of cattle herds in the 1880s and 1890s, and that was followed by several closely-spaced years of huge floods.

And, because the cattle had over-grazed the Tucson



A combination of drought, overgrazing, falling water table, and a series of floods beginning in 1888 caused channel downcutting

Arroyo cutting initiated at a new irrigation canal being constructed by Sam Hughes north of Saint Mary's Road

By 1910 the Santa Cruz channel was a continuous arroyo from Tucson to San Xavier

Basin, run-off, when there was a rain event, accelerated. Instead of having the grass and the other vegetation to slow the run-off so it could infiltrate and recharge the aquifer, it was denuded, and so the water didn't soak into the ground; it ran off rapidly and caused these huge floods. And, because the water table had dropped from the drought, and from this - and because the - it

was not being recharged, then river channels seek out the level of the water table, and that's what happened.

And at a place where Sam Hughes, our pioneer, Sam Hughes, was building a huge new canal to carry - divert water from the river to his fields, that's where the arroyo formed. And, by 1910, that arroyo was continuous, all the way upstream to San Xavier. And there were frequent newspaper stories, very alarmed newspaper stories, about what was - the changes happening to the river.



In 1891, the Allison brothers rebuilt the irrigation system, including a new reservoir and a ditch that extended north to Congress Street and irrigated 1,160 acres by 1895.

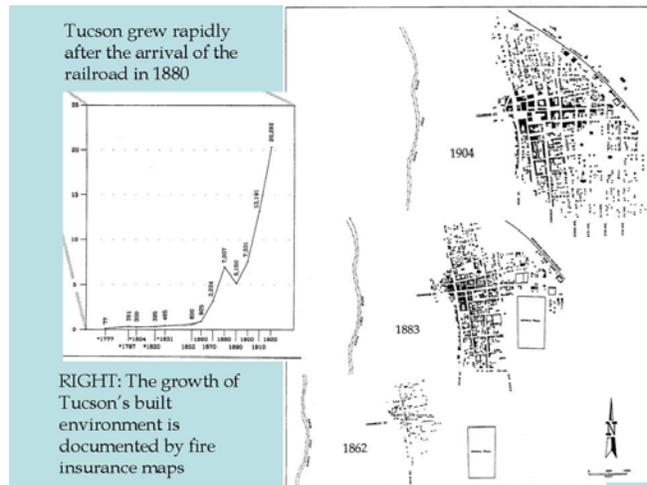
An "East-Side" canal was built in 1896 after much of the irrigated land on the westside became salinized.

A wooden flume carried water across the channel from new 15-foot deep artesian wells at the foot of Sentinel Peak.

But, in 1891, the Allison Brothers rebuilt the irrigation system, but an important thing is they - they couldn't rely on surface flows anymore because the channel was entrenched. But, they dug a series of wells at the base of "A" Mountain and they carried the water across the river channel with a wooden flume and they were irrigating almost 1,200 acres on the west side by

1895, but those quickly became salinized and they had to build a new canal on the east side and open up new irrigated areas on the east side because of the salinization. This is a map that shows areas in southern Arizona that were irrigated around 1900.

Well, Tucson grew very rapidly after the arrival of the railroad, and these maps are - are showing building footprints that were on - this is that 1862 map done by the



Tucson grew rapidly after the arrival of the railroad in 1880

RIGHT: The growth of Tucson's built environment is documented by fire insurance maps

Union troops - but these two maps, 1883 and 1904, are fire insurance maps. And, actually, the urban area was much larger than that, especially to the south, the barrios to the south, but since the people in the barrio didn't buy fire insurance, they weren't mapped, so . . .

There continued to be lots of land speculation

and these crazy development schemes, but a businessman who was going to become one of Tucson Mayors, Levi Manning, bought the Allison Brothers' properties and built - dug new deeper wells to supply new canals that he built, and the water table had dropped to an astounding 20 feet, so he had to dig new wells.

Now, in 1911, a group of investors from

In 1902 Levi Manning bought the Allison's' properties and further developed the well-field below Sentinel Peak to supply four main canals by 1910.

The water-table had dropped to 20 feet.



The Santa Cruz River flowing by the ruins of the San Agustin mission, circa 1910

A group of Chicago and British investors bought part of Manning's land in 1911 and developed the "Crosscut" - a line of 19 new wells across the floodplain ranging from 45 - 150 feet deep and connected by a horizontal shaft.



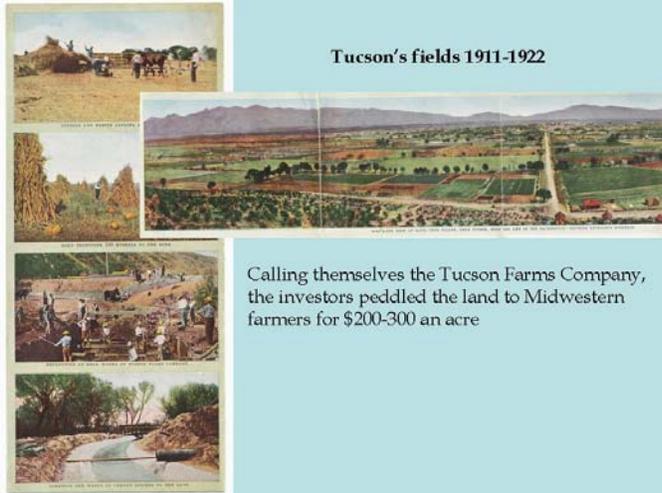
The 1911 Crosscut

They installed electric pumps, replaced the wooden flume across the river with a 4-foot-diameter concrete siphon, and lined some canal segments with cement



Chicago and Great Britain got together and they bought part of Manning's land, and they built this amazing new line of wells, deep wells, connected by an underground horizontal shaft - this is called the "Crosscut," and they - they installed electric pumps and they built new flumes. Anyway, this was quite elaborate and, for the first time, cement-lined canals in Tucson. And they called

themselves the "Tucson Farms Company," and they really heavily marketed land to mid-western farmers and produced a series of brochures where they had hand-tinted the photographs to make Tucson look extremely lush, a very attractive investment. Here's the - this is a photo showing the construction of that



Tucson's fields 1911-1922

Calling themselves the Tucson Farms Company, the investors peddled the land to Midwestern farmers for \$200-300 an acre

Crosscut that I was telling you about.

Well, the Tucson Farms Company did not turn out to be a financial success, but the speculation and the development schemes continued. An important one was in 1913 - the - the river channel formally flowed along what now we call the "West Branch" - but, in 1913, a diversion channel, a dike was built, to divert the flow over to the "Spring Branch" is what it was called, but that's the current channel of the Santa Cruz River. And the focus of farming shifted south to the Sahuarita area where they were cultivating guayule during World War I as a rubber substitute, and north to Marana where cotton cultivation started.



A 1915 flood destroyed the first Congress Street Bridge

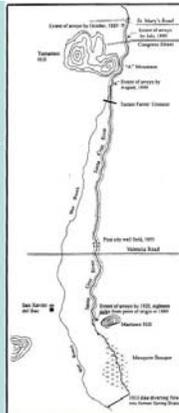
RIGHT: Santa Cruz Valley in the 1920s

A 1913 dike diverted the river channel south of San Xavier

In 1916 the Intercontinental Rubber Company purchased 9,700 acres near Continental to irrigate native guayule, a rubber substitute during World War I (converted to cotton in 1920s)

In 1920 Edwin Post drilled wells and built canals to cultivate cotton at Postvale (now Marana)

The Tucson Farms Company was not a financial success, and in 1922 the newly formed Flowing Wells Irrigation District took control of the Crosscut and distribution system



But, in the 1930s,

with groundwater, they were still doing agriculture. Here's a 1936 aerial photo and you can see there were still fields right next to the urban area, and it was not until a very large flood in 1940 really wrecked the infrastructure, the agriculture infrastructure, that that agriculture right near the

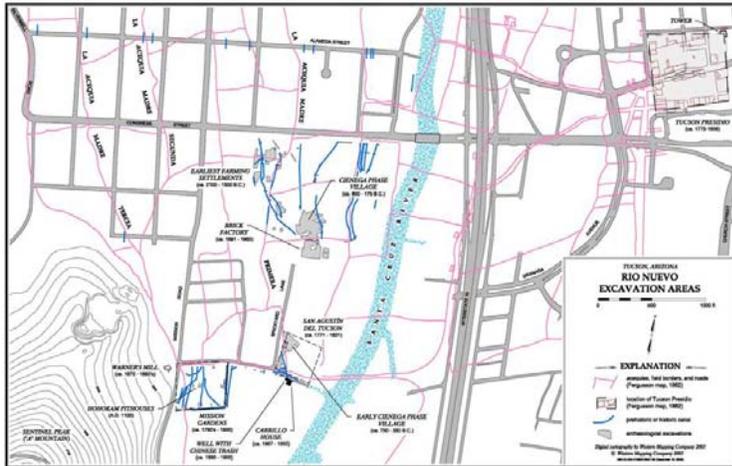


1936

With groundwater pumping, irrigated agriculture continued near downtown during the 1930s

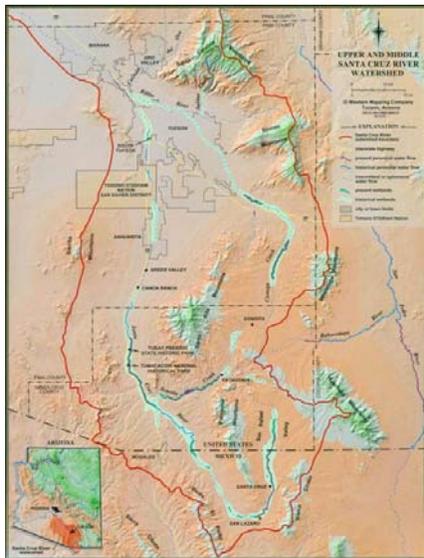
A large flood in 1940 destroyed most of the waterworks near Tucson, bringing an end to 4,000 years of agriculture in that location

Canals found during the Rio Nuevo archaeology project range in age from 1500 B.C. to the 1880s



here's the mission area, here's the Mission Garden. All these blue lines you see are canals. This is a sequence of canals and the layers of the floodplain going back 3,500 years. These are the earliest canals that are known in North America.

So, taking this long view of time, what - what are some of the patterns, the trends we can see? Well, I wanted to come back to this map of the watershed because that's - that's how it has worked for 4,000 years for people. And things like



Sustainability lessons of the oasis:

- Think like a watershed
- Surface flows and riparian habitats depend on high water tables
- Balance population with local water supplies
- Prioritize water for drinking and local food production
- Share water supplies and shortages proportionally
- Avoid the "tragedy of the commons"

when you over-graze the watershed, or there's drought in the watershed, then everything is integrated at that scale. Also, that - I talked about the Santa Cruz and its tributaries being discontinuous streams. Well, the few stretches that had year-round flow, historically, all had - basically, it was because there were high water tables or - or some impermeable material, but the key habitats of the Sonoran Desert are those riparian areas where there's high water tables. And, obviously, prehistoric peoples didn't have the luxury of getting completely out of balance with their local water supply, and they had to prioritize water for drinking and for food production. And with the cost of energy

downtown area came to an end finally, ending 4,000 years of irrigated agriculture in that location.

So, I'm almost at the end here. The archaeologists working on the Rio Nuevo Project have dug in lots of areas, including the Presidio - here's the Presidio in the downtown area - but they also dug - here's Congress Street - and they found all of these canals there -

when you over-graze the watershed, or there's drought in the watershed, then everything is integrated at that scale.

Also, that - I talked about the Santa Cruz and its tributaries being discontinuous streams. Well, the few stretches that had year-round flow, historically, all had - basically, it was because there were high

increasing and people talking about how - people talking about food miles, and the importance of eating local foods, we may need to convert some of our cotton fields and some of our other floodplain land - lands from - instead of potential subdivisions to - back to agriculture for food. We may be in that position. And then, you know, the water supplies had to be shared and - and - and shortages had to be shared.

And, finally, we need to avoid the - the kind of tragedy of the commons that was caused when the - the cattle barons, basically, almost wrecked the watershed and caused the river to become the way it is that we know it today. So, I'm going to stop there.

CHAIRMAN JIM BARRY: Wow, I'm exhausted.

(Applause.)

Do we have any questions for - for Jonathan? Bruce?

MEMBER BRUCE GUNGLE: I - I heard you correctly deny that - that you have archaeological evidence of six channel-cutting episodes in the last 6,000 years; is that right?

MR. MABRY: Well, it's geological evidence, but it's -

MEMBER BRUCE GUNGLE: Oh, it's geological. Okay.

MR. MABRY: - these archaeological excavations in the floodplain has given us these terrific informative exposures of the layers of the floodplain.

MEMBER BRUCE GUNGLE: Right.

MR. MABRY: So, piecing together those different exposures, we can correlate them and, using radiocarbon dating, reconstruct the history.

MEMBER BRUCE GUNGLE: Right. The - the head-cutting episode of the late 1800s was pretty consistent across the streams in southern Arizona. Do you know if all six of these were, like, for in the San Pedro, for example? Is there any evidence of that as well?

MR. MABRY: Most of the major down-cutting cycles of the Santa Cruz do seem to - do appear to correlate with major down-cutting cycles along other rivers in Arizona, but we know the most about the Santa Cruz, and so we don't - one theory that is testable with - with future investigations is that these major cycles of down-cutting are related to El Nino cycles, and that the large floods that come during El Nino cycles could've triggered the - the - these widespread down-cutting cycles.

MEMBER BRUCE GUNGLE: Do you have publication that you reference that?

MR. MABRY: Sure, I can provide that.

MEMBER BRUCE GUNGLE: Can I get that from you?

Thanks.

CHAIRMAN JIM BARRY: Bonnie, did you have something to say? Question?

MEMBER BONNIE POULOS: I - I just like a perspective here. Early on when we started meeting in April, there were some comments made about agricultural use in the Tucson Valley that really kind of shed a very negative light on agriculture and its impact on water, and it seems to me that it's really in your perspective in terms of how you look at agriculture and the type of agriculture that affects our ground water table. Can you comment on that in terms of the current-day agricultural uses of this land and how it compares to the historical use of agriculture and - and its impact on water?

MR. MABRY: Sure. This is probably the longest continuously cultivated region in the United States, but the type of agriculture shifted during the 1800s, and it shifted from food production to cash-crop production, like cotton and guayule and other crops, and so it 's not - it's not for local food production anymore. And the types of - crops like cotton are the thirstiest crops out there and they require much more water than the crops that were cultivated here over thousands of years, the food crops. So, there 's different ways to irrigate that are much more efficient. There's different crops that are much less thirsty, and I - I hope we start thinking about that again, so . . .

CHAIRMAN JIM BARRY: Mark?

MEMBER MARK STRATTON: Yeah, just a question. I mean, you focused a lot on the Santa Cruz itself, but areas like Cienega Creek, where we still have surface flows in that area, have there been any studies in that area of any previous agricultural use, or why is that area actually still maintained as a flowing area of the Pantano Wash versus some of the areas along the Santa Cruz River?

MR. MABRY: Yeah, the Cienega Creek is here, so it's a major tributary of - in the watershed, so I'm talking about the whole watershed, and Cienega Creek never had a wide enough floodplain to have any significant amount of agriculture; the same thing along the Pantano Wash. So, most of the agriculture was always concentrated along the Santa Cruz.

CHAIRMAN JIM BARRY: Anybody else? Does anybody in the audience have a question? Yes, sir.

CLYDE STAGNER: The balance of the population with the local water supply, based on that (inaudible; not speaking into a microphone) subtract evaporation losses and then allocate the remainder and what's (inaudible) now and what would be left (inaudible) for growth. Would that fit your plan?

MR. MABRY: This - this is not my plan. I'm just telling you what - the way it was for thousands of years before

we had industrial technology that allowed us to build a \$3.8 billion canal from the Colorado River and do inter-base and transfers of water and bring in water supplies from outside of this watershed.

UNIDENTIFIED MALE SPEAKER: Thank you, sir.

MR. MABRY: But - but, for 4,000 years, people had to live with the water that - that was available in the watershed.

CHAIRMAN JIM BARRY: Short one, Bob, please.

ALTERNATE MEMBER BOB COOK: (Inaudible; not speaking into a microphone) actually sit on top of "A" Mountain back in 1947 took a (inaudible) slide of Santa Cruz Valley looking south, and it is an amazing revelation of - even in 1947, there was a lot of small farming (inaudible) food crops, and it was taken in February of that year, and actually that - that colorized - that image of - of the lush valley there actually it was very lush.

MR. MABRY: I'd love to get a copy of that slide if you are willing. Thank you very much everybody.

CHAIRMAN JIM BARRY: Jonathan, thank you.

(Applause.)

CHAIRMAN JIM BARRY: Okay. Let's take a five-minute break. Jonathan, excellent, excellent presentation.

(Break taken at this time.)

* * * * *

<p style="text-align: center;">PRESENTER #4 DAVE TAYLOR, PIMA ASSOCIATION OF GOVERNMENTS: POPULATION TRENDS AND PROJECTIONS</p>
--

MR. TAYLOR: Here we are, the Old Pueblo, Optics Valley, one in the same. Following up on John's comments, this is where Frontera and Frontier crash together and that automobile wreck of two cultures, one coming north and one coming west, landed on top of local folks. We just celebrated Tucson's birthday, August 20th, 1775, but I would warrant that for 200 centuries the local folks had not lost Tucson, so it didn't need to be found. Typically, literate civilizations of whatever stripe think that time begins when they show up and can write about it. So, one of the things I hope we take from tonight is you get a sense of the time-depth of this community and of the people who have been here living successfully in it for many centuries, not just 150 years, which counts for most of us.

So, we're in the after-land, Optics Valley, and we're also a composite of a great number of different folks. I suggest another thing about John's talk that we think about when

we talk about population, our original port of entry was Guaymas. Anglo entrepreneurs married a Mexican connection; that's who had all the wagons and the horses, and we had many alliances, family alliances that related to that connection. When the railroad came in 1880, the axis of trade wasn't north and south anymore; it was east and west. The alliances fell apart, racially exclusionary language started showing up in

OLD PUEBLO - NEW TUCSON

- Frontera meets Frontier
- One of the oldest, continuously settled communities in the New World
- Yet, we are Optics Valley, a Mega-trend City, and NAFTA-Land
- We were all Native Americans for 200 centuries, then Spain, then Mexico, then the U.S.

the inland empire of California, and much of what we talk about population inside of Pima County is totally connected to those realities. And I'd also mention the fact that bilingual kids are not liabilities, but appreciation assets because our ties

PAST IS PROLOGUE ?

- Original port of entry was Guaymas - early Anglo entrepreneurs married a 'Mexican Connection'
- Coming of the railroad in 1880 changed the axis of trade from North-South to East-West. Alliances fell by the way.
- Our new 'Port of Entry' may return to Guaymas or Topolobampo. Mexico is committed to a Guaymas-Tucson Rail Corridor. NAFTA-Land returns the original pattern?
- Bilingual kids are appreciating assets not liabilities. They will make the alliances in Latin American our generation did not accomplish.

we do that two different ways: Something called a "Housing Unit Method;" that means, essentially, count up the building permits. We'll talk about it in a little bit more detail in a minute. And something call a "Composite Method," which is just, basically, record keeping.

deeds on the east side of the train tracks and we kind of turned away from each other, and we kind of forgot who we were.

Our new point of entry may, in fact, be Guaymas again or Topolobampo, or that port that's talked about south of Ensenada. So, one of the things I want to talk to you tonight is the seamless connection south of us, north of us, perhaps into with Latin America will just continue to evolve.

Let's step down to the nitty-gritty. Your Chair asked me to discuss population estimates. It's real simple: By Executive Order of the Governor, formerly DES, now the Department of Commerce, are empowered to produce population estimates annually for Arizona, its 15 counties and its 99 incorporated entities, and

The mandate by Executive Order of the Governor is that all State agencies have to use these numbers. Why it matters in your discussion is any time you're dealing with the Department of Water Resources at the State level, they're mandated to use those State-produced numbers. They don't have the option of taking another forecast.

What do we use the things for? It sets the expenditure limits of all incorporated entities and counties' budgets; it's our Proposition 13; it keeps the budgets from taking off. So, you get population growth plus inflation, and that's how much you can increase the budget. A

Housing Unit Method

- Last Census Enumeration, plus
- Newly Issued Residential Permits, times
 - % not built
 - % occupied
 - Household Size
- Equals Household Population, plus
- Group Quarters Population, equals
- Current Population Estimate

- detract (sic) the ones that were never built, subtract the ones that are vacate, multiply times household size, and that is household population. To that we add the people in group quarters population. What's that? Dorms, jails, prisons, nursing homes, places where people are not living independently, and the other current population estimate. It turns out if you do this well, it's really accurate; and Arizona does this pretty well. They are not great disagreements about the estimates since we first started doing this in the mid-'70s.

The other method is the Composite Method and what that is, is we break the population up into age groups, and then we use certain administrative records to estimate that cohort. We use birth records for the ages one to four, school enrollments five to 17, how many licenses are loose in the world for driving cars, gives us kind of a surrogate for those 18 to 64, and Medicare registrations for 65 and older. You take the ratio of

Population Estimates

- **Methods**
 - H.U.M., Housing Unit Method
 - Composite Method
- **Mandate**
 - Exec. Order: State Agencies
- **Uses**
 - Expenditure Limits, Econ. Estimates Comm.
 - Mid-Decade State Revenue Sharing
 - Economic Development

mid-decade revenue sharing; it's one of the options. Local communities can use the estimates for that; that's a new thing, and they're mostly used for economic development.

How do we do 'em?

Well, here's the Housing Unit Method: Take the last census, add up all the building permits - there's a little trick to how we count 'em and how we lag 'em

those administrative records to the age cohort in the last census and you apply it today against the record count. So, it's entirely predicated on State agencies keeping very good records of licenses to drive a car and school enrollments. The Feds take care of Medicare. Well, it turns out there's no problem at all about birth and death records.

They're kept extremely accurately, no problem. MVD licenses are all over the map; there's no consistency at a State agency level, year-to-year, over how they do that, and so it kind of messes this basic technique.

Let's leave the estimates for a bit.

We've talked about who does 'em, the State. Local communities do their own. They're not necessarily, quote, sufficient, unquote, but used nonetheless.

The other thing we're going to talk about are forecasts or projections. What's the difference? Well, forecast means I think I know the answer. A projection means that if you assume this, this and this, here's the answer. Well, none of us are brave enough to do forecasts. There's several ways we do 'em. The State does what is called a "Cohort Survival Model." What is that? It says, "Marcelino, you're of

Composite method

• Administrative records substitute for age cohorts

• Births >>> Ages 0-4

• School Enrollments >>> Ages 5-17

• MVD Licenses >>> Ages 18-64

• Medicare Registrations >>> Ages 65+

• Ratios of Admin. records to each age cohort are established at each Census

a certain age, a certain sex, you have a certain probability of making it to the next year. You have a certain probability of not making it to the next year. You have a certain probability of having a baby during that year." So, we survive the population one age at a time since the last census making certain estimates about how - who migrates in, who migrates out, and when you do that,

Population Projections

• Methods –

– Cohort Survival [The AZ DES/DOC method]

– Econometric [The U of AZ method]

– Composites of the above, plus Curve Fitting

• Mandate: All State agencies

• Uses:

– State agencies for capital planning

– Local governments for planning generally, however PAG does not use the State Projection(s)

you get population forecasts. Well, that's the stuff we use at the State level; it has this defect: It assumes nothing changes for 50 years. Everything changes.

The other way we can do these forecasts is to do it econometrically; that is, measure the economy. And the University does this very well. They have a national renowned model. They're quite good at what they do. And PAG, and other local jurisdictions, commonly rely on that series rather than the official State, or formerly DES, numbers.

And we can have composites of both methods, various states try and use an econometric front end - oh, five, six years' worth - to get the current business cycle, and then they use cohort survival thereafter, and that's a very, very common technique.

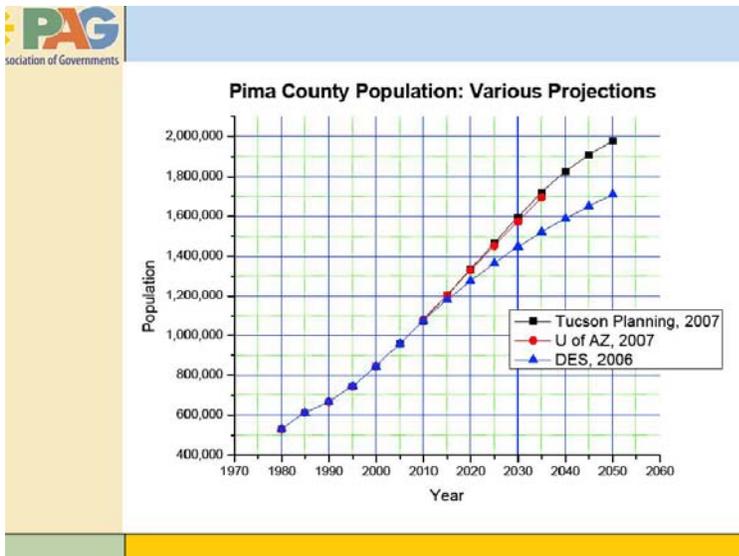
The mandate, again, by the Governor is that all State agencies have to use these projections. So, who do we care about in this line of work again? Water Resources, ADOT, any big State agency that's doing a large capital project anywhere in any of our jurisdictions are mandated to use these numbers.

What about them? Well, they use them for capital planning. All of the large utilities, people who are in charge of things called "water" and "wastewater" are sort of stuck with doing this because you have to have some way to explain why the capital plan reads the way it reads. And so engineers ask planners, like myself, where are the people going to be and how many are there going to be? And then I say, "Well, we live in the desert, where are you putting the pipes and I'll tell you

where the people are going to be." So, we chase each other in this tautology as to who the prime Mover is.

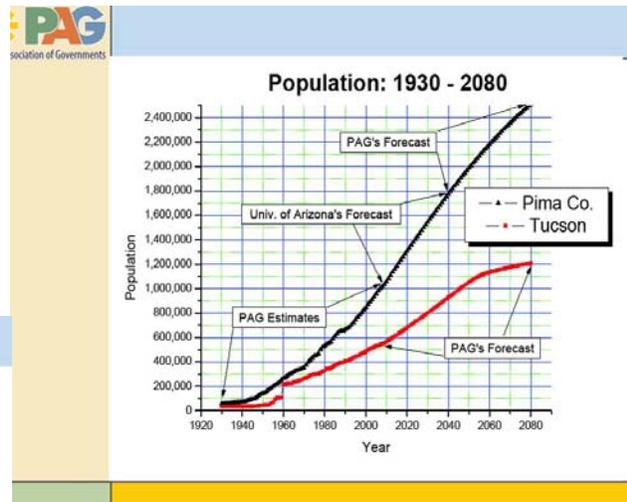
This is the result: The black line is stuff I made up when I worked for City Planning; the red stuff is what the University's econometric model says; and the blue stuff is the State. And why do you care about any of this? And that's because that guy, the

State's number, is way too low in the out years. It turns out right now it's a little high in this period, the period we're in right now. And so if I go to the next year, this is kind of what we currently believe is truth. These are estimates that have been based on past history. There's the present moment. The University's forecast - it'll be released tomorrow - is this



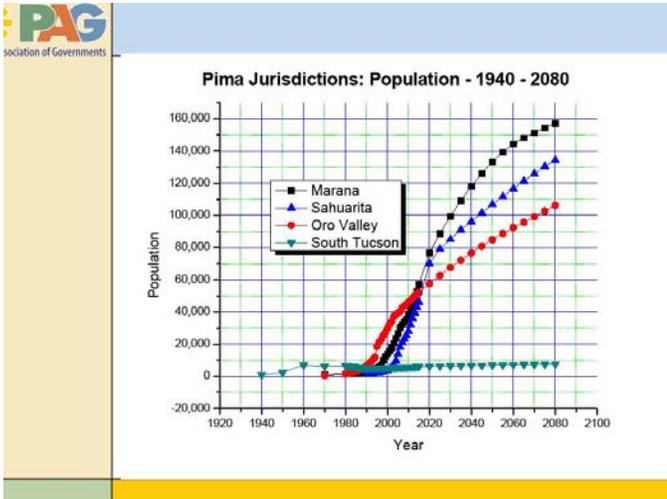
bit of a line, and then we fit, by curve-fitting methods, a likely end to that, but the end of anything you'd call a model is right here.

Why do I go further than that? Well, because the engineers who build 50-year capital life things want to go out further out than 2040.

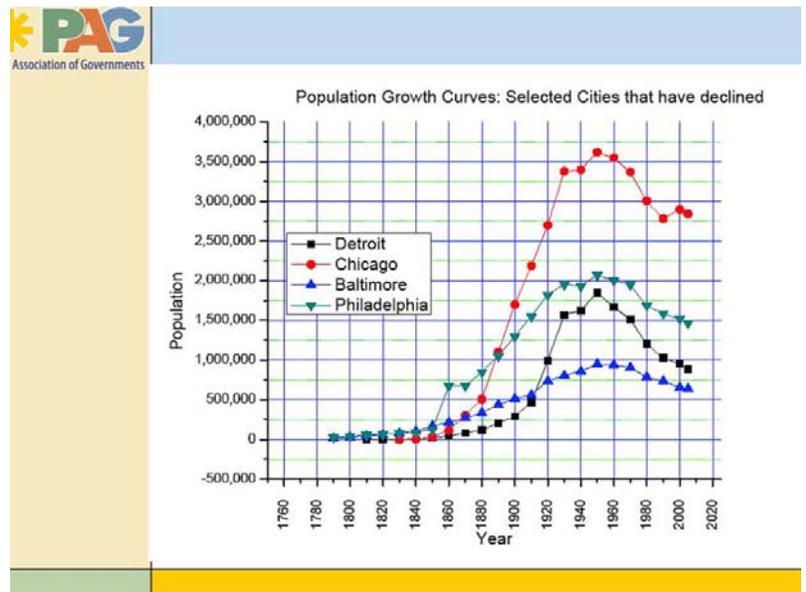


Does that make that real? No. Does it make it our best judgment? Yes. And below that just a guess as to how Tucson will grow.

And here's the other jurisdictions in the Valley, and you can see a consistent theme to all of these is they have a

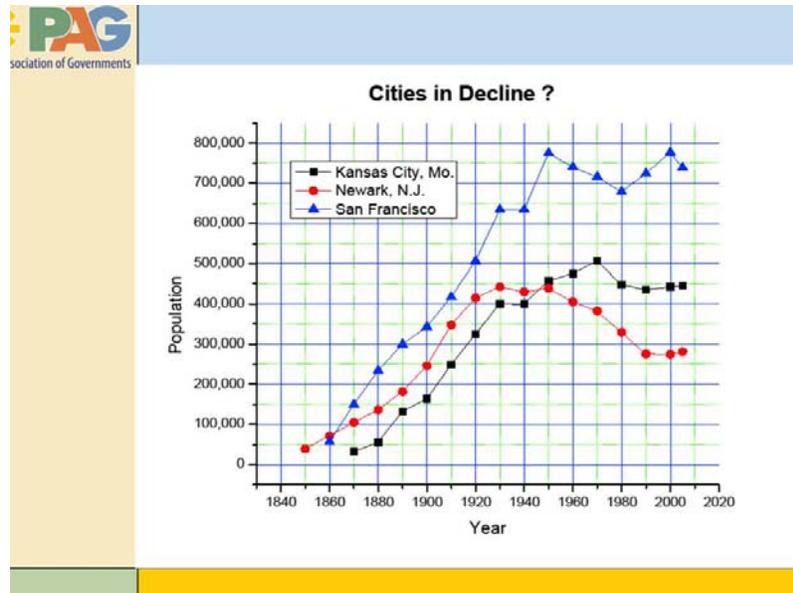


period of logistic growth nearly going to the moon, and then they kind of tip over and start slowing down; same thing here with Oro Valley; same thing with Marana. And you say, "Why do you guys think they're going to grow that way? 'Cause nearly all big cities have.



Here's an example of American cities that have peaked, and you can see what the shape is. Here's Chicago; here's Chicago today. Here's Philadelphia; same thing. What they have in common is 1950, Rust Belt Industries; that's when they reached their peak.

They're on a down-slide now. Does that mean anything especially treacherous? Well, it might in the case of Detroit. But, here's Kansas City, San Francisco and Newark. Take a look at San Francisco; it was at its height right in the end of World War II; it goes down a little; comes up a little;



comes up a little; goes down a little; comes - it might just oscillate like that forever, so might Tucson. Other communities the same.

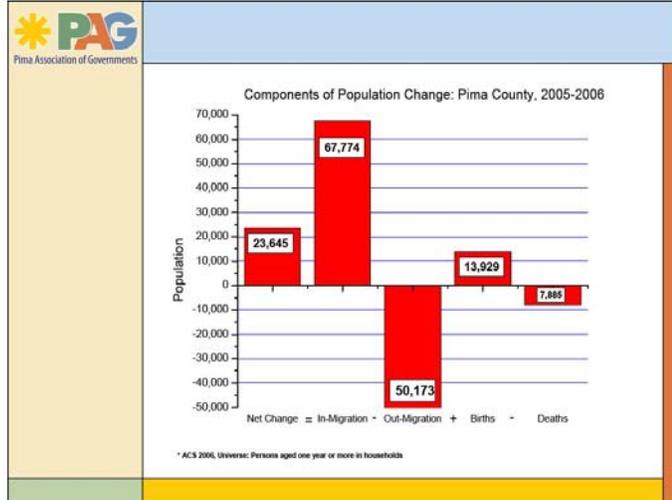
If I were to do Paris - I just did - by hand, this is what Paris looks like. Here's 1500, they were about, eh, 60,000 people, peaked at nearly 3 million people in 1920, and today they're about 2 million. Does anyone feel that Paris is a failing community or that you wouldn't go there? Or, if you stay at the George (inaudible) they're not going to nail you for \$853 a night? As I can testify to.

So, one of the things to keep in mind, even if Tucson, Pima County, reaches a peak population at some point in the future - opinions differ as to what that point is - and it starts to slide off, that doesn't mean much. We can just oscillate, fiddle about some point typically related to the care and capacity of the place, does it still have charm? Is it nice to live here? Is it affordable? Those sort of things. Are the schools nice? And you can go like that forever. How old is Paris? Well, the first population count in Paris was 59 B.C., okay? So, 2000 years they've been at it and they're still going fine. The airport is very busy.

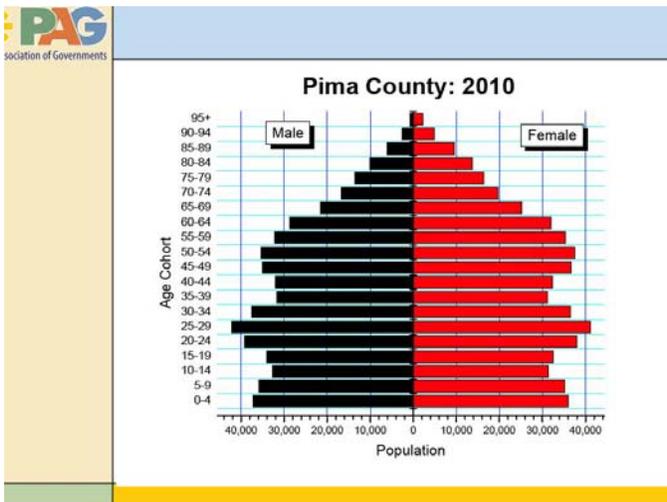
So, the thing to take from this is nothing untoward happens when you get off of that steep, climbing curve; that's very common in Rust Belt post-World War II communities. I don't have an example of a community that has climaxed that came from that background as Tucson did. We don't - we haven't been at it

long enough. We probably need another 40 years to find one that finally tops out.

This is what the components of population change are all about and, to get anywhere with our argument, we have to keep these straight. That's the number you see in the papers. Dave, how much did we grow? 23,645 between those two years. But, what really happened is that many people came in; that many people left. They were convinced of your argument, your service club's mission and why water is

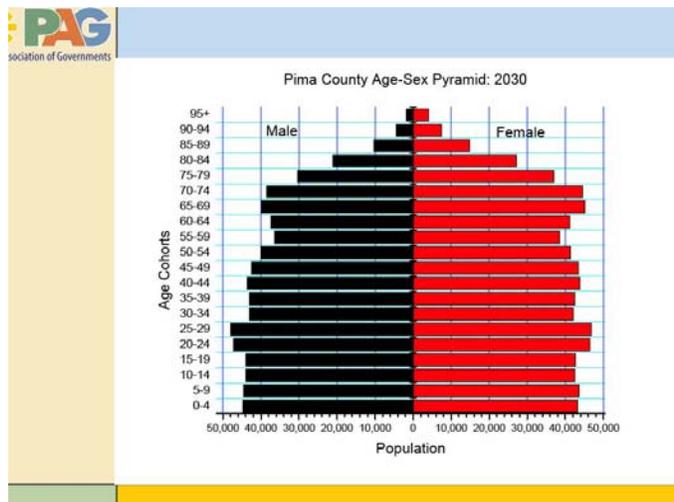


important, and they wrapped the tea set and all that literature and left. That's how many of us were born; that's how many died.



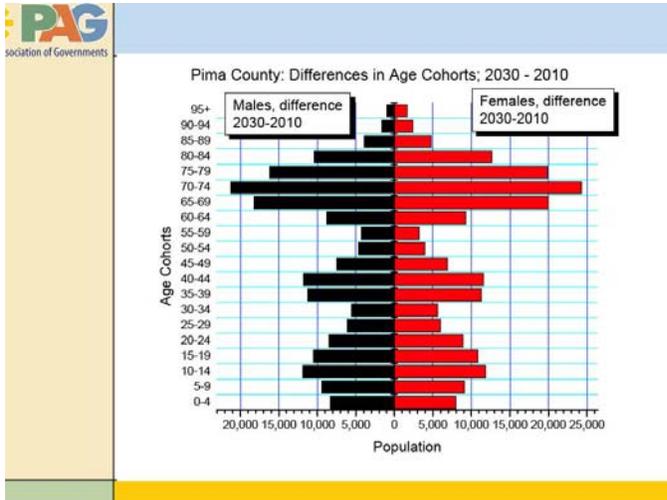
Now, an age/sex pyramid helps to describe what's really going on in the population, and it's okay if you look at this chart. Babies are at the bottom, seniors are at the top, boys are to the left, ladies are to the right; that's 2010. That's what we look like in

2030. Now, typically, rapidly-growing community, Third World communities, Guatemala, places like that, look like an ABCO Christmas tree, a triangle, very few people at the top, lots of babies. As societies mature, they start squaring up to where each age cohort has approximately the same number.



Let's go look at 2030. When I see a pattern like this that says

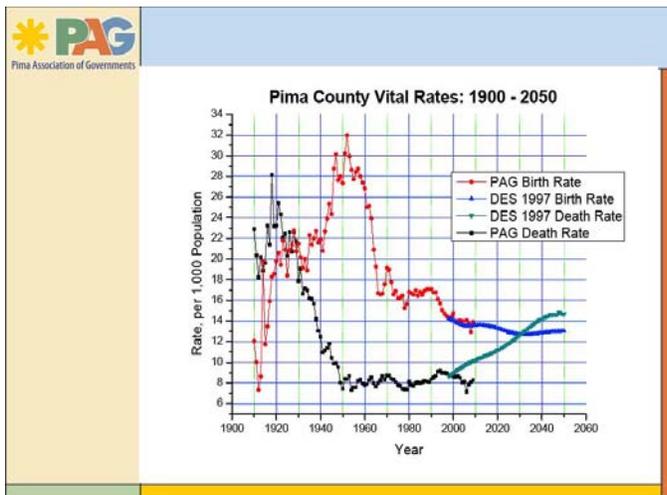
"Denmark," and it says they go socialist. If you subtract the difference between 2030 and 2010, that's this chart. Now, this is the DES official forecast, the one that we don't like so well. Why don't we like it? It makes us too old. There are



too many of these people and not enough of these, and way not enough of those. But, see what the tax consequences would be if this part - the working age - had to carry all of these and all of those. You would have taxation like western Europe, like west Germany.

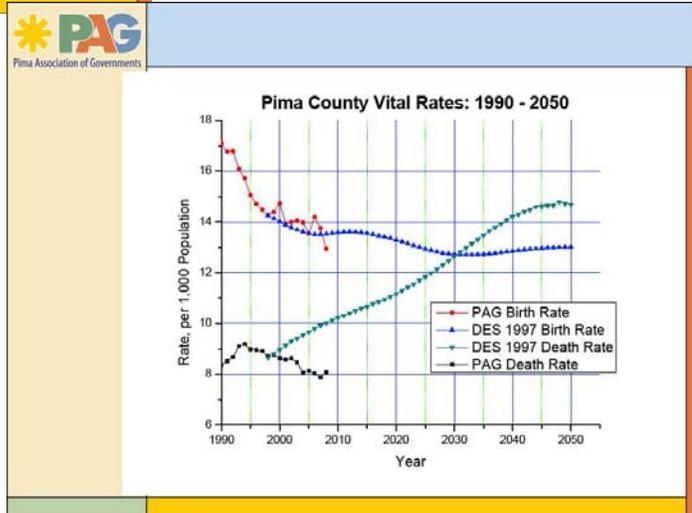
Now, what's wrong with the State forecasts is real simple. These are called vital rates, births per 1,000 people, deaths per

1,000 people. Let's take a look at deaths. Here we are back at 1900. Notice the death rate is above the birth rate. This was

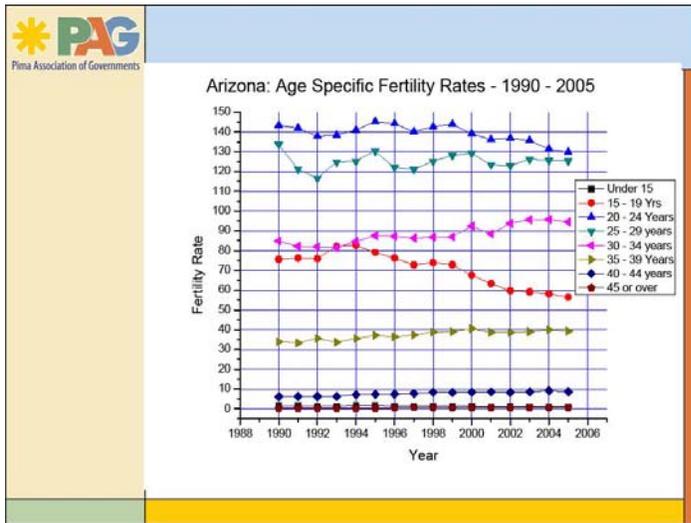


the tubercular cure place. Everybody came here for the cure; a lot of people died. We didn't make so many babies then. Here birth rates take off. What is this? This was right after World War II, folks. That's all those GIs that came back and that's what the baby boom's all about. Here's 1946, there's 1965 when it's over. Then birth rates have

just eased along this line; it's about 14 per 1,000. What's wrong with DES is they take it too low. What's really wrong with DES is the death rates, which has just been bopping around the number eight per 1,000 are - here's the first of their models, that's where they think the death rate's



going to go. They kill us off too fast and make us older than we need to be, and here's where the actual data is. The next chart expands that part of the chart. Again, here's birth rate; they're not doing so badly. This is the DES model, and this is reality. Here's death rates; there's their model; totally cuckoo.

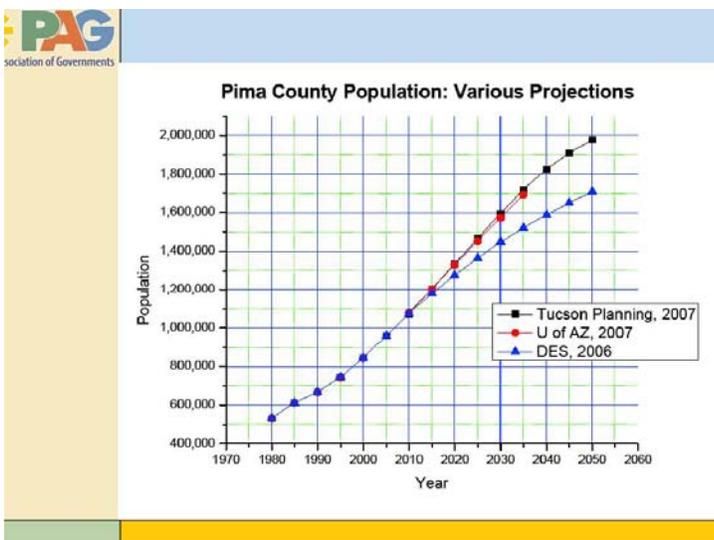


Now, they're going to hire a real demographer. We're going to get a better staff working at the Department of Commerce to clean up this act, but right now the official forecast, especially in the out years, are way too low. Right now, they're too high. They're insensitive to the economy. Here's an example, they don't have to be off much in the distribution of migrants by

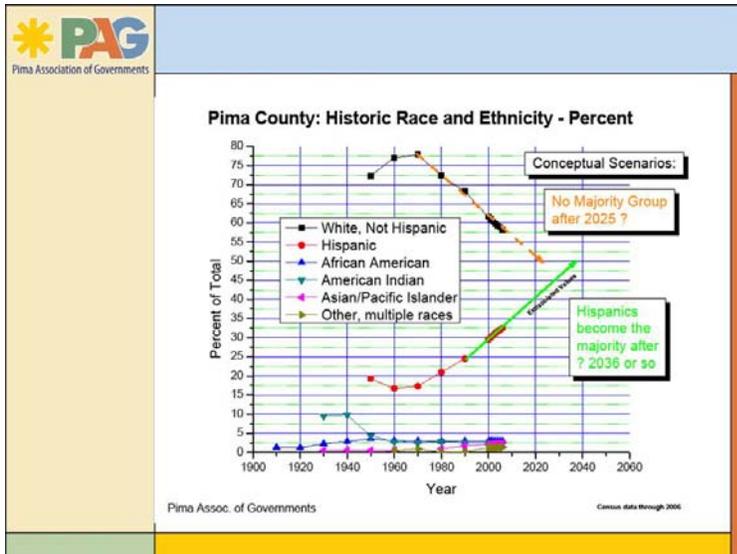
age. Here are women of child-bearing age that have lots of babies. Notice they're in their 20s and early 30s. Here are ladies who don't have babies, 'cause they're out of that business. The DES model, essentially, gives us way too many folks in this age - groups and not enough of these, and the reason for that is they don't have good records on international migration, only domestic migration, and because the pool of prone-to-migrant Americans was getting older and smaller, they naturally discount what I would call "Hispanic migration" that doesn't have a piece of paper and, because that's largely unknown and, especially unknown how many people of that status

stay here; it's just - just conduit to get to Denver, to hook up with your brother-in-law. Well, we don't know because much of this population doesn't stand around on corners waiting to join focus groups and talk about immigration issues.

Again, what are the effects of the forecasts is the University's model in red,

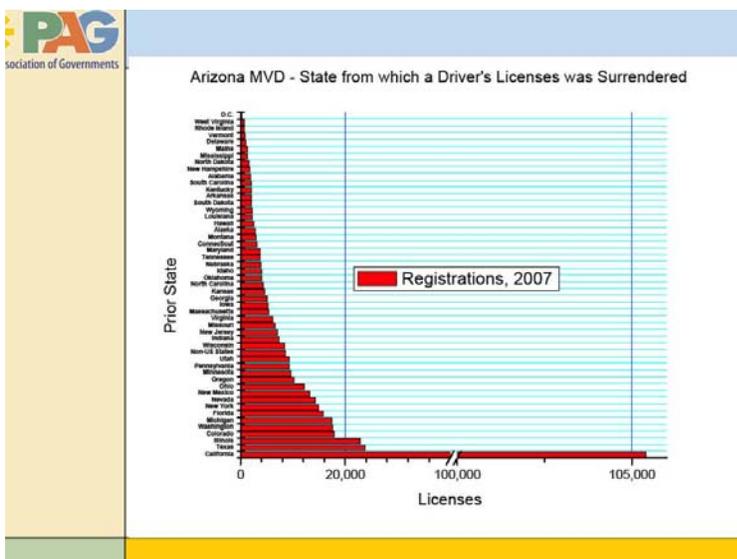


and the stuff that we've done for years matches up so much that we've currently combined them into one. This is where the State starts to diverge from that, and the result is: You're quite a few folks short of a full load by the time you get out to, say, 2050.



Here, we don't forecast racial or ethnic sort of distributions, but here's an example of what happens in a place like community - a community like Tucson where, back in the '60s, Hispanics were barely 20% of the population; Anglos were about 76% of the population - this is the City of Tucson, and Pima County are similar

in this. If you extrapolate - and that's what orange arrow is - that means Dave made it up - you would see probably about the year 2025 no group is a majority in Pima County. We are a majority/minority community. But, if we keep going, it looks like Hispanics might cross the 50% line about 2036. The key is to keep this concept in mind; that's one



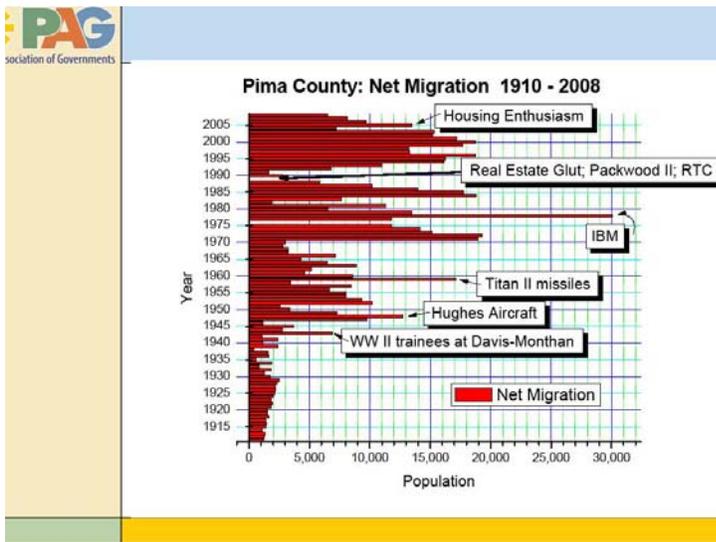
person's judgment as to how it'll be. We don't know. You can't predict flows in migration that are driven by Federal policy.

Again, that's what we're talking about. Let's look at migrants. Where do the migrants come from? California, Texas, Illinois. That's why we got WGN here and people

like Jim Barry. People from Chicago don't know any better. Surrounding states, New York and New Jersey. If we adjust for the population of the place, California goes to, like, seventh place. Where's California? There they are. Who wins? New Mexico, Nevada, Wyoming, Alaska.

Now, one of the things about our migration is people migrate to Tucson from surrounding counties, surrounding states, the Pacific Northwest, Chicago, New York, New Jersey. Where do they go to? Same place. All migrants return to wherever they came from if it doesn't work out here. The move was supposed to fix the marriage, fix the kid's asthma, you know, whatever; it didn't; you go back to where your network is. The net migration drives population growth.

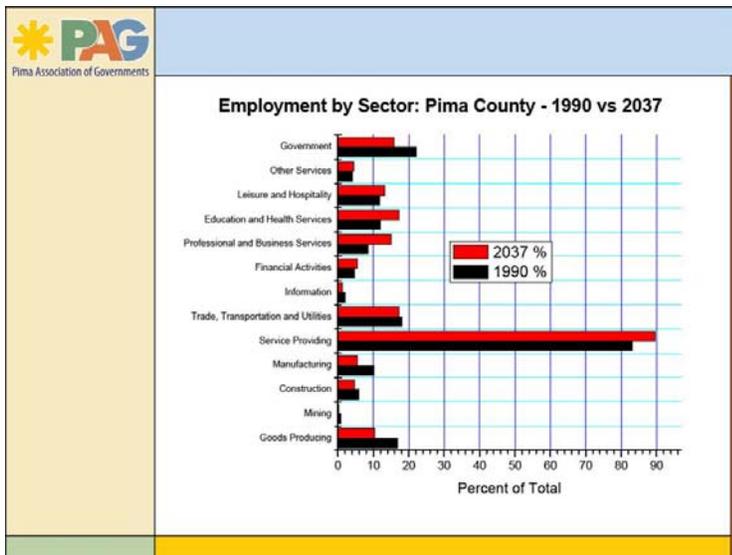
So, here, World War II, 90-day wonders show up at Davis-Monthan, Hughes Aircraft opens in 1951, Titan II Missile construction cycle, arrival of IBM. Here's a - not a peak, but a valley, the real estate glut, 1989, had almost no growth, and



the current housing enthusiasm, I guess I'll call it, that peaked in 2005. What's the point of this? Jobs drive growth. So, if we know what's going to happen on the jobs, we can predict population better. And that's why PAG and other jurisdictions tend to use the University's econometric model for most of their forecasts because it is grounded in the reality of current

economic cycles.

So, what's going to happen here? What do you care about this? The thing to keep in mind about it is how many service jobs there are. Notice that 90% of the jobs are service? There are already 83. We have to tax that if you're



going to have a revenue base that can drive infrastructure needs in the future. We don't.

Here's housing, another thing that is part of our cycle. Here's the normal trend line of housing price. Notice it got a little frisky and took off. Where should it be? About there. About \$220,000.

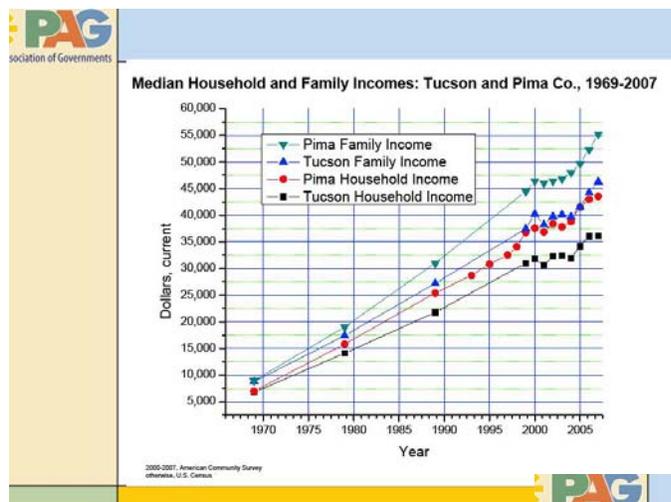
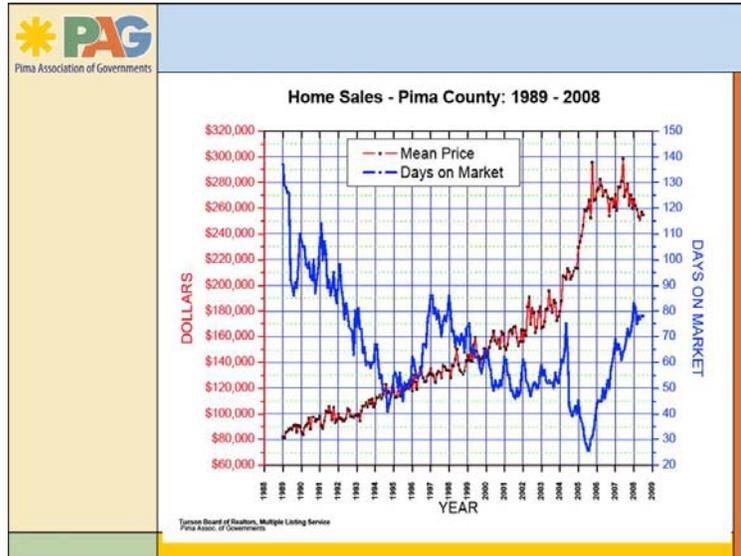
Where is it? It's just below \$260,000; it's got another \$20, \$25,000 to come down; that's average price where housing is priced as shelter, not as investment. Until it comes down to that level, you're not going to see any return in the housing market.

What's this year? Ooh, here's construction, down a mere 91% over last year. Mining is up; again, small numbers. Notice how many pluses

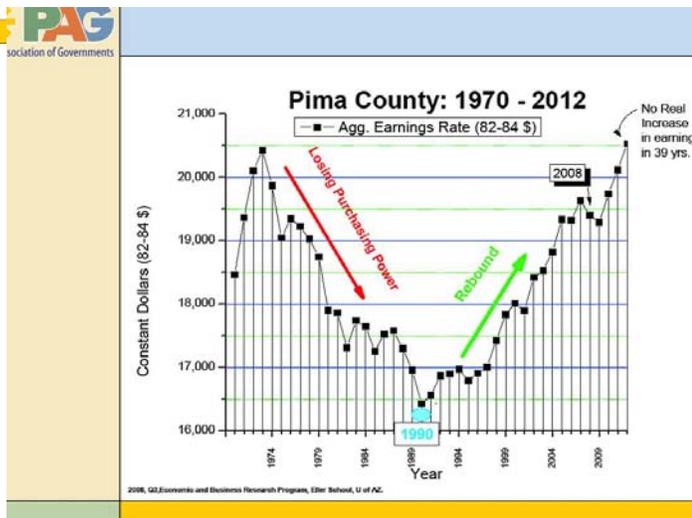
there aren't? Notice how many negative changes there are? 2009 is not going to be much more fun, except towards the end.

Here's the growth in income. You say, "Whoopee."

Looks like a Chamber of Commerce slide, getting better, Pima County. The reality - and this is the meanest, awful chart I ever made - this is the average earnings per worker adjusted for inflation. From 1973 to 1990, we lost purchasing power in Pima County. It has been gradually coming back, with a few dips. Here's the current dip. We

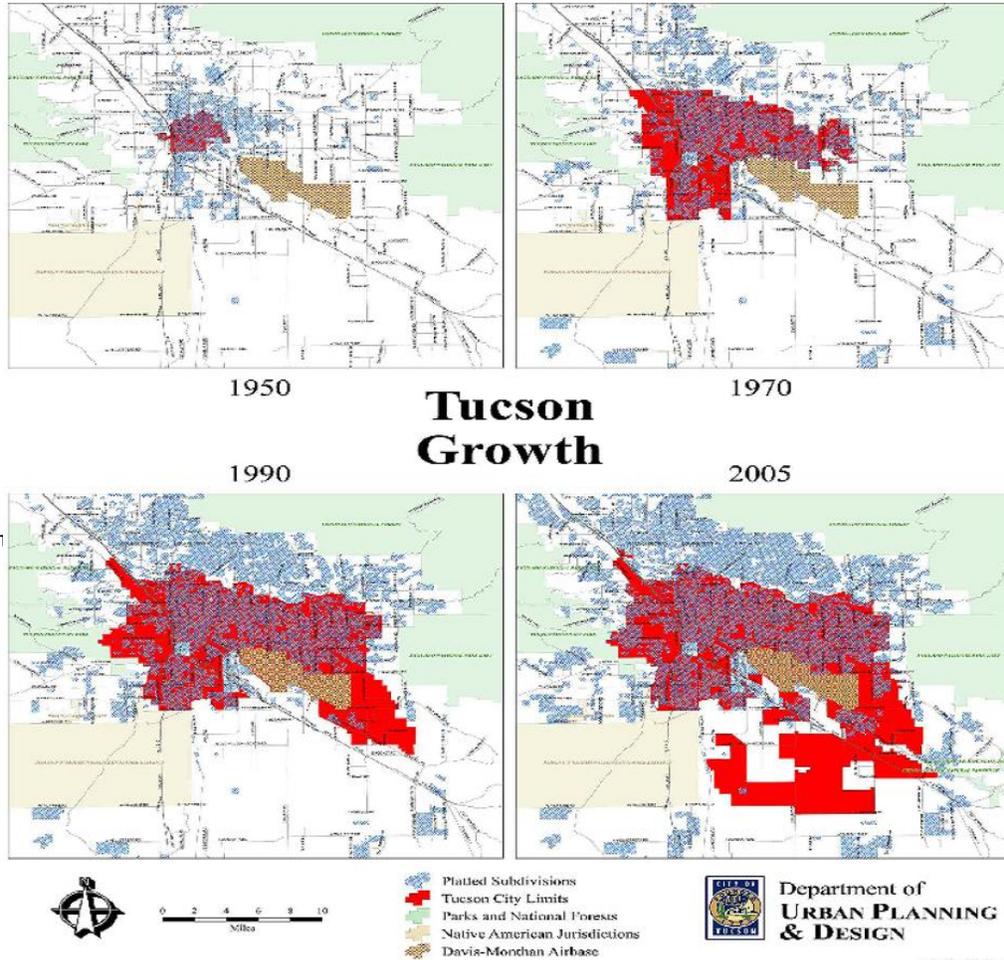


will, in the year 2012, be exactly equal in purchasing power with 1973. If you want your infrastructure dollars to last, we have to make sure we never do this again, because you got - your assessed valuation dollar in here is about half of what it was back here. You have a lot less money per dollar in your rates



to do anything with. And if our average earning power per worker can continue on this trend, all will be well, but notice that it's been 39 years and we're even.

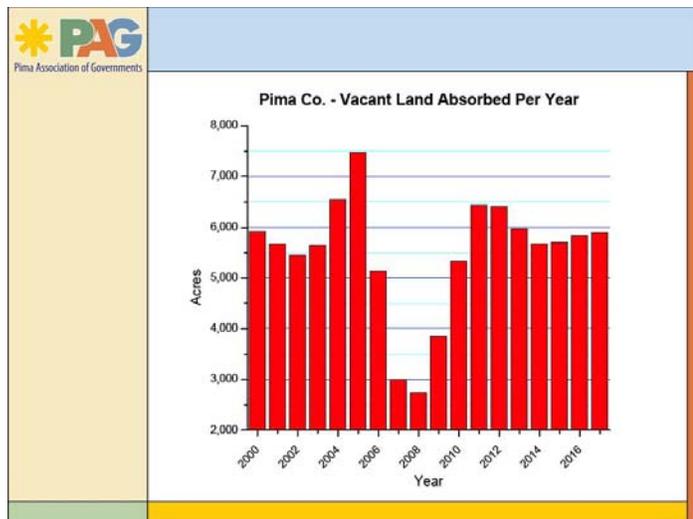
Poverty rates. They haven't changed markedly; got a little better some places; totally flat in Arizona. Tucson's - the little red stuff - we tend to bounce a little bit more. Here's Pima County. Nothing remarkable about poverty rates.



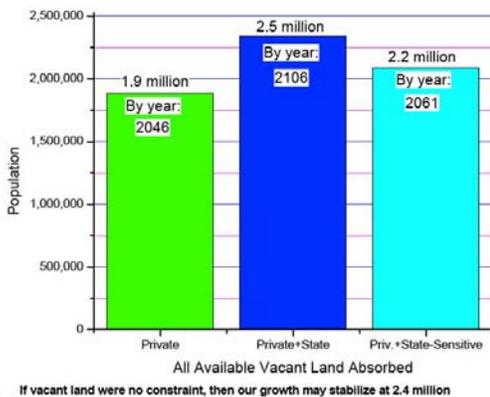
what was already planned. Except in the Southlands - in this area out here - that's going to be

continued to be the thing - all the action's going to be in the unincorporated County and the other jurisdictions if what you're interested in is dividing a more sustainable community.

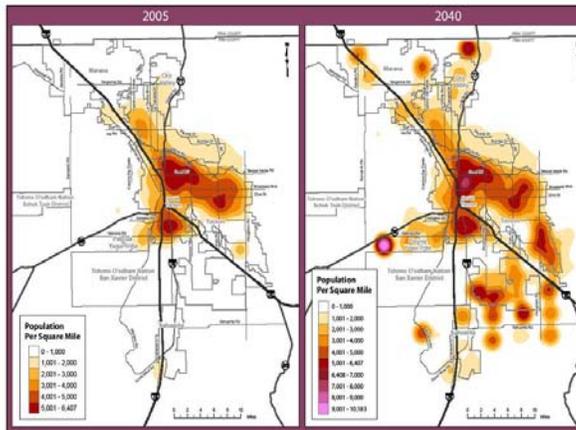
This is how much land we absorb per year, about 5,300 acres per year. What's that? That's 15.3 acres a day; used to be 12; that's 83



Maximum Growth of Pima County: Vacant Land Scenarios



square miles per decade. Consequences in, if you just measure all the private land, you run out of it in 2046 at about that population. If you use private plus State land, we go into the next century, near 100 years' worth, to about that population. And, if you take the sensitive lands in the Sonoran Desert Conservation out of this,

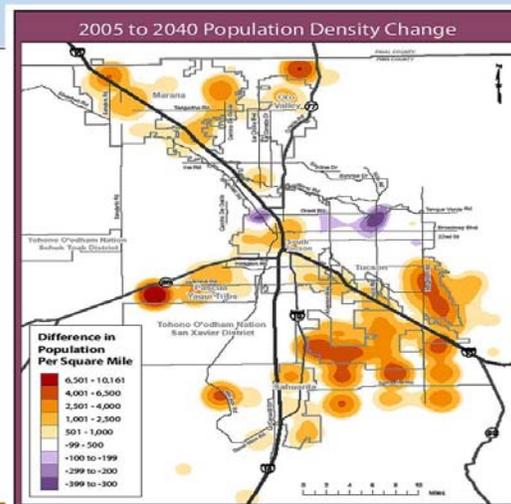


that's about when we're out of dirt, and that's about how big we are. And I'll leave it to the water people to say when they're out of stuff.

This is the consequence of the growth that we've just been talking about. This is where the population is dense in 2005, and this is where it's going to be in 2040. Notice the big additions here, big additions here, here, if

Arroyo Grande's real here, and in northern Marana

Again, the same sort of picture. Here's the deal: in 2036 we'll be the fifth largest state in the nation. Fifth. We're currently seventeenth. What does that mean? Only California, Texas, New York and Florida would be larger. Why does this matter? Well, it matters because we may be overpopulated and underdeveloped. We're not going to move our per-capita income relative to national average. Where it's 85% right now, it's going to actually decline to 80%. What's this mean for you and me?



It means our schools are not getting it done. The companies we're recruiting are not getting it done if you want a viable economy. We have to do a better job. We have to make more investments.

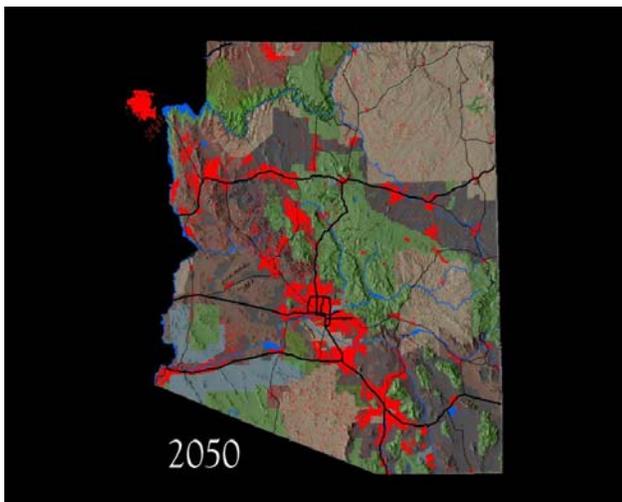
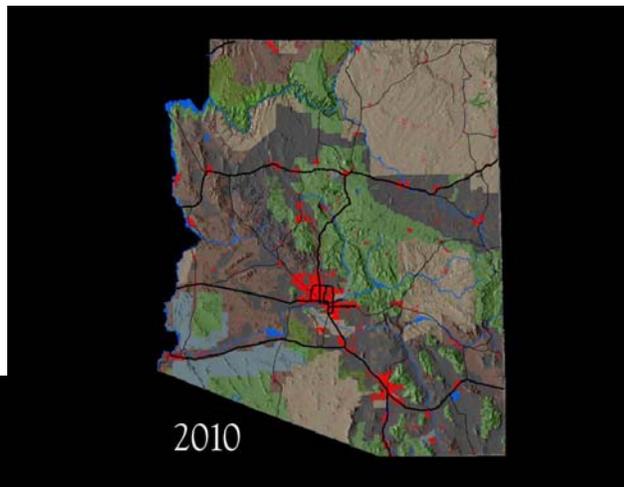
Megapolitan Geography



Lastly, megapolitan geography. We were going to have the guys that are really expert in this come talk to you and that didn't work out. Notice here, Pacific Northwest, here's the eastern seaboard, and here's Atlanta, the kind of Charlotte and Raleigh area, here's Florida. Eighty percent of the business of

America is done in the red paint; that's where almost all the new growth is.

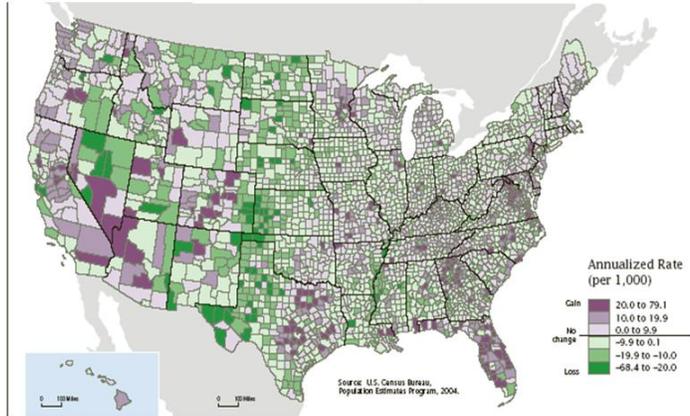
Notice this guy, the smallest one and the most rapidly growing. Also notice this guy and this one. If everybody in Arizona has a red dot on his head, this is where we are in 2010; that's where you are in 2050; it doesn't wanna stay there, does it?



All right. Notice - let's go back to 2010 - go forward to 2050, and that's what it is. It's goes from Prescott to Nogales. Why do you care? That's 90% of the gross domestic product of Arizona comes out of that now; in the future, it'll be 98%. All of the actions in this corridor. Why would you care? Well, you're going to share water with these people, or water politics, or power, or something.

The Sun Corridor: 10-20 %
Average Annualized Rate of
Domestic Net Migration –
Where Will These People Live?

And what I want you to think about is right now all the growth's up north; it shifts south by 2050. And notice the Casa Grande area, that's probably where the airport is, the next Phoenix.



Source: "Domestic Net Migration in the United States: 2000-2004", U.S. Census Bureau, 4/20/06 (www.census.gov/prod/2006pubs/p25-1135.pdf)

Lastly, here's this thing.

These - green paint means people are leaving; purple paint means people are flooding in. Notice the coast of California is losing population, but the inland empire is not. Remember that red map? That part, this part, and this part are joined at the hip; it's all one area clear to Guaymas, I think. I call it "El

Slurb;" it could be "Mexifornia." I don't know. I'm working on that name; may need some help there.

Chinese money. Why? We're the customers. Maybe they invest in the - in the port's development. Mexico's seawater maybe, Arizona science, their solar technology, California markets. What do you think? We don't know what this guy will be. Sharon Megdal sort of hinted at



El Slurb

- Seamless connection from Sacramento to Guaymas ?
- Mex-A-Fornia?
- Chinese Capital – Mexican Seawater – Arizona Science-California Markets
- Hyper-Regional Governance?

it.

The major issues we'll skip, 'cause we're out of time. Let me just go to this guy. Whatever you've read in the paper about the major issues, it isn't sprawl, it isn't even water, it's not sewer, it's not congestion, it's not trans- - it's not any of those things, it's this. And if you take anything from our comments today, take that line, please. If we are going to survive, we have to join hands. We're all in one boat on the same lick, and bickering and fighting with each other over the scraps is a loser game.

Major Issues

- Increased access to goods and services by means other than the automobile. Mobility can not be reserved for the wealthy.
- Preservation and revitalization of older portions of the community - reinvestment, infill, and rehabilitation. We must build upon a century of investment.

Major Issues

- Funding of public services by appropriate, urban revenue sources.
 - We must tax services.
 - By 2040, Az = 5th largest State: Over Populated and Under Developed?
- Regional approaches to regional problems
 - ***“The time for action is past,***
 - ***Now is the time for mindless bickering.”***
 - » Former TUSD Superintendent

So, as I end - as Jim kind of noted, we're at the end of our working lives - as I end my tour with you, one of the things I would say is keep holding hands. Stop screaming at your neighbors and see if we can't work it out. Thanks.

(Applause.)

CHAIRMAN JIM BARRY: We're going to go straight into - into Bob Cook. I will point out that it's ten to 9:00, and we're going to have to deal with that issue after Bob's done.

Major Issues

- Increased commitment to environmental quality and protection of endangered species. We need to buy open space and sensitive areas suitable for preservation.
- Construction of land use patterns that unify communities rather than divide them.
- Increased development of master-planned communities rather than subdivisions done in isolation.

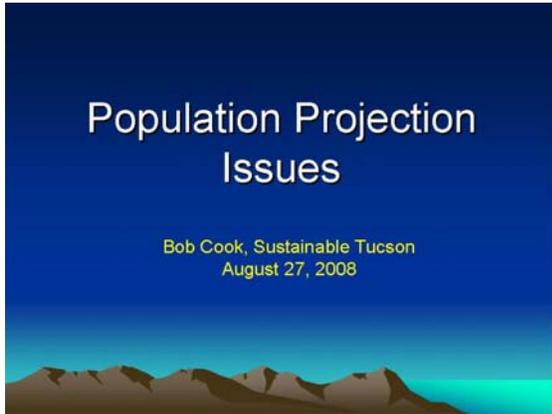
Major Issues

- Sprawl, however defined, is NOT the Issue
 - nor is density, water, sewer, congestion, transit, the environment, preservation, taxes, development, mixed-use, or growth.
- The issue is whether or not we can make a more sustainable community rather than a collection of revenue starved, competitive, parochial fiefs.

PRESENTER #5

BOB COOK: ISSUES WITH POPULATION PROJECTIONS

MR. COOK: I want to thank the Committee for inviting me to speak on this issue. I like to start out by framing this a little bit by an experience that I had in the earlier part of my career.



Back in 1990 - and that was the year where Tucson hit bottom, the last time we hit bottom, as Dave pointed out in a couple of those slides back - I worked - I was hired as a Strategic Planner for a major public utility, and I was - one of

my tasks in the early years was to provide analysis and projections for the requirements for serving that Service Area as time went on. That - that public utility was Pima County Community College District.

And back then, in 1990, we - we were experiencing rapid growth in our enrollments, and so one of the first tasks they had me do was to do an enrollment projection model, and it's very similar to population projections in that you, you know, you do a lot of econometric work. You - you get data sets and you run linear regressions and you - you see what variables correlate.

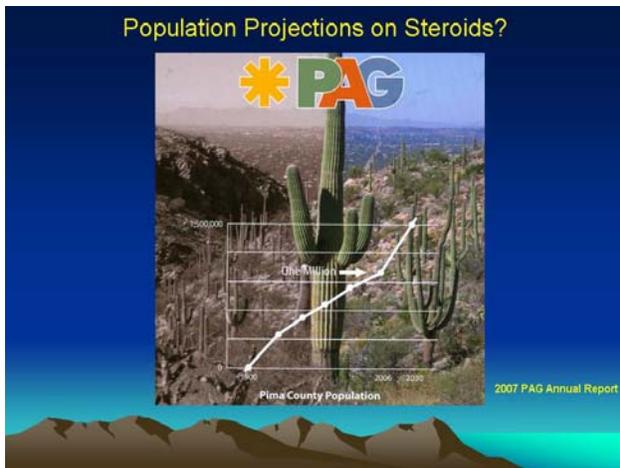
The conventional wisdom when I started that job was that population growth and unemployment rates were the - were the main variables that really drove it, and I found out that - that, in 1990, that really didn't explain what was going on in - in our enrollment patterns, and ran a number of data sets. I visited with Dave Taylor. I got a lot of data from him at the City. But, interestingly enough, I found out that one of the main variables that really drove - that was correlated with enrollment growth at that time was the bankruptcy rate. There was enormous bankruptcies in this area in 1990, '91, and so on, and that really was driving a lot of the - we had (inaudible) of the population, traditional students, nontraditional students. That enrollment projection model that I developed was very useful for about five years into the '90s. It explained a lot of the - the growth at the various campuses, differential growth; helped us do a good job of planning.

The reason I wanted to talk today, really, was about some concerns that was raised in, actually, the first pre-meeting of this Committee when the Director, Mike Gritzuk, of the Regional Wastewater gave his presentation of the - the Master Plan for the Wastewater System, and he explained that the - the infrastructure requirements for our future Wastewater System would really be based upon the PAG numbers for 2030, and



that raised a lot of concerns because, as a member of Sustainable Tucson, we had put out a little brochure for the Growth Forum in March, the *Arizona Daily Star* Growth Forum, questioning the assumptions of growth. And - and then when this came out in - in June, there was also an article in the *Arizona* - in the *Arizona Republic*, June 15th - this was June 16th - and I realized that

it was time to really sort of publicly jump into this issue because there's a real disconnect between the - the - the numbers that we're getting out of our official bureaucracies and what's actually happening with population.



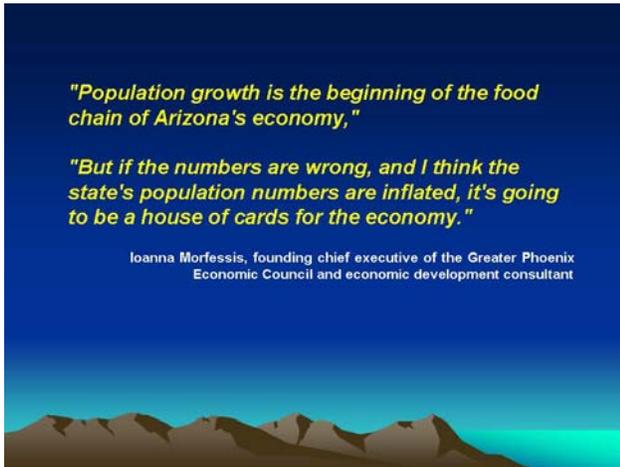
I went to the PAG website and found that if you look into the - the recent estimate numbers that PAG was doing, our rates had actually fallen by - by a half. We were only growing about 1% in the last year, even though we can see that the annual report of PAG - this was put out last November - shows an unexplainable jump in

population from 2006, where we hit 1 million people in the region. I still don't know - and we're all wondering really where - where this great growth is really coming from.

And to the extent that these - these population projections are driving decisions that are ultimately going to work their way through the planning process and into the electoral process as to what we're going to invest in, how much we're going to pay for it, and who's going to pay for it, I think it's really important that we get a little more sober and

begin to question what some of these population projections really are about.

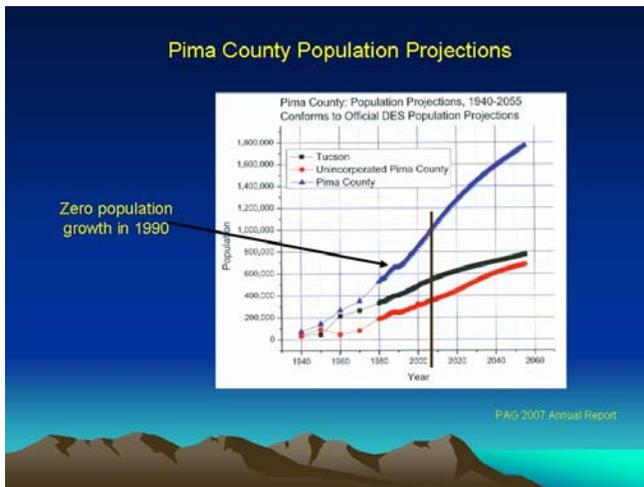
I think that a lot of the things that Dave said in some of his projections, there are a lot of assumptions built into those, and we need to, I think, make those assumptions a little more transparent and talk about them. I do agree that the economic variables are very, very important in really



understanding population change and, even though there are these four components, there's in-migration, out-migration, births and deaths, most of the action is going on in the migration category, whether in or out.

This was a quote in - in the article in the *Arizona Republic* of June 15th, similar to the article that I just showed. Iona Morfis (ph.) is a prominent Phoenician who founded the - the

Phoenix Economic Council, and this is what she said in - in June - something we've all suspected and most of us understand - which is that population growth really is a prime driver of Arizona's economy and has been if you look at our history; in fact, population growth and economy prosperity seem to be hand-in-hand. But, there's some suspicion that, perhaps, the numbers that we've been using in the last few years don't really match reality and that could spell problems for our economy, to the extent that our economy is based - or largely dependent upon population growth. What's going to happen when population slows down?



This is a chart that came out of that annual report in November of last year; it shows this rapid acceleration of population growth. One of the things that is often overlooked is - is this point in 1990 where the economy went south. There was a number of problems. We'd just gotten through the savings and loan crisis with the - which the Federal Government bailed out. Also, we lost a lot of

employment through IBM leaving town pretty much. It was a tough time in Tucson in 1990, and we didn't have any population growth. So, we actually have a precedent where we weren't growing. And I want to raise some questions tonight about really whether these high-growth projections really have a basis in our future.

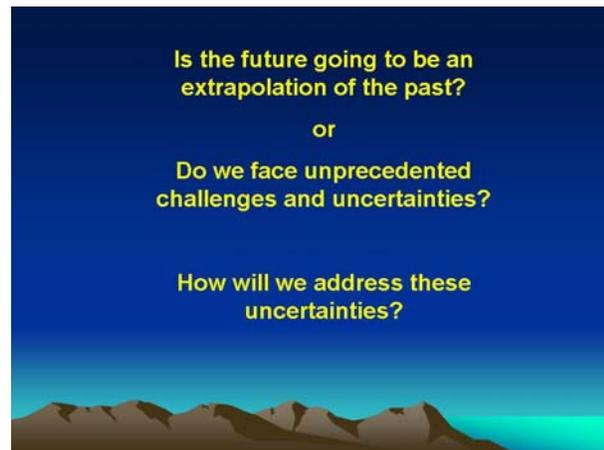
I think we all have to - to sort of, you know, come to a realization that, you know, in our - in our planning we really do have to analyze, with some scrutiny, these assumptions and projections that we're building into our plans, because they really do translate into decisions about investments later.



This is really the - the question that I want to leave you with tonight: Is the future going to be an extrapolation of the past, or do we face unprecedented challenges and

uncertainties? And I think the first uncertainty really is how we answer that first question. And then as we move on: How are we going to address these uncertainties?

I think the comment that - that Sharon made about understanding the context of population is going to be very important as we move forward, and I'd like to introduce some of the contextual issues that - that will affect how population



actually moves, either up or down, and I'm going to divide those into sort of supply and demand.

Supply being, you know, what is - what is going to take to build the infrastructure to serve future population growth? Arizona's been growing approximately 3, 3-1/2% a year; that's a doubling time of 20 years. So, every 20 years

Arizona's population has doubled in the last 40 years. What that means is we build a second Arizona every 20 years. The problem with that is that we get behind and we don't quite finish the job every 20-year period, and we are fraught with deficiencies, which I'll get in later.

These are some of the big areas of - of questioning, really looking at future water quality and the costs of bringing additional water into this area.



I think it's clear to most of us that, you know, at some price water supply is infinite. I mean, we can bring in as much water as we can, as long as we can pay for it. Can we pay for it, and what will that be?

I'm not going to get too much into my favorite, which is energy costs, but I will refer to some aspects of it. This is probably one of the

biggest uncertainties facing our economy right now, and I'll try to provide a little bit of evidence; it has to do with our - how we plan our Water System; but, more broadly, it has to do with the vulnerability of Arizona and Tucson's economy to these rising energy costs, and also construction costs. I'm going to look at that a little bit.

And climate change mitigation, I wanted to bring that in, because that's a cost that hasn't really been figured into any of the equations. When we had an energy expo a year and a half that PAG put on, I asked one of TEP's analysts, Tom Hanson (ph.), who runs the solar program for the corporation, whether they were including carbon taxes in their calculations in comparing - comparing coal fire versus solar energy. And, well, he said, "No, we're not."

So, we're not even including in - in our planning some of the variables that are going to really come into higher importance, and anyone who doesn't believe that we have to invest in climate change mitigation is not paying attention. This is a critical civilization challenging issue for us, as well as energy. All of these factors will affect how we can prepare the State to accept additional population in migration, that is. And, to the extent that these costs go higher, the attractiveness of Arizona will diminish.

Let's look at some of the demand areas. Job creation, job destruction. Well, if Tucson's economy, or Arizona's economy is so dependent upon development and growth and - and - and housing and so on - and that's actually crashing right now -

how is continued population going to grow? There's sort of a tautology there. If we're not growing, where are the jobs going to be created? And, to the extent that jobs are driving the attractiveness, that's a big question mark. Absolutely, we're going to need to diversify our economy and, certainly, diversify it towards sustainability, build jobs that create sustainable products and services, but I don't see that on the table as a priority issue for economic development yet. Certainly, our ability to afford what our incomes are, what our levels of consumption are.

Vehicle miles traveled. I wanted to put this in here because it's a variable for traffic demand or traffic volumes. And the conventional wisdom was that this would - and, by the way, in the '90s in - in Pima County, vehicle miles traveled was - was increasing three times the rate of population growth. So, we were a driving culture and we were driving faster than we were growing. And the - the assumption was that this would always go up, up and up, but as we're going to begin to see - there's been a big story about this particular variable. And because we are a car-dependent, sprawling southwestern City, you know, the relationship with our car is going to change how our population changes as well.

Climate. We've - we've heard reports. We have a lot of scientists at the University of Arizona that have been studying global and regional climates, and it looks like the 20th century was the wettest century in the last 1,000 years, and the southwest is due for, not only the impacts of long-term climate variability patterns - i.e., we're moving into a drier period historically - but the - the human-induced effects of climate are going to create a much hotter, drier area. Will - how will this affect the attractiveness of this area in terms of the - the rates of population growth that we've seen in these official projections?

The burden of growth costs? Big problem. You know, one the attractivenesses here is that we've had an unusual business model for growth; basically, we - we lower the cost to - to newcomers. We don't charge very high impact fees. Only recently have we ever had impact fees, and they're nowhere near the actual costs of growth, so they - they get pretty much amortized to - to the future, and we use growth to pay for the needs of our operational budgets going forward, and we sort of - sort of eek out small amounts for our capital budgets to - to - to serve that - infrastructure needs, but we never quite get the infrastructure job done.

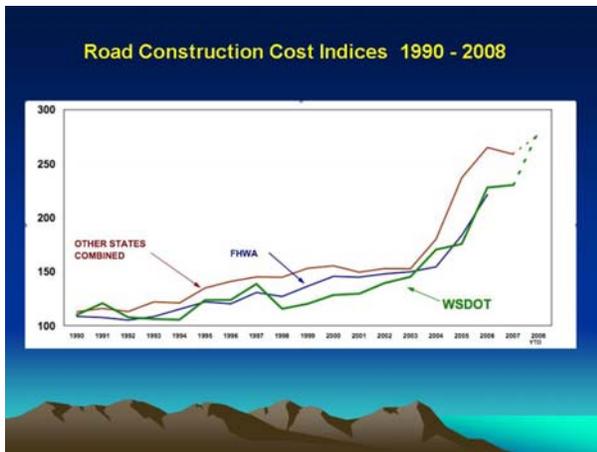
Cost of living, quality of life, those are pretty self-explanatory. This is just a major, major story, and if

you're not paying attention to it, I don't think we're going to do very well in planning for the future.

The price of oil was \$10 a barrel ten years ago. Now it's over \$110 a barrel. That's a - that 's - our economy was built on \$10 to \$20 a barrel oil, our whole economy. How long



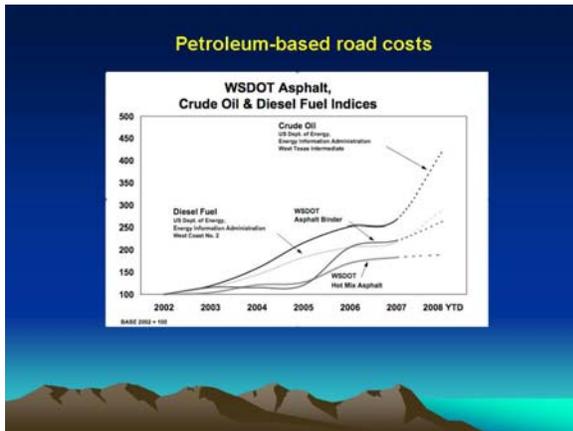
is this - this rise in - in oil prices going to affect us? I mean, how long is it going to keep on going? Well, some people say that because of the fact that we've gotten all the cheap stuff, the easy-to-find stuff, and the demand around the world is increasing at such a rate, we're - we're actually coming into a time when we're going to have permanent increases in - in this particular resource which is so essential to our economy.



And this isn't just oil for - for driving our - our transportation, our mobility. If you - much of our infrastructure depends upon the cost of oil in - in costing out. This is from the Washington State Department of Transportation. These are trends for - for some of the inputs into road construction, as well as oil itself, and you can see just in - in - in that six-year period dramatic changes of - in that index reading. Let me go back to this. This is just an overall composite indices of road construction costs in Washington State, probably not too dissimilar from our own. And you can - you can sort of look at, you know, infra- - any infrastructure, I mean, in - in terms of the water infrastructure and the wastewater infrastructure, they use some of the same materials. If the future per-unit cost to



serve people is going up like that, who's going to pay for that?



components of road construction costs. So, the - the bottom line here is that we can't - we - we can't follow that as a model. We really have to be pretty - much better about estimating our costs, because what this is going to lead to is the fact that we've got "X" amount of projects out there in which many of them will never be built because we simply cannot afford - we've never budgeted for the real costs that they're



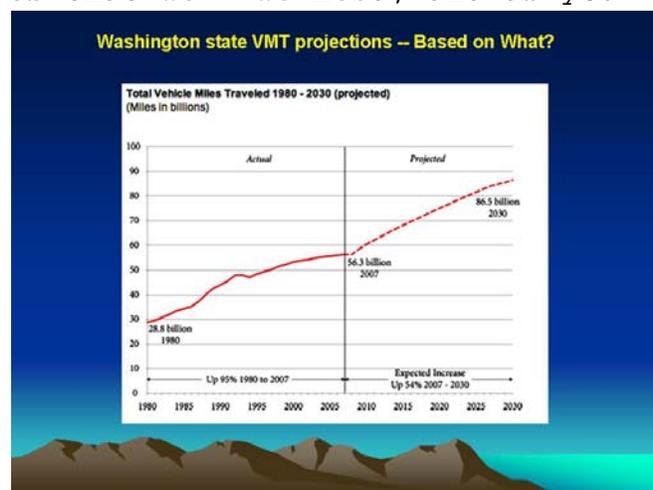
When we did the RTA Plan back in 2006 - and that's been lauded as one of the best practices regionally, in terms of a cooperative successful election where we actually got a transportation plan passed by the voters - the - all of the budgets for all of the road projects in that plan were costed in 2006 dollars. This - this indicates that during that same period this was the inflation of the

going to be. And this is just a change in a 12-month period.

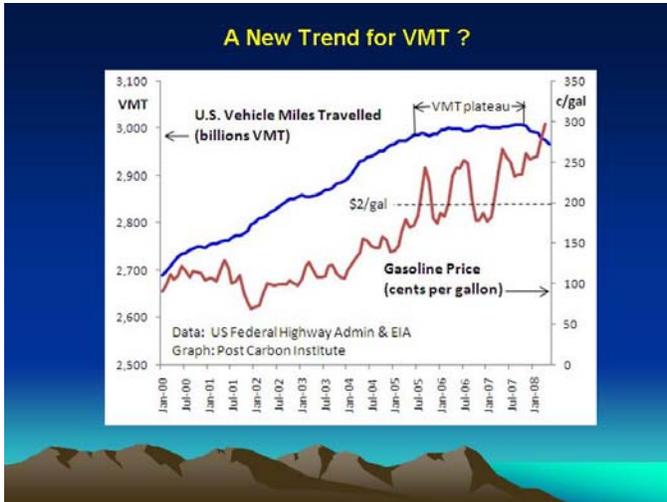
Now, these fluctuate; maybe they're not as dramatic this year as they were last year. But, as we'll see, there's many, many factors that are driving the cost of construction up. This is one of 'em, China. Look in 2005, look at the - the impact, construction in China, had on - on the availability of materials

to - to build the infrastructures that we - we need, and as you - anyone who watched the Olympics, I mean, how - how could you not be awed by the fact that there's a whole, you know, 21st Century civilization going up over there.

I think Dave covered some of these differences in - in - in - in the different jurisdictions locally. This - this issue



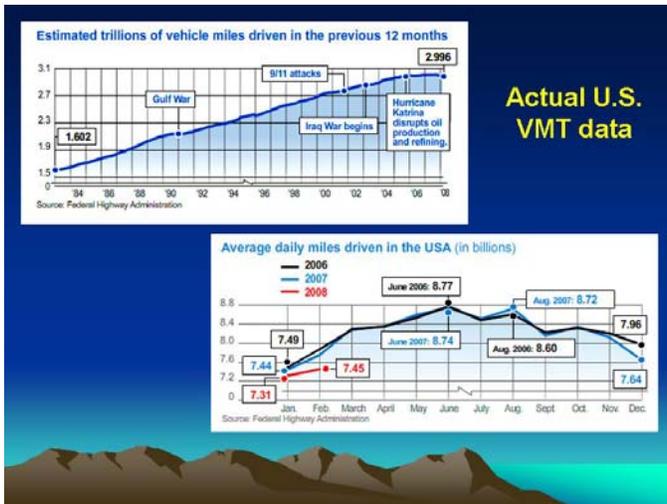
will come into play, I think, when we're talking about values and - and what priorities we're going to develop regionally when some jurisdictions are poorer than others; some have different preferences for growth rates; some want to grow fast; some want to grow a little bit slower.



Going back to that VMT thing, as I mentioned, the VMT curve was always upward-sloping. There had never been a time when it - when it peaked, or - or began to decline, but in the last - what is this? The last seven years, we - we actually see a dramatic change, and there is some correlation between the cost of gas and the - the amount of driving that we do. I suggested this during the

RTA process that the price elasticity of gas - of gasoline would actually impact the demand for road capacity; it was ignored. But, here we're seeing the fact - that, in fact, there is a response from people when things get too expensive. So, we're looking for alternatives to cars.

Again, some more slides.

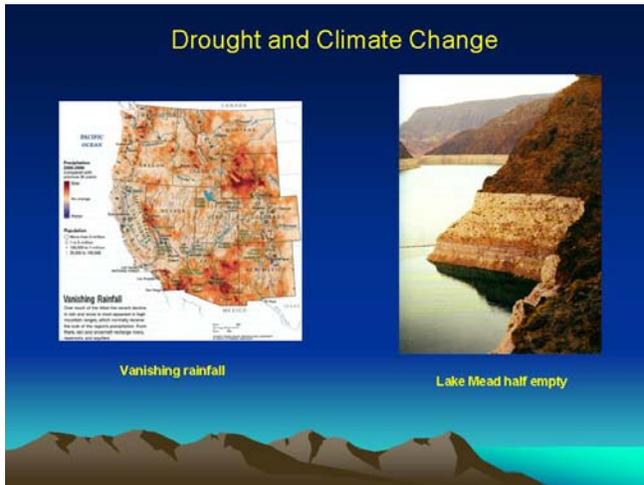


This one on the bottom actually shows in the last three years how the VMT is going progressively down and - as you can see in this bottom. And, in this one from '84 to 2008, you can see that - that long curve and then slightly declining. What's - what's the future going to be? This is - this is not unlike what - what I presented with the PAG slide in the beginning about this unexplainable jump in population.

This is a chart that was done by the Transportation Planners in Washington State. It's very interesting because it actually shows a leveling off of - this is up to 2007 on the - on the left here - these are actual numbers - you see a leveling off of - of VMT, and we're actually seeing that nationally, as I said. But, for some unexplainable reason, they're - they're projecting this great increase in driving. So, where does that

come from? What's the basis of that? Are we so addicted to building roads and can't handle the - the notion that maybe, you know, people aren't going to be driving as much and we're going to have to do something else about providing infrastructure for mobility?

This is really, really big. This was a map that was published in the *National Geographic* in February; it indicates that in the last - well, between 2001 and 2006, these are the



precipitation change patterns. We're in Ground Zero here in Arizona in terms of heating and drying. And if that doesn't raise some concerns about the future in our ability to attract that kind of population growth to keep our economy going, well, I don't know what is.

Lake Mead. Chris did a great job of showing you the - the Lake Mead volume picture; it's - it's half-empty right now. I could've said it was half-full, but the statisticians are saying that it's almost impossible that it will ever be full again; that's of concern.



This came out of a very important study that - that Nicole was a lead researcher on called "Five Trends Tucson," the City of Tucson published it in 2004. I really liked this particular graph because it

really shows what's going on in the - the difference between what our - our capital needs for building infrastructure to meet population, both current and future, and our ability to actually raise the capital. On the left here you see existing unmet needs and then future growth related to unmet needs, and then you look at the - the capital available for those needs. This is somewhat dated, but it shows that the backlog of infrastructure deficiencies are competing for limited capital, and this is going to happen when we start anticipating what the - what the project budget for the Wastewater Treatment System is

going to be, because it is going to be competing with transportation infrastructure, et cetera, all the deficiencies

GENERAL PLAN IMPLEMENTATION COMPONENT

"Implementation is perhaps the most important step in the planning process. Plan implementation allows the policies to take effect, builds trust with the citizenry who participated in the planning process, and provides the opportunity to evaluate the outcome of the policies. It is the purpose of the Implementation Component to ensure that key policy initiatives within the *General Plan* are implemented. The Implementation Component sets a time frame for: (1) developing a Cost of Development Element implementation time frame....."

City of Tucson General Plan

that we're going to have because those RTA projects aren't going to get built because they are too expensive, and the RTA Board is - is grappling with that right now.

I don't want to go into this too much right now, but when Bonnie Poulos was on the City Planning Commission back in 2000, I believe, she and a number of other revolutionaries were - were very concerned that - that the City of Tucson get more aggressive about actually calculating the total costs of growth in - in Tucson, and developing a cost of growth model based upon actual data, and linking that with - with a fair cost recovery system for allocating the costs of that to - to growth. And we've got some really good language - at another time we can go into this. Most of this has not been done - this was

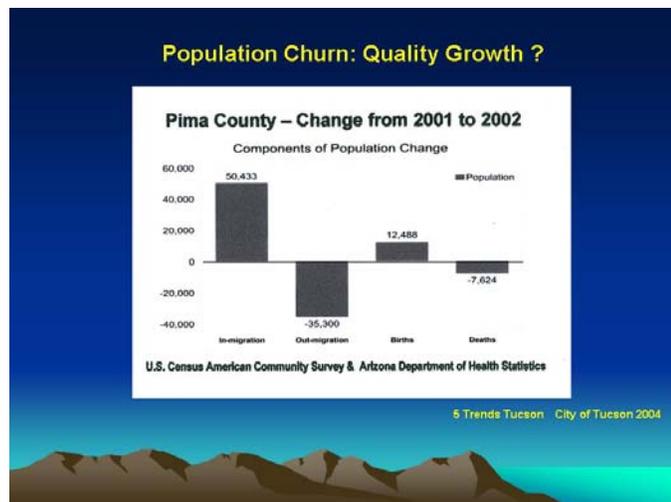
III. CITY of TUCSON GENERAL PLAN IMPLEMENTATION COMPONENT

- **Cost of Development Element Implementation Time Frame**
 - a. "Submit a time frame for implementation of the policies set forth in the Cost of Development Element (Element 12). The implementation should include completion of a study, using an accepted methodology, to determine the total cost of growth and development in prioritized areas of the city. As a part of the study, develop a Cost of Growth Model that tracks actual costs over time."

City of Tucson General Plan

actually a mandate for the City to - to actually analyze the - the true costs of growth, total costs of growth. We have done small studies for separate pieces of infrastructure, but we've never looked at the whole thing. And if you don't know what growth really costs, how can we plan for growth? That's a big question in my view.

This was also in that same general plan. I



think it pertains to what we're doing right here, which is that, you know, we need a cooperative regional process to really come up with the estimates and projections that we feel comfortable with, because they're going to drive our decisions.

I also have this - I want to do a different sort of twist than - than Dave did, because this population churn is - is a characteristic of our growth, and it's a question mark. I mean, is this the kind of growth we really want to have? You know, everyone says, you know, people just want to move to Arizona. I was at the Annual Water Conference in June up in Phoenix, and the State Land Commissioner said he just got back from New Jersey and, you know, all of his friends and relatives, they all want to move out to Arizona. Well, yeah, I mean, that's the story everyone says. But, you know, a lot of people come here, but there's something about it here that makes people want to leave, a lot of 'em. So, you know, what is going on here? Is this the kind of population growth that we're really going to be planning for?

And, as you can see, the births and deaths are pretty much, you know, low-profile in terms of where the action is.

Inflated projections to sell a tax election ?

Congestion tomorrow

- In the next twenty years our population will increase by 54%,
- 67% increase in elderly/disabled transportation needs, and
- 96% increase in vehicle miles traveled; these factors will result in:

A 550% increase in severe travel congestion



And - and how - how are these going to - this in-migration, out-migration pattern going to change when all of these uncertain variables are brought into the picture? I don't think we have a past that we can extrapolate that's going to explain that, so we're going to need some new tools.

Finally, I just wanted to end on this Power Point slide that was in part of the - the sales of the RTA election back in 2006,

and I put it up there 'cause I hope when we come to developing a campaign for the capital costs, and the way we're going to finance the new Water System and the new Wastewater and Effluent System, that we don't produce Power Points like this, because it - it . . . it indicates - I mean, it's sort of like this fear thing, I mean, you know, this horrible thing is going to happen if we don't do something about it, and population will increase. Well, there's no certainty in that statement, as we can see. Certainly, the - the vehicle miles traveled data is - is totally erroneous in terms of what's going on right now.

And what's interesting - I actually went back after - after reviewing some of this RTA material, looking at PAG's traffic count maps that they do every year - and one of the most contentious projects in their RTA Plan was the Grant Road widening. I looked at traffic counts on - on Grant Road in 2005, 2006, 2007, in fact, traffic counts were actually going down in that corridor where it was going to be expanded at the time of the election, and they were putting this kind of - of propaganda out there to sell the election. We can't afford that. People don't believe this stuff.

Finally, in conclusion, I want to just make a couple of broad statements that I think might be helpful in addressing what I think are - are serious uncertainties. We need to address these things. We need to actually put them on the table and analyze them and - and bring - bring some critical thinking to them. We need to be adaptive, you know, to - to what's really going to happen. We can't build a Wastewater System for

We need a Water / Wastewater / Effluent Plan that:

- Addresses all major Uncertainties.
- Is Adaptive to emerging reality.
- Is Flexible to the appropriate scale of need.
- Prioritizes the needs of current residents over future residents.
- Allocates the infrastructure costs of new growth to new populations.
- Is Responsive to all members of our community.
- Considers a Sustainable balance of all infrastructure needs.

another 500,000 people that may or may not come here. We don't have the - the - the surplus capital or the ability to finance that at a time when there's so many other things that need our attention too.

Going down to the bottom one. We need a balance. We're going to have to balance all of these

infrastructure needs. Flexible, flexibility to the appropriate scale of need. Prioritize the needs of current residents over future residents. This is - this is absolutely essential. I mean, we really need to take care of our deficiencies and serve the people who live here well, not the people who are going to migrate in, in the future under some - under some assumption. And we certainly need to allocate the infrastructure costs accruing to new growth to new populations; that's absolutely essential.

So, when we do budgets, we really need to have - have explanations that show what part of the system that we're going

to be paying for is really an improvement of the system for current residents, and what part of that investment really is going to accrue to growth, and we need that very clear and transparent because that will determine the way we decide to allocate the costs. So, thank you very much.

(Applause.)

CHAIRMAN JIM BARRY: Committee, I'm going to ask you if you have any questions to hold 'em. I'm going to throw it open to Call to the Audience and I'm going to ask you all to stay so we keep it a quorum, but I wanted to make a suggestion. We haven't allocated enough time. This is a three-and-a-half-hour meeting. We can't have three-and-a-half-hour meetings. I think we need to revisit our schedule at the next meeting, okay?

Call to the Audience.

* * * * *

CALL TO THE AUDIENCE

CHAIRMAN JIM BARRY: Call to the Audience. Yes, Colette.

COLETTE ALTAFFER: Just one quick thing, and that is what's becoming apparent is that, although this whole group is meeting on the issue of water, it seems as though you may need to consider recommending that we do a more holistic look at not only just water, but fuel, because I don't think what most of us realize is that the reason we have six and a half billion people on this planet is because oil has made it possible for us to grow enough food for that many people, and by some estimates when we run out of oil we will only be able to feed 2 billion people. So, I think we need to be factoring in a lot more than just water and what that's going to do to the Tucson region.

CHAIRMAN JIM BARRY: Oh, geez, Colette.

Mr. Stagner? That's right, put me out of my misery here.

CLYDE STAGNER: Ms. Megdal earlier mentioned something. I have here a copy of the permit for Avra Valley CAP Water Blend, and it is one of the best permits I've ever seen - I've had some experience with 'em - and I urge every one of you to get a copy of this.

In here, they - they measure the quality of the water before and after it's withdrawn, they cite many, many pollutions, many without MCLs. They never quote the U.S. EPA. They require the monitoring be done by a separate entity other than the operator with the specifications, which brings up the point we should have a Water Quality Department in this City. They also require quantity analysis and report and, not only

input, but require the evaporation of those ponds to be reported. We need such a balance in what you're doing. You need to get the total water available, subtract the losses, allocate your present needs, assign priorities to the remainder of the water, and then let the politicians fight over prioritizing it later, which they'll do. Thank you.

CHAIRMAN JIM BARRY: Thank you. Anybody else? Yes, sir.

HECTOR CONDE: My name is Hector Conde. I'm going to repeat what I said yesterday to a representative of the Recharge District in a meeting in Catalina, and what it is, is that we have a situation in our area where there is no recharge. The recharge is done in Avra Valley, which is 15 miles away and 15 - more than 1,000 feet under the - on the altitude; therefore, since the water - everybody knows - doesn't go uphill, we are never going to recharge, we're never going to have Safe-Yield in that area.

I know that there is nothing you can do here except try to make some common sense in the legislature so that they don't allow these things to happen in the future. (Inaudible) thing that it's happening in Oro Valley, it's (inaudible) pipe from the CAP canal to the town, but it's not going to recharge; it's going to blend, or probably clean - clean the water for use. And I made a study a few years ago and I concluded that there is not going to be Safe Yield by 2025 in that area. Thank you.

CHAIRMAN JIM BARRY: Thank you. Anybody else? Yes, ma'am.

MAXINE STECKLESS: Quick question. We've heard about the -

CHAIRMAN JIM BARRY: Give - give your name, please.

MAXINE STECKLESS: Oh, sorry. Maxine Steckless (ph.) from the Cienega Watershed Partnership, and I'm here because I know that part of the planning includes looking at the whole - the Santa Cruz Watershed, but the results of the contribution by the surrounding watersheds, including, for example, the Cienega Watershed and how it contributes to the water of the Tucson Basin. Is there any consideration of these neighboring watersheds and the - and the growth and development of those areas and how it's going to impact the Tucson Basin? That's my question.

CHAIRMAN JIM BARRY: You know, in - in Call to the Audience, we can't response. We can only - okay. Anybody else? Well, I'll entertain a motion for adjournment.

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Call to the Audience) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on August 27, 2008.

Transcription completed: September 5, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF SEPTEMBER 3, 2008

List of Presenters:

1. Arlan Colton & Albert Elias: Presentations on Land Growth and Pima County

Presenter # 1

**LAND USE GROWTH IN PIMA COUNTY
PRESENTATION BY ARLAN COLTON
PLANNING DIRECTOR FOR PIMA
COUNTY
AND
ALBERT ELIAS, PLANNING
DIRECTOR, CITY OF TUCSON**

MR. COLTON: Okay. I normally move the mic down, but this is ridiculous. I've never had to move it up before.

CHAIRMAN JIM BARRY: We did that just for you.

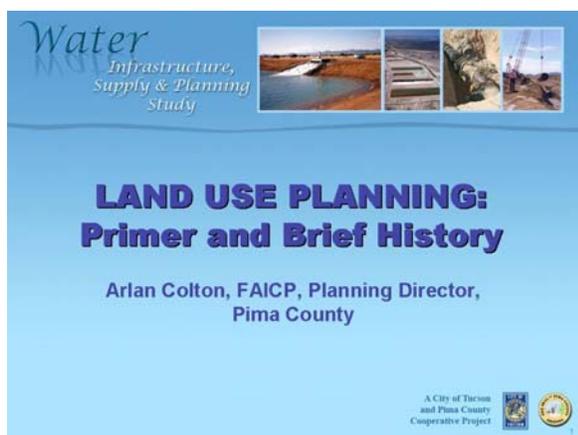
MR. COLTON: Thank you.

MR. COLTON: Yeah. Thanks very much for - for having me and - and Albert here to - to talk about Land Use Planning. We're - we may go through like lightning speed. There's a lot to cover and we cut out a lot on threat of a lot of things.

CHAIRMAN JIM BARRY: Could I - let me interrupt. So, you have a little bit more time than when we first planned.

MR. COLTON: Oh, now I got to stretch?

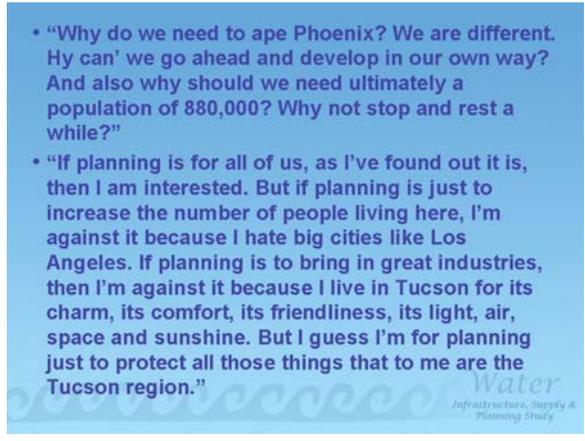
CHAIRMAN JIM BARRY: Well, you don't have to - you don't have to talk really fast, you can talk normal.



MR. COLTON: I - to begin the - the discussion about - I get to talk about planning for the past, if you will, 'cause it's important to understand what - what happened here. Everybody arrived here at a certain time in their life, that is, at a certain point, things were going on, and the knowledge usually is based on from whenever - whenever you arrived here. If you were born

here, it's still based on whenever you arrived here, usually plus six or seven years.

Let's look at the issues that we're being discussed over a period of time. I pulled out three quotes - these are two of them - from a report. One of my colleagues, former colleagues, wrote an excellent history of land use in Pima County, and I was able to summarize a lot of material from that, but you can see these - these quotes. The - why do we need to ape Phoenix? We are different. Why can't we go ahead and develop in our own way? Why not stop and rest a while? That was a quote from 1958 by a - one of the original founders of the Tucson Regional Plan - which I'll talk about - back in the 1930. And this report actually has a picture of her from 1912 hugging a saguaro - that's kind of interesting - literally.



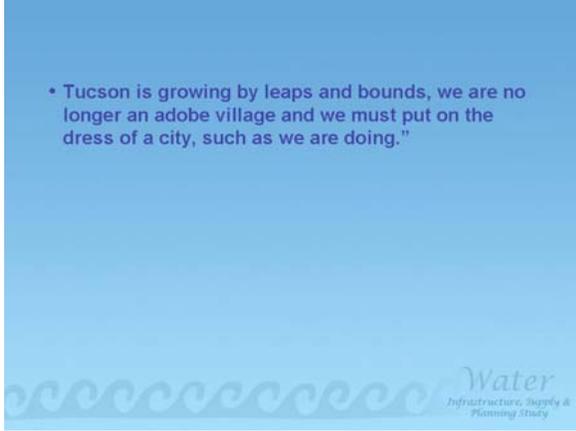
• "Why do we need to ape Phoenix? We are different. Hy can' we go ahead and develop in our own way? And also why should we need ultimately a population of 880,000? Why not stop and rest a while?"

• "If planning is for all of us, as I've found out it is, then I am interested. But if planning is just to increase the number of people living here, I'm against it because I hate big cities like Los Angeles. If planning is to bring in great industries, then I'm against it because I live in Tucson for its charm, its comfort, its friendliness, its light, air, space and sunshine. But I guess I'm for planning just to protect all those things that to me are the Tucson region."

Water
Infrastructure, Supply & Planning Study

The second quote: Planning - I won't read the whole thing, you can read - "If Planning is for all of us, as I found out, then I'm interested. But, if it's just to increase the number of people living here, I'm against it because I hate big cities like Los Angeles." This quote came from somebody who was quoted in the *Arizona Daily Star* in 1943.

And the final quote, "Tucson is growing by leaps and bounds. We are no longer an adobe village and we must put on the dress of a city, such as we are doing." 1929.



• Tucson is growing by leaps and bounds, we are no longer an adobe village and we must put on the dress of a city, such as we are doing."

Water
Infrastructure, Supply & Planning Study

To understand what happened locally, you need to understand a little bit about Arizona planning history at the state level, and in - in the '20s the then Secretary of Commerce, Herbert Hoover, developed what were considered to be Model Zoning Enabling Legislation. They also

ultimately did Model Planning Enabling Legislation; that got a lot less air play.

Arizona Planning History Highlights

The Legislature:

- 1925 Municipal Zoning enabling legislation
- 1943 Local Post-war planning boards
City and County both formed them in the same year
- 1949 County Planning and Zoning Act
- 1973 Urban Environmental Management Act
Framework for general planning in effect today
- 1974 County amendments on zoning and subdivisions

Water
Infrastructure, Supply &
Planning Study

History Highlights (continued)

- 1980 Groundwater Management Act
- 1998 Growing Smarter Act – comprehensive revisions
Plan Elements
Public Participation
Planning mandatory
Municipal general plan election
- 2000 Growing Smarter Plus Act
Water Element

Pima County Planning History focus' on land-use
planning and ties with water

Water
Infrastructure, Supply &
Planning Study

zoning - and - and Arizona was actually one of the first 11 states to adopt Herbert Hoover's concept of model Legislation.

In the '40s, local post-war planning boards, recognizing that there was going to be a lot of stuff having to happen in terms of infrastructure, men coming back from the war, et cetera, lots of work to be done, post-war Planning Boards were all in vogue, and the Legislature passed authority to local government to do them, the City and the County both formed them that very same year.

The next major milestone was in 1949. Counties got planning and zoning authority in the State of Arizona; these were permissive in nature; not mandatory. But, it also - the 1949 Act did - what we're still living with today in counties - it confused planning and zoning and - and smooshed them together in one big thing, and we've been trying to pull them apart ever since, so far unsuccessfully.

In 1973, the next major piece of Legislation - remember this is shortly, a few years after Earth Day and Environmental Awareness, they passed the Urban Environmental Management Act. What this did was it provided the framework for general planning in cities and towns that are the bases for what's in effect today in Arizona. The - again, planning is not mandatory; it is optional, but it is - it is there. If you plan, you follow their framework, all the different elements of a plan.

In - also in 1974, following that, they didn't give the counties that same - quite - quite that same authority, but county amendments on zoning, which made zoning mandatory for counties - it used to be permissive - and gave - was passed, along with subdivision authority. Now, obviously, a lot of subdivisions occurred in the unincorporated area, but there wasn't a whole lot the County could do about them. They looked at them, and that was about it. The City also got involved in subdivision review in counties back then because of that.

Other major highlights in 1980, the Groundwater Management Act was passed, and I'm going to talk a little bit about water in conjunction with planning here at - at various points, but the - the connecting points at - in - at the State level are few and far between. I'll try to uncover them all.

In 1988, the Groundwater Management Act, obviously - you're, obviously, very familiar with now, so I'm not going to go into any detail there - but, the impact for us dealt primarily with subdivision activity. In 1988, and then again in 2000, the Growing Smarter Act, and the Growing Smarter Plus Act were adopted. These were the first breakthrough growth attempting to - to make planning mandatory, growth management attempts that the State of Arizona did.

The list of items under the Growing Smarter Act are up in front of you. There are many, many more. I didn't list them up, just some significant things, but the importance of new planning elements. The importance that now cities, not counties, once the City Council adopts a plan, has to put their plan to a vote of the people, that's unique in the nation, nobody else does that in the country. And then in the Growing Smarter Plus Act, adding the water resource element to the planning process are significant changes as a result.

Now, one of the things that I wanted to focus here, and to let you know up front, before I get any criticism about this, is that I'm focusing on land use, and to the extent that it ties in with water from a land use planning standpoint that - I'm not focusing on transportation, although as the Chair stated - stated, everything is interconnected, and that is the planner's nightmare, and I'm not really focusing - except in one or two mentions on conservation, so I'm not going to talk about the Sonoran Conservation Plan, although, arguably, that is a land use component, but a land use for conservation.

Planning History: 1920

City Population = 20,292; County Population = 34,680

1925 First City commission on planning - failed
1927 Tucson Zoning Commission
First City zoning ordinance adopted 1930
Based primarily on current usage of property
April 1929 - 200 people attended public hearing

Water
Infrastructure, Supply &
Planning Study

So, what I've done is I'm going to take you decade to decade. Pick your favorite song of the decade and have it humming in your head while I go through this. What I've also done for each of the decades is identify what the city population was at the census - that's the 1920 census - and what the County population was as a whole in 1920. Interesting to compare in

contrast as we move through this, the comparison of those two numbers to each other, how close they are, but then also the - the nature of how they grow, in some cases, exponentially.

In 1925, Tucson made its first attempt to create a Commission on Planning, and it got nowhere; it failed. They reconstituted as a Tucson Zoning Commission, and was able to pass the - the - through the Commission and the Council, the first City Zoning Ordinance in 1930; it doesn't look anything

like the Zoning Ordinance that we had today, or the Zoning Ordinance that existed in 1941, but it was the first Zoning Code. And, primarily, what they did is: Where are the existing uses? Well, let's zone for those. Fairly simple.

But, interestingly, look at the population of the City of Tucson, and look how many people attended a public hearing on zoning in 1929, four months, five months before the stock market crash. I don't know what that has to do with anything, but I thought it was interesting.

CHAIRMAN JIM BARRY: Everything's related to everything.

MR. COLTON: Everything's related to everything else. I will occasionally tell jokes and it's nice if you laugh every once in a while. If you laugh at the stuff that isn't a joke

. . . .

CHAIRMAN JIM BARRY: We'll apologize.

Planning History: 1930

City Population = 32,506; County Population = 55,676

City Planning Commission appointed in 1930
1932 Regional Plan report presented
Budget issues (depression)

Tucson Regional Plan, Inc. formed in 1937
Concern over unregulated development outside the City
County planning and zoning enabling legislation sought unsuccessfully

Water
Infrastructure, Supply & Planning Study

MR. COLTON: Thank you. The - in - in the '30s, the - the City Planning Commission that had been appointed in 1930 had contracted for a Regional Plan Report to be done; it was the first time they did this, and a report was made; there's - it's all very well-documented in here. But, again, it's the '30s, there are budget issues, there's a depression. The City Planning

Commission asked for \$500 from the City Council; they were refused. So, you know, planners have complexes for a reason.

The Tucson Regional Plan, recognizing that this wasn't going to happen through the Government, the Tucson Regional Plan, a private entity, building on similar work that had occurred in New York and other places - very successfully in New York, by the way, formed in 1937 - the major concern was over, tah-dah, what we would consider to be lot splits today, but unregulated development out in the - in the County outside the City.

We were - they were concerned about it primarily because John Murphy had just bought a whole bunch of land up in the Catalina Foothills and what it looked like getting from the City to his fancy places in the Catalina Foothills was starting to look pretty shabby. My neighborhood, which is at Glenn and Tucson Boulevard was built in 1950, it was in the County, just to give you a sense of when I talk County and City. They attempted to seek County Planning Enabling Legislation, unsuccessfully, although it happened eventually.

Planning History: 1940

City Population = 35,752; County Population = 72,838

1941 City Planning AND Zoning Commission established

1944 City adopted new Zoning ordinance

Tucson Regional Plan

First comprehensive plan – Segoe Plan 1943

Land-use, transportation, public facilities

Water and sewer addressed by the City; County couldn't adopt

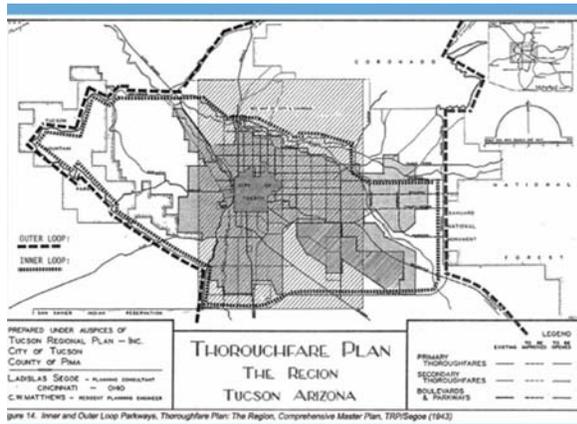
1943 City-County Planning Office formed

Water
Infrastructure, Supply &
Planning Study

Regional Plan got busy, they incorporated a private entity.

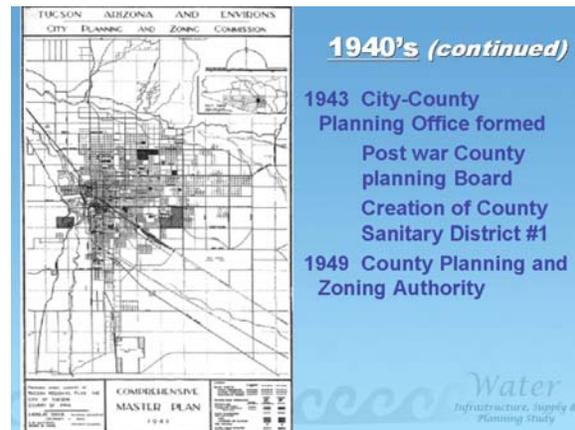
The first Comprehensive Plan was prepared in 1943; it focused on Land Use Transportation and Public Facilities. Water and sewer were addressed to some extent, but not to a great extent, mostly as infrastructure. The City adopted a number of the provisions of the Regional Plan, not all of them, but they - the County couldn't, because the County didn't have authority.

In 1943, the - unique to many jurisdictions - the City and the County got together and formed a Planning Office. To give you a sense of what things looked like, this was the 1943 plan for the - the City, or at least for the - the urbanized area.



create it, but they made - paved the way for one to be created, and - and that Sanitary District led through a number of iterations to becoming the County Wastewater System today. In

In the '40s, growth was apace, but not that fast, comparing to the 1930s. Another - yet another Commission was established at the City. The City adopted a new Zoning Ordinance, after three years of pain and suffering in 1944, and that was the Zoning Ordinance in the City that pretty much looked like the one that existed in the City up till 1995. And the Tucson



1940's (continued)

1943 City-County Planning Office formed

Post war County planning Board

Creation of County Sanitary District #1

1949 County Planning and Zoning Authority

Water
Infrastructure, Supply &
Planning Study

1949, again, the County got planning and zoning authority. This is another one of the 1943 maps.

Planning History: 1950

City Population = 45,454; County Population = 141,216

1953 City zoning passed by voters
Joint planning office reconstituted as a Department
County "Comprehensive Plan" was Zoning Plan
Department focus on school and neighborhood plans
Criticized for missing the big picture
1950's saw rise of large unincorporated area

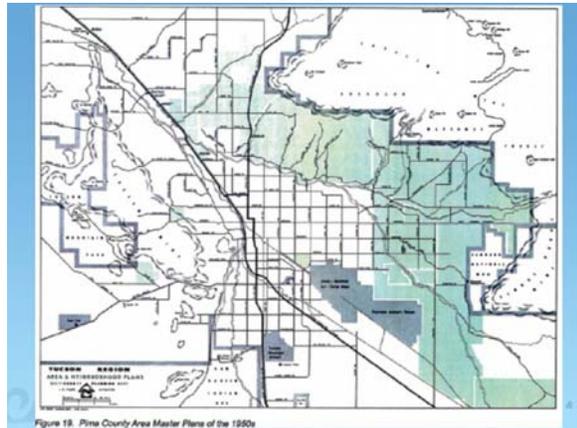


In the '50s, given that the County had now authority to do planning and zoning, the County - actually, it says "City Zoning passed by voters" - it's actually "County Zoning was passed by voters" - it took a lot of effort to do that, but they - they were successful, enabling themselves to do that. The Joint Planning Office became a Department, so it was a

City/County Planning Department. The County Comprehensive Plan that was approved was really Zoning; it wasn't really Planning.

CHAIRMAN JIM BARRY: Ten minutes, Arlan.

MR. COLTON: Okay. The Department focused on school planning, neighborhood planning, but they were criticized for missing the big picture.



In the 1950s, as you can see by the County population number, started to see the - the rise of large unincorporated area. This gives you an indication of some of the Master Plans that were done around the - the City and the County, the Catalina Foothills and the Rincon Valley, particularly here.

In 1960, the - you can see the population number mushrooming greatly, the Area Plan focus continued. The 1960s saw, because of the criticism of the '50s, the adoption of the City/County General Land Use Plan, and that existed for quite a number of years; that was not a Comprehensive Plan, per se; it was a Land Use Plan; it was assumed that Area and Neighborhood Plans would be developed as a result of - developed and implemented,

Planning History: 1960

City Population = 212,892; County Population = 265,660

Area Plan focus continues
Tucson Regional Plan organization revived
1960 City-County General Land-Use Plan adopted
460,000 by 1975; 1.4 million by 2000
City Plan (Tucson Urban Area) and County Plan
Not a comprehensive plan
1964 Joint planning department served



implementing the - the General Land Use Plan.



Figure 21. General Land Use Plan: Tucson Urban Area (1960)

area. You'll recognize the red as most of the strip commercial that we see, and then this is the - the greater region. Lots of development was planned out towards Avra Valley, in particular.

Planning History: 1970

City Population = 262,933; County Population = 351,667

Satellite communities planned beginning – Green Valley, Rincon Valley, etc.

1972 Joint Comprehensive plan begun

1975 "massive" (561 page) document released contained growth

1977 Plan revised; focused more on land-use
Three groups presented alternatives

City adopted in 1979; County tabled action in 1978

Water
Infrastructure, Supply &
Planning Study

produced this - what was called a "massive document" it was; it was about this big; some of you saw it; some of you remember it. In - while it provided for a number of alternatives, it promoted contained growth, and I'm not going to get all of what that meant. But, what was said about it was interesting. The people that were complimentary to it referred to it as "an ambitious experiment and a blueprint for change." The people that didn't like it so much, referred to it as an "aletis (ph.) manifesto and socialistic"

In 1964, the Joint Planning Department was actually severed, not served; it - it ceased to be. There was too much - arguments, shall we say, two - two masters; one - one group trying to serve two masters, and it was disbanded. This gives you a sense of the 1960 General Land Use Plan in the City

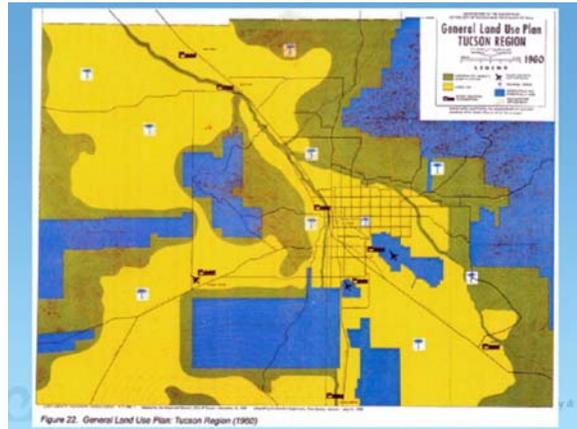


Figure 22. General Land Use Plan: Tucson Region (1960)

the - what we still live with today as watershed planning experience, up until really relatively recently was - in 1972, City and County began work on a Joint Comprehensive Plan.

Three years later they

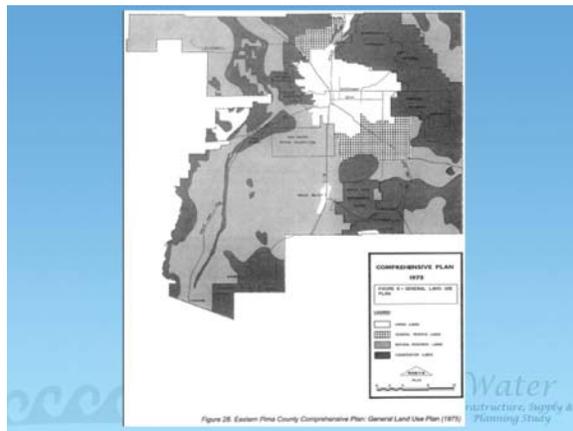


Figure 28. Eastern Pinal County Comprehensive Plan General Land Use Plan (1979)

and some other words that I can't repeat. It eventually became a planners' nonemployment act, and as people were run out of town on a rail.

The three groups that I mentioned on that slide were the Legal Women Voters, the Chamber of Commerce, and then the lead environmental organization of the time, the Southern Arizona Environmental Council, which presented alternatives. Ultimately, the City adopted the Comprehensive Plan in 1979. The County tabled it in 1978, never came back to it. Also, in the '70s, by the way, Oro Valley and Marana incorporated.

Planning History: 1980

City Population = 330,537; County Population = 531,443

Need for regional planning promoted by private sector
 1982 report - Tucson Tomorrow
 1983 Goals for Tucson released findings
 1984 ULI/AIA Design report

County adopted Conceptual Land Use Element of the Comprehensive Plan – assumed PAG 2015 pop. for under 1.1million, with 453,000 in unincorporated area

City concentrated on area and neighborhood plans
 1984 City adopts Major Streets and Routes Plan
 1985 County adopts new zoning code



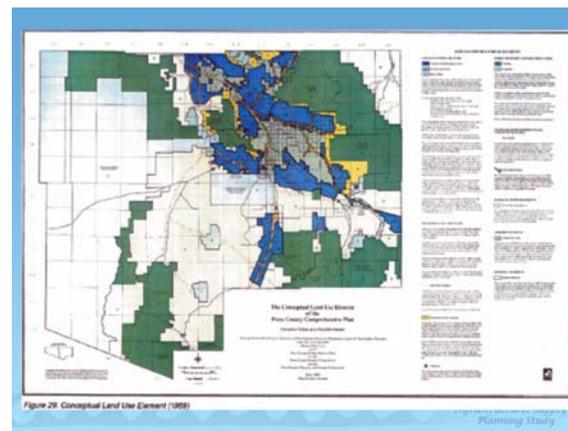
That's a sense of what the '75 plan looked like.

1980s, the - we - we, again, had more calls for Regional Planning again. The Tucson Tomorrow Group was formed, published a report in '82; that spun off a program called "Goals for Tucson" looking for findings; they did 28,000 surveys, 1983.

In 1984, Urban Land

Institute, American

Institute of Architects Design Report and, ultimately, by the end of that decade, the County had adopted the Conceptual Land Use Element, the initial attempts at a First Comprehensive Plan, and you can see what the population projections were. We've exceeded that in some cases already, or were close to exceeding it, but certainly sooner than 2015. The City was still concentrating on Area Neighborhood Plans, and you can see the notes about major streets and routes in the City.



The County adopted a new Zoning Code. This is what that Conceptual Land Use Element looked like back in 1989.

Planning History: 1990

City Population = 405,390; County Population = 666,880

1992 County adopted Eastern Pima County Comprehensive Plan
 1960 plan, most area plans repealed

1995 City Land-Use Code replaces zoning code



So, we move forward to the '90s. In the '90s, lots of things happening; not so much on the slide. The eastern Pima County Comprehensive Plan was adopted in 1992. Most of the Area Plans that existed in the County, plus the old 1960 plan were repealed, and the City was working on the Zoning Code and

adopted one in 1995; it basically became the Land Use Code, much reviled by many, understood by three people, as far as we know. I was given permission to say that.

Planning History: 2000

City Population = 486,699; County Population = 843,746

2001 County Comprehensive Plan Update adopted
2001 City General Plan adopted

- Growing Smarter driven
- Water Element included for first time
- Voter ratification of City General Plan

Neither plan had strong implementation element

2006 Proposition 207 passed

- Private Property Rights Act

Water
Infrastructure, Supply &
Planning Study

So, the modern era. Where - where are we today? Well, because of Growing Smarter, both the City and County had to adopt new plans. They did. They were - included a water element for the first time. Neither plan had any strong implementation element to it, which is a problem, and the other major thing that happened in 2000 - in the 2000s, 2006, was Prop 207. I

won't go into the details, but recognize that, as we go forward and look to change zoning laws in the State of Arizona, that's going to play a significant role. You can ask me questions later.

And my last slide for this section is to talk about

Planning and Water

County planning: Water quality; flood plain zoning
City planning: Safety element (water quality)
Allowance for limited moratoria (water as public service)
Strongest nexus has been subdivisions

Growing Smarter Plus Act (2000)

- Water Resources Element for Municipalities and Counties
- basic supply and demand accounting
- no new studies
- counties not water providers
- Pima County updated Water element in 2008
- Tucson Water - Long Range Water Plan

Water
Infrastructure, Supply &
Planning Study

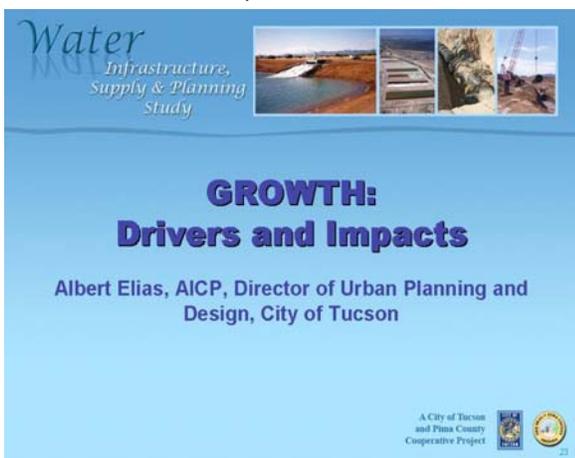
planning and water, and I wanted to summarize where the connections existed in the statute, and where - where we have - where we have relationships. County Planning, actually, in the statutes, it refers to water - in terms of water quality as one of the areas that you could look at. In the City planning statutes, it shows up as water quality in the safety element. Those are the two

places, historically, where water made a difference and, certainly, not water quantity.

It also shows up in the moratoria statutes that existed; the ability to do a moratorium. Water is considered a public service; therefore, it could be something that you could base a moratoria on. Before anybody gets real excited in Arizona, in - in this room, in Arizona, a moratoria after public hearings is good for 120 days. You're not going to solve a whole lot of problems in 120 days. You can re-up this for 120-days periods, but you have to hold a public hearing every single time; it doesn't get used, and for that reason. The strongest nexus between planning and water, historically, was at the subdivision level; both at the City and County, and that's because of the Assured Water Supply requirement that's called for in the Groundwater Management Act in 1980.

So then - brings us to the Growing Smarter Plus Act, the 2000 Act, that's where the Water Resources Element was required for most municipalities and counties, at least the larger ones, and really what was it supposed to be? It was supposed to be a basic supply-and-demand accounting. If I'm going to provide this many - this much in land use, what's my supply, what's my demand for water going to be? What are - what's my supply for water? Do these match? If they don't, fix it. Either fix it and reduce the amount of demand by reducing the land use, or find alternative sources and show that accounting in that. A few communities and counties in the State of Arizona actually did it that way. Most, including the City and the County did the same thing; they put all these policies into effect on here's what we're going to do about water. Here's some good - in some cases, feel-good things, and some things, realistic things. But, the Water Resources Element also said no new studies; it didn't want to cost a fortune to - to communities and Counties not being water providers, realized that they would have limited information, and so that fact was accounted for in the - in the element.

Pima County did update its Water - Water Resources Element just this year and - and tied it a little - much more closely to rezoning and to Comprehensive Planning. I'm not going to get into any detail about that. Tucson Water, really, if you think about it, the Long-Range Water Plan serves that role; it is not - not anything particularly in the Water Resources Element of the - of the General Plan of the City of Tucson. So, that concludes my history part.



I'm going to turn it over to Albert to talk about drivers and impacts, and I'll join you back in just a little bit.

MR. ELIAS: Thanks, Arlan. And maybe as we transition here, I might just add - I don't know what your opinion is about City and County cooperation, but Arlan's been a great friend and a colleague of mine for many years, I have a great deal of respect for him, and we're good friends on top

of that, and we even do crazy things like finish each other's sentences and stuff. So, I do want to let you guys know that it's a privilege to be able to speak with you today and - and I feel really blessed to be able to do what I do in my hometown. I was born and raised here. I have a pretty big stake in this community, maybe not so much financially, but because I want

this to be a better place for my kids and my children's children, so that's why I get out of bed every morning.

But, I - I wanted to kind of take a moment here to talk a little bit about growth, I mean, and try to get back past the simplistic aspect of it where we know it's not just about population growth, or the economy expanding that really kind of - what are the factors related to growth, and why - why do we want to explore this area? Well, I think we want to get a better understanding of those factors and really see if they can lead us to, perhaps, a more compelling vision for the region and that might actually lead us to some action and follow-through.



So - so, let me just start by saying one of the key things about growth is Tucson is a wonderful and beautiful place to be. Duh. You all know that, right? But, I think for those of us who live here and we see the mountains every day, and we see the kind of natural beauty of our community, I think we forget that that's extremely attractive to other people.

Our climate, affordability, our natural beauty, our access to recreational areas, our cultural assets, such as art and entertainment, our access to institutions of higher education and opportunities for training, those are all hugely attractive to other people. And I think on - on - in terms of the local economy, we have many opportunities for jobs and businesses here and, you know, that - that's a really key element. And I'm going to talk some more about the economic factors, but I just - for those of us who are here all the time, I think we tend to overlook how attractive our community appears to other people on many, many different levels.

I want to talk a little bit about some of the factors related to growth and the fact that, basically, we have enjoyed plentiful land and water. Now, we all now it's getting more expensive and we all - also have come to learn that there's growing uncertainty about the availability of land, and also the availability of water and future supplies, and how much they might cost. But, generally speaking, that has not been a negative here, which is a fascinating point, given that this is a desert that we live in. Likewise, on the infrastructure side, infrastructure costs have gone way up exponentially, in fact, in recent times, just like fuel's gone up. They've increased in a dramatic way, and - and that's a constraining factor.

The other thing I want to share with you is that the idea of regulation is - is a huge factor in terms of growth, and

Constraints of Growth

- Availability and affordability of land and water
- Cost of infrastructure
- Government regulations



Water Infrastructure, Supply & Planning Study

for someone like myself who's in the business of regulation, I don't take that lightly. I believe that at all levels of Government, from the federal down to the local level, the regulatory decisions that our elected officials make, and our lawmakers make, clearly affects growth; it affects us in terms of the time it takes in order to go through a development process, and time is money, and it also affects

investment capital, which is clearly diminishing and it's becoming more difficult to access. So, those are big considerations.

There's also, of course, that - the fact that we've enjoyed a pretty vibrant economy locally and - and, as a result of that, we've had pretty good revenue streams, and they are

Positive Aspects of Growth

- Economy (jobs and business creation)
- Tax revenue (funds services and infrastructure)



Water Infrastructure, Supply & Planning Study

clearly related to growth. I mean, people move to Tucson often because they can get jobs or opportunities that they couldn't get in other - other areas. Businesses feel like this is a place where they can establish their business, and expand their business successfully, and jobs are really central to prosperity and stability in our community.

Likewise, as the economy grows, those tax revenues that go to Government help pay for infrastructure and public services and facilities and - and,

Negative Aspects of Growth

1. Quality of Life
 - Congestion
 - Air quality
 - Environmental degradation - riparian / open-space
2. Public Services/ Infrastructure
 - May not be able to keep up with demand



generally, our Governments haven't been going bankrupt. They've been able to provide basic services. Now, we can quibble a lot about the nature of those services and how effective they are and that sort of thing but, essentially, those - that - that has really been a real positive aspect for growth.

So, let's talk a little bit about the negative side of things. Now, everyone has an opinion on the negative side; it seems to be easier for our community to focus on the negative side, rather than the positive side. But, clearly, the desirability and the livability of our community can be affected by some of the strains that we put on our - on our environment. Climate, for example; the affordability of our community; housing, that sort of thing; our natural beauty, when we destroy it; and, you know, eliminate natural - natural landscapes and replace those with built environments, some of which aren't very attractive; sometimes our access to recreational facilities is taken away by development; we might cut - we might be cut off from a recreational area that we accessed and - as a result of new development. The demand for public services and infrastructure can sometimes be greater than our ability to provide them, or sometimes we don't provide them in a timely manner; people have to wait sometimes years before that infrastructure is available. And - and, likewise, on the economic side, sometimes the - the, you know, pollution or other natural - natural resources can make our community less attractive, and that clearly affects growth.

One of the things I do want to specifically mention is that - remember that the opposite side of growth is a shrinking or a stagnant community, and I think, once again, this is something that we always have taken for granted in our community, because we - we don't seem to see a lot of that, but there's a lot of examples - and Dave Taylor mentioned a few last week - in terms of mid-western and east coast cities that suffer from stagnant economies and loss of population.

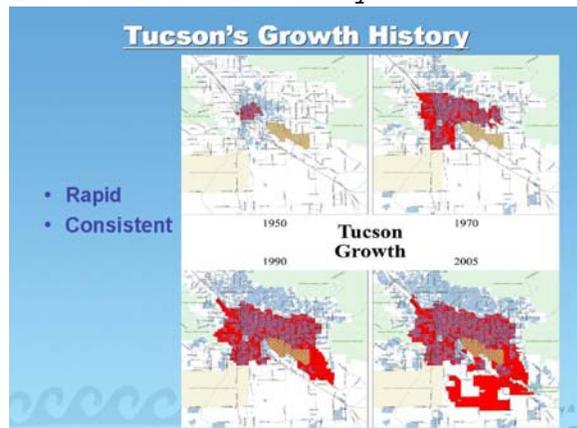


This picture I purposely picked, because it's the

southeast corner of Twenty-Second and Park, and for those of you who are familiar with that area, you know that this building has been vacant for years, it's got commercial zoning on it, and it was only recently demolished. So, that kind of stagnant, visible - visible kind of stagnation in our community is - is really an issue. So, where we want to go is that best practice in a city

is to have a robust economy, and then you mitigate the negative impacts associated with - with growth. And I want to tell you this is what every community does, this is not special about Tucson, every community in the United States, and many

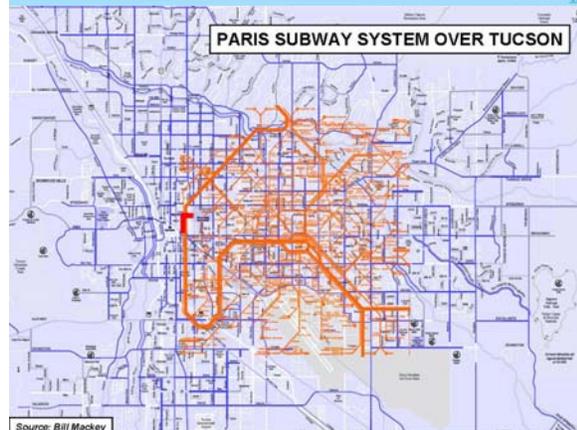
communities all over the world are striving to achieve this, and it's not that easy.



annexed as time went on. And, although this graphic only goes back to 1950, I do want to point out that, you know, even the early native farmers who were irrigating and growing crops along the Santa Cruz River, that evolved over time from just four or five small groups of people to a number of villages along the Santa Cruz, they had to deal with growth too. And, as those new people came along, it had an impact on 'em. So -

CHAIRMAN JIM BARRY: Ten minutes, Albert.

MR. ELIAS: Okay. So, how has Tucson grown? Let's -



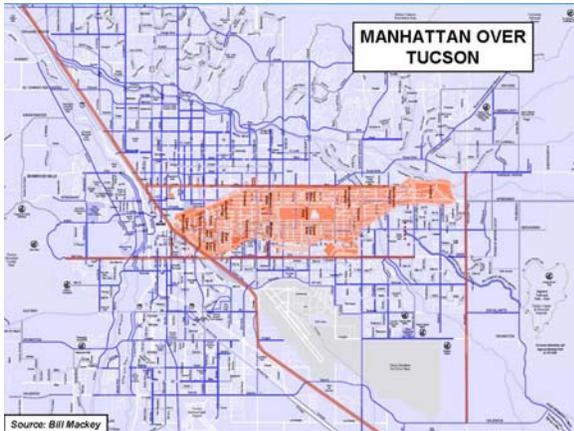
Historically, as Arlan pointed out through his numbers, we've had pretty rapid growth, and it's been consistent, especially since the post-World War II period, and this graphic shows in the blue areas that have been subdivided, and then in the red, the City limits. So, you can see that growth has always taken place primarily outside the City limits, and then it was

let's talk about that a little bit, because I think it's easy to pick off some unattractive aspects about how Tucson has grown. Some people say, "Well, sprawl is pretty ugly and - and it's so prevalent in our community that, you know, how can - how can we feel good about that?" Well, I think the reality is, is that we can come to consensus as a community about

how we want to have a more sustainable approach and, you know, some smarter ways of growing than we have in the past. Clearly, these kinds of things have been problematic, you know, so I don't want to duck those. I think we want to say that right up - right up front.

Now, a couple of fun slides to kind of talk a little bit about the sprawl issue and

get a sense of this. This is a - this is a picture of the - it's - it's an image of the para-subway system overlaid on top of the City of Tucson, so you can get a sense of this. Now, remember Tucson region's population is about a million. And Paris - the City of Paris, has a population of about 2.1 million, so it's about twice as big in - in the City of Paris compared to the City of Tucson. So, you can kind of get an idea of spatially how their key transportation network overlays in the city.



This one's even more interesting. It's Manhattan overlaid on top of the City of Tucson, and just some comparisons. Tucson's about 227 square miles, and it has about 4.6 people per acre. Manhattan has about one million six hundred and twenty million (sic) people, and it has about 70,000 people per acre. Now, I - I'm - I'm not trying to suggest that Tucson could ever be like Manhattan;

that's not where I'm going; all I'm trying to do is illustrate that Tucson's characteristics are - are unique, low-density, one-story building profile, and very auto oriented. Manhattan, very high-density, medium- to high-rise kind of building profile, and pedestrian and transit-oriented. So, we've chosen two different paths.

Why Has Tucson Grown This Way?

- Preferences
- Fewer constraints
- Cheap land
- Government wants revenue
- "power" - who owns the land
- Lack of regional coordination
- No neighborhoods



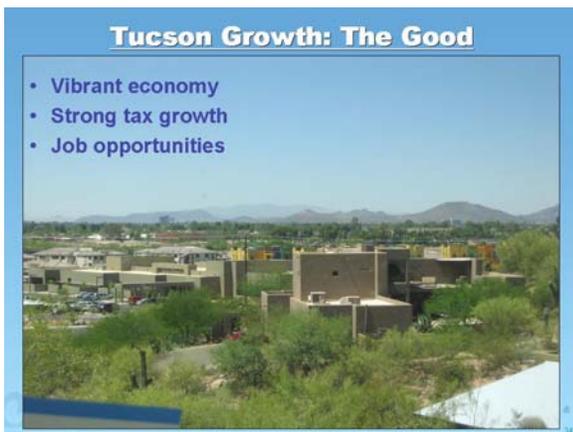
Water Infrastructure, Supply & Planning Study

So, why has Tucson grown this way? I mean, this - this kind of image that many people who come to Tucson is that I want three acres and a horse for Johnny. I mean, this is real. I mean, we prefer - we've shown a strong preference, historically, for family housing. We've also kind of had a lack of physical - fiscal and physical constraints that, you know, could affect the way we grow.

Our - our tax structure has really incentive local Government to capture the revenue it needs to provide services. Property owners who own vast tracts of land have, historically, been very influential when growth-related decisions were made, and that is, in part, because there's been kind of a lack of community consensus about how and where we want to grow, so

we've been vulnerable to that sort of thing. And it's only recently that we begin to prioritize regional decision-making, even though it's been talked about, as Arlan pointed out, many, many, many times over the years. So, what we've seen is that our edge areas tend to have - they don't have organized neighborhood leadership and - that engages on development issues, so - so that's kind of further fueled all the new growth, all the new development going to the edge of our community and leaving quite a bit of vacant or under-developed land in the core of our community.

So, let's kind of look at the good and the bad. Some people say, "Is it good or is it bad?" Well, I say, "It's good and bad," and we have to absorb both sides of that equation. First the good, I mean, on the - in terms of the economy, we've generally had a lot of jobs over the years, although they're not always high-wage enough for our preferences. We - we've enjoyed very low unemployment rates.



Tax - on the tax growth side, we've generally had the tax dollars, as I mentioned, to build the infrastructure we need and maintain it, and we've built quite a bit in terms of new public facilities, and we've - we've provided opportunities for people. Tucson has always been a place where you can come and achieve your own personal dream. You see that in our immigration pattern today, and it's always been like

that historically. If you come here and if you work hard, you have a chance to get ahead, and that's real key to the good part of our community; it's perceived as a place of opportunity.

CHAIRMAN JIM BARRY: Five minutes, Albert.

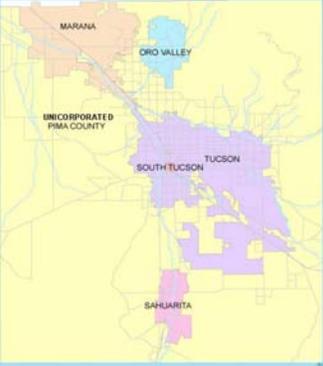
MR. ELIAS: Okay.

Let's look at the bad side, you know, rapid growth is meant that we have a lot of development that's, frankly, not very well thought out. We've built fast; we've built cheap, really not a lot of big-picture consideration, or clear decision-making, you know, a lot of incremental decision-making. Developers kind of build where it's easiest to build, and that



Regional Coordination

- More region planning
- More natural resource preservation
- Clear infrastructure and funding strategy
- Designate activity centers



tends to be on the edge in the green fields, and in the center city, that's - that's not where the growth is taking place; it's almost all been pushed to the edge. I think Tucson's Government and kind of decision-making around land use has been primarily reactive. We've been weak when it comes to steering development to a certain

place where we want it. Subdivisions are kind of - they're - they're subdivisions; they're not neighborhoods, and neighborhoods are really what people value.

And - and I think the other point I want to make is that oftentimes our public services have kind of lagged behind the development and we - we get 'em built, but sometimes it takes ten, 15, 20 years before there's a library or a park, or an appropriate urban roadway to where new development has taken place.

So, in Tucson, our local Governments haven't historically been able to determine how and where development should occur. Instead, each governmental entity kind of make its own decision irrespective of what the others are doing, and I think this lack has led to, in some cases, developers pitting one Government against another Government, you know, that - well, if - if this Government didn't give me the answer that I wanted, I'll go find another one and I'll annex over there and maybe they'll give me a better deal.

And I think we've had some difficulty in preserving large-scale natural areas, although we're doing better with that. And I think we've had some infrastructure coordination and funding issues. Too often those decisions have not been made in a kind of thoughtful way. And I think we've had some lack of clarity regarding where our retail and job centers are going to be. So, we've come up a little bit short in that regard.

Development Regulation

- Historically not a dominant role
- Too much vs. not enough regulation
- Balance between free enterprise and government regulation
- Balance between free enterprise and government regulation
- What is the appropriate role for the public sector?



Water
Infrastructure, Supply &
Planning Study

In terms of development regulations, our local Government has not historically played a dominant role in regulating development. And - and let - let me be clear here, some people are okay with Government not being real involved on the regulatory side. Some people desire a stronger regulatory role by Government, but I think we do have

to acknowledge that over-regulation can stifle an economy, and that under-regulation can lead to abuse of community assets and some not-very-well-thought-out development at the end. So, there needs to be balance between free enterprise and Government regulation, and the - we need to think really clearly about what the appropriate role for the public sector should be in our community, because some people have really high expectations: Government can fix everything. And then other people say, "Well, all Government does is get in the way. Let 's just get rid of it because it - we're not getting good results out of it." So, I think my - my - kind of leads me to some - a concluding observing, and really that - I - I think history's shown that we can't really effectively stop growth.

Key Observations on Growth

You cannot plan to stop growth...

- Direct where it goes
- What should it look like?
- How do we pay for it?



take? What should it look like? And then, also, how are we going to pay for it? And what part of the economy are we purposely going to try to grow versus other segments of the economy that - that don't necessarily want to growth - we don't necessarily want to grow?

So, I'll stop right there and we'll transition into the next -

CHAIRMAN JIM BARRY: Wait, wait -

MR. ELIAS: - part of our presentation.

CHAIRMAN JIM BARRY: - let me do something here.

MR. ELIAS: Sure.

CHAIRMAN JIM BARRY: There's a lot of information. So, let me see. Is there any questions in the audience first? Anybody have any questions? Questions, not statements. One minute per question. Go ahead, Mr. Stagner. Come to the microphone, please.

CLYDE STAGNER: You include high-density, high-rise populations in your work as you refer to in Manhattan for the City of Tucson.

MR. ELIAS: I guess - what'd I say in this next segment, we're going to talk a little bit about density and

high-rise and that type of thing, I mean, I think a core community value in Tucson is its low profile. We - we don't -

CLYDE STAGNER: (Inaudible; not speaking into a microphone.)

MR. ELIAS: Well, you asked if I think high - high-rise buildings are appropriate in Tucson.

CLYDE STAGNER: In your planning for the City of Tucson for future residents of citizens, do you include high-rise, high-density buildings similar to those in the Island of Manhattan that you show?

MR. ELIAS: No, I don't think we're going to get those in Tucson.

CLYDE STAGNER: Thank you.

CHAIRMAN JIM BARRY: Anybody else?

COLETTE ALTAFFER: Just a quick question for Arlan. Arlan, you separated the population - you separated the population figures up there for Tucson and Pima County. Tucson, technically, is part of Pima County. Is there a reason why we keep those figures separate?

MR. COLTON: Yeah, that's a good question. And that point was made to - to show you what the City of Tucson is relative to Pima County as a whole. The Pima County number includes the unincorporated area and the other jurisdictions of the County, most of which didn't exist before 1974.

The other important thing to note is that - that today if unincorporated Pima County were a city, it would be the fourth largest city in the State of Arizona, much bigger than anything in Maricopa - than Maricopa County, so - and the reason is that Maricopa County, they annex in the City of Tucson - in - in the - in Pima County, some annex, many don't annex anymore.

I want to add one point if I can to something that - that Albert said - and I want to put this into perspective as well as long as I'm doing that. From a regulatory standpoint, we look at it and say, "Do we over-regulate? Do we not over-regulate?" Relative to the rest of the State, we have a reputation in Pima County, and Pima County, the City of Oro Valley, and others for certain, of being intensely regulated. We have more overlays zones than most, and we have more process to go through if people want to develop. We're - we're probably on a par with Scottsdale. We're probably only exceeded by Paradise Valley, which allows almost nothing new, and Queen Creek which, historically, is also very regulated.

CHAIRMAN JIM BARRY: Let me just see about the audience, then we'll come to the Committee, okay? All right, go ahead, Bruce. Bob, wait one second. Go ahead.

MEMBER BRUCE GUNGLE: Arlan, your - your numbers here, I thought I understood them, but now I'm confused.

MR. COLTON: Okay.

MEMBER BRUCE GUNGLE: Does the County population include the City of Tucson in these -

MR. COLTON: Yes.

MEMBER BRUCE GUNGLE: - these numbers you have here? Okay. So, you have the City population and then you have just all of Pima County?

MR. COLTON: Yes.

MEMBER BRUCE GUNGLE: It's not - got it.

MR. COLTON: Yes.

MEMBER BRUCE GUNGLE: All right. I didn't realize that at all.

MR. COLTON: Yeah, and actually -

MEMBER BRUCE GUNGLE: I thought it was different.

MR. COLTON: - my - my colleagues -

MEMBER BRUCE GUNGLE: Okay. Thank you.

MR. COLTON: - here put the numbers together for me and I wanted to make sure that that was true, too, and that was as of the census -

MEMBER BRUCE GUNGLE: Well, that - that makes -

MR. COLTON: - at the beginning of that period.

MEMBER BRUCE GUNGLE: - more sense with what I -

MR. COLTON: Yeah.

MEMBER BRUCE GUNGLE: - understood it to be.

MR. COLTON: Yeah.

CHAIRMAN JIM BARRY: All right, Bob. Bob, go ahead.

ALTERNATE MEMBER BOB COOK: Yes, Albert. You contrasted rapid population with community stagnation and, you know, part of that is because, you know, our economy is largely driven by population growth. What about a scenario where we have 1% annual population growth and a diversified economy with rising per-capita incomes? Wouldn't that be a nice vision for the community?

MR. ELIAS: Great vision, extremely hard to achieve.

CHAIRMAN JIM BARRY: Okay. We saw Mr. Cole.

CLYDE STAGNER: Shouldn't they identify themselves?

CHAIRMAN JIM BARRY: Yeah, you're right. Identify yourself.

CHARLES COLE: Charles Cole. My question's for Mr. Elias. If growth cannot be perpetual, and if you cannot plan to stop it, how do you envision that it will stop? How will it end?

MR. ELIAS: I don't know how to answer that question. I - I guess my point is that there will - history has shown us that the area will continue to grow. We - we might not know exactly how fast or how slow, but history has shown us that it will continue to grow. So, I think - I was trying to assert

that we should consider thinking more carefully in coming to consensus as a community: Where do we want that growth to occur, and what form to do want it to take? And then, thirdly, how are we going to pay for it? And if we can answer those three questions, I think it gets us beyond should we - should we just accept growth, or should we do everything we can to stop growth? So, I 'm - that was my point.

CHAIRMAN JIM BARRY: Let me ask the Committee a question. I've been meaning to do this: How many people on the Committee think, for whatever reason - and whenever it happens - that there is some inherent limit to how big Pima County's going to grow? Okay. Good. Any more in the audience? Any more questions? Margot?

MARGOT GARCIA: Margot Garcia for Mr. Elias. I was wondering have - you talked a little bit about economic growth and there were certain kinds of growth that you thought - certain kinds of economic growth you applied that were more appropriate for here. I'm not sure if that was quite the right implication. I was wondering if you had done any study of looking at what is the water use of different kinds of economic growths, economic sectors and how, in other words, you get the most economic buck per unit of water?

MR. ELIAS: That - that's an excellent question. I haven't studied that personally, but I do know that our colleagues over at the University of Arizona, you know, Marshall Warden has done extensive work on the nature of different economic segments, and I think each of those economic segments, of course, has different water use characteristics; looking at mining, looking at agriculture, looking at, say, research and development, or some kind of manufacturing activity, or the service sector activity of our - of our community, and I think that's part of where I was going with my suggestion that we should decide not only where we want to grow and the nature of what that built environment - that new-built environment should look like, but how are we going to pay for it? And - and what segments of our economy should we purposely say, "Well, let's work on expanding that segment." And one of the reasons why we might choose a given segment of the economy is because we - we might feel that it uses less water potentially for the long term than another segment of the economy, which we might say, "Well, they're a high-using - high-water-using segment of the economy, perhaps, that's a less sustainable place in terms of long-term economy growth."

CHAIRMAN JIM BARRY: One more question from the audience, anybody? Okay. Does anybody on the Committee have a question that they're just burning to ask? All right. Good. Oh, John.

MEMBER JOHN CARLSON: Population trend, you started out that the County population was 1.7 of the City, and later it grew clear to 2 and then it backed off, and I'm just wondering since we're grappling with who should pay for what and when, and who should plan what and where, is there - is there a disconcerting - a break here that we can't figure out or - and the other thing, of course, we're notorious for getting less money from Phoenix 'cause we got so darn much unincorporated. You want to comment on any of that observation or what? If you don't, that's fine.

MR. COLTON: I will comment to the extent that I think that those numbers that you saw - at least what I put up there - we're looking at build-out populations of plans that have been developed in this County over the course of the years; obviously, they weren't achieved. One of the things that I noted in doing the work was we had some plans that seriously underestimated the population that was projected to occur, and others that seriously overestimated clearly were in that year and were no longer there.

One of the interesting ones I thought was the post-World War II era where they had the 1943 plan they had done that, assuming 100,000 people in the Valley by 1963. Well, they had actually achieved that in 1948, five years later. So, it grew much more rapidly than anybody had anticipated.

On the other hand, we've had some planning efforts and build-outs, and build-outs are - are odd concepts; build-outs of plans because they usually are never are going to be achieved, because they assume that all land is going to be developed in a certain way at a certain time; that doesn't happen. But, they are interested as theoretical maximums, in any case. So, I look at it as - as the - the - what we know as the population's growing, too, the population is growing, but on a declining basis; it's still growing, but it's not going like this, it's going like that, and the, you know, it will continue to do.

And to tie that to one of the other comments is that, at some point, it's not so much that you're looking necessarily at new growth, but you are looking - what - what drives an economy is also redevelopment, and you will see over time more and more redevelopment of existing infrastructure and housing and commercial, and whatever, in the urban.

CHAIRMAN JIM BARRY: All right. Now, Arlan and Albert, you've got something to go that you cannot possibly get done in the ten minutes you've got left to do it. How do you want to handle that? It's - it's 7:30, we're gonna protect 15 minutes for Call to the Audience. You've got something that - that if you just did it would probably 25 or 30 minutes, is there any way you can - can really quickly point to - to slides

that people ought to be aware of, remembering it is an issue that we can bring back in Phase II?

MR. ELIAS: My - my suggestion, Mr. Chairman, is we can go through these real quick. A lot of these are - are a little more visual, frankly, and I think we can through 'em with - with more - with fewer words.

CHAIRMAN JIM BARRY: Okay.

MR. ELIAS: Does that - do you think we can do that?

MR. COLTON: Yeah.

MR. ELIAS: Okay.

CHAIRMAN JIM BARRY: Well, better get going, time's a wasting.

MR. ELIAS: Time's a wasting.

MR. COLTON: We're going to tag team this.

The first - first talk - first comment, and I won't go through this in detail for that purpose. You now have these in your record. These are the Smart Growth principles from the - the Smart Growth Network. These are national - nationally-developed. I think our point is we do a few



of these things really well, and we do a lot of them not so well, and our codes and our plans oftentimes talk about separating uses, as opposed to mixing uses. They don't talk necessarily about compact building design, which is not what we mean by Manhattan, not we're not talking about Manhattan, but we're just talking about how we utilize our land form today. We don't necessarily provide a great variety of transportation choices, and I think it is fair to say we do not, in this community - and I'm going out on a limb because I retire - I could - I could - I'm eligible for retirement in a couple of months, I won't retire - but, we do not make development decisions predictable, fair and cost-effective.



MR. ELIAS: So, in kind of building on that, here's a couple images of some alternative ways of using our land than the traditional detached family home that we're - that's so



prevalent in our - in our community. And here, you know, these are - these are kind of two- and three-story building profiles, and one of the keys here is that they're a little more pedestrian-oriented; they also save infrastructure dollars, and kind of promote the ability to walk and be - have where you live close to where services are.

Here's another example of the redevelopment concept that Arlan referred to. The photo shows an old salvage lot - yard on Stone Avenue that was converted to a three-story in-fill project, and I think that's an example of the kinds of opportunities that we might have.

Development Alternatives (continued)

- Includes rehabilitation
- Stabilizes neighborhoods and links nearby services and amenities
- Utilizes infrastructure

 A graphic with a blue background. On the left is a list of three bullet points. To the right are three photographs. The top photo shows a large, modern building with a mix of colors. The middle photo shows a similar building from a different angle. The bottom photo shows a large, multi-story building with a mix of colors and a prominent entrance. Blue arrows point from the text to the photos.

Here's another thing we want to point out is that we've got some very specific opportunities that we should be concentrating on, in my opinion. Clearly - let's talk about the opportunity in the built part of the City first, in-fill on vacant land. We know there's going to be a big public investment in these regional transportation plan corridors where there's going to be investments and the private property along those corridors creates some opportunities for us to look at new ways of attracting development.

Opportunities

- Infill on vacant land
- RTA Corridors
- Designated Activity Centers
- Downtown with TIF funds

 A graphic with a blue background. On the left is a list of four bullet points. To the right is a large, detailed map of a city grid with various colors and lines. Below the map is a small photograph of a building. The text 'Planning Study 43' is visible at the bottom right of the map.

Also, in our downtown area, we have an advantage that no other downtown in Arizona has, and that's the fact that we have tax increment financial funding

available to improve the infrastructure there, and that doesn't cost local residents anything additional in terms of tax dollars.

Here's another image of the Stone Avenue and Sixth Street



intersection that just kind of gives you an idea of another - the existing building forms and some things for you to think about in terms of new alternatives and new approaches that we haven't seen a lot of in our community.

Let's switch now to kind

of our thinking about the edge, and I think

there's - there's a lot of things we can do, once again, to cast this in a regional context, aligning our - our comp plans and our general plans, kind of making our regulations a little more consistent and seamless, and then also coordinating our infrastructure decisions better, getting developers to pay for key pieces of infrastructure so that they aren't paid for by the general public. I -

CHAIRMAN JIM BARRY: Five minutes.

MR. ELIAS: Okay. I want to take 30 seconds here to just point out that, in terms of the edge of our community, we have a great opportunity in the Houghton area to plan and zone 12,000 acres of State Trust Land, and we can do it comprehensively, as opposed to doing it one 80-unit subdivision at a time. And we really need to kind of take full advantage of this opportunity as a place where development is in sequence,

Houghton Area Master Plan (HAMP)

- Mix of uses within a compact development
- Variety of housing types and densities
- Transportation and circulation system offering mobility alternatives
- Regional open space system that preserves environmentally sensitive areas
- Passive open space amenities and active recreational opportunities
- Long-term, phased approach to development

because there's already some infrastructure there, and it's a logical place where edge development could move to next without skipping over four or five miles of vacant land and then trying to put many thousands of people. So, I think we should consider how we can take advantage of our opportunities in terms of in-fill, and our opportunities in terms of the edge of our

community.

Encouraging Better Development

- Growth area policies in the General Plan & Comprehensive Plan
- Community Education and Engagement
- Regional Cooperation
- Regulations
- Partner with developers
- Infrastructure decisions

MR. COLTON: In - in building community towards the edge I think was also one of the focus points of the Southwest Infrastructure Plan and how to finance it. I'll just show you the picture and then I'll talk from that. The Southwest Infrastructure Plan, which is southwest of town, the City of Tucson, is to the east and Tucson Mountain Park to the north, the San Xavier Reservation to the - to the south, was sparked by three requests to amend the Comprehensive Plan, but our intent here - again, won't go into any detail - is to create a place where there was an employment center, a place where some jobs were kept, where people lived; almost like a satellite - maybe not town, but satellite neighborhood or community, and figure out a way to finance the infrastructure to pay for it. So, our next steps are the rezoning process which begin next month and the finance of plan implementation.

Southwest Infrastructure Plan (SWIP)

Purpose: Sparked by three requests to amend the comprehensive plan

- Land-Use planning approach with Conservation Lands
- Infrastructure and Financing are known upfront before development
- Accommodations are made for an Employment Center
- Smart Growth and Sustainability set standards for transit-oriented, walkable community

Build-out (2050): 58,840 dwelling units (44,600 new)
 County Infrastructure Investment upwards of \$1billion in current dollars

Next Steps: rezoning process and finance plan implementation

Water
 Infrastructure, Supply & Planning Study 47

Growth Management Tools

1. Land-Use Regulations
 - Zoning
 - Subdivision regulations
 - Incentive zoning
2. Distribution and Timing of Growth
 - Development caps
 - Allocation systems
 - Growth and service boundaries
 - concurrency
3. Tax Issues
 - CIP
 - Impact fees
 - Improvement districts
 - CFD's

Water
 Infrastructure, Supply & Planning Study 48

I will not go through all of this. We were asked to talk a bit about growth management strategies. I teach a class on this. I took four weeks of lecture and put it in two slides, and - and this is one of them. But, basically, if you look at growth management, there are - I identified six tools, five and a half, land use regulations, distribution and timing of growth, tax issues,

negotiation opportunities, protection of critical environmental areas, and then, finally, the half is kind of annexation, because it fits in several places. And, again, I'm not going to go through the detail of those.

Impact fees I was asked to talk about a little bit and, again, I can't do justice for that. I'm going to

Growth Management Tools (continued)

4. Negotiation opportunities
 - Zoning conditions/exactions
 - design
 - TDR
 - Transportation Demand Management
5. Protection of critical environmental areas
 - Ways to stay: PDR's
 - Ways to pay: acquisition
 - Way's to regulate:
 - federal laws
 - special districts
 - zoning overlays
6. Annexation

Water
 Infrastructure, Supply & Planning Study 49

m

say about four things: One is, is that the legal framework for how municipalities and do county - and counties do impact fees in this State is set by State law.

Impact Fees

- State Law sets legal framework for impact fees
- City and County have policy guidance and impact fee program
- City: transportation, parks, police, fire, and general government
- County: transportation

- Fees are uniform with exceptions
 - Central City
 - Could become based on specific benefit areas (SWIP or HAMP)

Can be credits on impact fees
Example: building a facility

Water
Infrastructure, Supply & Planning Study 81

There's things you can do and things you can't do. Both City and County, obviously, have policy guidance and impact fee programs. The City's program focuses on a number of different areas; the County is transportation only.

Now, you may say, "Ah-ha, doesn't the County have fees for parks? Doesn't the County have fees for wastewater? Yes, but they're not impact fees.

The fees for wastewater are connection fees, not impact fees, and the fees for parks are in lieu fees, meaning you could provide the park or pay a rooftop fee under certain circumstances, but they're not - they weren't adopted as impact fees.

Impact fees need to be uniform in nature. In other words, apply to everybody. You can do specific benefit areas, and I think that was the focus point of the SWIP, the Southwest Infrastructure Plan, and the Houghton Area Master Plan. You can also get credits on impact fees. If you build a police station they're not going to collect the impact fee to make you pay for it.

And to wrap up, we have two picture - two - two - three - three slides. We were going to do this as a tag team. Maybe I'll just do this really quick.

MR. ELIAS: Go ahead.

Common Threads

- Engage the entire region in comprehensive regional planning that cuts across jurisdictional boundaries.
- Make hard choices about which costs the region will pay to secure the economic growth and quality of life desired.
- Recognize that public investment in new roads, sewers, and schools on the fringes are dollars that are not being spent in existing communities.

Water
Infrastructure, Supply & Planning Study 82

MR. COLTON: One of the things that you heard from the beginning of the presentation here on the history, how we got to where we got into what we've been dealing with now is some commonality, and I think these points secure that: We look at it as the learning experiences throughout time. We need to figure out a way - and I realize the study area that you're dealing with now is a little

smaller - but, in gauging the entire region in Comprehensive Regional Planning that cuts across jurisdictional boundaries is critical. Making the hard choices about which costs the region

will pay to secure economic growth and the quality of life, recognizing that public investment in our infrastructure and our

schools on the fringes, if we do that, we're not spending that money in the community.

We also recognize that - that throughout time we've - we've realized that if we build first on the land closest in, we don't have to expend lots of extensions of infrastructure. The compact contiguous physical growth that you see in the Smart Growth principles show up here.

Common Threads (continued)

- Build first on the land closest in; build where there is existing infrastructure. Encourage compact, contiguous physical growth by targeting central parcels already served by infrastructure for development.
- Build the community wisely with logical infrastructure expansions and conserving the natural resources on the fringe.
- Better align local land-use policies, codes and processes with the region's public-policy objectives

Water
Infrastructure, Supply & Planning Study 51

Again, common threads through history of things people have said. We know how to do this, we're just not doing them.

The logical infrastructure expansions, I think we've covered, but the conserving natural resources on the fringe is something we're doing well in this community, and we should pat ourselves on the back, and that's where I will mention the Sonoran Desert Conservation Plan.

Better aligning our land use policies and codes, our ordinances with our processes and our plans, they're not necessarily aligned today. We still have suburban codes. We ought not to have suburban codes if we're - if we're trying to create an urban environment, at least in part of the community.

Common Threads (continued)

- Change the public perception about what kinds of development should be acceptable in the region.
- Encourage a diverse housing stock. People need a variety of choices to create a healthy community. Be proactive in promoting and encouraging a diversity of housing products.
- Need communitywide consensus regarding the Tucson region's future to preserve the most important asset and economic engine: its quality of life.

Water
Infrastructure, Supply & Planning Study 51

Looking at public perception, we've talked about - and I'm not going to go into that in detail - but, more - most importantly, when we talk about diverse housing stock, when Albert shows you the pictures of these are alternatives, these are choices, and what we're saying is, is that people need to have choices, people need to have

choices for the type of housing that they want to live in, the places they want to work, how far they want to commute, how much they're willing to pay for gas. Well, no, they don't have a choice in that, do they? In terms of how far they want to travel and spend that money for gas versus using Sun Tran or another rapid transit system that, hopefully, could be developed. We need to figure out ways to encourage - and with Prop 207, that's what we're talking about - is encouraging a

diversity of housing products, because we're not going to be able to mandate a lot of new things.

And then, finally - and I think this is an important point to both Albert and I - we need to find somehow, some way, we've tried year after year after year after year, dating back to the 1930s, to develop some kind of community-wide consensus, and at least what we can live with regarding our future for the region to preserve that quality of life, because that quality of life makes the economic engine what it is.

Thank you very much for listening.

(Applause.)

CHAIRMAN JIM BARRY: I want to thank Albert and - and Arlan. Very good. And I'm sure they we're going to revisit many of these topics in Phase II.

Call to the Audience.

* * * *

CALL TO THE AUDIENCE

CHAIRMAN JIM BARRY: Call to the Audience. Mr. Stagner? Three minutes, I'm going to enforce it.

CLYDE STAGNER: It's just going to be short. It's on the census.

CHAIRMAN JIM BARRY: Okay.

CLYDE STAGNER: (Inaudible; not speaking into a microphone) by a German written in 1931, "And they call and move and go to their obligations. I feel them in me. How I (inaudible) fulfill. They are I. They all are only one organism. The termite state. They all fulfill its responsibility. Their task for their seed of this state. Individual termite does not give it. There is only one me."

I've lived in New York City. I've ridden the subways. I've had a button broken on a brand new trench coat in 1949 when you're shoved aboard it, and this is based on the CVC reference and its presentation tonight where psychological benefits have been mentioned of three people living together.

We also have the situation of the fire bombing of Toyko, the fire bombing of Hamburg, the Warsaw ghetto with its high-density population. We've had the London bombing. New York City cannot be evacuated in case of an emergency, and I give you as a reference Mr. Suddich (ph.), Naval Post-Graduate School master (inaudible). It takes 68 hours to evacuate Phoenix.

All my comments are based on do not go into high-rise such as they have in Manhattan. The people in Manhattan are earning money that they're earning in Manhattan; it's high-cost. If you're going to build the high-rises here, you're going to

bring in low people. The people living in the apartments now are people who cannot afford houses. Thank you.

CHAIRMAN JIM BARRY: Anybody else? Colette? Or - okay. Colette first.

COLETTE ALTAFFER: Colette Altaffer. There's so many issues here that, obviously, we can't spend a great deal of time on, so just a few things I want to point out. You talk about Government regulation and how there's a lot of criticism about how onerous it is, yet if you'll ask a neighbor they will tell you, particularly with the Land Use Code, that it provides the barest minimum of protection for a neighborhood. You talk about citizen involvement, yet neighbors have to fight to get a seat at the table, and all too often when we talk about stakeholders, neighbors are not included in that.

We talk about the TIF funding for Rio Nuevo, yet we have these recent articles in the paper about our sales tax revenue is still down. So, when we have a new commitment for bonding of nearly half a billion dollars for Rio Nuevo, I have to wonder who ultimately is going to pay for that. And then we talk about the HAMP and the Southwest Infrastructure Plan. In the Southwest Infrastructure Plan, the calculations for infrastructure costs, according to the County, were something like \$30,000 per home if we were going to ask that growth to pay for itself. In the so-called HAMP area, which is really the Westcor Development Area, in which we are hearing the HAMP pretty much being discarded by Westcor as not having done the hydrology well enough, we are hearing figures of \$50,000 and up for the infrastructure, and that leads us into this whole thing of community financing districts and who pays, particularly when you have massive foreclosures in a subdivision. Anyway, many, many questions and not enough time for answers.

CHAIRMAN JIM BARRY: Well, Tres is next. He was up first.

TRES ENGLISH: My name's Tres English. Almost three years ago, the County hired me to do a study of the condition of our existing tract homes. As part of that study, PAG gave me a database with about 20,000 households in three different, fairly representative segments of the community, which included every single, single-family home lot in those three zones. In those three zones six to 8% of the land was listed as vacant.

And I would like to know what relevance the idea of in-fill has when we're talking about the existing City, if only - if less than 10% of the land is vacant within the major part of what we would consider Tucson? What - what are the real opportunities for significant increases in density that would impact any of the issues, the public infrastructure issues, that we're talking about? And mind you those are randomly scattered

parcels, they are not necessarily located at anyplace you would want them to be in order to deal with transportation, or water, or any other infrastructure issues. So, I think that the - the point that in-fill will somehow give us all sorts of new opportunities is seriously misguided because, within the City limits, virtually every home that we have is a masonry building and will probably outlast any home built today just because of the nature of the construction.

CHAIRMAN JIM BARRY: Thank you. The gentleman there wants to speak. Make sure you give - give us your name, please.

RON PROCTOR: Yeah, my name is Ron Proctor. I'd like to just extend an invitation to Sustainable Tucson's next meeting. We have monthly meetings. Our next one is Tuesday, the 9th. We're hosting four representatives, candidates for the CAP Board. So, we'll be directing questions their way - their way, also have an open question/answer session. It's going to be held at the Northwest Neighborhood Center, which is on - on Sixth Avenue, just south of Grant. Everybody's welcome. Please come.

UNIDENTIFIED FEMALE SPEAKER: What's the date again?

RON PROCTOR: It's the 9th, September 9th.

UNIDENTIFIED FEMALE SPEAKER: Time?

RON PROCTOR: It's from 6:00 to 8:00.

UNIDENTIFIED FEMALE SPEAKER: Thank you.

RON PROCTOR: Thank you.

CHAIRMAN JIM BARRY: Oh, Bob. I'm sorry. I just thought you were going to do it. Excuse me.

ALTERNATIVE MEMBER BOB COOK: Bob Cook. Just a couple comments on paying for the cost of growth. This is a real sticky issue. The Grower Smarter, I think, process that ten years ago started the ball rolling in the right direction. We - we've got some good language in the City's - Tucson Plan. I brought this up last week. But, yet, today - this is eight years after, or seven years after that plan, we have yet to do a total cost of growth model, and I don't see how we're ever going to get a handle on the cost of growth and paying for growth unless we really do that as a community, as a region. What are the real costs of growth, both capital and operational, including all aspects of public services and public infrastructure? And update that model with actual costs over time so it's a reliable tool that every jurisdiction can use. That would go a long way to establishing the basis for - for how we're going to recover these costs of growth.

Now, on impact fees, there's a couple of - of points here that need to be made. The - the City of Tucson has gotten onboard with impact fees, but we've got a little clause in that impact fee program, that impact fee ordinance, that caps the

annual increase in the adjustment of that fee to cost of construction to 5%. So, if we have inflation in the cost of construction of our infrastructure at 25%, 50%, that differential between 5% and 25% is paid by the existing taxpayers, and that is totally unfair. We've got to remove that clause from our impact fee ordinance in the City of Tucson.

Arlan mentioned that impact fees are enabled by State law, both City and County, there are different legislations for each, and one of the criteria is fairness and uniformness of application. On the commercial impact fee side, we see a really big problem in the way commercial impact fees are scheduled, and the main problem is that it only applies to businesses that have permanent locations. Much of the economic activity in this community is in mobile businesses and in construction -

CHAIRMAN JIM BARRY: Thirty seconds, please, Bob.

ALTERNATE MEMBER BOB COOK: - and that needs to be fixed, because the construction industry is not paying its fair share of commercial impact fees. I'll end there.

CHAIRMAN JIM BARRY: Anybody else? Geez, you drove Frank out of the meeting.

Anybody on the Committee have anything that they need to - to bring up? All right.

I'll remind us our next meeting is next Wednesday in the morning here. Okay. I will entertain a motion to adjourn.

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on September 3, 2008.

Transcription completed: September 11, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPTS OF SEPTEMBER 10, 2008

List of Presenters:

- 1. Charles Cole: Water Harvesting*
- 2. Julio Betancourt: Climate Related Resource
Uncertainties - Part 1*
- 3. Kathy Jacobs: Climate Related Resource
Uncertainties - Part 2*

**Presenter #1
Charles Cole, Citizen: Water
Harvesting**

MR. COLE: Thank you for allowing public input. What I'd like to do over the next 15 minutes or less is have us focus on the question of the potential for harvesting rain water and using that as part of our water needs.

MEMBER JOHN CARLSON: Could you tell us who you are and where you come -

MR. COLE: Yeah, name is Charles Cole. I'm an academic biologist, research scientist. I have a Ph.D in ecology and evolutionary biology from the U of A, 1969. From there, I went to the American Museum of Natural History in New York, worked there 34 years and I'm still, while retired, active on their scientific staff. Do a lot of work at the Southwestern Research Station in the Chiracahuas and in South America, and it was in South America that my wife and I ran into the concept of rain water harvesting.

CHAIRMAN JIM BARRY: Charles, let me interrupt. Is this fact sheet yours?

MR. COLE: Yes.

CHAIRMAN JIM BARRY: Okay.

MR. COLE: That goes with today's talk.

CHAIRMAN JIM BARRY: Is the Rain Water Harvesting Fact Sheet in front of everybody? Go ahead, Charles.

MR. COLE: All righty. So, when we -

CHAIRMAN JIM BARRY: We've already used up a minute and a half of your time, but I'm just getting - start now. The clock starts now.

MR. COLE: When we started to build our retirement home - it's up here in the Tucson Mountains, on the east slope of Tower Peak overlooking the City of Tucson, a couple of miles or so off of the end of Grant Road, and it's notorious for two things in respect to the water issues. We're off the water grid

and people have had the experience, too many of them unfortunately, of trying to drill for a well, and either getting no water, or getting water that lasted for only a year or two until they sucked it all out of the pocket they hit, and then running out of water.

So, with this information in mind, we decided we better just go independently and be on our own. We did put in a well, we didn't want to rely on it. So, we also decided to harvest the rain. Where do we keep the rain water? We keep it in a cistern that's nearly 26,000-gallon capacity. It's 10-feet deep and 20-feet across. How do we get the water into the cistern? We just capture the rain that falls on the roof. You see gutters all around the roof, and down spouts take the water into pipes in the ground and start piping it over toward the cistern. But you see here a fiberglass box which has filters in it; that's the foot rule on top for a scale. These boxes are mail-ordered from a company in Ohio, as mentioned in that article by Peter Pfeiffer in the *Fine Home Building* magazine which was our model for building this.

So, I'll pull the lid off of the filter box, and you see the first thing the water encounters in here is a eight-inch hardware cloth, and that - if it hasn't rained for three months or so, that takes out large things like beetles and twigs and leaves that may have blown up onto the roof. Now, I'll take the lid off of this filter here and you see there's a fabric filter that catches an awful lot of the sediment and then the water goes through the filter into this pipe and on its way on toward the cistern already pre-cleaned. Now, I'll take apart the rest of the filter box there and you'll see that it has a false bottom; that false bottom allows the first 35 gallons or so of the rain water that comes off the roof to just be dropped right out of the box and into a drain pipe and on off into an arroyo nearby so that the gunkiest water after the rain doesn't go into the cistern.

All right. So, we got the water into the cistern. How do we know how much water is in there? And you see this little stand pipe on the side here. You know how to check the oil in your car or truck, you have a dip stick? I just pop the lid off of this pipe here and I have an 11-foot-long dip stick, and I can measure the depth of water in the cistern up to, with accuracy, within a quarter of an inch. If you want to get real fancy and put in a digital readout of some kind, you could do that, too.

Okay. How do we get the water from the cistern into the house? Well, this is a pump house here and I'll lift this roof onto one side and we'll see that we have here a pump and we

have two filters, so water is drawn automatically on demand. We don't have to think about it, don't have to participate in it in any way, it's just like having a pressure tank on your well, if you have a well; it's done automatically that way. When the pressure's low, it turns on the pump, brings the water through these two 20-micron filters.

Now, for those of you who don't normally think in microns, put your thumb and index finger together, and then start to slowly pull 'em apart until you can see light coming through there, and that's just about a millimeter, and there a thousand microns in a millimeter, so that shows you what kind of filtration we have at this point when we take it down to any particles that are larger than 20 microns, and the water goes on into the house.

And this is the pressure tank. And behind the pressure tank - you can forget this tub, that's the brine tank that goes with it, your water softener for the well. Well water's terrible stuff. We use it as little as possible just to keep the well from becoming dysfunctional. So, this has nothing to do with our treatment system. The pressure tank is what brings the water in on demand and establishes the pressure throughout the house, so we have here a large activated charcoal filter tank that the water goes through when the water is called on into the house.

Then up behind that we have two more filters, a carbon block and a sediment block. These go down to ten microns and five microns, and an ultraviolet lightbulb that the water passes over, which blasts any biologicals that may have made it in the water up to that point, and then from here the water goes into the house, and that's the water we use for showering and flushing the toilets and everything at the kitchen sink, washing, dishwasher, clothes washer, et cetera.

But, for the water that we drink, we have a small reverse osmosis unit under the kitchen sink and, by the time the water comes through that, there's just about nothing in it that you want to worry about; it's really clean. I swear we have the best water in town, and I'll put it up against anybody's if somebody wants to do some testing. So, that's the water we drink and we cook with.

Now, in winding down here, what I'd like to do is discuss a couple of possibly bad ideas, and I say "possibly bad" because I don't - I'm not sure they've been investigated sufficiently yet to know whether they're good or bad, but I want to point out too that in building this system, we're entirely independent now. For three years we haven't had to use the well because of the rate at which the water goes in, and our rate of

use from the cistern, and we have a seven-month supply of water in the cistern right now; it's been overflowing since January on and off, and we hope the winter rains will start in three months. I also hope that the next speaker will not tell us that the rainfall is going to stop in Tucson over the next few years. But, I want to point out, too, that in doing this we did this without putting any demands on the Tucson Water's infrastructure, on the groundwater of Tucson, or on the Tucson taxpayers, and anybody can do that. New developments for whether resorts, malls, housing, single houses, multiple houses, what have you, all the developers need to do is start making calculations with their engineers and consult with hydrologists for the part of town where they are, find out what the rainfall is like where they are, put in a fudge factor for bad years of rainfall, good years of rainfall, calculate your square footage area of which you can collect water when it rains, the size of the cistern, et cetera, and then you're in business. This is what they do all over Australia. Google rain water harvesting in Australia someday, you'll be surprised at what you get. Collection surfaces can be roofs, multiple buildings, garages, carports, solar panels.

So, let's get crazy here for a minute. This is where the bad - possibly bad ideas come in. On a broader scale, wouldn't it be interesting if, perhaps, the engineers with Tucson Water and the engineers with electric utilities would get their heads together with people who know something about the aquifer - of course, Tucson Water knows that and rainfall and the possibilities for harvesting in different parts of town and think about combining projects, sort of along the line that Bob Cook was talking about the other day.

For example, we've trashed out a lot of desert in Avra Valley already, and we have all those settling tanks for the CAP water, and someday when we're getting energy independent from foreign oil, we're going to be thinking about huge acreages, square miles of solar panels somewhere. What are we going to do? Are we going to destroy that much more desert for them? Or can we put solar panels on stilts out there in Avra Valley over the water collection basins and can we hook up gutters to them and we - can we collect clean rain water that comes off the solar panels so that we set up anywhere we choose to set them up and then we can take that clean rain water, pipe it either into the aquifer or off into the City Distribution Center? We could cover the CAP canal area with solar panels and capture rain water and we could do it with all the large parking lots in town. People pay twice as much to pay to park in the covered parking section of the Tucson International Airport than they

pay for the uncovered parking. Imagine what electricity could be generated if we covered parking lots with solar panels and we put gutters on 'em and collected rainfall off of those gutters.

A lot of people ask the question: "If you collect the rainfall and utilize it and then send it on its way, aren't you having a negative impact on recharge of the aquifer?" The answer seems to be "No." There's a national average of 61% of the rainfall that rather immediately returns to the atmosphere by evapotranspiration; doesn't have any chance to get down into the aquifer anywhere, anyway; that's a national average. And the average in Tucson where it's warm and dry is even higher than that. But, by capturing that water and getting it into a water-tight container and putting it to use, you get 100% of it, you don't lose more than 60%. And look at the amount of water, the volume that comes off the Santa Catalina Mountains with the rainfall over there. Engineers must be able to come up with a way to capture that rainfall in a fairly harmless fashion and either get it into the aquifer or get it into reservoirs and get it ready for distribution to Tucson.

This may require changing some laws, but our water laws are getting old now and they were formed at a time when we didn't know as much about the aquifers and the challenge in the Tucson Basin as we know today. And we have legislators and what our laws should be doing is working for us not for the past, but for today and tomorrow. So, if there are some legal constraints to some of these thoughts, I don't think those should prevent us from going ahead and trying to come up with the best ideas for solving water problems and adding to our present distribution network capabilities if we can change laws if necessary to help us for tomorrow.

Among the very many good ideas we've heard in the course of these meetings, there's been one that I don't think is as good as the others, and that is an idea that on the one hand says we should develop a tremendous effort and extensive infrastructure development to get ourselves reliant upon foreign water while, at the same time, we're working so hard to get ourselves independent and off of the addiction to foreign oil.

In closing, I'd like to thank the members of the Committee for your long, hard efforts on this project. I can't think of anything that is more important for the future of Tucson. Thank you very much.

(Applause.)

CHAIRMAN JIM BARRY: We've got five minutes left. We'll take questions. Bonnie?

MEMBER BONNIE POULOS: Thank you very much, Mr. Cole. I don't know if you have heard about the Rain Water Harvesting

Ordinance that is in the works for the City of Tucson that may be going for vote in October that would require commercial developments to harvest a certain percentage of rain water for use in their outdoor landscaping. Do you think that's a step in the right direction, or do you think that we need to be doing other things in terms of setting some models for encouraging or mandating water harvesting?

MR. COLE: Well, it is definitely a step in the right direction but, as you say, it doesn't go far enough. Why think of water usage only for outside use when, in fact, it doesn't take much to clean it up and use it for human consumption; in fact, that water's pretty darn clean to begin with. So, I wouldn't draw the line in outdoor usage by any means, and they certainly don't in Australia and elsewhere.

By the way, the City of Santa Monica, California, just built a new library and they built it atop a 200,000-gallon cistern, so this sort of thing is getting underway. I don't know if they're drinking that water or not, but they certainly should be.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: Yeah, many questions. You didn't talk anything about the dollar investment, both the capital and the maintenance and operation of your system, and a couple of those filters, I don't know how the hell you get them to change and that sort of thing. But, the other thing is do you use anything for your landscaping and how about the big deluges, they just roar past your house, you don't try to capture them or anything? Talking about runoff. Go ahead.

MR. COLE: We don't capture the runoff, but that could be worked with also, so that's a potential for other projects. We thought what we caught off the roof would probably be adequate for our needs.

MEMBER JOHN CARLSON: Yeah, I see that.

MR. COLE: And it's working out that way. Our builder estimates that we had to add \$35,000 to the cost of our construction loan and mortgage to pay for this. And, when you look at the locality where we are, that turns out to be a good deal. A recent estimate to pipe water up into Camino del Cerro nearby was that they were going to assess every homeowner \$50,000 to \$60,000, and they voted it down. Other people in our neighborhood whose well has given out on them pay \$7,000 a year to haul water, which means our system has paid for itself already. So, it's more expensive than an in-town water system would be, but for off-site and out-of-grid, it's economical. Maybe \$70 a month to change all the filters; they're easy to get at and easy to change. One of the expenses is the ultraviolet

lightbulb which gets changed every year, and there are a lot of filters involved. It's really difficult for me to get a precise figure on the filters because our well water goes through those filters, too, and it's awful stuff, so it requires them to be changed far more frequently than they would be if we went 100% on the - on the cistern.

MEMBER JOHN CARLSON: How's your electric bill?

MR. COLE: Electric?

MEMBER JOHN CARLSON: Yeah, how's your bill?

MR. COLE: There's just the one pump like you have on a well pump, there's nothing more involved in the electric. Oh, well, the UV light. I don't know how to dissect that out of the electric bill.

MEMBER JOHN CARLSON: Okay. But, it's minor MR. COLE: It's minor.

MEMBER JOHN CARLSON: Yeah.

MR. COLE: Yeah, yeah. No, this can be done in an economical fashion.

CHAIRMAN JIM BARRY: Okay. One more from the Committee and one from the audience. I see that gentlemen. Vince, go ahead.

VINCE VASQUEZ: I guess the question of Tucson Water. What's the average residential water bill?

CHRIS AVERY: About \$17 a month.

CHAIRMAN JIM BARRY: Okay.

VINCE VASQUEZ: How much?

CHRIS AVERY: Seventeen.

VINCE VASQUEZ: Thanks.

CHAIRMAN JIM BARRY: Okay. One from the audience. Yes, sir. Come up here and give us your name, please. You got one minute to ask a question.

JIM BRAITHWAITE: My name's Jim Braithwaite. You've done a wonderful job of taking out the particulates, which is a great first cut on pathogens and UV is very effective. Adding ozone would dramatically increase the disinfection power because the UV stimulates the ozone. Have you considered that in your planning or in your literature review?

MR. COLE: We have not.

JIM BRAITHWAITE: Okay. Thank you.

MR. COLE: I'll look into it now.

CHAIRMAN JIM BARRY: All right, Mr. Cole. Thank you. Very good presentation. Thank you very much. (Applause.)

TRANSCRIPTS OF SEPTEMBER 10, 2008

List of Presenters:

- 1. Charles Cole: Water Harvesting*
- 2. Julio Betancourt: Climate Related Resource
Uncertainties - Part 1*
- 3. Kathy Jacobs: Climate Related Resource
Uncertainties - Part 2*

Presenter #2:

**Dr. Julio Betancourt,
Senior Scientist, USGS:
"CLIMATE-RELATED RESOURCE
UNCERTAINTIES - Part 1"**

Introduction to next presenters from Chairman Jim Barry

CHAIRMAN JIM BARRY: Okay. Let's move on to presentations on Climate-Related Resource Uncertainties... I just wanted to remind us of some slides that we've already seen 'cause, in large part, we're talking about climate and climate variability and how it's going to affect the Colorado River Basin. And you can see that we get 144,000 acre-feet per year out of the Colorado River and, if you add in the Groundwater Replenishment District, another 12.5, so it's about 157,000 acre-feet via the CAP. So, it's important, but it's also part of a larger context. It's not just Pima County, it's those seven states that make up the Colorado River Basin.

Next slide, please. So, in 2020, we're talking about Tucson Water, that looks like about what -Eighty percent Colorado River Water? So, our stake in the Colorado River Water and the reliability of it as a source is enormous and it's important that we keep that in mind when we listen to Julio and Kathy talk today.

And the final slide is we do have this tiered Shortage-Sharing Agreement and there is hope that that is going to go some considerable length to protecting the municipal supplies but we need to, perhaps, revisit that at some time. So, I just wanted to remind us of these slides, because we have an enormous stake in the Colorado River, and so we have a great stake in what we hear about it today.

Our first presenter is Dr. Julio Betancourt, who is a Senior Scientist with the U.S. Geological Survey, and an Adjunct Professor at the University of Arizona in Tucson. He got his Master's and Doctoral Degrees from U of A. He's probably (inaudible) over 130 technical papers and a wide variety of scientific journals. He focuses on climate variability and climate change and how that affects floods and fires and droughts in ecosystems; conducted field studies in the western U.S. and throughout the world. And, over the past four years, he has helped educate and organize our community to stem the spread of African Buffelgrass. I also would mention I have known Julio for a long time, and the last time we ran across each other we were trying to save Tumamock Hill using the County's 1997 Open Space Bonds. So, with that in mind, Julio.

DR. BETANCOURT: Thanks.

CHAIRMAN JIM BARRY: And I will remind you, you've got 30 minutes.

DR. BETANCOURT: Okay. Thanks, Jim, and thanks for the opportunity to address you this morning. So, what I want to talk about is actually the sensitivity of the water supply, both climate variability and climate change in the Colorado River Basin. And remind you that what we've done in switching from groundwater to the surface water of the Colorado River is that we've now changed over to water supply that is actually more subject not just to climate variability, but also to the climate change.

So, I'm going to have a couple of little tutorials here about climate variability -- globally and relative to the Colorado River. I'm going to talk about climate change, and then I'm going to give you an example of a study by a close colleague of mine, Greg McCabe that actually takes some of the Colorado River supply through a water-balance model, and some of the projected changes in temperature, along with some of the possible climate variability. Most of these exercises actually come up with very similar results, so I'm just going to show you one as an example, so you can see what it is that people are doing to address this issue, and then I want to finish with a

I. Decadal-to-Multidecadal (D2M) Variability

- Long intervals when observations remain above/below mean
- Characteristic of instrumental record of past century & tree-ring record of last two millennia
- Synchronized across multiple basins
- Forcing not well understood (oceans); may or may not be predictable
- Unclear how natural D2M will function with climate change
- Water planning has glossed over the problems posed by D2M variability

couple of comments about the projection now from the Intergovernmental Panel and climate change for less precipitation and not just higher temperature

So, first, I want to talk about an issue that we refer to as "Decadal to Multidecadal Climate Variability," and it's defined as long

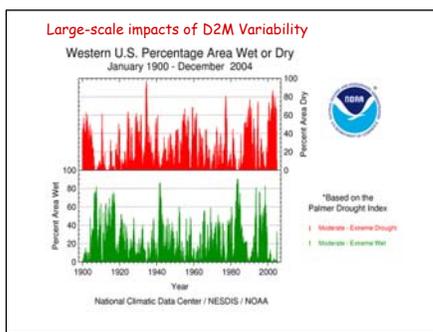
intervals when the precipitation or the stream flow observations remain either above or below the mean from a few years to a few decades. This is very important. It's actually very characteristic of the instrumental record of the past 100 years, and also of the tree ring record of the last two millennia, a lot of it that has been generated at the University of Arizona.

The thing that's interesting, and perhaps troublesome, about this kind of climate variability is that it's synchronized across multiples basins. So, when we have problems in the Colorado River Basin, more than likely we're also having problems in the Mississippi River Basin, we're having problems in the Rio Grande Basin, maybe even in the Columbia Basin. This kind of variability tends to be broad-scale, subcontinental in scale. The forcing is not well-understood. We generally think that the hydroclimatology on land has a lot to do with variability in the oceans. We don't really understand the forcing all that well, you know. Where's it coming from? It's operating through the ocean, but we don't understand whether it's internal variability, or externally driven variability, like solar, or volcanic forcing, for example.

It may or may not be predictable. And I think some of the new evidence having to do with variability in the North Atlantic Ocean in which there is actually a system of currents, a conveyor belt that takes a long time to play through that has kind of intrinsic quality to it that may actually give some predictability to hydroclimatology on land based on what it is that the North Atlantic is doing in terms of its kind of slow operation.

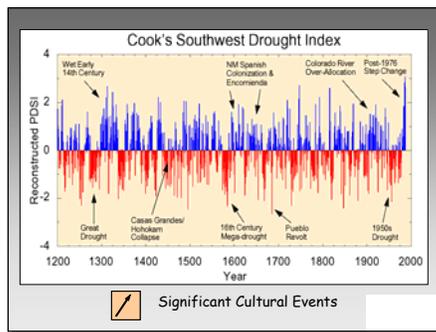
It's unclear how this kind of variability will function with climate change, and I'll argue - and I think most of us would argue - that water planning has generally glossed over the problems posed by Decadal to Multidecadal Climate Variability. If we haven't adapted to this kind of natural variability, that's going to make it that much harder to adapt to climate change.

So, by Decadal to Multidecadal Variability, I mean



this kind of pattern in the red is actually the percent area experiencing dry conditions based on the Palmer Drought Severity Index, which shows these slow oscillations. In fact, at the beginning of the century, you can see the early period in the early 1900s, and in the wet areas down below in the green, that was actually probably the wettest period in the

last century. In the red, you can see the 1930s and the 1950s throughout, and then picking up again since about 1999. And below you can see these relatively wet periods in the '80s and the '90s when our populations grew really, really fast; it's been abnormally wet until the last few years. So, this is what I mean by Decadal to Multidecadal Variability, and you can pick this up in the tree ring record.

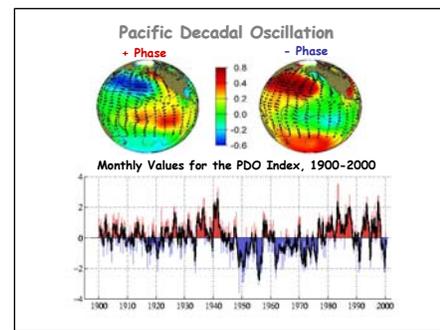


Ed Cook's Southwest Drought Index is based on many, many chronologies, and you can see this kind of fluctuation between relatively dry conditions and relatively wet conditions. So, there's not an equal chance in any given year of getting a wet year or a dry year. Wet years tend to be clustered and dry years tend to be clustered as well.

And you can see some correspondence in these notable cultural events: The Great Drought that ended up in abandonment of the Colorado Plateau by the Anasazi. The Casas Grandes Hohokam Collapse in the 1400s. This big 16th Century Mega-Drought from 1575 to 1595 that was basically coast to coast. The Pueblo Revolt in 1681 came at the tail-end of a major drought from 1673, roughly, to 1681. And then you can pick out the Colorado River over-allocation in the beginning of the century, a relatively dry period from 1930-1960, followed by this big step change in climate where it got relatively wet.

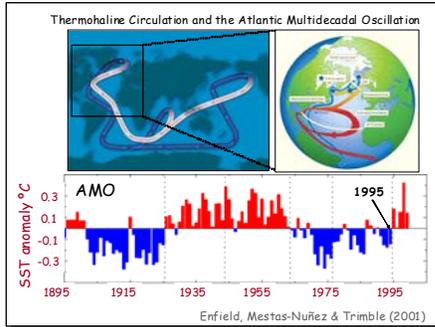
So, this is not only what modulates our water supply; it's also what modulates ecosystem response to climate variability. So, we get these big die-offs of the pinyon and the ponderosa and other things when you have droughts and, in the wake of that disturbance, you end up getting recovery once things get wet again.

So, there are lots of ideas about how this variability is forced- what the reasons and the causes for it are. Most of them have actually to do with the oceans. You've heard about El Niño Southern Oscillation and the Tropical Pacific; this is inner-annual variability that also has kind of a decadal signal to it. It is a physical mechanism; you can actually model it, although not really well in the general circulation models, but you can actually model it; it's physical. We



know a lot about it.

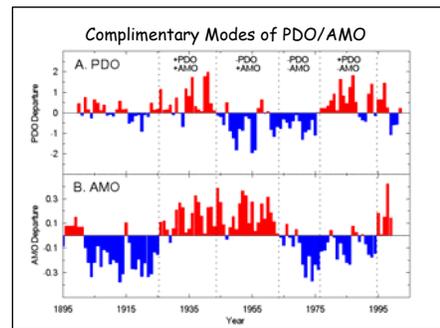
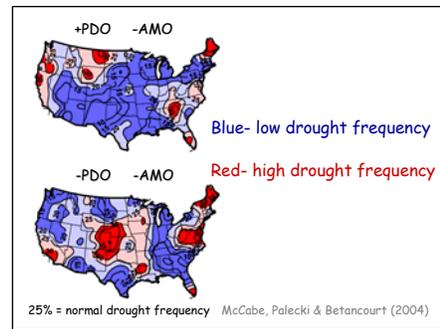
And then there are these other oscillations that you're going to be hearing about: The Pacific Decadal Oscillation, or the PDO, and the Atlantic Multidecadal Oscillation, or the AMO. And I'll show you in a minute what they look like. But, we don't know whether the PDO is actually a physical mechanism; it may be a statistical artifact; whereas, the AMO, we know that it is a physical mechanism tied to what is called the "Thermohaline Circulation."



It is possible that the Atlantic Multidecadal Oscillation, through exchanges of latent heat flux from the Caribbean over to the Tropical Pacific may actually force decadal-scale variations in El Niño and Niña.

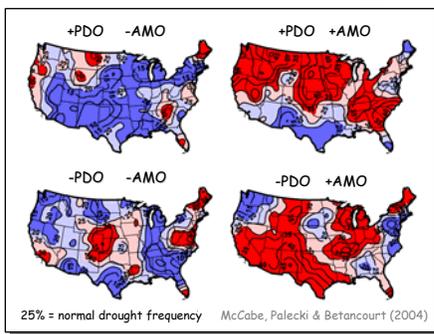
This is the Pacific Decadal Oscillation; it kind of looks like El Niño and La Niña in terms of sea surface temperatures at the top, with the positive phase giving us a lot more precipitation in the southwest; the negative phase, less precipitation. The time series is down below and you can pick out this relatively dry period that we got into from 1946 to, roughly, 1976 when the PDO was actually in its positive phase. And then, once it goes positive, generally we have more precipitation in the southwest.

Here is the Atlantic Multidecadal Oscillation, the time series is actually down below; it's basically average temperature from zero to 70 degrees latitude in the North Atlantic; it is actually the surface expression of something called the "Thermohaline Circulation," this conveyor belt that takes water from the tropics, takes it north into the North Atlantic where it becomes denser, as it becomes saltier and colder, it then sinks at depth and then returns back towards the equator. It's part of a larger, global circulation of heat and water. A packet of water takes about 1,000 years to make its way around. The inflection points in the time series are actually 1930 and 1960 and, in general, when the North Atlantic is warm, when it's in the red in the time series, there's a tendency for North America



to experience widespread drought; and, when it's in its cool phase, there's a tendency for most of North America to experience relatively wet conditions. And you can see the change that happened around 1995 where the North Atlantic turned warm. And so this is an interesting comment that I'll make and that is: That whenever - whenever we see more intense or frequent Atlantic hurricane activity, we also see drought across most of North America, and there is a link.

So, you have to look at these things (e.g., PDO and AMO) in complementary modes so you can see these sort of scenarios that I've put together with the two time series where the PDO and the AMO are either in their positive or negative phases. And so, in general, when the PDO is in its negative



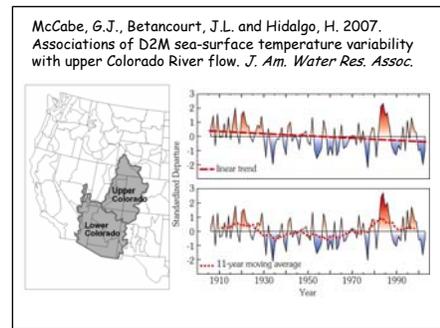
phase and the AMO is in its positive phase is when we get the most intense droughts in western North America and, particularly, in the southwest.

So, I'll show you what this looks like mapped out. Don't bother too much about the numbers, just remember that blue means low drought frequency, and red means high drought frequency. So, let's take the AMO, map

out when the North Atlantic is cool and change the PDO from positive to negative to see what happens. So, on the top you see that what happens is that when the AMO is cool in both instances (both positive and negative PDO), North America is overall wetter than normal; whereas, what you end up doing when you change the PDO from its positive to the negative phase is you actually shift the areas of drought, for example, to the Pacific Northwest when the PDO is in its positive phase, and then back to the southwest when it's in its negative phase. In respect to the PDO, as well as El Niño/La Niña, the Southwest and the Pacific Northwest tend to behave in opposite fashion.

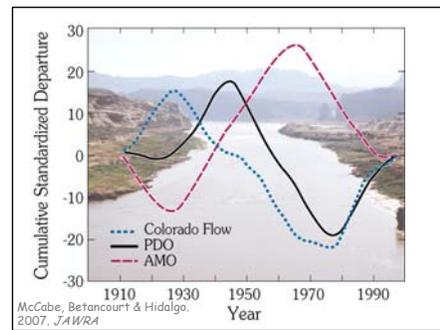
When the North Atlantic is actually in its warm phase, we have exactly the opposite, where we have continental-scale drought over the U.S. Again, when you change the PDO from negative to positive, you shift the areas that are either wet or dry from the Pacific northwest to the southwest.

So, let's look at the Colorado River real quick. This is from a paper where we looked at these kinds of things last year with Greg McCabe (USGS hydrologist) and I and

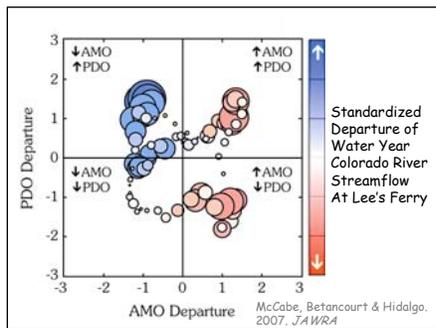


Hugo Hidalgo at Scripps Institution of Oceanography , and so what you have here are two times series of Colorado River stream flow of natural - naturalized Colorado River stream flow, and you see this sort of general trend downwards, and then we take that trend out and we just look at the variability over time, and you see these periods of relatively low flows, and these periods of relatively high flow. And I want to sort of put those into context relative to some of these climatic indices that I've been referring to.

So, I'm not going to go into a lot of detail. You'll get the picture here pretty quickly. This is cumulative standardized departures of Colorado River stream flow, plotted up in the blue dotted line against the PDO in the dark line the AMO in the dotted red line. You can see this inverse relationship between the stream flow and the AMO, and less so with the PDO. So, taking this at face value, the Pacific is surprisingly less important

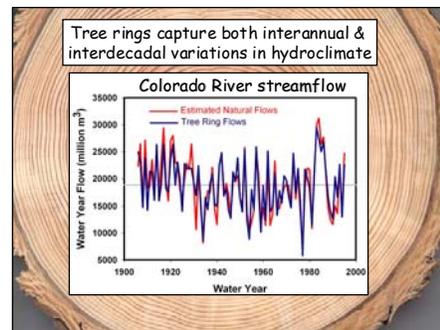


in Colorado River stream flow than the North Atlantic.



Now, we've looked at these patterns frontwards and backwards and we've also looked at them back in time, and now I want to introduce the tree ring record. I'm sure most of you are familiar with the fact that annual rings, particularly

in conifers, are indicative of climate during the season that the ring was produced. And particularly averaged over relatively large areas, there's a tendency for the tree ring widths to actually capture not just the inner-annual variability in precipitation and stream flow, but also the decadal scale variability. So, here you see by decadal scale I mean this kind of slow variation over time in tree-ring growth vs. Colorado River streamflow during the 20th century.

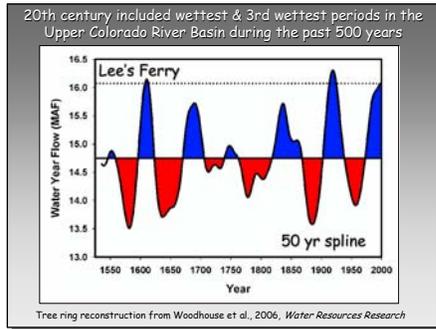


CHAIRMAN JIM BARRY: Fifteen minutes, Julio.

DR. BETANCOURT: Okay.

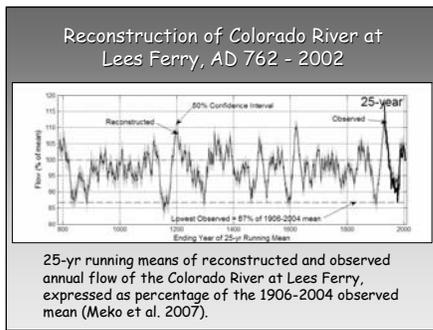
So, let's take back in time some of this data for Colorado River stream flow reconstruction that just happened and

was published first in 2005, and then again in 2007 by Connie Woodhouse and Davie Meko and Steve Gray. And this is a 500-yr reconstruction that was published three



years ago, and now they've actually taken it back more than 1,000 years. And there's some really interesting aspects of this chronology. Here we are in the 20th Century, with this big, huge wet period from about 1905 to 1921, and then here's the dry period in between, and then the wet period that returned. You can look back further in

time and compare the magnitude and frequency of such periods back in time. And take a look at this 1130 to 1150 drought, there's absolutely no reason why that drought could not occur today, by the way, in terms of the boundary conditions, the



earth's boundary conditions. So, you know, it's pretty obvious that the last 100 years doesn't really capture the variability that's occurred over the last 1,000 years.

Here's another example of this now smoothed out with a 50-year line - and the story here is the 20th Century included both the wettest and third-wettest periods in the upper

Colorado River Basin during the last 500 years. So, there's a little bit of an illusion of surplus from the 20th Century instrumental record that does not actually match in the tree ring record.

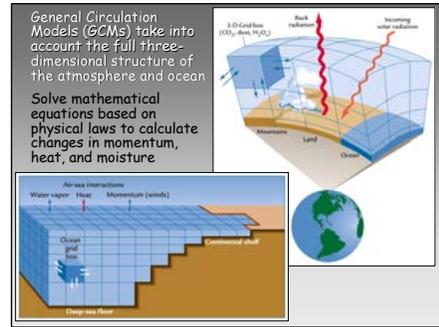
Okay. Climate change in the West. You've been hearing and reading about this in the newspapers. There's been a one to two degrees Celsius, depending on the elevation, warming since the 1980s, longer and hotter growing seasons, less snow pack,

- II. Climate Change in the West
- 1-2°C warming since 1980s; longer & hotter growing season, less snowpack, earlier snowmelt & streamflow, more large fires, more extensive bark beetle outbreaks, etc
 - ~60% attributed to greenhouse gases
 - Different hydrologic studies agree more or less on how warming will affect UCRB water supply
 - Multiple climate models predict less precip at subtropical latitudes, more at high latitudes
 - Regional climate has exited envelope of natural variability & past no longer indicative of future

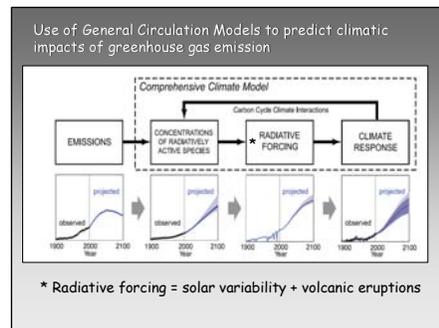
earlier snow melt and stream flow, more large fires, more extensive bark beetle outbreaks, et cetera. All these things are tied together to this this advance in the onset of spring and a longer growing season, including things like we're getting a greater proportion of precipitation as rain rather than snow higher up all of these mountains which are,

basically, the water towers that we depend on.

There's a recent study by people at Scripps and USGS where they've actually taken general circulation models and downscaled them into both regional climate models and hydrological models, and 60% of these patterns that we're seeing are now attributed through this modeling to the buildup in greenhouse gases. Again, most hydrologic studies agree, more or less, on how the warming will affect the water supply in the Colorado River. There's a new development now, particularly with the last Intergovernmental Panel on Climate Change (IPCC) report, that are now almost unanimously predicting less precipitation at subtropical latitudes, more at high latitudes. I'll have a slide at the end that refers to this, where the southwest is actually in the crosshairs.



The last point that I'll make is that the regional climate has exited the envelope of natural variability, and the past no longer is indicative of the future. So, we use these general circulation models that take into account the full three-dimensional structure of the atmosphere and the ocean to solve mathematical equations that are based on physical laws to calculate changes in momentum, heat and moisture. I'm old enough to remember when this first started, I didn't have a lot of confidence in what I saw, and now I have a tremendous amount of confidence. These models have really improved. These are heroes in the scientific community. These guys have done a marvelous job. So, one of the things they do is they take these models, they plug in the emissions and then, through a series of steps, they'll look at the impact of the concentrations of those radioactively active species of compounds, they'll look at the radiative forcing. By "radiative forcing" I mean solar variability or volcanic eruptions which can, in fact,



modulate the climate, and then they look at the climate response. So, this allows them to actually take any of these steps and look at it separately and together, and this is what has been done with the IPCC, and the answer to questions about the uncertainty of climate changes that follow. And that is that, when you take the natural forcing and you force the models just with the natural forcing, they can't reproduce the actual

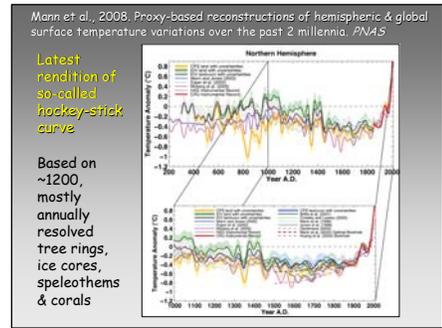
observed temperature trend, but when you take the two together they reproduce it fairly well.

CHAIRMAN JIM BARRY: Let me ask a quick question. Can you explain what you mean by "forcing?"

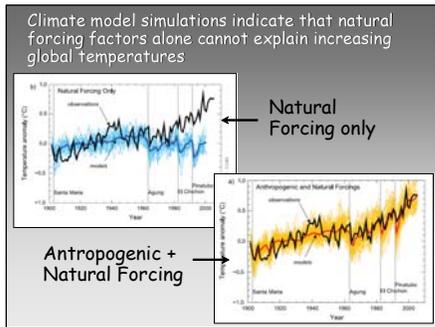
DR. BETANCOURT: By forcing I mean what is the initial reason for why the climate is changing? It could be that you had a volcanic eruption that puts a lot of particulates up in the air and blocks the sun, or it could be solar variability.

CHAIRMAN JIM BARRY: Okay. I gotcha.

DR. BETANCOURT: So, people have actually taken great pains to collect proxy data for instrumental data, and these are tree rings (inaudible) and corals, and then developed something that you've heard about, I'm sure, before, which is this hockey stick curve with this big change over at the end. So, this is the latest and greatest, this is a paper that just came out in the proceedings of the National Academy of

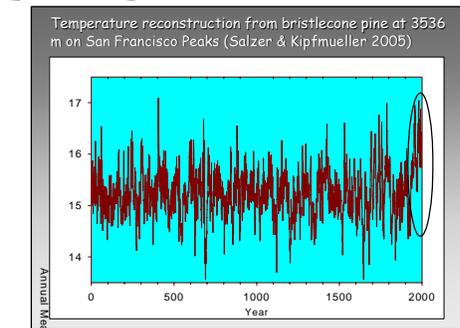
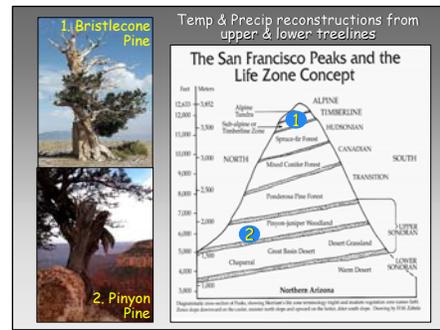


Sciences by Michael Mann at Penn State and others. It shows that over the last 1,000 years, clearly, the last century has an anomalous rise in temperature throughout the northern hemisphere and, actually, globally. Now they've taken it back another 1,000 years and you could argue the same for the last 2,000 years that the recent increase in temperatures is unique.



And

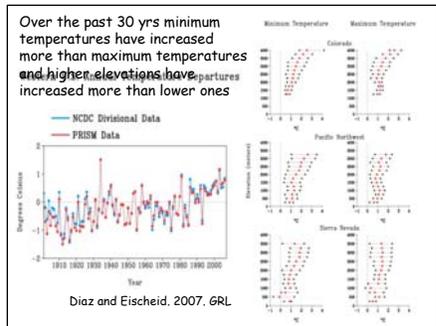
you can actually see this in our own data. I'm going to take you to the upper tree line at San Francisco Peaks where Bristlecone Pine actually responds to the length of the growing season and summertime



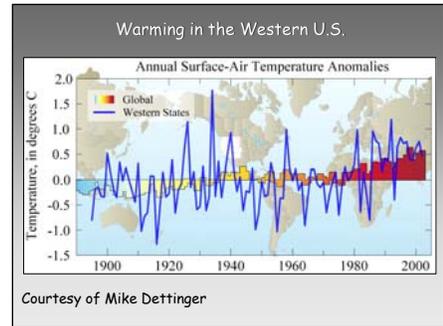
temperatures, and there's a wonderful reconstruction that spans the last 1,500 years from upper tree line just north of Flagstaff and San Francisco Peaks, and here it is and at the end here's this big rise. So, these Bristlecone Pines at upper tree line that respond primarily to

temperature variations are now adding an unprecedented amount of wood every year.

If you look at the temperature trends over the last 100 years throughout the west, that is that blue line, you can see the rise over there at the end, it almost appears like in step fashion. You can see that around 1984, or in the 1970s, and certainly by 1984, there's this big

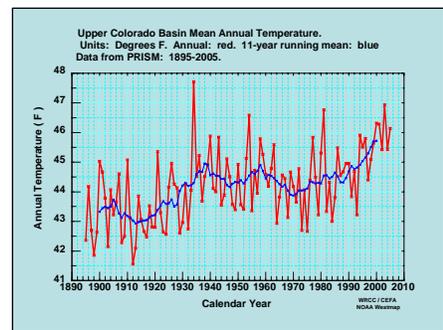


shift to higher temperatures, and underneath it is actually the global temperature curve. There are two observations to make about these temperature changes in the west, and one is that minimum temperatures have increased more than maximum



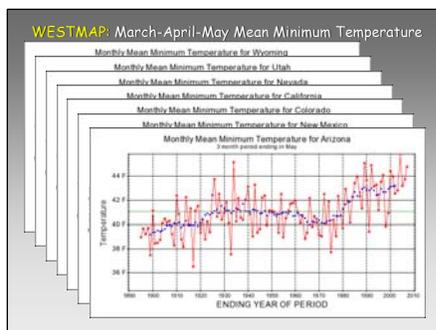
temperatures, and then that higher elevations have increased more than lower ones which, of course, affects snow packs. So, at lower elevations there's been about a 1 degree C increase and, at higher elevations, there's been about a two-degree C change in temperature.

CHAIRMAN JIM BARRY: Ten minutes, Julio.

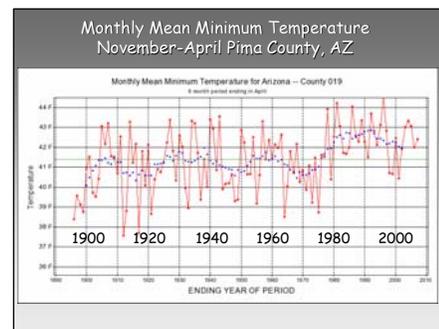


DR. BETANCOURT: Okay. You look at temperature averaged over the upper Colorado River, here's the trend and you see that rise there towards the end.

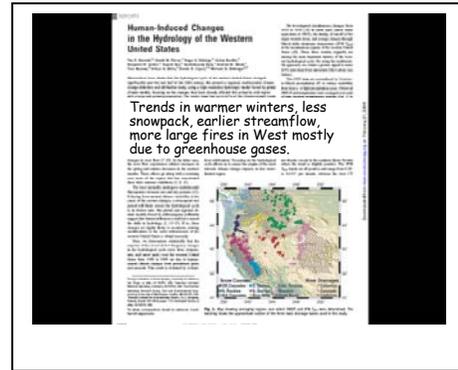
And then what I want to do is show you all of these Colorado River states. This is not just the tyranny of averages over a region; each one of these regions has pretty much the same change, and this is a change that's



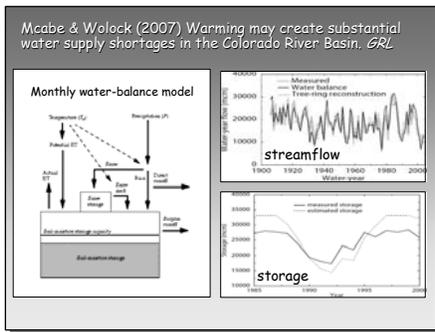
occurred relatively recently and you look at Arizona and you can see this big change after about 1984, but relatively flatlined below



until you get to the beginning of the century. You want to look at Pima County, it's exactly the same thing. This is something that is being seen everywhere; it's not just a matter, again, of the tyranny of averaging over large areas. So, there's been this study by Tim Barnett, et al., that I mentioned and that is that the trends in warmer winters, less snow pack, earlier stream flow, more large fires in the west are mostly due to greenhouse gases.

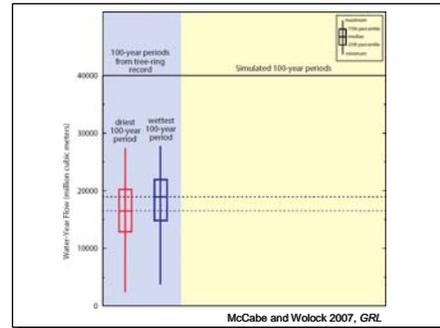


Now, what people have done

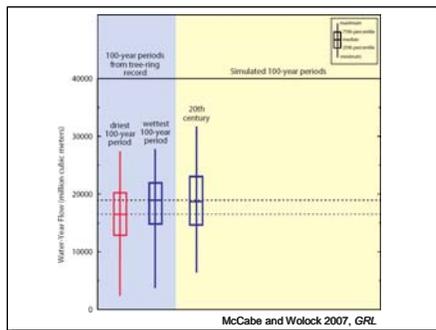


with the Colorado River, they're taking all of these trends and actually starting to plug them in to hydrologic models. These next slides come from a study by Greg McCabe, who's a USGS scientist and actually Dave Walock, another USGS scientist, and they've taken a water-balance model where they can partition precipitation

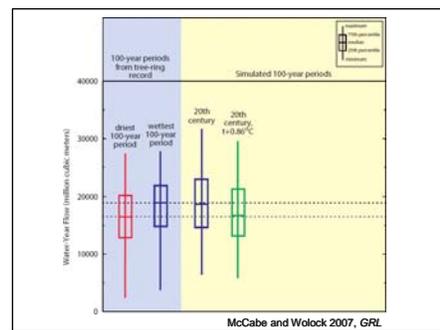
into different components and they can basically back out stream flow and, also, storage out of these models and then play different games, increasing the temperature by a degree or two degrees C, and then actually using past droughts as the scenario to see what would happen.



And so I'm going to take you through this really quickly.

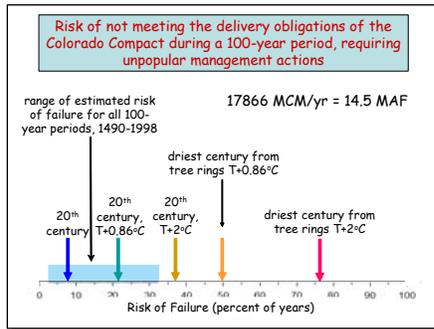
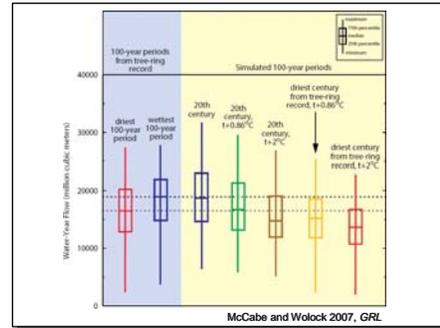


So, this is water year flow in million-cubic meters per year, and so the first thing I'm going to show you is the driest 100-year period from the tree ring period and the wettest 100-year period, sort



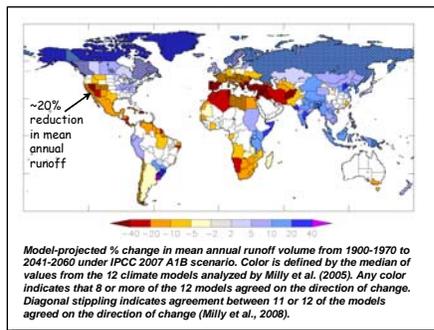
of defining the envelope of variability, that's where the 20th Century is, when you add 0.86 degrees C, even if you don't change the

precipitation, you end up looking like the driest 100-year period in the last 500 years. When you add two degrees, you actually go below the envelope of natural variability. And then if you take the driest century from the tree ring record and you add 0.86 degrees C, which is what we've experienced in the upper Colorado River in the last 100 years, this is what you get. And, with two degrees, the driest century would produce something like this.



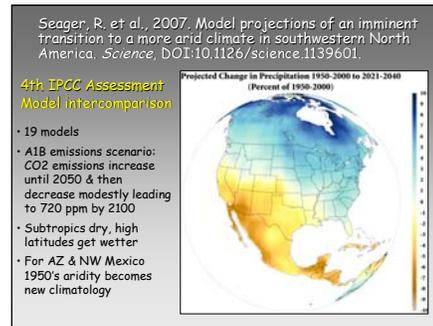
more than 75% if what we look at are two degrees warmer and we apply that the driest century from tree rings.

I want to move on real quick. I just want to say that for most of these scenarios, increasing reservoir storage capacity will not mitigate the effects of increased temperatures at all.



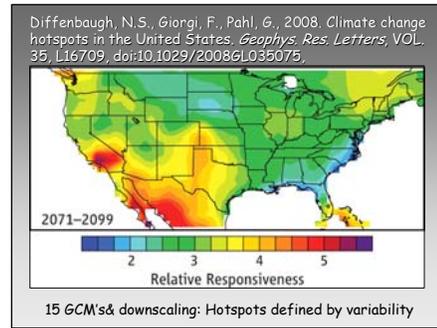
So, that's what they're saying and - and, actually, the scientists that work on this are pretty insistent that this is the case. I still think there are some questions, but I think this is troublesome for us. And, of course, the devil's always in the details. That white area in between the yellows and the

And the bottom line is the following: This is the risk of not meeting delivery obligations in the Colorado River Compact during 100-year period requiring unpopular management actions. And so you can see that the risk ranges from 10% or so, maybe 20% if we add just a degree C without really changing the precipitation, all the way out



to to
 the way out
 to
 what's going to happen is the high latitudes are going to get wetter and the low latitudes are going to get drier, and you can see this bull's-eye painted over the southwest. The argument here is that in the 21st Century, the mean climatology is going to look more like the 1950s drought.

blues raises the question of how big is that white area, that neutral area? That neutral area seems to be centered over the Colorado River, so are we just going to see stationarity, where the precipitation is not going to change much over the Colorado River, but we're going to be impacted further south? And so there's some real questions here. And people are now running downscaled regional models to try to get a better handle on what's going to happen exactly in the southwest. For example, Noah Diffenbaugh and others have now taken 15 general circulation models and they've looked at the regional sensitivity to changes in different climatic parameters, including their means, extremes, and variance. A map of relative changes in climatic variance shows the Southwest as a hotspot for climatic change.



So, I want to make one final comment and then I'm done. We had a paper come out in science earlier this year - the title was "Stationarity is Dead, Whither Water Management." Stationarity is actually the assumption that the future is going to look like the past, and I think we've now exited the envelope of natural variability in a directional but, yet, uncertain direction. And so now projected changes in runoff during the multidecadal lifetime of major infrastructure projects are large enough to push the hydroclimate beyond the range of historical behavior, and much of the fundamental assumptions that we've used in water planning and water management worldwide are now violated by this particular phenomenon. So, I'll leave it at that. Thank you very much.



(Applause.)

CHAIRMAN JIM BARRY: Julio, thank you. Can we hold questions until both of the presenters are... okay Dan - go ahead.

MEMBER DAN SULLIVAN: - if I could. Well, our science has started basically (inaudible; not speaking into a microphone). There's no doubt that global warming has generated intense (inaudible) on both sides of - the other side is (inaudible) seen here today, this is the question, so you can correct me where I'm wrong, is that there has been an enormous variability in the past concerning (inaudible), without greenhouse emissions being (inaudible) the cause of those enormous changes and

fluctuations, but certain scientists seem to be saying now that we have the same manner of variability in the future, it must be greenhouse emissions -

DR. BETANCOURT: No, that's not what we're saying.

MEMBER DAN SULLIVAN: Well, the only cause (inaudible; not speaking into microphone) between what is happening now and the past is the (inaudible) of how temperature changed. Other than that is there any other reason?

DR. BETANCOURT: Let me back up a second and say that when you run these models, you take into account the so-called forcing, the natural forcing, whether it's solar variability, which we can actually compute or -

MEMBER DAN SULLIVAN: And then some scientists say today is the cause for recent (inaudible).

DR. BETANCOURT: By "some" you're talking about a fraction of a fraction.

MEMBER DAN SULLIVAN: (Inaudible; not speaking into a microphone) that doesn't mean that necessarily more; that they're a fraction of a fraction.

DR. BETANCOURT: No, but I guess what I'm telling you is that variability is actually taken into account; that natural variability and the forcing, whether it's solar variability or whether it's volcanic forcing is actually taken into account in the models, and when you do that you actually can't reproduce the actual observed global warming or regional warming or length of the growing season; that these are not things that have changed in the same way within the recent past.

MEMBER DAN SULLIVAN: (Inaudible; not speaking into a microphone).

DR. BETANCOURT: Oh, no, there's no question that these things have happened before in the past. They haven't happened this quickly, and they haven't happened in the context of the kind of demands that we have on natural resources, including water.

CHAIRMAN JIM BARRY: Okay. Let's -

MEMBER DAN SULLIVAN: (Inaudible; not speaking into a microphone) -

CHAIRMAN JIM BARRY: Let's revisit this.

MEMBER DAN SULLIVAN: - (inaudible; not speaking into a microphone).

DR. BETANCOURT: I'd be more than happy to have this conversation with you after.

TRANSCRIPTS OF SEPTEMBER 10, 2008

List of Presenters:

1. Charles Cole: Water Harvesting
2. Julio Betancourt: Climate Related Resource Uncertainties - Part 1
3. Kathy Jacobs: Climate Related Resource Uncertainties - Part 2

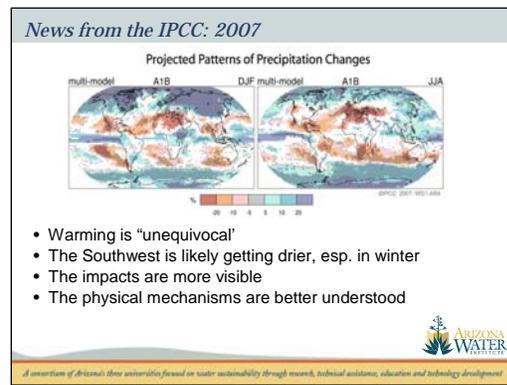
**Presenter #3:
Kathy Jacobs, Executive
Director Arizona Water
Institute:
"Climate Related
Resource Uncertainties
- Part 2"**

Introduction to next presenter from Chairman Jim Barry
CHAIRMAN JIM BARRY: Our next presenter is Kathy Jacobs, who is the Executive Director of the Arizona Water Institute, which is a consortium of Arizona's three Universities, focused on water sustainability. She worked for the Arizona Department of Water Resources for 23 years and was Director of the Tucson AMA for 14. She has worked on climate change and water management issues at the national level for over a decade and is on the California Department of Water Resource's Climate Change Advisory Committee. Kathy?

MS. JACOBS: Thanks, Jim. It's a pleasure to be here today. And I actually want to make a point of acknowledging the contributions that Julio has made to this whole topic. Frankly, it requires almost a renaissance scholar-type of mind to pull all these pieces together that he just shared with you, and he's one of several people who influenced me to change from being an ordinary, regular water manager to being somebody who actually has been trying to bridge the gap between the climate science and the water management experience because, frankly, there is a very big gap. We haven't yet figured out how to use the kind of information that Julio just presented when making long-term management decisions. The talk I'm going to give today talks a little bit about what the climate implications are for water management, but then I'm essentially going to go into an area I really haven't talked about before, which is sort of specific advice for people in this part of the world as to how you might respond to this information.

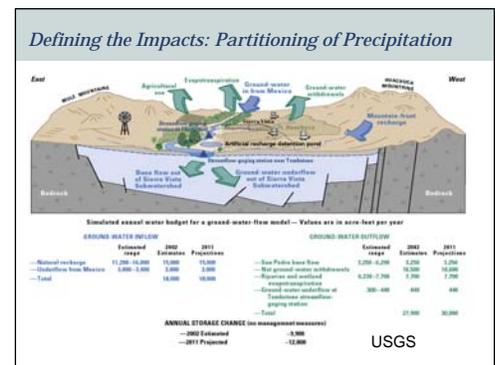
So, I know you've seen lots of presentations about what's going on with the Colorado River and the way the allocation scheme works. I think the part of the reliability issue associated with the Colorado River has to do with the management overlay. Lots of people have different perceptions about what all this means to water management in Tucson and in various parts of the west, but there is this bottom line condition which is that it has been over-allocated. But we do have a water management system which is capable of responding in many ways to some of these kinds of challenges that we're discussing.

One of the things that Julio mentioned was the International Panel on Climate Change (IPCC) that is actually the consensus of thousands of scientists across the world, including 170 countries, who come together every five years to compare what is going on from a climate science perspective. These folks came to the following conclusions in this year's study: The warming is unequivocal. There is no doubt whatsoever that the globe is warming. They came to a conclusion that there's - I believe it was a 95% certainty - that warming is influenced by human activity. More important to me was that for the first time the International Panel on Climate Change said that the southwest is not just getting warmer, it may actually get less precipitation as well. This is new news because, historically, all of the conversation about precipitation has been that we really don't have a good enough handle on what's happening precipitation-wise.



We get it about the temperature; precipitation is still a little confusing. But, what we do see in this (I'm sorry, this is small) is the winter situation modeled from multiple models. I think it's 19 models, and this is the summer situation.

In the winter, you see this big, brown blob over the southwest. In the summer, you see a big white area over the southwest. What the white area means is that the models don't agree. What the brown area means is that the models do agree. And, as Julio mentioned, it's not



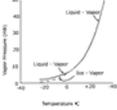
exactly clear where the upper part of this line is, but the point is we're now seeing models agreeing that precipitation is going to reduce, and that is a bit of a problem.

So, one of the things that I've been trying to do is

Connecting Science and Water Management



- Projected climate change impacts on flows in the Colorado are significant; majority of models project 10-40% reductions in runoff



- Temperature affects both supply and demand – the demand side of this equation is important
- Implications for groundwater not well understood

help people understand what the implications of this kind of information might be from a water management perspective. This is actually a model of the San Pedro watershed. But, it's very important for people to understand where the source of water comes from that actually recharges the aquifer and flows in the rivers, et cetera. A very great percentage of it actually

comes from mountain front recharge into the aquifer, or from recharge coming through river basins that results from precipitation. So, if you are getting your recharge from the mountain front, it matters a lot what's happening with the winter precipitation and the snow pack. The point of this is the impacts of climate change and climate variability are actually different on different watersheds, and you need to understand the hydrology of your own watershed to the extent that you're dependent on local resources, as opposed to imported resources like the Colorado River.

When people look at the climate change impacts on the Colorado River, there really are no conclusions at this point that you would have an increase in flows. There's a fairly wide range in terms of what the decrease might be, but it's in the 10 to 40% range. Does that mean it's going to be lower every year? Of course, it does not. And what Julio just got through explaining to you is this impact of climate change is actually going to lie on top of an underlying pattern, which may or may not change dramatically, an underlying pattern of dramatic shifts from wet to dry.

Importantly, however, temperature is a huge variable in the hydrologic cycle; temperature affects both the supply by causing more evaporation from reservoirs and by reducing runoff availability, but also demand. This is not something people talk about that much. When you see increases in temperature, it increases municipal demand for landscaping; it increases demand for energy for cooling; it increases demand for the environment; and it increases demand for agriculture.

So, we have a demand side of this equation that we're not necessarily putting into the context of what's also happening with the supply side. And, further, we have not yet

gotten to the point where we're very sophisticated about understanding what the impacts on the groundwater supplies might be, and almost nobody is talking about that. So, we have a set of assumptions that are based on stationarity as Julio indicated that, in the future, we'll have average inflows of groundwater, average inflows of surface water, and the only thing that's going to vary is what people do. Well, that's actually not the case. We're probably going to be seeing changes in both the groundwater supply and the surface water supply, and we need to figure out how to deal with that.

Increasing demand, decreasing supply

- Growth and water supply issues: Increasing demand, changing values and over-allocation mean future "normal" droughts lead to greater impacts and more water rights conflicts
- Integration of long term planning, land use, water supply, flood control and water quality plans is imperative

On top of that, we have this increasing growth scenario. Obviously, we have a little break thanks to various mortgage companies that may or may not have done us very many favors, but we do have an ongoing growth pattern in exactly the places where we are expecting to see some of the biggest impacts of climate change. So, one of the obvious conclusions, which is actually very obvious, but very difficult, is that we need to do a better job of integrating the way we develop our land, integration of long-term planning, land use, water supply, flood control, and water quality. Now, if you thought it was difficult to integrate all the different kinds of science that Julio was talking about, this is even more difficult because of all the social factors that are involved. But frankly, this is the direction we need to go and it's very difficult from an institutional perspective.

Now, just to talk a little bit more about the sources of uncertainty that are associated with climate, a lot of the way the Colorado River is managed is through modeling, and the group I work with has looked at a lot of the assumptions in that modeling. One of the keys ones, obviously, is inflow. I mean, the degree to which we have water in the reservoirs is dramatically affected by whether you're in a wet period of time, as Julio just described, or a dry period of time.

Sources of Uncertainty

Table 5: Combining Assumptions to Form Best- and Worst-Case Scenarios

Key Assumptions	Shortage Probability	
	HIGHER	LOWER
Inflow	Prolonged drought (e.g. 1999-2004)	Extended high flows (e.g. 1983-1986)
Demand – UB	Limit: 5.4 maf Rate: UCRC	Limit: 4.8 maf Rate: AWBA
Initial Conditions	Jan. 2005 (i.e. 50% capacity)	Jan. 2000 (i.e. nearly full)

Dustin Garrick

There's also this Upper Basin demand factor, because one of the things that's actually saving us right now from hitting shortages is that the Upper Basin has not actually developed its full allocation of water supplies and, therefore, the assumptions you make about how quickly they do that have a lot to do with how reliable our water supply is.

And, third, initial conditions, when you start these models, if you start them with the reservoirs dry, or half-empty, you come to a very different conclusion very quickly than if you start with all those reservoirs completely full. And what we've actually had the opportunity to observe in the last ten years is the reservoirs going from almost completely full in 1999 to being half-empty in 2005 much more quickly than anybody anticipated could happen. So we now have had the opportunity to experiment with different initial conditions.

*6 Reasons **not** to worry about Colorado River supplies in the next 20 years*

- Municipal demand has highest priority on CAP
- Upper Basin demand not built-out
- Shortage sharing criteria increase the likelihood of shortages for agricultural users but decrease the likelihood for municipal users (more frequent, shallower droughts)
- Significant AWBA credits available and groundwater in storage
- Las Vegas
- Basin states have a track record of working together, despite ongoing rivalries... **However....**

I'm going to share with you some of the reasons I'm not as hysterical about the short-term as I am concerned about the long-term in terms of water supply availability and the implications for people who are dependent on the Colorado River. I mean, first of all, municipal demand has the highest priority on the Central Arizona Project. That's a good

thing. It's much smarter than the way California sets things up where their agricultural priority rights are actually higher than municipal in many cases.

The Upper Basin demand is not built-out. The Shortage Sharing criteria that were just adopted do a lot to actually buffer the municipal interests against the implications of shortages. We do have the Arizona Water Banking Authority, which is a very far-sighted operation that has been created to actually firm up municipal water supplies, because we all realized, even before climate change, we were not going to have perfect reliability on the Colorado River System.

We also have a lot of groundwater in storage. There's lots of acre-feet of groundwater underneath the Tucson Basin; it's estimated to be around 60 million acre-feet for the Tucson Active Management Area; that does not mean it's a good idea to pull it out, but it is there.

Another reason is that we may or may not want to get terribly worked up is the fact that Las Vegas' total source of water supply comes out of Lake Mead. Do I think Lake Mead is going to go absolutely dry so that Las Vegas has no water?

Absolutely not. The management system in place is intended to keep that from happening and Pat Mulroy is not in favoring of blowing away.

Then, finally, in terms of this not worrying part, lots of people talk about conflict in the Colorado River. The reality is we do solve problems, we have evidence of that in the most recent shortage-sharing discussions.

CHAIRMAN JIM BARRY: Fifteen minutes, Kathy.

MS. JACOBS: Thanks.

I, however, have more reasons why I'm actually quite concerned about the longer-term. First of all, all these modeling efforts that were just described to you track what the emissions scenarios are likely to be, and a lot of them have some pretty rosy assumptions. The actual emissions scenarios are higher than anything that's been modeled, including in the most recent IPCC discussion.

Temperature impacts are a bigger driver than people are acknowledging and they really affect demand, as well as supply. The energy water nexus, which is the fact that energy is required to pump and deliver and treat water and water is required to generate energy - those two things together mean we have to consider energy shortages as well as water supply in a much more coordinated context than we have in the past, and we're not doing that very well yet. This is sort of brand new news to the world. We're not sure what the impacts of climate change on groundwater will be, but they could be significant and, as we all know, we're still pretty dependent on groundwater in this state, even in this area.

Extreme climate events. We've talked a lot about averages and what might happen in a decadal situation. There is the potential for low probability, high-impact events that are caused by ice sheets or big changes in ocean circulation. We are not prepared for those kinds of events; just in the same way we're not prepared for these truly decadal-scale droughts that have been seen in the tree ring record.

9 reasons that the longer-term IS worth worrying about

- Current emissions track exceeds the highest scenario modeled by IPCC
- Temperature impacts are a huge driver of supply reductions and demand increases
- The energy-water nexus means that water supply planning and energy planning need to be conducted in tandem ...
- We are not sure what the impacts of climate change on groundwater will be, but they could be significant
- Extreme climate events and system failures CAN happen and we are not well prepared for them

And the final reasons I'm worried: CAP has a lower priority than other interests.

Reasons that the longer-term IS worth worrying about (cont).

- CAP has lowest priority on Colorado River; CAGR and Arizona Water Banking Authority are dependent on excess water
- The AWBA has not stored credits in the Tucson AMA in proportion to the size of TAMA's municipal allocation; this slightly decreases reliability
- CAP is more subject to climate variability than groundwater
- People are more unpredictable climate!



Central Arizona Groundwater Replenishment District, and the Arizona Water Banking Authority, who are sort of responsible for part of our savings account, are dependent on excess water and, to the extent that excess water doesn't exist, they don't function as well. The Water Bank has not stored credits in the Tucson Active Management Area in proportion to the size of our

municipal allocation. This means that the stored water is actually not physically in this Active Management Area. It has to come through the Central Arizona Project canal; that increases our issues with reliability. And, as Julio indicated, we are moving to a renewable water supply, which is a good thing. We have a redundant water supply because we have groundwater and we have surface water but, to the degree that we are actually becoming more dependent on CAP, we are more subject to climate variability than we were before.

And, finally, if you look at the whole scheme of things, the uncertainty associated with the behavior of people far exceeds the uncertainty associated with the climate, and this is a big challenge.

So, my perspective is we can't wait to start making investments in climate adaptation. And by "adaptation" I don't mean looking at mitigation of climate, of emissions of greenhouse gases and the carbon footprints, and all that kind of stuff, I'm talking about what water managers need to do in order to respond to all this.

So, the impacts of climate change on water supplies are already visible across the west. We haven't had much chance to really show you that but it is, in fact, the case.

The potential for decadal to multidecadal drought is real. New infrastructure requires decades to plan and build. Look at how long it took us to get the Central Arizona Project here. The likelihood of damage from extreme events is increasing, and this is a totally uncontroversial conclusion. When you increase the rate of the hydrologic cycle, you increase the impacts associated with extreme events. We've seen more

Investments in Adaptation are needed TODAY

- Impacts of climate change on water supplies are already visible and vulnerability is real
- Potential for decadal to multi-decadal drought is real
- New infrastructure requires decades to plan and build
- Likelihood of damage from extreme events is increasing
- Ecosystems are especially vulnerable
- Climate change adds stress to a system that is already stressed

intense rainfall, et cetera. We are very concerned about ecosystems from the perspective that they can't evolve quickly and protect themselves fast enough to deal with all this, and climate change adds stress to our own institutional, political and economical system which, in case anybody hadn't noticed, isn't doing terribly well right now, anyway.

So, what are we going to do about all this? This is sort of the happy ending part. There are lots of tools available to deal with all this, and many of them are actually good for the economy and good for us as managers. One of the ways to respond when you leave a stationary system and you don't



So what are the adaptation options for water management?

And how do we deal with the combination of climate variability and climate change?

know exactly where you're going, is to move into something called "adaptive management" where you're doing a better job of actually tracking what's happening and tracking the responses to your own management activities. It's not an easy thing to do, but it is an alternative to sort of pretending everything's going to stay the same all the time.

Adaptive management is more expensive because it requires more information and it requires more judgment on the parts of managers themselves, and so it's not something that everybody thinks is such a fabulous idea but it is, in fact, a lot better than staying still and watching while things sort of fall apart. One of the things that this means is we need to do a better job of monitoring all of what it is

Adaptive Management Requires Better Information

Salt River Project Monitoring Station

- Need to improve monitoring and data collection to identify and respond to regional and local trends, and allow for better early warning systems
 - Focus on critical or vulnerable systems
 - Operational, real-time delivery
 - Better data access, storage and retrieval
 - Real-time analysis, visualization; "smart" monitoring systems
 - Feedback and evaluation

that we're seeing out there, whether it's demand or it's supply, but particularly we have to focus on critical and vulnerable systems and identify what they are. We need to work better on real time delivery of information so that we can work smarter. We don't wait 15 years to identify a trend after the trend has already happened, we actually have

Adaptive Management

Adaptive management (AM), also known as **Adaptive Management is more expensive and data intensive than traditional, stationary management models. It also requires more expert judgment from managers.** Information needed to improve future management. AM is often characterized as "learning by doing." *Wikipedia*

the computer capability to see how these things are changing over time as we are actually experiencing them.

We also need to do a big review of our engineering assumptions

Adaptation: Revise Engineering Assumptions

- Re-evaluate engineering assumptions re: potential for more extreme events and longer-term droughts
 - Extremes could be of a different nature
 - Variability may be outside of the range of our experience
 - Abrupt changes may result in limited time to respond
 - Non-stationarity: the past is no longer an analogue for the future



so that we can move beyond this stationarity concept and think about extremes potentially being of a different nature, the variability could be outside our experience, because we've only experienced it in a very short slice of history. We need to think about the fact that there could be abrupt changes where we don't have a really quick time frame in which we have to

respond. And we need to think more, particularly those who are concerned with long-range water supply planning, about what it means to not always be looking at the last 30 years of record as what the next 30 years is going to be about.

We obviously have a whole portfolio of new technologies that are available to us, and they will be part of the solution. We will not solve this whole thing focusing on simply low technology options. So, desalination - I'm sure you've all heard - is a major focus for many folks. Reuse and recharge of municipal wastewater is a big focus for this group and many others. There are those who believe weather modification is a big piece of this. Rain water harvesting, we just heard an excellent presentation about how that might fit into the picture. We need to do a better job of managing our flood flows. And I think we need to think more about integration and redundancy of our delivery systems for reliability, and this, basically, is really a pumps-and-pipes kind of solution.

CHAIRMAN JIM BARRY: Ten minutes, Kathy.

MS. JACOBS: Thanks. So, part of what we need to take into account is this idea that energy and water are really about the same thing, and so we can't do our energy supply planning

Adaptation: Evaluate and Incorporate New Technologies

- Expand portfolio of technology solutions:
 - desalination,
 - reuse and recharge of municipal wastewater,
 - weather modification,
 - rainwater harvesting,
 - improved management of floodflows,
 - integration/redundancy of delivery systems for reliability



separately from our water supply planning. Most water technology solutions that we're talking about are very energy-intensive, whether you're talking about desalination in the Gulf of Mexico, and pumping sea water up to Arizona, which is very highly energy-intensive, desalination of brackish groundwater, cloud-seeding, dry-cooling of energy facilities, all

of these are very energy-intensive, we need to take that into account. And energy will be more expensive and probably less attractive in the future because of carbon emissions concerns.

We need to take a broader view of assessing what it is that we do when we make decisions, and think about future generations and the implications of what it is that we're doing, not just from a carbon emissions perspective, but from an economic, social, and environmental cost perspective. So, I'm basically putting that out there as a suggestion; that while you're in your decision-making process, these things also get taken into account.

When we're looking at trying to protect the environment, there are certain basic facts. Protecting the environment actually costs less than restoring it. And so to the extent that we still have environmental amenities that we care about protecting, we need to do a better job than we can do today.

And, further, operating watersheds so that they are integrated for water quality and water quantity objectives and you take into account various land use decisions that you can incorporate in order to protect the aquifer, all those things are great ideas and, as I said before, they're almost impossible.

So, you know, long-term planning situation, again, we need to sort of expand the envelope of the types of futures that we're considering and sort of reframe both the inputs to our modeling and the outputs.

So, for example, Jeff Tannler, who is the Director of

the Tucson Active Management Area (well, hopefully), when he's developing the Fourth Management Plan, will think about how the inputs, the supply side of our water balance might change, in addition to how the demand side of the water balance might change in this context.

Adaptation: Environmental Protection

- Prepare for vulnerability in ecosystems: manage invasive species, protect instream flows in key habitats, prepare for extreme events; preservation is always cheaper than restoration.
- Restore and maintain watersheds as an integrated strategy for managing water quality and quantity; Land use practices can protect groundwater recharge areas, restore natural processes in watersheds to increase infiltration, slow runoff, improve water quality, and augment the natural storage of water.



Challenges: The "Watery" Perspective

- Most water technology solutions are energy-intensive:
 - inter-basin transfers,
 - desalination,
 - cloud seeding,
 - dry cooling
- Energy-intensive options will be less attractive in the future.
- Evaluate capital and water rights decisions re: short and long-term energy and water supply requirements



Triple bottom line analysis: consider economic, social and environmental costs, carbon emissions, multi-generational considerations

Conservation is clearly a part of the solution, and it's even a bigger part of the solution in the context of this "watergy" - or energy/water consideration, but we also need to be really careful that we don't use the water that we conserve that we're intending as a buffer against drought to grow. In other words, if we want to save a buffer or a water supply that's going to keep us from being in trouble when we go into one of these long-term dry periods, we need to make sure that it doesn't actually get used to build new subdivisions.

We also need to focus on exterior demand more dramatically than interior because, as we all know, we can reuse the interior water through any of a number of mechanisms. Conservation does have double benefits and, because of that, the cost-effectiveness of it actually increases over time.

Adaptation: Conservation

- Distinguish conservation for long-term water supply from drought planning; avoid hardening of demand and maintain a buffer for shortages; focus on exterior demand
- Conservation has double benefits: it saves water and it saves energy. It also has fewer environmental impacts than supply side solutions.



Adaptation: Infrastructure

- Arizona's water supply, wastewater treatment and flood control infrastructure is aging and undercapitalized. There is a need to rehabilitate and improve key infrastructure.
- Water quality impacts, largely related to temperature, increased concentration of pollutants, and impacts of extreme events and fires, will require additional investments



A consortium of Arizona's three universities focused on water sustainability through research, technical assistance, education and technology development

Looking at infrastructure, there is no doubt that across the state we are seriously undercapitalized. We have not been investing in any of our infrastructure, whether you want to look at the roads, or you want to look at the water systems. We have not been taking care of them properly. And I'm not saying that's the case, specifically, for the Tucson and Pima County area,

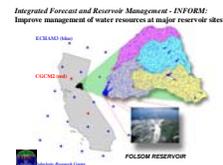
but it will require more investment.

And, further, there are significant water quality impacts associated with global warming, which I haven't had time to discuss, but they include increased concentration of pollutants, the impacts of fires, for example, and sedimentation on reservoirs, these things will require additional investments as well.

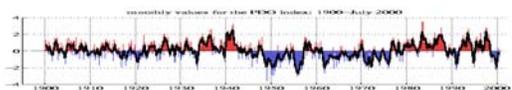
One of the things that I work on most specifically is the use of climate forecast information, taking the kinds of information that

Adaptation: Increased Use of Forecasting Tools

- Improve understanding of climate drivers and variability at multiple time scales
- Produce better predictive information (based on probabilistic forecasts)



Improve understanding of decadal climate variability and phase shifts

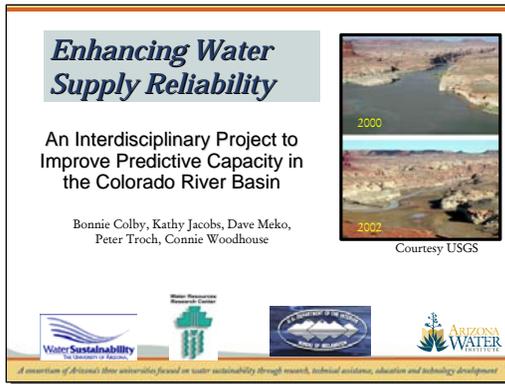


Julio was talking about, such as these dramatic shifts in what's going on with these ocean indices and trying to get to a place where, perhaps, we could actually predict that we would be going out of one phase and into another. If we get to that place, we can seriously improve the way we manage reservoirs, for example.

This is a study that I'm involved in, in partnership

with the Bureau of Reclamation, using a whole series of approaches to help them incorporate climate information, both variability and change, into the way they manage the Colorado River System.

And I just have a couple of examples of outputs from this process. We have been working to identify better ways of projecting what climate conditions might be in individual watersheds in the

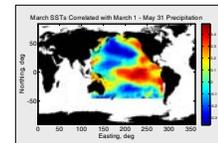


future and come up with some statistical mechanisms for using not these big oscillations that Julio is talking about, but specific places in the ocean that can be used for predictive capacity for different watersheds across longer period of times. We can actually project temperature and water supply with higher skill than if we used the PDO and AMO that he was talking..

Basin-Specific Climate Prediction

- Seasonal predictions commonly conditioned by climate indices, e.g., ENSO and PDO
- Relationships between sea surface temperatures (SSTs) and the Little Colorado River basin's hydroclimate are located
- The SSTs from these regions of highest correlation are used as predictors.

BSCP's are closer to the historical record in the Little Colorado than hindcasts using standard climate indices as predictors.



Matt Switanek
(Peter Troch)

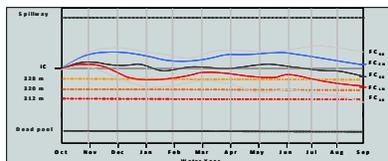
CHAIRMAN JIM BARRY: Five

minutes, Kathy.

MS. JACOBS: And we've also been looking at ways to

use hydrologic information to predict or project conditions under which we would be more likely to cross, for example, the thresholds in the Colorado River Management System, where you go from surplus to normal to shortage conditions. Understanding that you might be approaching one of those thresholds in advance is very useful to the Bureau of Reclamation.

Potential for improved system modeling and forecasts using ENSO or other conditioning.



Evaluating potential to cross shortage thresholds given specific initial reservoir conditions and climate predictions

(Peter Troch)

Adaptive Management

- Adaptive management has its limitations.
- It is expensive,
- It requires professional judgement,
- It is data intensive,
- It requires management at multiple time scales to acknowledge lagged effects.

but you can't have static, prescriptive management in response to dynamic conditions

So, adaptive management has all kinds of limitations, but it's essentially about using science better than we use it today, and you can't essentially use the same kind of historic version of water supply to project into the future if you have a management system - I mean, when the climate itself is changing over time.

So, we've got lots of

issues to face in Arizona, in the west, among them climate change is just one. We've got a lot of complexity, you know, we've got growth, we've got legal challenges, and lots of institutions that are not necessarily ready for the kinds of change that may be required. To a very great degree, scientific uncertainty is used as a rationale for inaction, and I'm trying to make an argument to you that there are lots of no-regrets things that can be invested in that increase our reliability and reduce our vulnerability to impacts which will both be both economic and social.

But, there are limitations to how much people are willing to pay for these solutions and, frankly, we're entering an era of limits where we're going to be moving water supplies from one area to another, for example, agriculture still uses 70% of the water in this state; it's a pretty easy solution, from a theoretical perspective, that we can move that water to municipal, but there's economic and political problems associated with that.

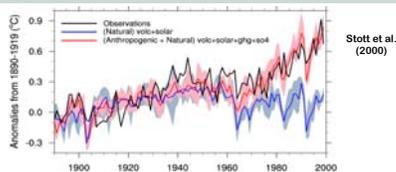
Emerging Policy Issues in the West

- Drought and climate change implications for water management and safe-yield/sustainability
- Increasing complexity and legal challenges to management system/limited adaptive capacity of institutions
- Scientific uncertainty used as a rationale for inaction
- Unwillingness to pay for long term solutions/make the tough choices
- Era of limits = redeploying existing supplies = economic dislocations



Lake Powell's decline
J. Dohrenwend, USGS

Conclusions: Climate Change Impacts on Water Issues



- The past is not an analog for the future; "Death of Stationarity" *Science*
- Implications for water management at multiple scales, both supply and demand
- Historic variability + climate change = increased impacts
- Predictive scenarios should examine the full potential range of future extremes and impacts on pumping and recharge

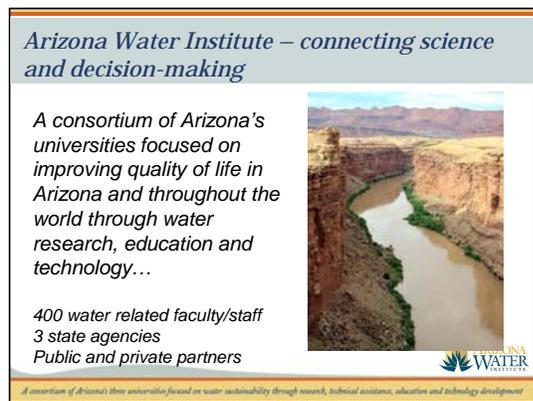
So, just sort of in conclusion from the water management perspective, the past isn't an analog for the future anymore because of this Death of Stationarity concept. The implications for water management are different at different scales and in different watersheds and affect both the supply and demand.

Historic variability is a

huge challenge. When you add climate change on top of it, the climate change may actually not add all that much stress to the system. You don't even have to go there to think about the fact that climate change is part of our problem, which I firmly believe it is. But we're not even prepared for the historic variability.

And, finally, predictive scenarios need to examine the full potential range of future extremes and impacts if we're going to do a good job of limiting our vulnerability, which brings me to my conclusion, which is: Integrating science with policy is what the Arizona Water Institute is all about. We have incredible resources at the Universities that can be useful to you in your decision-making process.

There's over 400 faculty members across the three



Arizona Water Institute – connecting science and decision-making

A consortium of Arizona's universities focused on improving quality of life in Arizona and throughout the world through water research, education and technology...

*400 water related faculty/staff
3 state agencies
Public and private partners*



A consortium of Arizona's three universities focused on water sustainability through research, technical assistance, education and technology development.

Universities who do water-related work, and it's my job to make sure they do it in a way that's useful for you. So, if there's any way we can help in dealing with the issues that you're facing, we'd love to do that. Thank you very much.

(Applause.)

CHAIRMAN JIM BARRY:

Kathy, thank you. Okay. We - we'll have question and answer, and it can be for either Kathy or Julio or both. Bob? Now, remember, let me - ground rule, it's a question and it's one minute.

ALTERNATE MEMBER BOB COOK: I'm very interested in this sort of debate between adaptive management and climate change mitigation. In the John Gertner article that you recommended, there's a statement that Lake Mead statistically will never be full again. Malcolm Hughes' recent study shows that the last decade before 2006 was the hottest in 1,300 years. We, obviously, have limited financial resources. One of the things the IPCC didn't include are some of the feedback loops, like the warming of the tundra and so on that could actually, you know, create some maybe surprise cascading dynamics.

Don't you think the argument for climate change mitigation is much more powerful than trying to save the pine beetle and the Buffelgrass invasion and all that? I mean, don't we really have to reduce the greenhouse gas emissions to solve this problem?

MS. JACOBS: I'm not here today to argue that we don't have to deal with the emissions issue and, frankly, it is huge

and important, and it actually already is receiving an awful lot of attention. I think it's going to change our economy; it's definitely a really dramatic driver. And it is all about future generations and some people believe it's about the future of our society. So, there are many people who think this is the moral issue of our society today. And I'm not here to argue that that is not the case.

What I am arguing is that all those impacts are not 100 years from now. We are experiencing impacts today. Water managers are not ready for those impacts. We have things that we need to do today about our Water Management System that moves beyond the issue of dealing with emissions; that's really what I'm saying.

CHAIRMAN JIM BARRY: Julio, you want . . .

DR. BETANCOURT: About a week ago, I went to a public talk at the Center for Creative Photography at the University by a chemical engineer...

ALTERNATE MEMBER BOB COOK: Yeah, I was there.

DR. BETANCOURT: ...by the name of Nate Lewis. I think you asked a question, didn't you?

ALTERNATE MEMBER BOB COOK: Yeah.

DR. BETANCOURT: Yeah.

ALTERNATE MEMBER BOB COOK: I stirred the pot.

DR. BETANCOURT: Yeah. But, what was interesting is the message that Nate Lewis had that this problem, in terms of mitigation, will either get resolved in this generation, or not at all. And because of some pretty serious issues about the different energy sources and when you scale them up to global, how much are they a solution and how much are they, not but a trickle. And so I actually think that we have to with everything, almost every environmental issue today, we have to keep in sight parallel tracks. The first one is the mitigation one, which is in the foreground. What can we do to stabilize carbon in the atmosphere?

But, the second one is the likelihood that we will not get it done and, by 2050, we'll be at 500 parts per million. And, if that is the case, then we've set into motion things that are going to happen over the next few hundred years because of not just the residence time of carbon and other greenhouse gases in the atmosphere but, you know, also the fact that you've got things like the thermal inertia of the ocean, which plays out over centuries. This is something that Nate Lewis argued, once we go down that path, basically we couldn't restore this, or this couldn't get restored naturally in 3,000 years. So, I think you have to keep both tracks going at the same time.

And, in fact, I've recently spent the last three or four years trying to develop a national phenology network for the U.S., which basically measures observations on the response of plants and animals, including crops, to the changes in climate, not because I want to detect how much of a response there's been because but because we're not going to adapt to climate change unless we have phenological models and observations that we're then integrating with climatic forecast to figure out how crop production is going to change; to figure out how invasive species are going to behave; to figure out how bark beetles are going to behave.

CHAIRMAN JIM BARRY: Let's - let's get another question, okay? We're running out of time.

DR. BETANCOURT: Okay.

CHAIRMAN JIM BARRY: Okay? Bonnie?

MEMBER BONNIE POULOS: I work in the biological sciences, and I recognize the need to better integrate science with policy decision, but what about the sociological sciences that can be utilized in order to educate and steer public policy in a certain direction? Is that really happening, and how important do you think those kinds of scientists are to this whole process?

MS. JACOBS: Well, I actually specifically mention that because I do think it is very important. I mean, clearly, this is a social and an economic issue, as much as it is a physical science issue. And so the degree to which we are able to adapt and are willing to pay for solutions, those things are issues that social science can help with. I wouldn't say that it's well established. The connection between science and policy is a big gap right now, and social science and physical science, there's another big gap. So, it's something to be aware of and worked on and it's needed, but I wouldn't say it's very well advanced at this point.

CHAIRMAN JIM BARRY: Vince?

MEMBER VINCE VASQUEZ: Kathy, just a point of clarification. You used a figure of 60,000 acre-feet in the Tucson AMA underground, and the ADWR presentation said 60 million.

MS. JACOBS: I meant 60 million. Sorry.

MEMBER VINCE VASQUEZ: I see. Can we use that figure in terms of understanding the legal availability of groundwater?

MS. JACOBS: No, you can't.

MEMBER VINCE VASQUEZ: No, I'm not suggesting that we use that water, but understanding that in terms of our buffer that we're working with.

MS. JACOBS: yes.

MEMBER VINCE VASQUEZ: And understanding our current overdraft conditions and kind of projecting how many years' supply do we have if we were to cut off the Colorado River?

MS. JACOBS: Well, first of all, you asked if we can assume that that's legally available? And the answer is, "No, it's not legally available," because under the Assured Water Supply requirements, it's only the water that's above 1,000 feet that is considered as physically available. Also, a very large proportion of that is not physically recoverable; the fact that it's there doesn't mean that it's actually accessible, useable, et cetera. So, no, I would not recommend that you use that number. I'm only saying that there is a fairly significant groundwater buffer here. We're in much better shape, for example, than Las Vegas, which doesn't have that level of comfort.

CHAIRMAN JIM BARRY: All right. I'm going to move to the audience. Give us your name, please.

MADELINE KISER: I'm Madeline Kiser, and I'm a member of Sustainable Tucson. First, just a quick comment. This - individually, these would've been superb; together, they're amazing, and I'm just curious about where in our state, in any newspapers, is the clarity of that vision, if it's appeared yet, because it's a totally new horizon.

Given that the past can't predict the future and the other areas of the world are facing similar factors, which areas of the world inspire you in terms of adaptive management? When you look out for inspiration and the need for dialogue across different parts of the world, best practices, what are you looking at? Where are you looking for inspiration?

MS. JACOBS: Well, you know, one of the things that I find really difficult is that people feel that you can actually transplant things from other parts of the country and other parts of the world into our institutional framework without limitations and, obviously, there are really significant hurdles to that, but I think everybody points to Australia as being one of the places that has, you know, a very advanced economy, and has really moved forward dramatically in all kinds of water management fields because they're up against the wall. I would say, from an advanced society perspective, that's a great place to look. There are all kinds of amazing things that have gone on all over the world that incrementally could be useful, but I guess that's my perspective.

CHAIRMAN JIM BARRY: Julio, do you want to add anything?

DR. BETANCOURT: The Netherlands for keeping the sea at bay. I had a Dutch student for a while and she would regale me with these stories of engineering and trying to keep the ocean from flooding the Netherlands and it's pretty - a pretty amazing story of adaptive management and and really good engineering and foresight.

I'd say California and for the following reasons, not that they've solved their problems, but California in terms of the acceptance of scientific expertise and the incorporation of that scientific expertise in the planning over the last decade; I mean, it's pretty remarkable. I think we're behind the curve.

MADELINE KISER: Part of the reason I ask is just thinking of this upcoming Sustainability presentations, it would be good to be able to draw from best practices of regional planning and using science and adaptive management from elsewhere.

DR. BETANCOURT: Thanks for your question.

MADELINE KISER: Thank you.

CHAIRMAN JIM BARRY: Anybody else from the audience?

Tres?

TRES ENGLISH: My name's Tres English, I'm also with Sustainable Tucson. What I saw in both your presentations, but particularly yours, Julio, is the global nature of some of these things. The maps, the global projections of climate, of temperature and water, it seemed to stretch across the entire temperate regions of the planet and that's much of the world's food supply comes from those areas. So, I suggest that, perhaps the water and energy connection really needs to be expanded to water, energy and food. And that has a real implication for us here in Tucson because, while a majority of our water is used for agriculture, it's not currently used for local food production. If the whole world's food system is going to become destabilized, we're going to need to increase the amount of food that's produced locally.

So, Kathy, when you're talking about conservation, particularly, exterior conservation, I think the implication in what you're saying is that that's all decorative stuff, and my thought and my question is don't we need to be looking at our exterior water use as wasted now, but as a potential source of local food production, and how does that impact our water policies?

MS. JACOBS: I see that more as a social and economic question than really a hydrology question. I mean, because there's an energy component to our food, I think energy costs and global economies are actually going to drive this to a very great degree and we need to make our own decisions as a society

about how we're going to deal with that. I personally think that growing vegetables in the desert is not probably going to be as efficient as growing vegetables in a place where there's more water and it's more temperate. But, there are many people who are obviously very committed to growing their own food for very good reasons, and I think that's their right to do that.

CHAIRMAN JIM BARRY: One more question and then we'll go to Call to the Audience. Just one. Dan had his hand up first.

MEMBER DAN SULLIVAN: Question for Kathy. Kathy, I'm not certain I agree necessarily that all the moral issues we have facing the world today that this is the one - it's certainly one of the ones, but in the course of your presentation and the slides, I'm willing to expand my horizons. There was a reference to either a magazine article or a paper, *Death of Stationarity, Science*. Do you have any further application as to whether I could access that?

MS. JACOBS: I think this guy knows.

DR. BETANCOURT: I was actually one of the authors of that paper.

CHAIRMAN JIM BARRY: Let me interrupt one second, though. I think when we sent out the packets and further reading, I think it's it's in there also.

MEMBER DAN SULLIVAN: I thought I had read these, but I didn't see that one.

CHAIRMAN JIM BARRY: Okay. Go ahead. Go ahead and answer. But, we'll get it to you.

DR. BETANCOURT: Do you have another question or - another question.

MEMBER DAN SULLIVAN: No, that's it.

DR. BETANCOURT: Okay.

MEMBER DAN SULLIVAN: Thank you.

MS. JACOBS: It's in *Science*, yeah.

CHAIRMAN JIM BARRY: Okay. Well, Kathy, Julio, thank you very much -

(Applause.)

CHAIRMAN JIM BARRY: That was excellent. And I'd like to point out that they both met their time limits, so one down and five to go.

We'll do Call to the Audience.

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on September 10, 2008.

Transcription completed: September 20, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF SEPTEMBER 17, 2008

List of Presenters:

1. *Rob Marshall, The Nature Conservancy*
2. *Julian Fonseca, Pima County Natural Resources Parks and Recreations Department*

**Presenter #1:
ROB MARSHALL, THE
NATURE CONSERVANCY:
ENVIRONMENTAL NEEDS FOR
WATER**

CHAIRMAN JIM BARRY: Now we move on to - I got the presentations: Environmental Needs for Water. And the first presenter is Rob Marshall, who's the Director of Science for the Nature Conservancy in Arizona. He's been with the Nature Conservancy since 1997, oversees the work of nine Staff, supports the Land and Water Protection efforts and works with private and public partners in developing science to support effective land manage- - land and water management.

Prior to joining the Nature Conservancy, Rob was a biologist with the U.S. Fish & Wildlife Service and U.S. Forest Service, obtained his Master's in wildlife ecology from the School of Forestry and Environmental Studies at Yale University, and he's a member of the Pima County Conservation Acquisition Commission. Rob, thank you very much. And you've got 30 minutes, and the Committee has directed me to remind you when you've got 15 minutes left and ten minutes left and five minutes left and, when you have nothing left, we'll cut you off.

MR. MARSHALL: All right. Thanks, Jim. Good morning to all and thank you for the invitation to come and speak this morning. As I was mentioning to Jim, I'm an early riser, whether I want to be or not, so this is no problem for me to come out this early, but I'm really impressed with the commitment of this Committee to make the effort, because I'm sure some of you are not early risers. So, I was asked to talk about Environmental Water Needs and to give you a statewide perspective, and then Julia Fonseca is going to zoom into Pima County. So, the topics that I'm going to cover today are really to show you some data that we've been working with over the last

Topics Covered

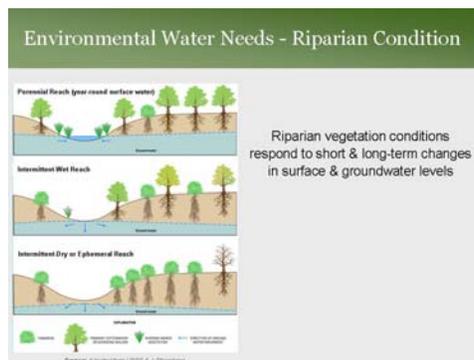
- ✓ Environmental needs for rivers, wildlife, and riparian habitat
- ✓ Relationship between land use & water availability
- ✓ Priority mechanisms for land & water protection



mechanisms available that are used for land and water protection.

But, I want to start by reminding us all that our river and riparian systems provide a number of services to us for free, and they also have a number of values. Some of those services include provision of drinking water, and water to irrigate our agricultural crops. They purify our wetlands and our water and they also recharge our aquifers that supply our groundwater sources.

Our riparian systems, of course, sequester carbon; they provide oxygen; they filter the air; they provide lots of recreation opportunities. And here in the southwest, in particular, they are very, very valuable for wildlife. And you can imagine we live in an arid environment and so you come into these areas that a sudden you have vegetation, you have lots of space, and are very important really harbor an disproportionate State's wildlife, smaller areal have a lot of they're very small acreage-wise, but they harbor a disproportionate share of the State's wildlife, so they're very important from those standpoints.



have water, all of lots of have lots of food, cover, you have so these systems in the fact they inordinate or amount of the given their extent. You don't riparian areas,

You know, often in the past, when we've talked about conservation of these resources, it's really been framed as protecting nature from people, but when you think about it from the standpoint of they provide service to us, they provide it

for free, and those services we have to pay for if they're not there, this really becomes protecting nature for people.

Okay. So, I was asked to talk about Environmental Water Needs; this is a big topic. You can take many college courses on this, so I'm going to just give you a thumbnail and talk about a very small component of it, and it's the relationship between our groundwater and surface water and riparian condition, or riparian health. And I'm going to use this little diagram here to start us off and then I'll show you some pictures.

So, the essence here is that riparian vegetation conditions respond to changing surface and groundwater level, over both short time frames and longer time frames. And what we have in these three diagrams are the spectrum of conditions. At the top, we have a perennial river system that flows year round and has surface water in the bottom. We have an ephemeral or reach that's dry and just has flow in response to precipitation events.

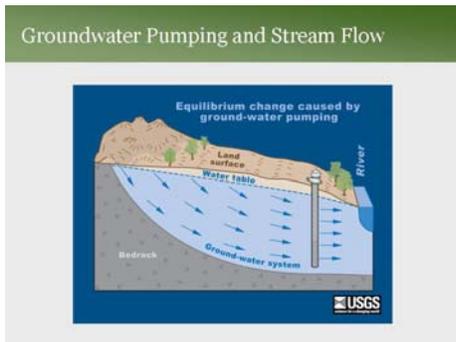
So, let's look at the characteristics in the top frame. We have flowing water, so we have an aquatic ecosystem here. We have wetlands plants. When you go up onto the banks, you have riparian trees, shrubs, lots of vegetation. You have high groundwater levels. When you get into an intermittent reach, water that only flows here we have groundwater tables. Obviously, you



flowing water, so you start to lose your marsh vegetation. You start to lose some of the big trees because they can't access the groundwater, your vegetation gets lower in stature, you have fewer species, less wildlife diversity. And then you get to the bottom end of the spectrum, these ephemeral reaches, where groundwater levels have dropped to the point where they can't really support the riparian trees that need saturated soil, so you get shrubs, you don't have any aquatic community, just much less diversity. So, this spectrum occurs naturally out there, but it also can be exacerbated by human activities in the floodplain, and I'll talk about those in a little bit.

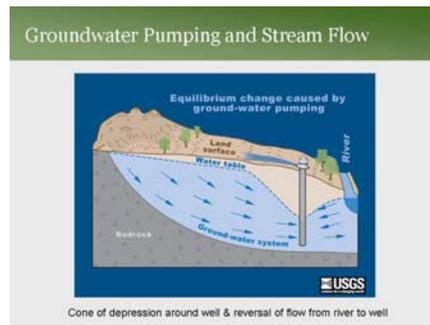
To make it more real with pictures, here we have the San Pedro River just over the Catalina Mountains. This is a perennial reach, so notice we have a flowing stream; it's year-round and has its own aquatic community. It's got fish; it's got frogs; it's got all the components, detritivores and herbivores and consumers. It's a very rich ecosystem. There's a lot going on in there. You go out to the banks here, you have a lot of wetland vegetation, then notice you have this big gallery forest of native riparian trees, cottonwood, willow, and boxelder. It's a very complex system. You can see there's lots of vegetation, space, cover. The temperatures are more moderate, there's a lot of places for wildlife, and there's a lot of interaction between the organisms living here in the terrestrial side and the aquatic side. Often you have species that are only here because they rely on food that's in the water. So, it's a very complex system.

Let's go to the dry wash here. This is the Rillito River looking downstream from the Campbell Avenue Bridge. You can see this is essentially a terrestrial system. It's dry for most of the time. There's one species of vegetation here; this is desert broom. So, very little diversity. You don't have to be a biologist to see that there's going to be a lot more habitat here for wildlife than there will be here. There's also going to be a lot more of our ecosystem processes happening here - a lot of water purification; carbon sequestration, et cetera.



alluvial basins, or the we have here in Arizona. courtesy of the USGS. is showing you is a that currently has no groundwater extraction out of it. So, precipitation falls on the land surface; it infiltrates and forms the water table; it flows towards the river, gets towards the bottom of the valley and pops out as discharge into this river. So, this is what we call an "equilibrium setting."

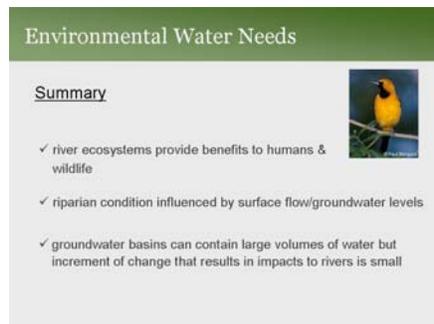
Okay. So, I mentioned to you that those scenarios occur naturally. They also can be exacerbated by human activities, and I want to walk you



through the relationship between groundwater and our river flow in our aquifers that This is And what this water table

Let's add in groundwater pumping. Here we add a pump. So, what happens here? The pump actually starts to draw down water where it creates what we call a "cone of depression," and if the pump is close enough to the river, or it's extracting enough water, it's actually going to start to capture this river flow and change the direction of water from the river back towards the well. And, as it does that, it starts to draw down the water and, over time with enough pumping, you can actually de-water a stream that way.

Why is this important? Well, Southern Arizona's aquifers - these alluvial basins - actually have lots of water, there is lots of water in these basins; it can furnish a lot of growth, at least over the short-term.



The slide is titled "Environmental Water Needs" and has a green header. Below the header, the word "Summary" is written in blue. To the right of the text is a small photograph of a yellow bird perched on a branch. Below the title and image, there is a list of three bullet points, each starting with a checkmark.

- ✓ river ecosystems provide benefits to humans & wildlife
- ✓ riparian condition influenced by surface flow/groundwater levels
- ✓ groundwater basins can contain large volumes of water but increment of change that results in impacts to rivers is small

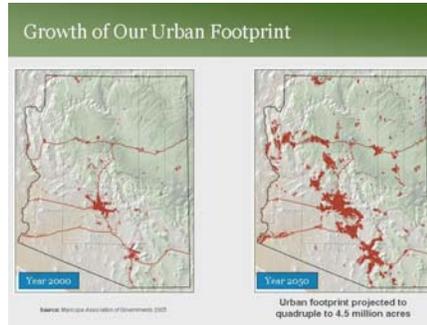
The problem is what discharges into the river is what falls from the sky on an annual basis. And so it doesn't take much impact, or it doesn't take much groundwater pumping before you start to lower this water table and affect the river flows. And this is the challenge we have in moving forward with growth where the growth will be relying

primarily on groundwater supplies.

To summarize, our river and riparian ecosystems provide a lot of benefits, a lot of services to humans and they're very important to wildlife habitat, particularly in this State, not just for the resident wildlife, but we also have migratory birds, bats, and other pollinators that are wintering in Central and South America coming through Arizona using our riparian resources as a stop-over as they migrate to places elsewhere in North America. So, this is a hemisphere resource that we have here. Riparian conditions and rivers are influenced by surface and groundwater levels. And then, although our groundwater basins can contain an awful lot of water, the increment of impact that results in adverse effects is actually small.

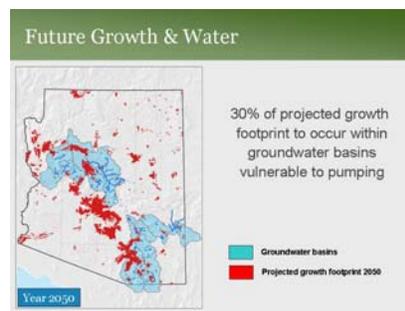
So, I'm going to shift into the growth data that we've been looking at. And to start this off, I just want to review the data on population growth. So, based on the Department of Economic Security growth projections, Arizona's slated to double its population by 2050, have over 12 million people, and so the question remains is: Where are we going to obtain the water supplies to furnish that population growth?

This map footprint produced Association of done these spatial projections out to actually a number of growth now. For the sake going to show you are the major highways and all these red dots comprise the urban footprint in the year 2000.



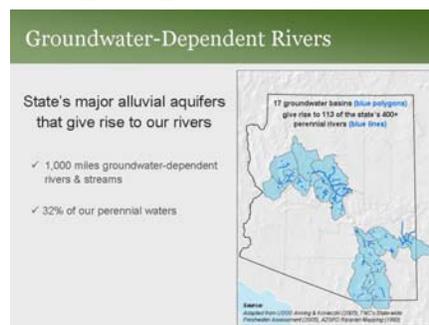
here is an urban by the Maricopa Governments. They've footprint growth 2050. There's of different sources projections out there of time, I'm just the MAG data. These

Let's and immediately there's a in the growth of in fact, it's going 4.5 million acres including areas in southern Arizona. the growth here is in Maricopa and These are growth projections; they're not real. Things are going to be different; it could be larger; it could be a smaller footprint. We have choices, so we can dictate what this growth looks like, but these are the projections.



move ahead to 2050 you can see that substantial increase the urban footprint; to consume another of land in total and northern Arizona, You can see a lot of projected to happen Pinal Counties.

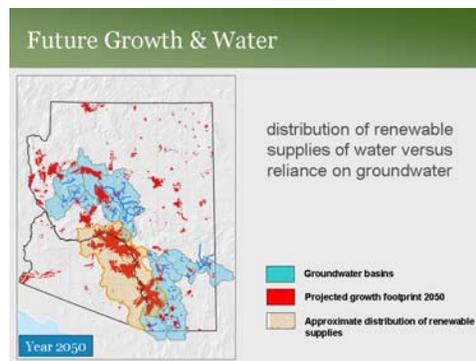
Let's start to look at the relationship between this growth and the distribution of our rivers and riparian areas. And to do this, I'm just going to focus on a subset of the river systems that we have in the State. We have a lot more going to point out this is a map of 17 that the U.S. has mapped, and the these groundwater groundwater basins these still give The groundwater our remaining perennial streams; in fact, it's about a quarter of the State's perennial streams. You have over 400 streams; it's a little over 100 streams and rivers that are furnished by these groundwater basins; it's 32% of our perennial water; about 1,000 miles of groundwater-dependent rivers.



water that I'm in the State. But, groundwater basins Geological Survey distinction between basins and elsewhere is that rise to rivers. discharges to form

The significance of this is that we've lost 36% of our perennial flow in Arizona over time due to diversions, to dams, to groundwater pumping; all legitimate societal uses, but uses that don't come without an effect to the environment. And so, in the past, we've gone ahead and done this without the technical information we know now about the importance of river ecosystems. Moving forward, we have an opportunity to do things differently so we don't continue to just lose these river systems and their accompanying riparian and wildlife resources.

Okay. So, let's put this growth footprint at 2050 over these groundwater basins, and just point out a couple of things. The red's the growth, these blue lines are the rivers, and these blue polygons are the groundwater basins that are going to be vulnerable to pumping because they discharge, they still give rise to these rivers. So, if we look at the growth, these blue lines are the rivers, and these blue polygons are the groundwater basins that are going to be vulnerable to pumping because they discharge, they still give rise to these rivers. So, if we look at the growth, you can see is that a lot of the projected to occur in Maricopa/Pinal County there's really no basins, so they're drawing from those basins, ostensibly they won't be. A lot of growth, though, the Prescott/Kingman area, down the San Pedro, even eastern Tucson, lower San Pedro Basin, this are all areas that are going to be, potentially, in conflict with the river and riparian resources that currently exist.

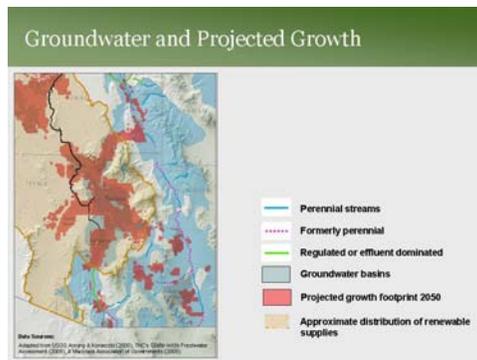


Okay. So, let's look at this from the standpoint of where we have renewable supplies. This is a very coarse analysis, because what I'm using as a proxy for renewable supplies are the AMAs, the Active Management Areas, as we don't yet have a layer put together that shows you the Central Arizona Project Service Area, which is really our only renewable supply in Arizona. But, let's just use this, 'cause it makes the point.

So, these are the AMA boundaries. This is the area where, theoretically, Colorado River water can be supplied and we can totally get off groundwater here and use Colorado River supplies. You notice a lot of the State does not have renewable water, including here, the San Pedro River and in eastern Pima County. And let's actually take a closer look. Julia Fonseca is going to go into much more detail at the County level but I just

wanted to take this data down to the super-County level, Pima County plus, and let's show you what it looks like. So, if you can see this, this blue outline here, are the alluvial basins. And this is, essentially, what Sean was getting at, the areas where groundwater supports surface flow. The status of surface flow of surface flow are these lines - and Julia, again, has actually much better data. So, these blue lines are areas where we still have perennial flow. This is the San Pedro River. Here's Sonoita Creek. Here's Cienega Creek. The red dash lines are areas that, historically, were perennial flow, but no longer are perennial, and then the green lines are areas that are effluent-dominated.

So, let's put the growth here. And the first thing I want to point out is if we had a better layer you'd see that we don't have here, or even Tucson, so overstatement "renewable" renewable with that, lots of to happen in have any so - and this forward and how we are going to grow and protect those supplies.



And the first thing I want to point out is if we had a better layer you'd see that we don't have here, or even Tucson, so overstatement "renewable" renewable with that, lots of to happen in have any so - and this forward and how we are going to grow and protect those supplies.

So, why does this matter? Well, I'm sure it matters for different people. There This is only a them. In basins that I there are species that And by either on the list, or they're likely endangered future. So, when those areas are gone, if we lose those species, it's loss of an irreplaceable resource.

The complex block is titled "Population Growth & Water Availability". It contains a list of reasons why this matters, along with two small images: one of a river flowing through a lush green landscape, and another of a colorful bird perched on a branch.

Why does this matter?

- ✓ habitat for 73 imperiled species
- ✓ loss of recreational opportunities & nature-based tourism
- ✓ increased regulatory burden/project costs
- ✓ impacts to those with surface water rights
- ✓ water supplies may be exacerbated by climate change

reasons for different are a lot of reasons. small portion of those 17 groundwater showed you statewide, already 73 imperiled inhabit those areas. "imperiled," they're endangered species they're very rare and to be on the species list in the

But, if wildlife's not your thing and biodiversity's not your major concern, there are other concerns, including economic concerns. First, we lose recreational opportunities

that many of us enjoy, if not all of us. We also start to lose nature-based tourism, which is pretty significant, particularly here in southern Arizona.

When we have more endangered species listed, we get increased regulatory burdens as we try to mitigate and try to weave our way through these complex endangered species issues, which increase project costs. And I can tell you as a former endangered species biologist, we're going to either pay on the front end by being proactive, or we're going to pay on the tail end as we try to mitigate, and paying on the tail end is always going to be more expensive and there's going to be less certainty, because when you've got endangered species you've got small populations, and the smaller they get, it becomes a numbers game, and you have no certainty that your actions are going to actually be able to recover them. So, it's far preferable to make the hard decisions up front; it's going to be far cheaper.

The other thing is that there may be people in this audience that own surface water rights, and so if people are pumping groundwater and affecting those surface rights, what's going to happen? We may get litigation. What happens with litigation? We get higher project costs, and so we're going to be potentially pitting groundwater users against surface right-holders. It has nothing really to do in the environment; there's just a societal conflict in the making; it's already happening in Prescott, between Prescott and Phoenix over the water supplies in the Upper Verde.

Finally, I know you've had presentations on climate change, so I'm not going to spend any time here, except to say that the effects to human water supplies that you've heard from Kathy Jacobs and others are only going to be exacerbated by these riparian systems and the wildlife. Why? We have technology that can help mitigate and help us adapt to the changing conditions produced by climate change. Wildlife species don't have that option.

When those tropical migrants are flying from Central America to where they nested last year somewhere in Pima County, that habitat's not there, they've got to make choices, they've got to make them fast, and if there aren't other choices to breed, they're not going to breed, they're not going to reproduce, those wildlife populations are going to go down. We have other options.

Okay. So, I'm doing - I'm on the last part of my section here. I'm going to stick to my times. So, now I'm going to talk about the mechanisms for protecting our rivers and riparian areas, and this is going to be very brief because the reality of - the reality is that we really don't have legal authority to protect particularly groundwater pumping. There's very limited authority to effect protection. And why is that? Well, there's no State jurisdiction over the regulation of groundwater pumping to benefit river, springs, wildlife, et cetera. There's no State authority to protect from groundwater pumping.

Some of you have either talked about Safe Yield in the context of this Committee or you know of Safe Yield. I want to dispel the notion or just make it clear that Safe Yield is about human

it's not about environment. under the Act says you aquifer what's basis. Well, about that those streams sky on an

allowed to extract all of that, you're leaving nothing for the river. So, Safe Yield is simply about managing human water supplies, not about managing water for the environment.

Mechanisms for Protection

Protection of rivers limited by lack of legal authority

- ✓ No state jurisdiction over regulation of groundwater pumping to benefit rivers, springs, wetlands, riparian systems, or wildlife
- ✓ 'Safe Yield' provision under Groundwater Management Act allows for use of all annual recharge for human consumption
- ✓ 'Assured Water Supply' provision does not require evaluation of impacts to rivers, riparian systems, etc.

protecting the The Safe Yield provision Groundwater Management can only take out of the recharged on an annual if you go back and think graph, what flows in is what falls from the annual basis. If you're

Similarly, the Assured Water Supply provision, this is about managing human water supplies. There's no requirement for an evaluation of impacts to rivers, streams, riparian systems, et cetera. And I want to clarify that just because these terms sound good; it's important that we don't confuse them with what provisions are actually in there to protect the environment. So, that's on the groundwater side.

If we look at the surface water side, there are some mechanisms but, water's protected indirect measures certainty is very Well, we have the have the stream going on where people who getting those

Mechanisms for Protection

Protection of surface water for the environment occurs through indirect measures or tools with limited certainty

- ✓ Stream adjudications & 'sub-flow' ruling
- ✓ Federal actions where Clean Water Act & ESA are invoked
- ✓ Land acquisition with water rights converted to instream flow for benefit of wildlife or 'sever & transfer'
- ✓ 2007 Pima Co. Plan Amendment requiring impact study?
- ✓ Shift from groundwater to CAP & re-use/recharge have potential but would require secure allocation to environment?

in reality, surface really through and the level of low. And why is that? stream for example, we adjudication process throughout the State hold rights are rights certified. If

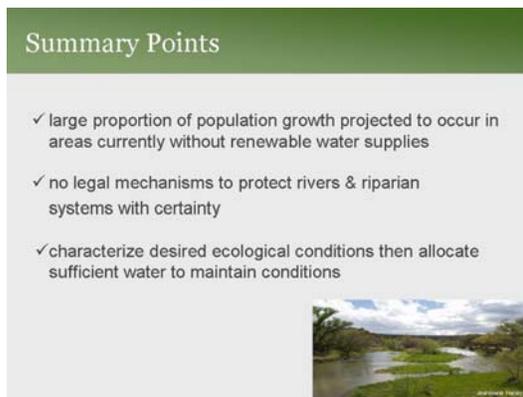
we're fortunate you have a senior right-holder who's on the downstream end and he or she wants his water, he's going to have a call on that water all the time, and that water's going to flow through that river to the downstream end. It'll benefit the river and the riparian ecosystem, but it's an indirect benefit; it's not happening because we set out to protect the river; it's happening because you have a senior priority water right down at the downstream end. If it's on the upstream end, I think you can see what happens.

You have federal actions to clean water and the Endangered Species Act. These are very blunt tools that were not intended to keep water in rivers. These are last-ditch efforts to stop species from going extinct. They really were not meant to keep water in river or to protect riparian systems, and they don't do a very good job of it.

The mechanism that is used most often is the acquisition of land with a water right, and then the conversion of that water right into instream flow to benefit wildlife and riparian systems. So, in other words, you take a water right that was, say, used for mining or agriculture and you convert it to an instream flow, which means you have a right to keep that water in the stream.

So, what's the problem? It's a mechanism that's been used on 38 different streams in the State so far by the Forest Service, the Bureau of Land Management and the Nature Conservancy, and there's 60-plus pending applications that the Department of Water Resources for more instream flow permits. There's two challenges. First, land acquisition land management is very expensive and very few entities can do it.

The second is that when you convert that use from agriculture to instream, your seniority changes. You have the prior appropriation system, priority dates, the goes to the earliest if you have a very right, 1912 water you convert it to flow, your priority 2008, which means on the list when call on water or if drought. So, when to instream flow, you



Summary Points

- ✓ large proportion of population growth projected to occur in areas currently without renewable water supplies
- ✓ no legal mechanisms to protect rivers & riparian systems with certainty
- ✓ characterize desired ecological conditions then allocate sufficient water to maintain conditions

The slide features a green header with the title 'Summary Points'. Below the header is a list of three bullet points, each preceded by a checkmark. At the bottom right of the slide is a small photograph of a river flowing through a lush green landscape under a blue sky with white clouds.

lose, essentially, your status on the river. That means in times of drought, or over-allocation, you're not going to have your instream flow, or you're going to have less of it than you have a right to.

Sever and transfer is a little more complicated; it's actually never been granted by DWR, so I'm not going to go into it at the moment.

So, what else is out there? Well, the Plan Amendment the Board of Supervisors passed in December of 2007 required an Impact Study; that's actually a very progressive move and a good policy advancement. But, as was mentioned in this Committee, there's no certainty. What will the County do if we have an Impact Study that demonstrates that there will be effects to our riparian systems? It's really an unknown and it's probably fraught with peril, given our litigious society.

Finally, we can shift from groundwater use to CAP, and that sounds good but, because so much of our area is not serviced by CAP, there's a large infrastructure cost and it'll be a fair amount of time before the infrastructure makes it to those areas and so the question is: Will that infrastructure be in place before we've already had adverse impacts to the rivers?

To summarize, from the data that we showed you can see that a fair amount of our population growth is projected to occur in these areas that do not have renewable water supplies, so there's the challenge. How do we maintain our river and riparian systems and accommodate the growth that's coming at the same time? We really don't have very good legal mechanisms to protect our river and riparian systems. The prior appropriation laws were set up for beneficial use. Beneficial use is agriculture and mining, domestic consumption, et cetera. And the provision, such as instream flow, they're useful and it's good that we have them, but they're not enough, particularly given the growth that we're seeing.

Really, there's two challenges. The first is we need to characterize the desired ecological conditions we want out there in the riparian systems; that's a scientific challenge; it's being done all over; it's pretty straightforward; it takes time; it takes money but it can be done. The greater challenge is a policy challenge and that is to allocate and to secure sufficient water to maintain those conditions.

I'm going to end here and just let you know that some of the data that was presented, that the Nature Conservancy's developed is on our Conservation Science Website, azconservation.org. You're welcome to go there. And I'm going to end it there, But, before I do mention I think reading that's science staff, Rivers and Water Southwest; it's a covers some of talked about. to have a sustainability, to pass around this work from the scientific literature. It's two alternative models of water use; one is a sustainability model, and one is kind of the *status quo*, and I'll leave those with you so you can deliberate, have those as part of your deliberation when you start talking about sustainability and thank you.



let Julia take over. that, I just want to you we emailed this done by one of our Jeanmarie Haney, on Management in the very good primer, the issues that we've And you also started discussion about and so I just wanted

CHAIRMAN JIM BARRY: Rob, thank you very much.
(Applause.)

CHAIRMAN JIM BARRY: Let me ask a question. Julia, where are you?

MR. MARSHALL: Back of the room.

CHAIRMAN JIM BARRY: What you're going to do is take Rob's presentation and then pinpoint it into Pima County?

MS. FONSECA: That's right.

CHAIRMAN JIM BARRY: Okay. Now, audience, do you want to wait for Julia and then have questions? I mean, Committee and audience, or do we want to have some questions of Rob now?

UNIDENTIFIED COMMITTEE MEMBER: I say wait.

CHAIRMAN JIM BARRY: Wait? Okay.

UNIDENTIFIED COMMITTEE MEMBER: Go ahead and wait.

CHAIRMAN JIM BARRY: Julia, come on up, please. So, our next presentation is by Julia Fonseca, who is the Environmental Planning Manager for the County's Office of Conservation Science. I've known Julia for a long time, and all I can say is what I used to say in the past, "Man, is she smart." She works with various scientists and agencies and nonprofit groups on conservation and monitoring of natural resources. She's been with the Flood Control District; it's now the Regional Flood Control District, I believe it's called, for 22 years, and worked on programs involving floodplain management, groundwater recharge, surface water quality and land

management. She received an MS in geology from the University of Arizona. Julia, thank you.

**Presenter #2:
JULIA FONSECA, PIMA COUNTY
NATURAL RESOURCES PARKS AND
RECREATIONS DEPARTMENT:
ENVIRONMENTAL NEEDS FOR WATER**

Sustaining Environmental Flows



*Pima County and Pima County Regional Flood
Control District
September 17, 2008*

MS. FONSECA: Thank you and good morning everyone. Unlike Rob, I'm not an early riser, but I appreciate this wonderful opportunity to get to speak about a topic that's near and dear to my heart and that is about sustaining environmental flows for streams and springs in Pima County.

You Committee members have been chosen for a really important role and that is to help the City and the County find what

I hope will be 21st Century solutions to what's really an age-old problem of how societies adjust their activities to the facts on the ground and, also, the historical legacies that have been left by previous generations.

So, what I hope to do is to define some key issues for you folks to contemplate as you move into Phase II, and I'm going to present three specific concrete examples of places where there are opportunities to protect existing riparian ecosystems. And I tried to choose these areas, not knowing of your debates about the study area boundaries, but thinking about the areas that close in to the Tucson Water Service Area, because I don't know what it is you will choose for your limits.

And when I use the term "riparian" today, I include the aquatic component, the stream side; it's not just the vegetation. A lot of times people think riparian areas are the lushly vegetated areas along streams, and I want you to also be thinking about the stream-flow component, and also the shallow groundwater ecosystems that support mesquite bosques, which often have a connection to groundwater, as Rob has mentioned.

Too often I think that discussions about water have left water from the environment out of the picture, if they've talked about them at all, and the consequences Rob described very well. I'm not going to go over those but they are, in part, what led to the Sonoran Desert Conservation Plan. A lot of the endangered species that we have in Pima County, and the ones that are not yet listed, but may be in the future, are related to aquatic ecosystems.

SDCP Riparian Goals

- Maintain floodplain functions
- Manage uplands
- Manage pollutant sources to maintain water quality
- Protect in-stream flows

And if you haven't heard about the Sonora Desert Conservation Plan, this was a very large public process, 600 public meetings to define goals for protecting our cultural and natural heritage in Pima County. There was a lot of work, 150 contributing scientists, 200 specific studies.

So, in your background documents, you do have a PDF handout that has the Sonora Desert Conversation Plan goals, and those include the biological goals, as well as specific riparian goals. And the reason that that's in your materials is that I think these goals you're going to be hearing -

CHAIRMAN JIM BARRY: Julia, let me interrupt one second. You're talking about this February 21st Memo?

MS. FONSECA: No. In the material, the background reading -

CHAIRMAN JIM BARRY: Oh, okay.

MS. FONSECA: In the background reading for this, there's a PDF that has the riparian goals and the biological goals. The reason that I provide the goals is that you Committee members will hear a lot of different proposals, and very specific ones, but I think that if you realize that the Sonoran Desert Conservation Plan has a lot of ideas that have already been debated at length with the public about where we should go and how we should get there, at least in terms of the ecosystem, this may help frame some of your responses.

So, let's see, I think I'll go to this one, since you don't have - you may not have a copy of that PDF. This is the shorthand version of the riparian goals for the Sonoran Desert Conversation Plan, Maintain Flood Plain Functions, Upland Condition, Pollutant Sources to Maintain Water Quality, and then, of course, Protecting the Instream Flows.

So, the question really is: How do you translate that to the particulars of your City/County Study? Well, floodplain functions are really important and have been greatly compromised, and it would be a good idea, I think, to have an integrated City/County discussion at some point about surface waters. Right now surface waters are managed through storm water management, through the AZPDES Program, they're managed

through floodplain management programs, and they're also discussed and affected greatly during our land use deliberations. So, there's a great need, I think, to integrate those across departments within the agencies and across jurisdictions. But, for lack of time, that's not going to be my topic today. Neither will Managing Upland Condition, although it has everything to do with what land use decisions are made and it affects the ecosystem of riparian areas greatly. I will touch a little bit on water quality and then the rest of this presentation will be about instream flows and groundwater-dependent sources for them.



- Sabino Creek
- Tanque Verde
- Agua Caliente
- Cienega Creek
- Santa Cruz River (effluent)
- Rincon Creek
- Agua Verde
- Ventana Wash
- Santa Cruz at Canoa...

So, as part of the Sonora Desert Conservation Plan, we did a great deal of inventory work, and this really helps understand where some of the remaining stream ecosystems are that can be affected by groundwater pumping or removal of other sources of water. One of the things we found was where our natural water sources are located. There was very little information that had ever been compiled in one place.

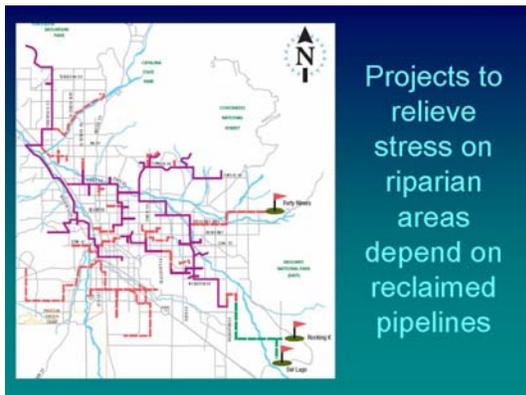
And, secondly, the surprise was: There's really a lot left out there in terms of perennial and intermittent streams, and this doesn't even show the springs. There are over 250 springs in eastern Pima County. In blue and in orange, you have perennial and intermittent stream segments, and then in light-blue color areas are the shallow groundwater areas. And nobody had ever taken the time to define those, but those shallow groundwater areas are areas that help support, or can help support, mesquite bosques, so that's why we included them in this ecosystem analysis. And this work was done in combination with Staff at Pima Association of Governments and it has its own set of reports if you want to go to the Sonoran Desert Conservation Plan Website.

A collage of images related to water resources in NE Tucson. It includes a photograph of a person riding a horse on a dirt path, a line graph titled 'Sabino Creek' showing water flow data, and a photograph of a fenced-in area with trees. A legend on the right lists: NE Tucson: Agua Caliente, Tanque Verde, Sabino Creek, Ventana Wash.

We also had inventories on hydro-geology, the distribution of species in eastern Pima County, and our water

supplies as part of the Conservation Plan, and some of those background documents were provided in your materials.

So, one of the important things to get out of this slide is that if you look at the distribution you can see that it's very unequally distributed. In Avra Valley right here you can see that there's an absence of these groundwater-dependent ecosystems, and that's important for you to know. There's one exception up here, which is Coccio Wash. It's a tiny riparian area that got dessicated in the '80s, and the watershed is completely destroyed because of mine-tailing, so it's not going to come back. But, aside from that one place, which was on a kind of a bedrock shelf, the rest of Avra Valley is very deep alluvium. Historically, it never had any flowing streams that were supported by groundwater, and so what that means is one could pump forever out there and never have this kind of link with a stream. That's good because Avra Valley was purchased as Tucson's water farm, basically, and there's been a lot of investment in infrastructure to store water in Avra Valley. Avra Valley is a great place for those kinds of activities.



But, you can see that the Tucson Basin is different; it's included in the USGS study that Rob Marshall referred to as one of those areas that does have a lot of places where groundwater comes to the surface, or near the surface, to support either stream flow or these groundwater-dependent riparian ecosystems. And, historically, there was groundwater discharge

along the Santa Cruz River and downtown Tucson and over at San Xavier del Bac, along the Pantano Wash, the Rillito Creek, and those areas have gone away. But there are still quite a few other areas in eastern Pima County where groundwater pumping can make a difference in terms of riparian ecosystems, and you can see that a lot of those areas are in northeast Tucson. In the northeast Tucson Basin, there are a number of different streams and springs, I would also say, that have some kind of relation to shallow groundwater. Because of these lush riparian environments, there's actually studies that have been done of the prices that people will pay to be near one of these lushly-vegetated areas. There's a substantial market premium just to be near there, even if it's not on your property that is reflected in the values, the property values out there. And it

also matters, apparently, about how lush it is. The more lush, the more you pay. So, it's a big amenity to the area.

Historically, a lot of this was agricultural. There's a lot of agricultural pumping to support pastures and farmland. And then, beginning in the 1980s, there was a lot more municipal pumping as well. So, this area's largely built-out now, but the groundwater table has been depleted. And, in fact, there was so much depletion, combined with a drought in 1989, that a lot of the wells in the area started to go dry. Wells that people had used for many years. They were generally shallow wells, I might add, along the stream.

And so, in 1989, Mayor and Council did something that was extraordinary. They passed a Resolution, a policy, that restricted the increase of groundwater pumping in this area, and I think they're probably the only City Council, to my knowledge, in Arizona that's ever taken a measure to voluntarily restrict groundwater pumping for the combination of reasons that included citizens' wells going dry, and the protection of the riparian ecosystem.

At the same time, they also directed Staff to develop a Conservation Program, and they said the Conservation Program should not only include the Tucson Water Service Area, but also the private water companies' and private users that are out there, so the ag people, as well as the a 49ers Water Company.

For the Conservation Plan, we reviewed the situation, That was in 1990 and around 2000, a little bit later, we reviewed the situation again to see, you know, what had happened with the water table and the condition of the riparian areas. So did the Parks Service. We still had concerns about the ecological condition in relation to groundwater pumping. We recommended reduced groundwater pumping, and also the importation of reclaimed water to the area, because that area lacks an alternative water supply.

And, happily, Tucson Water has built a reclaimed water since I think it was by 2006. The reclaimed line to the 49ers' golf course had been extended to the Rincon Valley, and this has made a difference. This has reduced the stress to the aquifer in that uppermost part of the Tanque Verde Valley where the storage is most limited underground. And people in the Wentworth area are reporting that their wells have come up, and there is actually stream flow in the stream again along Tanque Verde Creek. This is the 49ers' development, the golf course.

Here's the stream flowing, and then you have cottonwoods and a lot of mesquite bosque in that area. So, that's really helping. And this May, 2008, photo was taken - the prior summer there really wasn't much recharge in the Tanque Verde Valley. So, the - Upper Tanque Verde, the situation looks good.

Tanque Verde 49ers (2008)

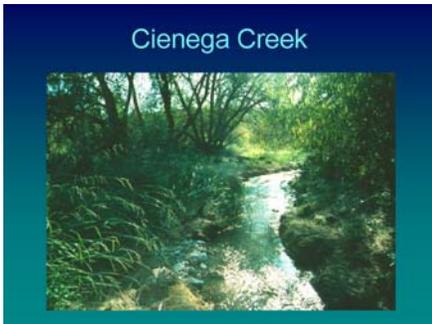


Farther downstream and along lower Sabino Creek - at least last time I looked at it - very serious situation. Their water table is still very low, and it's going to be. It would be a lot harder to make a difference there; that's a lot closer to the Central Wellfield. Not only is there Tucson Water pumping and - and some residual pasture land irrigation, there's also some use for the Tucson Country Club Golf Course, as well as the old Metro Service Area of - it was formerly called the "HUB Water Company."

One of the issues in the Sabino Creek/Tanque Verde Confluence Area is that Metro has only a few wells and it's a very limited service area, and they have no access in this area to the CAP blend that Tucson Water does. One of the things that could help relieve stress to the aquifer at the Confluence Area there with Sabino Creek and along Sabino Creek further up, would be an interconnection between the two systems. This would allow for a mixture of wells that would be further away from these areas to be used, and also to allow for some CAP blend. But, I realize that might be difficult between the parties, but there are emergency provisions already in place between not only Metro and Tucson Water, but other water companies that to address times when there might be supply limitations, such as drought. And drought times, as a matter of fact, are the times when the riparian ecosystems get the most crunch because water demand goes up because of landscape irrigation and water tables drop.

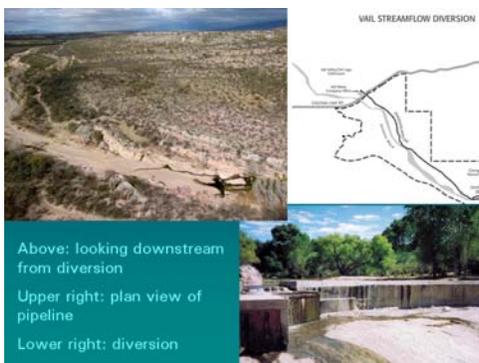
So, another thing that could help both along Tanque Verde Creek, Sabino Creek and, possibly, a few other areas would be to - to try to address the legacy problem left by these shallow wells that may be dry, but may actually be draining the - the shallowest part of the aquifer into the deeper parts. Sometimes what's left is a - we call it in hydro- - hydro-geologic terms these "transiently saturated aquifers" that are close to the surface, so they have an ecosystem role in keeping water up near the root systems of these riparian trees, but they can be drained inadvertently by wells that are perforated all along the casing as many of the old wells are.

It would take some sleuthing to find out what these areas are, but it could also be a form of well head protection protecting water quality for some of these companies.



So, I'm going to move on now to Cienega Creek as the second example. Cienega Creek is the ecological treasure of Pima County; it has a number of rare and endangered species; it's a beautiful place to hike. I encourage you to go. If you ever want to see what the Santa Cruz River was like in San Xavier del Bac and downtown Tucson, this is an example of it. It has a lot of the same plants and animals, albeit it's much smaller; it's much smaller than the Santa Cruz River ecosystem was. It's a lot of attention gets put on the San Pedro River, but Cienega Creek actually has a much more intact aquatic ecosystem than the San Pedro River and it's very valuable for that reason also.

It's also, as far as the recharge to the Tucson Basin, this is Cienega Creek right here, and about in here it flows into the Tucson Basin. There's a hydro-geologic structure - and the groundwater that's recharged in this area does not flow along Pantano Wash, rather it takes a different flow path that goes under the old IBM plant and can be traced even as far as the University of Arizona campus because of its distinct isotopic composition; this is from work by Chris Eastoe and others.



Above: looking downstream from diversion
 Upper right: plan view of pipeline
 Lower right: diversion

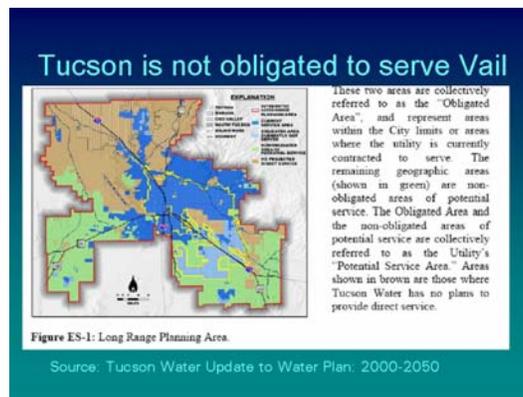
So, most of lower Cienega Creek - this area - is in a County preserve, but land acquisition alone seldom is enough to protect these stream systems. The fact that the land is acquired doesn't mean that the water sources are all protected. This is one place in Pima County where surface flows are diverted for use on a golf course, and that's pursuant to a historic water right, surface water

right of longstanding. There's a dam, most of it's below ground, there's hardly any of it sticking up. This is what it looks like here. Here's the riparian area, here's the stream flow; it

falls into a (inaudible) and then it goes in a pipeline about a mile and a half down to the Del Lago Golf Course, and it used to be used for irrigation a long time ago in that area.

So, it's a very important water source for the golf course, obviously; it's considered a renewable supply; it's not subject to all of the restrictions that would apply if groundwater were used. It also helps sell the houses around the golf course. So, there's no willing seller there. The County has expressed interest in acquiring this surface water right, but there's no one willing to sell and for understandable reasons.

In 1990, when the Board of Supervisors approved the Vail Valley development, which was a large master-planned community, there were plans to have a reclaimed line come to the area, and the requirement is that when reclaimed is available, they must use it on the golf course. And so, at that time, the surface water right becomes a lot less valuable and we would hope that we would be able to acquire that. But, there is no plan now to build pipeline, or on the five-year many years ago. reason, the proposed to put funds for a pipeline to this bond election; proposal. I that will happen. restore some of that's diverted here, it would be a way to get some of the flow back into Cienega Creek/Upper Pantano Wash.



the reclaimed there's nothing CIP as there was And, for that County has construction reclaimed area in the 2009 that's just one don't know if If we could the stream flow

Another complicating situation is the fact that this area is served by the Vail Water Company, and so here's Cienega Creek, and the brown area here is the Vail Water Company and so, you know, Tucson Water is not obligated to serve the Vail Water Company and it's considered non-obligated because there is this existing water company.

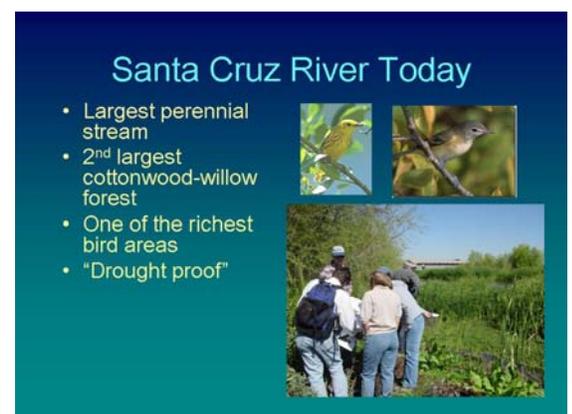
The Vail Water Company sits on this divide between the Cienega Creek Basin and the Tucson Water, so some of the wells are in the Tucson Basin and don't - we think - affect Cienega Creek. But there are a few wells that are up-gradient of the stream, and so that means that as they're pumping they will, eventually, have an effect on the Cienega Creek water supply

area. And so, again, an interconnect between such water companies could allow for more flexibility in the operation of the well systems to minimize future impacts as development increases in the area.

Another option might be for Tucson Water to consider buying Vail Water Company and, again, those kinds of flexibilities, perhaps, could be realized if they were united with the Tucson Water System, not through a contract, but through actual acquisition.

So, now I'll move on to the Santa Cruz River. If you think about the Santa Cruz River, downtown Tucson; it's gone but, you know, there's a lot of groundwater pumping in the Santa Cruz Valley still, and that water doesn't just disappear; it goes through our municipal supply system, through our toilets and over to Ina Road and Roger Road. So, the effluent that we see in the Santa Cruz River today is a mixture of water from the Santa Cruz Valley, as well as other places that groundwater sources, and even a little CAP; it's essentially been displaced. It's a very different ecosystem than historically occurred because there's no connection to groundwater; it's been disconnected. The effluent flow does not mix closely with the groundwater, and that's a distinction between our effluent-dominated reach of the Santa Cruz River, and the Santa Cruz River that you see down when you go to Tubac. You know that there's a very broad riparian ecosystem there. They have trails and encourage people to enjoy that, and that's because the effluent mixes there with groundwater.

Here, our - our Santa Cruz River, downstream of Roger and Ina Roads, is solely effluent, except when it's mixed briefly with - with storm water, but it is - it is the County's largest, longest perennial stream, and it does have the second largest cottonwood-willow forest, second only to Cienega Creek in eastern Pima County. So, it is an important riparian ecosystem for us. It's also one of the areas that's richest in bird life and particularly, migratory water fowl, something that we don't have a lot of in Pima County elsewhere.



Notably, it is drought-proof in the sense that a lot of what we're seeing in some of the streams and springs in Pima

County is that they dry up during these times of drought, and being Cienega went dry for several years during the 2000 drought, the flows at Agua-Caliente Spring are down; this is the case in many riparian and aquatic ecosystems throughout eastern Pima County. But, basically, the Santa Cruz River -

CHAIRMAN JIM BARRY: Julia, five minutes, please.

MS. FONSECA: How much?

CHAIRMAN JIM BARRY: Five.

MS. FONSECA: Five. Okay. Has - has very little left.

So, one of the things that you should know is that although the riparian ecosystem is great, the aquatic ecosystem is quite poor. The County is planning to improve that, and that will have very important riparian and aquatic ecosystem benefits because it will improve the base of the food chain. But, one of the issues is that there's no water allocated, none of the effluent is really allocated to the river; it's just there because it needs to be disposed of.



There is something called the "Conservation Effluent Pool" that has been negotiated between the City and the County, but that will not be sufficient to maintain flows in the river, and it was never really intended to do so. So, there are some significant issues associated with keeping the Santa Cruz River flowing if we want to keep those ecosystem benefits there.



So, you know, it's my hope that we do allocate some water to the Santa Cruz River. There is a handout today that represents the Science Team's position, the Science Team that helped develop the ecological component. The Sonoran Desert Conservation Plan does recommend that some water be allocated to keep the riparian ecosystem along the Santa Cruz River going, because that may be our most ecologically viable stream if some of the more dire global warming projections come true. And even if it isn't, it is something that right now does provide a lot of the ecological values that we have.

So, in conclusion, I want to say that land acquisition is seldom going to be enough to protect environmental flows. We need to allocate flows for these ecosystem functions, flows from groundwater, from surface water, from effluent. And I think municipal water companies are uniquely qualified to consider these issues of environmental flows. Private water companies can't; they are precluded by State statutes.

Tucson Water's Mission Statement does include considering and minimizing environmental impacts of operations and sustainably managing groundwater basins. So, Tucson Water's already internalized that. And the Pima County Board, on its part, has adopted a sustainability directive that dedicates County water resources to sustain and protect the natural environment. Unfortunately, the County doesn't have a lot of the water rights or effluent rights to devote to that purpose, but those that are, are there.

Water conservation - I want to suggest that water conservation could target some of these groundwater-dependent ecosystems and have a good benefit, more so than water conservation. Water conservation, in many areas, simply won't have an ecosystem benefit.

The reclaimed water infrastructure, and the potable water interconnections, could also be ways to relieve some of the stresses on the aquifers.



Conclusions

- Target GDEs for water conservation
- Use potable and reclaimed water infrastructure investments to reduce stress on GDEs
- Preserve and restore in-stream flows by allocating water sufficient for stream functions
- Maintain and improve water quality to streams, including effluent discharges

And, finally, I want to say it's great to re-vegetate areas, but this does not replace the ecosystem benefits of having a flowing stream that gets these pulses of sediment and floods that rework things, off-channel drip-irrigated, riparian vegetation and created ponds simply do not provide ecosystem function - they're not equivalent. So this is why we need to keep the focus on some of these stream flow issues.

And - now I think we're ready for questions.
(Applause.)

CHAIRMAN JIM BARRY: Julia, thank you very much. Rob, why don't you come on back up here. Mark?

MEMBER MARK STRATTON: Yeah, Julia. I know that during the ROMP process, Wastewater did look at, on the surface, what amount of flows would be necessary to maintain the ecosystem in the Santa Cruz River. Has that been finalized of what quantity of flow would be necessitated to maintain that, or is that still under study?

MS. FONSECA: Well, it depends on what reach you want to talk about. And I know some people have talked about why should we let it flow out of Pima County?

Ecologically-speaking, we have a report that talks about the value of that component of the Santa Cruz River ecosystem that lies within the La Ossa Ranch, which is a place where the flows of the river, basically, spread out and there's a mesquite bosque and wetland complex that supported bi-effluent in that area. So, in terms of defining a reach for study, our ecological recommendation would be to include that area through La Ossa Ranch. And, I believe, Frank Postillion has done some estimates of the stream flow that would be needed and these are in the 30,000 acre-foot range, but I do believe that it would - if we were serious about the effort to allocate effluent flows to the river, that's the sort of thing that we'd put more focus on.

It also, I think, depends on where your release points are, too, because if you just look at Roger and Ina Roads and Marana, those are the three release points that we have right now for effluent, the picture changes if you have more release points. So, one could look at options. But it's not all of the flow. There's more flow there right now than there has to be to keep a lot of these functions around. So, there's enough to not only keep a lot of the ecosystem functions, but also to use for other purposes, including off-channel storage and so forth; it's not an either/or situation.

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: Julia, an absence of discharge from the Nogales Wastewater Treatment Plant, would there be surface flow in the Santa Cruz in the area of, what, Canoa or Tubac?

MS. FONSECA: Probably not. There's Canoa Ranch, when it was purchased by the County, it was purchased subject to decisions that have been made by the developer and acquisitions of pumping sites for the mines. It's a water ranch for Phelps-Dodge. Many, many thousands of acre-feet are pumped out of that area, and that affects things, plus there's an agricultural - lower soppery (ph.) and upstream of that site, there's a lot of agricultural pumping as well. So, one would have to see some reductions probably of the existing stress on that aquifer.

CHAIRMAN JIM BARRY: Bob?

ALTERNATE MEMBER BOB COOK: With increasing reliance for CAP for our water supply and, consequently, content in the effluent stream, what will be the increase salt impacts on our riparian systems?

MS. FONSECA: Craig Tinney did some projections years ago about the increased salt load on the Tucson system, and I don't have on top of my head the results of that, but I believe that it was in the range where there are some ecosystem alterations. As you get up to 1,000 milligrams per liter of the salt load, basically, you start to see some shifts in composition - maybe fewer cottonwoods, more willow.

With a lot of sulfate, you start to get a lot of preferential enhancement of Tamarisk. We see a lot of that in the mined areas where there's a lot of sulfate releases. So, it can have some effects as you increase the salt, but the -

ALTERNATE MEMBER BOB COOK: In other words, the invasive -

MS. FONSECA: - you still get a lot of -

ALTERNATE MEMBER BOB COOK: - the invasive species?

MS. FONSECA: - the ecosystem benefits from the aquatic flow and, also, even from the structural, you know -

CHAIRMAN JIM BARRY: Yeah.

MS. FONSECA: - characteristics, willow has a lot of benefits as well.

CHAIRMAN JIM BARRY: Marcelino?

MEMBER MARCELINO FLORES: A question for Rob - and it's a long kind of (inaudible) question for clarification. Before the summary slides of the Environmental Water Needs, you had used the term "lots of water" as referring to the Basin, can you clarify that? What do you mean by "lots of water?"

MR. MARSHALL: Well, in the San Pedro Basin - Bruce would know better - there's many millions of gallons in that aquifer.

MEMBER MARCELINO FLORES: In terms of, like, acre-feet, what does that translate to?

MR. MARSHALL: Can you help me out, Bruce?

MEMBER BRUCE GUNGLE: No, I can't, Rob.

MR. MARSHALL: It's - it's -

CHAIRMAN JIM BARRY: It's a lot.

MR. MARSHALL: It's a lot of water.

MEMBER BRUCE GUNGLE: It's a very difficult thing to quantify.

MR. MARSHALL: Yeah, there's a lot of water and

MEMBER BRUCE GUNGLE: (Inaudible; not speaking into a microphone.)

MR. MARSHALL: And right now in the Upper San Pedro, the domestic consumption is less than 2% and they're already showing effects. So, it just makes the point where you can have a lot of water, but a small increment of change can have impacts to the river.

CHAIRMAN JIM BARRY: John, and then Sean.

MEMBER JOHN CARLSON: Couple of definitions, statements, and then I got a serious question. You said human consumption, and I presume that does not mean the stuff that goes in the crops and really is eventually consumed or able to be consumed by humans, is that right, when you use the term "human consumption?"

MR. MARSHALL: That's all categories, so agricultural use -

MEMBER JOHN CARLSON: Including what goes into crops. Okay.

MR. MARSHALL: - mining . . .

MEMBER JOHN CARLSON: It seemed like - okay. When you were talking about groundwater basins contributing to river flow, you use this quick term of "Pinal County - there's no Pinal County groundwater basin" when we know there's water there with even some people gonna buy up land and ship it up to Phoenix, you mean there's nothing there to contribute to river flow. Is that - is that what you meant?

MR. MARSHALL: So, in the area where the growth was projected, it doesn't overlap with the groundwater basins that support surface flow.

MEMBER JOHN CARLSON: Yeah. Okay. Here's my serious: "Cone of depression" or "cone of influence." My Master's thesis was on groundwater; it was in the northwest Nevada, but a hell of a lot of the data was USGS right along the Santa Cruz and other things down - down here, and I'm confused now, but State law in one place you could pump whatever and it had nothing to do with whether you were drawing it out of the river or not; that's the cone of influence on the river flow and, yet, I think there is some restrictions here, but I sense that you're saying that we really have to get into the ground - to our water laws and probably revise them. Is that a right interpretation?

MR. MARSHALL: So there is a sub-flow ruling associated with the adjudications on the San Pedro; they're delineating an actual boundary where pumping of groundwater off the river would actually - they'd consider it connected to the surface flow. But, in most of the areas, we don't have sub-flow rulings, so and - and when - if you're - if you're just a private individual with an exempt well, there's no restrictions.

MEMBER JOHN CARLSON: But, you're hinting that maybe we better look at this and revise?

MR. MARSHALL: Well, you know, the basic - the basic challenge with our water law is that it doesn't recognize there's a connection between groundwater and -

MEMBER JOHN CARLSON: Yeah.

MR. MARSHALL: - surface water -

MEMBER JOHN CARLSON: Yeah.

MR. MARSHALL: - so that's why we can pump and pump and pump even if it has effects in the surface water, unless it's a surface right-holder that -

MEMBER JOHN CARLSON: Yeah.

MR. MARSHALL: - wants to litigate, there's no -

MEMBER JOHN CARLSON: Well, maybe Julia -

MR. MARSHALL: - (inaudible) conclusion.

MEMBER JOHN CARLSON: - has a thought on this area. I don't know.

CHAIRMAN JIM BARRY: Well, let's go to Sean, please.

MEMBER SEAN SULLIVAN: First off, I have a 9:00 o'clock meeting, so I'm going to have to leave early, so I apologize for that.

And my question - I think Rob just started to touch on is: For a specific area, such as the Cienega Creek, are you able to determine a specific distance to keep wells away from, and also a maximum extraction limit for groundwater in order to ensure that that ecosystem continues to function?

MR. MARSHALL: Well, that's really a better question for Julia to answer, and Julia mentioned it, the closer you get your wells to the system, the quicker the effects are going to show up if there are effects. Where the aquifer lies and where they're pumping and where the washes are can be separate areas. But, I bet Julia could define where that pumping would start to affect.

MS. FONSECA: Well, actually, there was an effort back when there was a Governor's Water Commission on the subject, and there was a recommendation to adopt Groundwater Protection Zones and they actually used Cienega Creek as one of the areas. And, because this would be difficult on a statewide basis to get in and do site-specific studies, they were talking about a standard distance - and I don't remember if it was several hundred feet to maybe a quarter mile away - there is some renewed interest in - by the State in having Groundwater Protection Zones, mainly motivated by the sub-flow issue that - that Rob spoke of. So, you know, I don't have a lot of hopes for that.

But, it would be possible to define areas of - you know, it's a natural continuum, basically. You have to put a line on it, and so it would be possible to do that. There would be further studies required, but one of the advantages we have there is that there is a lot of hydro-geologic information and

more is being gathered all the time, including by people at the Flood Control District like Frank Postillion.

MEMBER MARCELINO FLORES: Mr. Chair?

CHAIRMAN JIM BARRY: Marcelino?

MEMBER MARCELINO FLORES: Kind of building on what John was beginning to ask. In terms of the isotopic composition work that was done by Eastoe and others, is that part of an adjudication argument, and how well was it received or is it being received?

MS. FONSECA: That work was research and it is not part of the adjudication and it is, to my knowledge, it's not been used in any way in the adjudication.

CHAIRMAN JIM BARRY: Any other questions?

MEMBER JOHN CARLSON: Yeah.

CHAIRMAN JIM BARRY: John's got a -

MEMBER JOHN CARLSON: Yeah. Julia, you - you mention about Vail being outside of Tucson Water and it could be bought or whatever, and you mentioned something about effluent up there. I heard there is some hope or push to get effluent up there. And the thing I've pushed, and they tell me I don't know what I'm talking about, is why not have an intermittent treatment plant halfway down the Rillito and instead of running another ten miles through enlarged pipes and then pumping it an extra ten miles back up to Vail. You got any thoughts in this area? I think it should be investigated thoroughly.

MS. FONSECA: You know, I'm not an operator of the Reclaimed System, so I think the folks that operate the Reclaimed System could offer the best insights about how it would improve their operations. My main ecological goal, I guess, would be to see groundwater pumping stresses relieved, and there's so many different ways to do that in the Cienega area; that could be one of them, but there are a lot of options.

CHAIRMAN JIM BARRY: Is this a fast one, Bob?

ALTERNATE MEMBER BOB COOK: Yeah, just to go to Rob's presentation on population projections; those are based on DES. DES is no longer going to be responsible for population projections because of the inflation in the recent decade. I understand that population projections are useful in

CHAIRMAN JIM BARRY: Bob, let me interrupt one second. Sean, when - for next week, will you be prepared, please, to come back and re-discuss your motion in light of what we heard today?

MEMBER SEAN SULLIVAN: Yes.

CHAIRMAN JIM BARRY: Okay. Thank you. Go ahead, Bob.

ALTERNATE MEMBER BOB COOK: Yeah.

CHAIRMAN JIM BARRY: And you are going to get to a question; right? Or you just going to make this a statement?

ALTERNATE MEMBER BOB COOK: Yeah. it's just simply a statement that, the big theme here in this Committee is whether the future going to be an extrapolation of the past, or are we really moving into a new future? And I think that posing these problems in light of a projection that's highly questionable is - needs to be pointed out.

CHAIRMAN JIM BARRY: Okay.

MR. MARSHALL: Well, you know, you mention that Bob - if I just may respond briefly. I was in a discussion with a number of demographers and that question was posed, given our current economic situation. The demographers' response was that It's always going to be cheaper to air condition your house in the southwest than it will be to heat your house in the northwest, and so economic opportunities are going to continue to drive people here. And so they were not as optimistic as you were that -

ALTERNATE MEMBER BOB COOK: What about the cost of water, though?

MR. MARSHALL: That trajectory might change. Now, granted, we can't project the future, but the cost of living here, the demographic changes in the country, I think that's an open question, so valid point.

CHAIRMAN JIM BARRY: Audience, any questions? Mr. Stagner? This is a question; right?

CLYDE STAGNER: Tertiary treatment from Las Vegas is put into Lake Mead and there are pollutants in there individually or (inaudible; not speaking into a microphone) causing the male fish to become effeminate. This effluent comes down the CAP canal, goes into (inaudible) CAP and ends up in the effluent that you are going to want to put out according to your presentation. In the effluent there's (inaudible) already been measured in the (inaudible) discharge. There are other contaminants (inaudible) -

CHAIRMAN JIM BARRY: Mr. Stagner, do you have a question, please?

CLYDE STAGNER: - in addition to the Las Vegas water (inaudible), which is diluted, you have all the wastewater coming to Tucson with these pollutants going into the effluent which are not taken out. Are you getting contaminant monitoring measurements from the Pima Wastewater Management people? Have you advised them which ones you need to look at? Do you have a list which includes the use of effluent for (inaudible) for and from?

MS. FONSECA: So, your question is concerning all of the contaminants that exist in effluent, and there certainly are a lot of them. And the problem is most acute for the Santa Cruz River effluent-dominated part because it's not diluted,

generally, with a base flow of groundwater and some other streams - effluent-dependent streams are.

Both Tucson Water and Pima County have been very concerned about the contaminants issue and there has been some research about the ability of our existing treatment plant and our recharge systems to attenuate those pollutants, and it varies; it varies according to the chemicals, and new chemicals are being invented every day.

There's also been studies of the effects of effluent on fish from effluent derived from the Roger Road Treatment Facility, and they are seeing some effects on fish that are in some ways similar to what they saw in Las Vegas Wash as well. So, it is an area of concern and, despite all of this - these issues, the facts remain that the Santa Cruz River effluent-dominated stream is one of the largest riparian ecosystems, and it's an unfortunate situation that that's where we are today - that one of our most reliable streams is one that depends on effluent that has constituents that are not good for aquatic life.

CHAIRMAN JIM BARRY: Anybody else from the audience?
(No response.)

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on September 17, 2008.

Transcription completed: September 27, 2008.

DANIELLE L. KRASSOW-TISDALE

Transcript of September 24, 2008

List of Presenters:

1. Jeff Tannler: Presentation on ADWR Water Budget for Tucson Active Management Area

Presenter #1

**ADWR Water Budget FOR TUCSON
ACTIVE MANAGEMENT AREA
PRESENTATION BY JEFF TANNER,
DIRECTOR
ADWR, TUCSON ACTIVE
MANAGEMENT AREA
(ALSO PRESENT LAURA GRIGNANO)**

MR. TANNER: Mr. Chairman, members, thank you very much for having me. I really appreciate it. As Jim mentioned, I'm Jeff Tannler. I'm the Area Director for the Tucson Office of ADWR. I appreciate the opportunity to present ADWR -

CHAIRMAN JIM BARRY: - stop you for one second. I've got - Gail Cordy, did you want to speak on the Study Area Boundary Issue?

MS. CORDY: Yes.

CHAIRMAN JIM BARRY: I'm sorry, Jeff. I just looked -

MR. TANNER: No problem.

CHAIRMAN JIM BARRY: - at this speaker card. Go ahead.

MS. CORDY: Well, actually, I was happy to hear that you're not limiting the scope of your study. I'm a hydrologist and, as we all know, hydrology doesn't stop at any manmade border or boundary. And so what I am encouraged to see this Committee consider, not only the current areas for Tucson - for Tucson water delivery, but the future areas, as well as the entirety of Pima County and beyond. I think that's really important not to limit your boundaries, because your hydrologic answers are - may come from within and outside. Thank you.

CHAIRMAN JIM BARRY: Okay. Calm down, Vince.

MEMBER VINCE VASQUEZ: So, all the groundwater basin - it should be groundwater discussion - I think that's my larger point is that -

CHAIRMAN JIM BARRY: Okay.



Now, we'll also be talking about the water use pursuant to grandfather groundwater rights, which are shown here in lurid green. Kinda remember that a lot of the water rights are in the Avra Valley area and down south toward the Green Valley area, keep that - keep that in the back of your mind. I knew I was going to do that.

Now, what's shown here in blue is the location of Service Area rights within the Tucson Active Management Area, and Service Area rights are the type of right that is held by a water company, a water provider, that type of thing. And then to just help orient you, the location of Tucson Water's obligated Service Area is shown here in snazzy orange, and I bet you couldn't tell I'm color blind, huh?

Tucson Active Management Area

- ◆ Goal of **Safe Yield** by 2025
- ◆ **Safe Yield:** *"A groundwater management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge in the active management area."* A.R.S. § 45-501(12)

City / County Water & Wastewater Study Oversight September 24, 2008

So, the Tucson AMA has a goal of attempting to reach Safe Yield by the year 2025. Safe Yield is a balance between the amount of groundwater withdrawn from the AMA, and the annual amount that is naturally and artificially recharged. Currently, the AMA is not at Safe Yield. We're in an overdraft condition. By constructing and

analyzing a Water Budget, we can see our progress towards Safe Yield over time, determine where we stand currently, and use that assessment to project toward the future to make an estimate of whether we're on track to meet Safe Yield.

One point to keep in mind is that the definition of Safe Yield is for the AMA as a whole.

You make have heard of studies where overdraft has been estimated for a smaller area within the AMA. One example is a consulting study that was done a few years ago for the Green Valley area. If you've got the data available, it may be possible to estimate overdraft for other defined areas, such as the areas served by a water

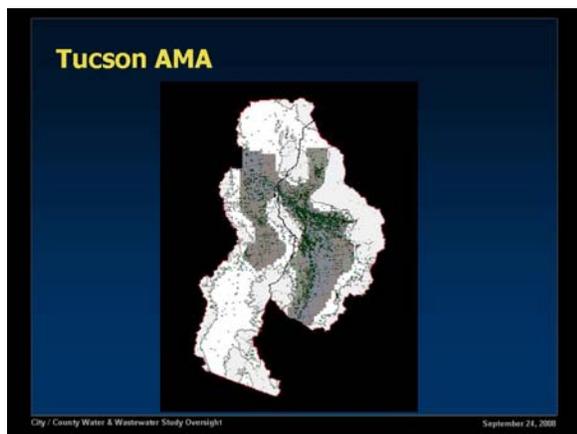
Water Budgets

- ◆ Hydrologic perspective
 - Groundwater Modeling
 - Examines pumping, water levels over time
 - "Wet Water"

City / County Water & Wastewater Study Oversight September 24, 2008

provider or a set of water providers, but the Groundwater Code and the Management Plans look at Safe Yield on an AMA basis, so that's what we're going to be focusing on for our discussion today.

Now, there's different ways about - going about construction of a Water Budget depending on what you're trying to determine, and I'll show you two perspectives. One of them is a hydrologic Water Budget, and that looks strictly at the volume of water in storage in the aquifer, with amounts input into and output from the system, and groundwater models are used, which involves dividing the area of study into individual cells and examining water levels and historic pumpage within these cells over time.



Now, what you see here is the Tucson AMA, and that dividing line in the middle is dividing the AMA into two sub-basins. On the left is the Avra Valley Sub-Basin and, on the right is the Upper Santa Cruz Sub-Basin. The gray areas on the edges are areas of hard rock where there's no aquifer and the white areas in between are the areas where the sand and gravel

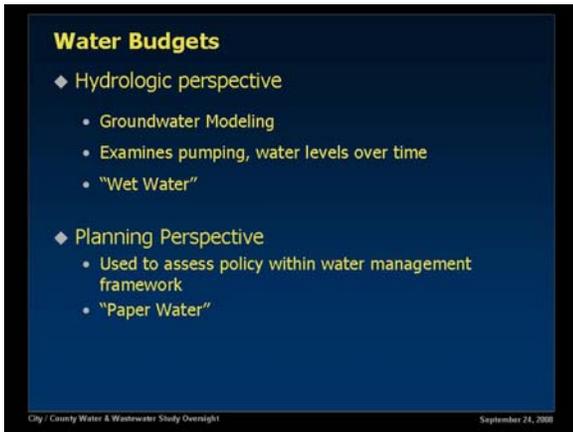
and clay form to make an aquifer.

Now, you can kind of think of this as two freeways merging, kinda - you know, think of I-10 and I-19, the water's going from south to north through the Avra Valley Sub-Basin on the left, and the Upper Santa Cruz on the right, where they meet is this area right here. Up here is the CDO Wash and it comes down; it all funnels into the Santa Cruz River and it goes out into the Pinal AMA up through here. So, this is all one basin, there's two different sub-basins; just, you know, we've had some talk about that earlier tonight, so I wanted to - wanted to point that out. And just to orient you again, here are the roads, major roads within the Tucson Active Management Area, if that kind of helps you picture things.

Now, what you see here are the cells for the Tucson AMA groundwater model, and then these dots represents wells that are used within the groundwater model from which water levels have been measured in the past, and these are GWSI wells; that stands for Groundwater Site Inventory, and that's a database that's maintained by our Hydrology Division.

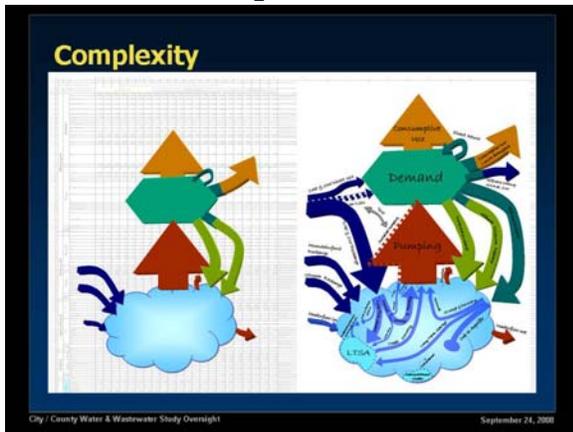
So, again, with a hydrologic budget, the amount of water in the area of study is determined and the amounts of water entering and leaving the aquifer are calculated, and you

think of it like a checking account: How much water's in the bank, how often do you get your paycheck deposited, or the surprise check from the lottery - sometimes that comes - and how quickly are you withdrawing cash? So, that's a good way of looking at it.



Another way of looking at the Water Budget is from the planning perspective. This method is used to assess the effects of policy in managing water and this is about - this is where the term "paper water" comes in and, unfortunately, where it starts to

get messy, and it really does get messy. Back in 1985, the rules were a lot more simple in the Tucson AMA, there was no Recharge Program, no water bank, no Assured Water Supply rules, no CAGR; it was mostly just groundwater use, which is what got us into this predicament.



Through the years, water management has just become more and more clever, and you've probably seen this thingy before, this is an illustration that former Tucson AMA Director, Ken Seasholes, had put together. Sharon Megdal, in one of the recommended readings on the - on the Website for tonight, she referred to this as the "Water Budget monster."

The cloud at the bottom - Ken likes to use clouds - that represents the aquifer. The arrow going out the top is consumptive use. The arrows on the left represent water coming into the aquifer, either naturally or artificially. And the arrows on the right would be return flows, or water that is used, but ends up back in the system in the form of incidental recharge. And then there's all sorts of nefarious activity going on in the cloud, in the - in the aquifer down below, and it's generally water policy at work. So, you may find this figure either intriguing, or maybe off-putting, but, in any case, it's fairly abstract and it takes a while to get your mind around it. Laura Grignano, my colleague who is also here, she and I refer to this quite a bit, because it does kind of help with the abstract of Water Budgets.

So, there's wet water and there's paper water and, as tempting as it is to stick with the strictly hydrologic Water Budget, we actually look at both, the physical side from the hydrologic budget and the policy from the planning budget. And remember both are for a specific area; in this case, Tucson AMA as a whole, and it's for a specific duration of time, and we're going to look at 1985 through 2006.

Analysis

- ◆ Hydrologic perspective
 - Groundwater Modeling
 - Examines pumping, water levels over time
 - "Wet Water"
- ◆ Planning Perspective
 - Used to assess policy within water management framework
 - "Paper Water"

City / County Water & Wastewater Study Oversight September 24, 2008

So, what's displayed here at kind of a 50,000-foot view - I don't expect you to read these numbers - that's a recent version of our Tucson AMA Water Budget, and this is from July, and this is probably going to get a few more tweaks in the future; there's - there's always something. Laura and I found a few details that we want to tweak just in the last couple of days; always subject to revision, but generally we feel - feel pretty good about the numbers. Now, I'll make sure that this gets uploaded onto the - onto the City/County Website as well.

Water Budget Table

City / County Water & Wastewater Study Oversight September 24, 2008

And we start by looking at demand by sector, break it down to agriculture, municipal,

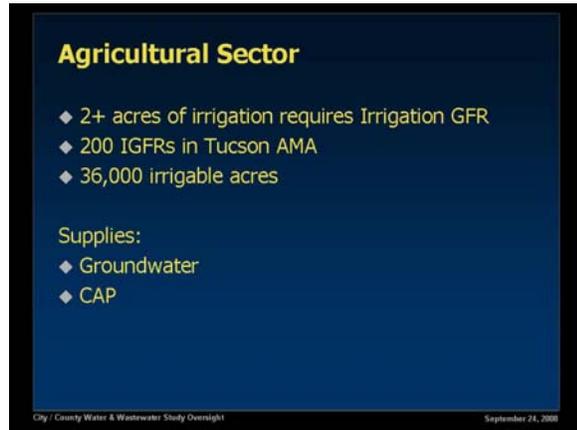
Sectors

- ◆ Agricultural
- ◆ Municipal
- ◆ Industrial
- ◆ Indian

City / County Water & Wastewater Study Oversight September 24, 2008

and industrial sectors, and then Indian water supply, since that does affect the overall water - Water Budget with any Active Management Area. And, as we go through this, I'll show you the assumptions that we use, some of the numbers for recent years. And we have some trends graphs for what's been happening over time for each of the sectors, and we'll look at those. And I'll warn you as I go through this, I'll probably inadvertently slip in a few abbreviations, like ag for agricultural, muni for municipal. I won't even realize I'm doing that, but fair warning.

So, for the agricultural sector, a little bit of background. The 1980 Groundwater Code put a number of limits on



water use within the AMAs, and one of those limits is that in order to irrigate over two acres of crops or pasture, that land must've been irrigated between the years 1975 and 1980. If land has that irrigation history, then it qualifies for an irrigation grandfather groundwater right.

Within the Tucson AMA, there are about 200 irrigation rights at this point, and that is about 36,000 acres that's allowed

to be irrigated, and most of that ag, like we saw in the - in the map earlier, that's standard in either Avra Valley, or in the Green Valley/Sahuarita area where FICA grows about 5,000 acres of Pecans. We do have one irrigation district that has a physical distribution system, and that's a Cortaro/Marana irrigation district; that CMID. Irrigation rights have an annual allotment of water. The combined total allotment for all irrigation rights within the Tucson AMA is a little bit over 150,000 acre-feet.

Now, as a side note, as land moves from agriculture to development, the irrigation right which stays with the property, that is usually permanently extinguished, and usually for Assured Water Supply credits. Until 20- - until the year 2025, a grandfathered right can be extinguished for Assured Water Supply credits; it - as you get closer to 2025, the amount of credits you get steadily decreases until 2025, when you don't get any credits. You get a finite amount of credits; that's not credits that you get each year; it's just a finite lump that you can use toward proving an Assured Water Supply. Now, the farmer that - that has the farm, they usually wouldn't need extinguishment credits, but these credits can be sold to an entity who could use them, and that would either be a developer - a developer or a designated provider.

One other note, just to - just to be clear, when I mention irrigation - again, that farms or pasture - so crops that are grown for sale or for human or animal consumption, that doesn't include turf irrigation under the Groundwater Code definition, and there are separate conservation requirements for turf facilities, so just to be clear on that.

Now, in the Water Budget Table, what's shown in- - includes water used pursuant to irrigation rights, either withdrawn from their own wells, withdrawn by CMID and delivered

to rights, or CAP water received, and this is just an excerpt of the - of the whole budget, but just for simplification reasons.

Agricultural Demand, Supply

Tucson AMA Supply & Demand 98 DRAFT, SUBJECT TO REVIEW
THIRD MANAGEMENT PLAN

All figures expressed in acre-feet

		2005	2006
AGRICULTURAL			
DEMAND			
Groundwater		95,848	87,755
Groundwater (in lieu)		68,458	63,511
SUPPLY			
Groundwater		16,400	18,794
CAP (direct use, no in lieu)		10,990	5,450
Other surface water		0	0
Effluent		0	0
INCIDENTAL RECHARGE		23,962	21,939

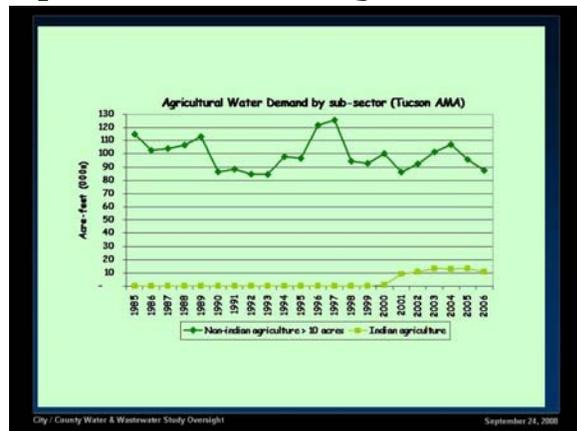
City / County Water & Wastewater Study Oversight September 24, 2008

Now, demand for 2006 was 87,755 acre-feet. On the supply side, you can see that 5,450 acre-feet of CAP were used in 2000. There's also a line showing in lieu groundwater. This is physically CAP water that's delivered to a farm and used in lieu of groundwater. This arrangement's called the "Groundwater Savings Facility," and we'll touch on this a couple

more times during - during the evening.

The owner of a CAP allocation, usually either a municipal provider, could be the Water Bank, they accrue recharge credits for the CAP water that's used at the farm, and this is kinda hard to picture. I'll - I'll touch more on this when we - a little bit later when we talk about recharge activities.

You can see also there's a line for incidental recharge. Let's talk about that for a minute. That's the amount of water that's estimated to have percolated down to the aquifer after being used for agricultural purposes. So, a

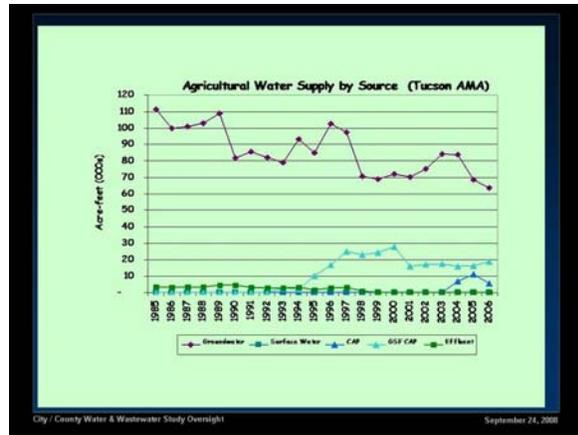


farmer applies water to his field, some of that water gets used by the plant and gets incorporated into the plant material or leaves through evapo-transpiration. Some of the water applied is lost directly from the soil through - to evaporation. Some is held by the soil itself. The rest of it eventually percolates down back to the aquifer. Now, we estimate

the amount of incidental recharge for agricultural as the percent of water reported as being used by the irrigation rights.

Before the year 1990, we estimated incidental recharge at a rate of 25% of the total irrigation water use. For the years 1990 up to present, we have reduced that - we estimated at 20% of incidental recharge, 20% of the irrigation demand. The reason that has changed, we assumed that irrigation efficiencies have increased over time as better technologies, better practices have been used.

So, the water demand by non-Indian agriculture over time has decreased overall, and it fluctuates, depending on how many acres are in production, which that depends a lot on the price of cotton and wheat and corn, if there are any subsidies, set-asides, also if it's a hot, dry year, then water is - use is, of course, higher. Indian agriculture has been increasing since about 2000 as a result of increased irrigation at - on reservation farms.



Now, the supply to meet non-Indian agriculture has changed over time. Historically, it was groundwater. And then starting in the mid-1990s, CAP water was used in lieu of groundwater at Groundwater Savings Facilities, GSFs. I mentioned that a minute ago. More recently, farms have been taking incentive-priced, non-Indian ag, or NIA pool water, and that's a type of CAP water that doesn't earn any recharge credits. There's not much to speak of as far as surface water in our - in our AMA. This shows up a lot more in the Phoenix Active Management Area because they've got the Salt River Project.

As you can see, there's a little bit of effluent that was used until about 1998. CMID had, historically, an effluent contract with Pima County, and they received some effluent up until that time when the contract ended.

Municipal Sector

- ◆ 26 Large Providers; 119 Small Providers
- ◆ 9 Designated Providers

Supplies:

- ◆ Groundwater
- ◆ Surface Water
- ◆ Effluent
- ◆ CAP

What we count in municipal includes large and small providers, water providers that have Service Areas rights. A difference is a large provider is one that serves more than 250 acre-feet of water. A small provider is under 250 acre-feet. Large providers have more stringent conservation and reporting requirements, but both

large and small providers are required to measure and file an annual report with the Department of Water Resources each year. In the Tucson AMA, we have 26 large providers and 118 small providers, and of these providers nine of them are designated under the Assured Water Supply rules.

Municipal Demand, Supply

Tucson AMA Supply & Demand		7/23/08 DRAFT, SUBJECT TO REVISION				
		THIRD MANAGEMENT PLAN				
All figures expressed in acre-feet		2002	2003	2004	2005	2006
MUNICIPAL (includes water utility)						
DEMAND		185,876	184,671	186,877	190,049	193,400
SUPPLY		155,043	122,252	109,620	105,276	105,132
Groundwater		19,047	49,650	64,340	71,132	72,179
CAP (direct line, reservoir, replacement)		0	233	173	188	210
Other surface water		11,784	12,227	12,744	13,453	15,941
Effluent		7,435	7,307	7,475	7,602	7,729
INCIDENTAL RECHARGE						

City / County Water & Wastewater Study Oversight September 24, 2008

Now, demand by municipal providers - again, that includes both large and small - and that includes both the residential and the nonresidential components. So, your house, obviously, would be in the residential side. The Circle K on the corner, or the Walgreen's on the corner, as it is these days, the carwash, many of the golf courses, parks, schools, Tucson Mall, everything

commercial that is provided by a water provider as a customer delivery, that is in the nonresidential, and that includes both effluent and groundwater that's served by a provider such as Tucson Water.

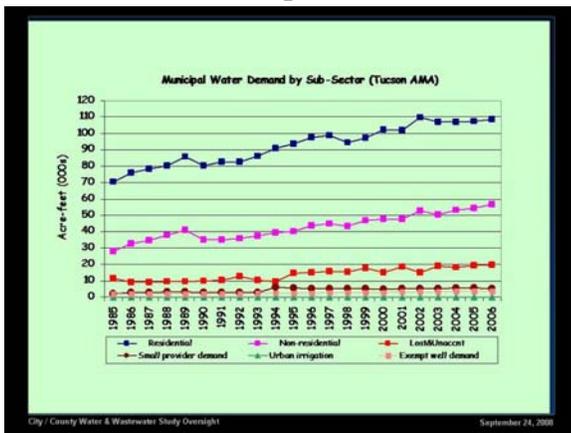
What's also included in these figures is lost-and-unaccounted-for water. What that is, that's the difference between what's withdrawn from wells and what's served to customers, and that can include leaks, un- - unmetered deliveries, if there are any. There may be, possibly, problems with individual water meters. Providers are limited to more than - no more than 10% lost-and-unaccounted-for water. So, that's their - that's their limit. Anything over that and there's a compliance issue.

Also, what's included in the muni sector is an estimate of pumpage from exempt wells. Now, just as a review, an exempt well is one that pumps 35 gallons per minute or less and, because of its relatively small pumping capacity, it's exempt from measuring and reporting requirements, they can also pump without having to have a groundwater right.

In the Tucson AMA, the figures for the 2006 that are shown here, that accounted for about 7,400 exempt wells. Right now, we ran a list recently, it's up to about 7,600. Within Tucson Water's obligated Service Area - just as an aside - there are currently about 1,800 exempt wells. Now, since exempt wells

aren't required to measure or report water use, we've used an educated estimate of about one-half-acre-foot per year per exempt well. So, that's a best guess estimate; that includes some exempt wells that don't pump; some exempt wells that pump more than that.

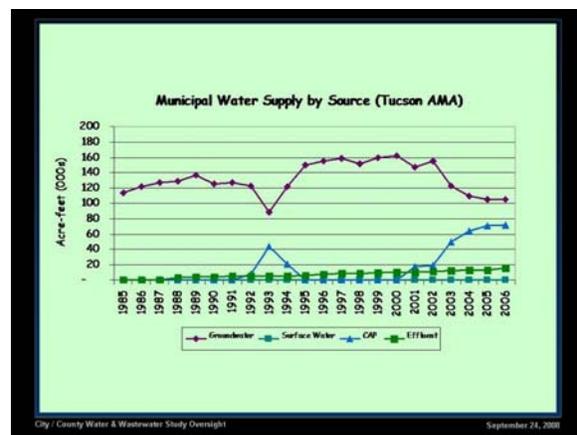
As far as municipal supplies used in 2006, there were



just over 105,000 acre-feet of groundwater used, 72,000 acre-feet of CAP, and almost 16,000 acre-feet of effluent, most of which is delivered to turf facilities that are served by municipal providers. There was a small amount of CAP used directly by Tucson Water in the treatment process at the Hayden Udall Treatment Plant and that's to keep it - keep it up and running. The remainder of CAP water is recharged and recovered.

So, looking at the trend graph for demand for large providers we break water again down to residential and nonresidential components, and you can also see lost-and-unaccounted-for water here. All these components have steadily increased with population growth. Small provider demand and water use by exempt wells are also shown on this graph; they're - they're toward the bottom.

As far as supplies used to meet that demand, the dark-blue line at the top is groundwater. The light-blue line below that is CAP, and you can really see the drop in groundwater and the corresponding jump in CAP in the years '92 through '94; that's when Tucson Water delivered CAP water directly. And you can see CAP water start to take off again, especially in 2003, and



that's as Tucson Water begins recharge and recovery at SAVSARP - at CAVSARP - and now SAVSARP - that's CAP water that is being blended into the delivery to Tucson Water customers. Effluent is a lot smaller supply, but you can see it's - it's steadily growing.

ALTERNATE MEMBER BOB COOK: Jeff, does that include CAP replenishment or is that just . . .? Does the groundwater that's shown there, that does not include then CAGR D replenishment any - anywhere on that graph in the blue or the...? So, the groundwater that's used in there, a - a good portion of that would be replenished?

MS. GRIGNANO: We actually have it on a separate line in the annual budget.

ALTERNATE MEMBER BOB COOK: Okay.

MS. GRIGNANO: It's not a - it's not as much as you think right now -

ALTERNATE MEMBER BOB COOK: Right.

MS. GRIGNANO: - which will increase, but - but it is on a separate line in the budget (inaudible; not speaking into a microphone) Jeff's going to mention (inaudible) up into this -

into this section, but we pull it out because it's relatively small (inaudible).

MR. TANNER: Yeah, you'll be - you'll be seeing that more in the future slides, so - and if you still have questions, we can keep on going through the . . . okay. So, any other questions so far? We'll - we'll take questions at the end, also.

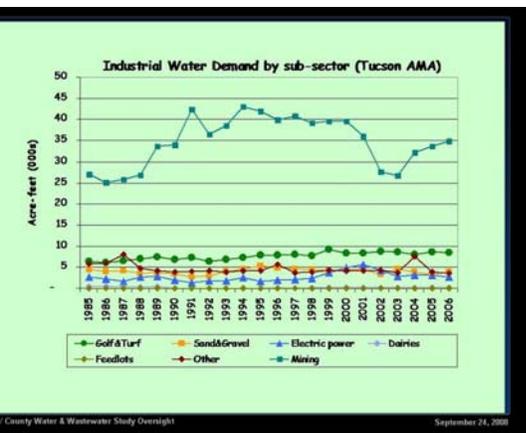
CHAIRMAN JIM BARRY: We're going to take questions at the end, please.

MR. TANNER: Okay. We'll do that. Okay.



So, for the industrial sector, that includes dairies of which we have one. There's a lot more dairies in the Pinal and Phoenix AMAs. Of course, we have mines, sand and gravel operations, power plants and many turf facilities. Generally, many

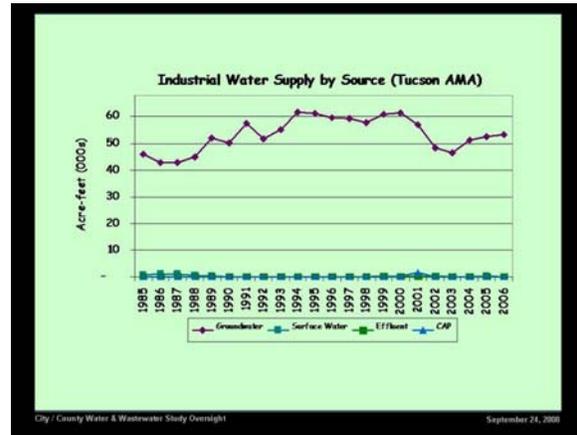
of these industrial facilities have their own wells and groundwater rights or other withdrawals authorities, and there are specific conservation requirements for each of these types of facilities. One thing



to note in case a question comes up: Rosemont is not included in these numbers for water use that you'll see, and that's because Rosemont Mine is not using any water yet, just in case that comes up.

Now, turf facilities include golf courses, parks, schools and cemeteries. Any facility that has more than ten acres of turf, lakes and water, intensive landscaping, that qualifies as a turf-related facility under the Management Plans.

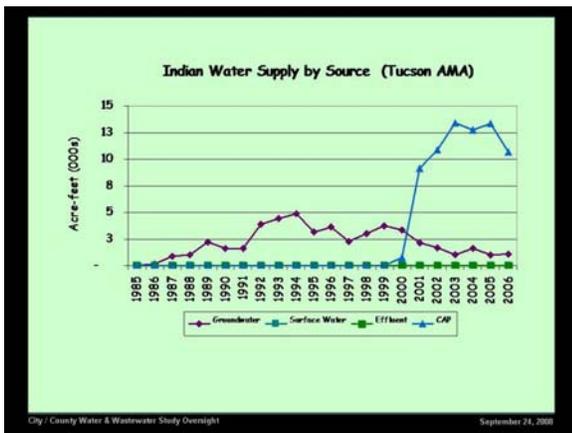
Looking at the numbers, the vast majority of industrial demand has been met with groundwater, which isn't - isn't surprising. The largest user of - within the industrial sector, is the mines. And this graph shows how much the mines use within the industrial sector; it also shows how much mine use fluctuates over time. Mines are the - the top line there. The fluctuation is mainly due to the price of copper. And, as far as mines, this includes the Sierrita, the Twin Buttes, Silver Bell and Mission Mines. So, on the supply side, you can see again that industrial demand has been met almost completely by groundwater.



Indian Water Use

Tucson AMA Supply & Demand		98 DRAFT, SUBJECT TO REVISE
		THIRD MANAGEMENT PLAN
All figures expressed in acre-feet		2005 2006
INDIAN		
DEMAND		14,370 11,678
SUPPLY	Groundwater	1,005 1,043
	CAP (direct use no. in flow)	13,365 10,635
	Other surface water	0 0
	Effluent	0 0
INCIDENTAL RECHARGE		3,341 2,659

Now, let's talk about Indian water use for a minute. Parts of the San Xavier and Schuk Toak Districts of the Tohono O'odham Reservation are located within the Tucson Active Management Area. Water use is not required to be reported to DWR and there are no State water conservation requirements. Water demands and recharge activities, though, can have an effect on the water balance within the Tucson AMAs, so that's why these supplies and demands have been included in the budget.



Most the demand is for agricultural irrigation, and most of the irrigation is served by CAP deliveries. Some groundwater is used for domestic purposes with some leased to ASARCO for mining. And incidental recharge comes largely from the agricultural sector. We base it, in this case, on 70% irrigation efficiency.

Now, as far as Indian supply, the Tohono O'odham have an allocation of 66,000 acre-feet of CAP between the San Xavier and Schuk Toak Districts. This is being used to meet ag demand, as

well as the Arroyos Recharge Program Project, which is located on the reservation.

Now, let's spend some time talking about recharge. This is where things get a little bit more complicated from the

Recharge

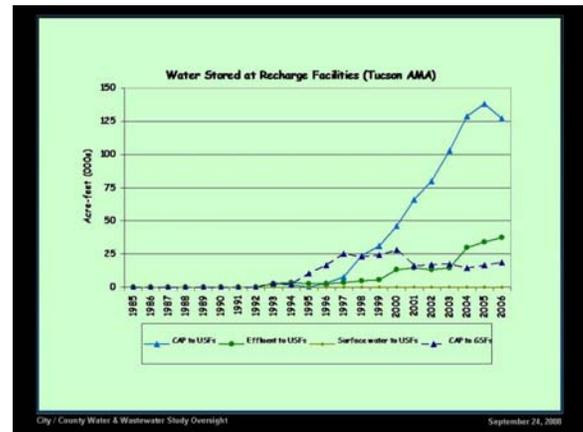
- ◆ Types of Permits
 - Water Storage Permit
 - Underground Storage Facility (USF)
 - Groundwater Savings Facility (GSF)
 - Recovery Well Permit
- ◆ Activities
 - Replenishment
 - Annual Storage/Recovery
 - Long Term Storage Credit Accrual

City / County Water & Wastewater Study Oversight September 24, 2008

accounting side of the budget. There are different types of permits to the Recharge Program, and I'm not going to get too mired in the details, but I do want to spend a little bit of time on this 'cause this might help you understand some of the different recharge activities that occur within the Tucson AMA.

A water storage permit allows an entity to store a certain amount of water, which is usually CAP or effluent, at a particular facility. A facility permit is issued to an entity who owns and operates a storage facility. So, an entity would have a facility permit for something on the ground, and then there could be multiple storage permits for multiple entities to store at that facility, so keep that in mind.

There are different types of facilities. An underground storage facility can either be constructed, which in a Tucson AMA that's generally spreading basins. Some examples of that would be CAVSARP, SAVSARP, Pima Mine Road Projects. Managed facilities are situations where effluent is discharged, let's say, to the Santa Cruz River, with Lower Santa Cruz Managed Project. So, they're using the - the river as the storage facility. The accounting's a little bit different between the two.

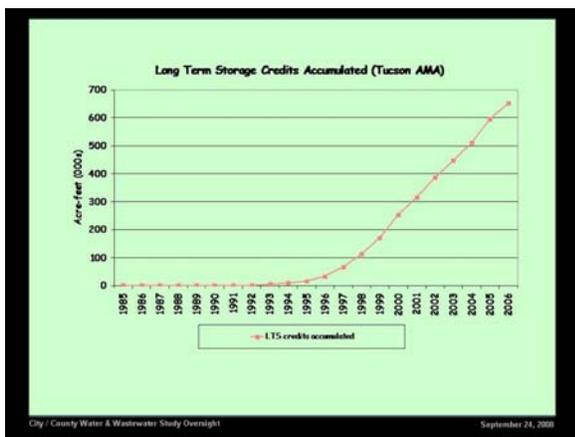


The other type of facility is our old friend, the Groundwater Savings Facility - that keeps coming up - this is an arrangement between a farmer and municipal provider, or the water bank. The farmer takes providers, CAP, physically, and uses that in lieu of groundwater. Credits are accrued, based on the amount of groundwater that is not pumped, those credits go back to who had the CAP allocation, which would be the provider in this case, and the advantage - advantages of this arrangement, the CAP water gets used more fully and more quickly than it otherwise would, and a provider can accrue recharge

credits even if they don't have direct physical access to Central Arizona Project water.

Now, one of the disadvantages is - that comes up, water can be withdrawn in a different location later on than where it was recharged. So, it's not a perfect arrangement. But, keep in mind this was to allow flexibility and to allow more quick and full usage of CAP, which is very important.

Now, some of the different recharge activities: Annual storage and recovery is easiest to explain and understand, CAVSARP and SAVSARP, the water is recharged and recovered within the same year. There are no long-term storage credits that are accrued. Long-term storage credits happen in a lot of cases where there are only certain cases where you can -



where you can accrue the long-term storage credits, but that's what happens a lot with Water Bank affirming for - for future supplies.

And I mention replenishment here, that can occur either beforehand - Rosemont Mine is recharging water in advance, replenishing in advance of their anticipated withdrawals - usually, replenishment is - happens

after-the-fact, and that is conducted by the Central Arizona Groundwater Replenishment District, CAGRD, on behalf of Member Service Areas, which are designated water providers, or member lands, which have certificates of Assured Water Supply; both of these have a replenishment obligation.

Landowners and water providers within the Phoenix, Pinal and Tucson AMAs rely on the CAGRD to replace groundwater for new developments. And I'll note that, again, Assured Water Supply and recharge rules allow recharge in one location within an AMA, and potential recovery of that CAP within a different area; again, this allows flexibility. One - one issue that can occur is, although AMA-wide, there is replenishment, there may be certain particular areas where water levels are declining if they're not in the same location where recharge has - recharge has occurred, so . . .

Now, this shows the amount of water stored at recharge facilities, and by different types of recharge facilities. Most of the CAP is stored at Underground Storage Facilities, or USFs, such as CAVSARP and Pima Mine Road. CAP is also stored at GSFs, and effluent has been stored at Underground Storage Facilities

as well. Now, this is a graph showing the amount of long-term storage credits that have been accrued through the year 2006.

Other Parts of Budget

- ◆ Riparian Demands
- ◆ Cuts to Aquifer
- ◆ Long Term Storage Credits
- ◆ Net Natural Recharge

Tucson AMA Supply & Demand		7/22/08 DRAFT, SUBJECT TO REVISION				
		THIRD MANAGEMENT PLAN				
		2002	2003	2004	2005	2006
All figures expressed in acre-feet						
OTHER						
DEMAND	Riparian	3,700	3,700	3,700	3,700	3,700
	Cuts to the aquifer	6,471	6,552	13,617	15,368	16,364
SUPPLY	LTS credits for replenishment	6,009	2,046	5,581	7,276	8,477
	Net natural recharge	60,800	60,800	60,800	60,800	60,800

City / County Water & Wastewater Study Oversight | September 24, 2008

Now, finishing up the last parts of the Water Budget Table, riparian demand accounts for the amount of groundwater that's used by riparian vegetation. The cuts to the aquifer line with certain types of recharge projects, there's an amount of water that's required to be left to benefit the aquifer that's not recovered, and that amount does not accrue credits, and there's different amounts of

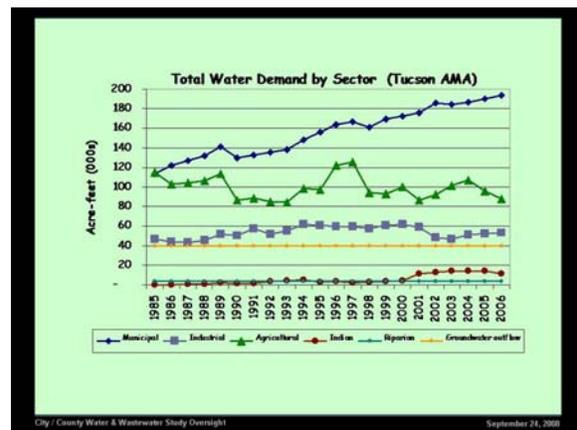
cuts to the aquifer, depending on the type of recharge that's going on.

Long-term storage credits for replenishment; that's actually a subset - that's what Laura was mentioning a minute ago - that's a subset of municipal replenishment, and that's probably going to go up higher in - in the budget under municipal - the municipal category, so . . .

And then natural recharge is the amount of water that's naturally recharged to the aquifer, and it's generally arrived by adding mountain front recharge, which is the amount of recharge that happens where the - the mountains meet the - the alluvial basin, plus streambed recharge, plus underflow in, which is water - groundwater coming in from the Santa Cruz AMA, in our case, and underflow out, which is water - groundwater leaving the AMA and going out to the Pinal Active Management Area. Now, note that natural recharge - that's not the same as incidental recharge. Incidental recharge is what comes from applying water, let's say, for a golf course, or for agriculture, and what naturally seeps back to the - to the aquifer.

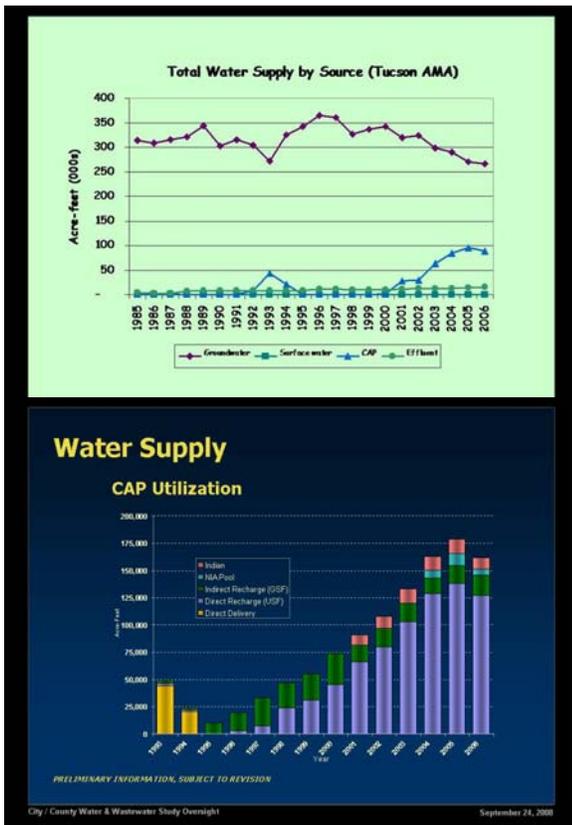
So, let's start adding all of this up. Here's an overall look at water demands by sector within the Tucson AMA. The top line is municipal, and you can see that's been steadily going up through time. Ag fluctuates; it's kind of coming down; definitely not as much as we might have predicted 20 years ago.

Here's a quick use - quick look at overall use of supplies over time for the



Tucson AMA. Again, you can see that groundwater is the largest source, and you can see a definite blip where Tucson Water did direct delivery of CAP. You can see the blip in - in CAP water, and then it comes back down. The - with the use of CAP - recovered CAP in the last few years, you can see that groundwater use is starting to come down again. This is a - just a quick look at CAP utilization over time within the Tucson AMA. This is from a presentation actually by CAGRD, but I thought that might be helpful for you to see what's been going on over time. The blue down at the bottom is direct recharge. The yellow at the left, that's direct delivery during '93/'94 time frame by Tucson Water.

And now we get to the very bottom of the - the budget table. There's the last line that talks about additional recharge for future use, this is where water that's been stored for recovery at sometime in the future comes in; that's water stored by the Water Bank for MI firming; that also includes interstate storage on behalf of Nevada.



And then the amount of over- - overdraft that's calculated. I'll take you to a graph in a second that's going to show how we've done with overdraft over time. I did want to mention - I'll continue on. Okay. So, let me do a little bit of explaining on this. The top line is groundwater. The - the second line down, which I think is - is teal, that shows the net natural recharge and cuts to the aquifer; that appears to be fairly steady; the reason is that just because of the whole - the whole scale of this. We assumed that natural recharge is fairly steady throughout time, just that averages out. GRD replenishment

has increased since about 2001 but, again, that's - that's such a small scale compared with the overall Water Budget that it - it doesn't - doesn't show up dramatically in this graph.

And overdraft is the bottom line in red. Now, I want to point out that overdraft, that is plotted - plotted on a reverse scale, so although it looks like overdraft is increasing in the last several years, that's actually getting closer to

zero, which is where that - that blue line is in the middle. You can see it - it mirrors the - the groundwater use just about inversely, and you can see that in '92, '93, '94, we got closer to Safe Yield, that's when Tucson Water was directly delivering CAP, they were required to stop doing that, so we went back to groundwater largely and now, through recovered CAP, we're getting closer again to - to Safe Yield.

So, our AMA goal, again, is an attempt to reach Safe Yield by 2025. Are we going to make it? Well, that's a very good question. All of this work that Laura and I and others in our Phoenix office, that's been done to - as part of the AMA Water Resource's Assessment, and it's going to help us in gauging where we are currently with respect to Safe Yield. What we're going to be working on very soon is projections of future demand and supplies.

In the Third Management Plan, we developed projections. For example, we predicted previously that ag use

was going to be reducing, and that is happening, but not nearly as fast as we had originally predicted. So, projections are sometimes off. They can be affected by a number of factors, and there's always some uncertainty, but we do need to make an educated guess so that we can start planning now.

Now, this is glimpse at an interactive tool that we are going to be

using in our analysis. You can check out what this is. You can ramp up and down different demands, supplies, sources of water, and this is something that Ken Seasholes, former Tucson AMA Director, developed. This is just an example. These are not real numbers, so don't go copying'em down.

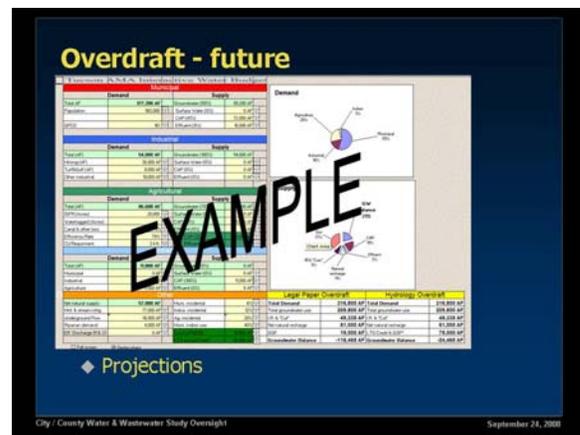
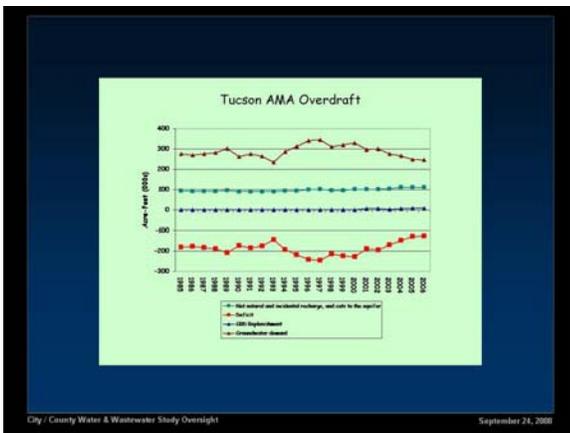
As you - as you adjust

Overdraft – Tucson AMA

Tucson AMA Supply & Demand		2028 DRAFT, SUBJECT TO REVISION				
		THIRD MANAGEMENT PLAN				
All figures expressed in acre-feet		2002	2003	2004	2005	2006
OVERDRAFT						
TOTAL		194,660	166,344	147,984	129,746	129,585
ADDITIONAL RECHARGE FOR FUTURE USE*						
OTHER	(Net artificial recharge)	385,016	447,058	511,020	596,041	652,470

* Includes storage for Colorado River drought, and interstate storage on behalf of Nevada

City / County Water & Wastewater Study Oversight September 24, 2008



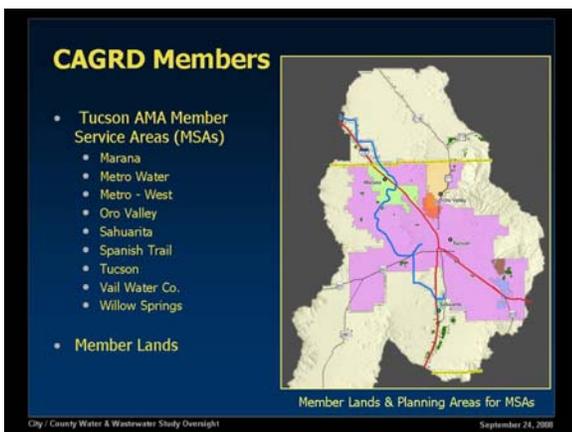
supply, demand for different sectors, different - different components of this, the pie charts on the right will - will adjust, and it's actually - it's actually pretty cool. I chickened out on - on having it in the Power Point presentation, 'cause I figured it would probably crash, but - but you kinda get the - get the idea.

This is going to be very helpful in a sensitivity analysis, figuring out what factors have the greatest effect in getting us to Safe Yield, and what factors ultimately do not have as much of an effect. And we can run different scenarios, different what-ifs, and some what-ifs. Let's say that shortages are declared on the Colorado River. What if a certain new mine begins withdrawing water in the future? What if overall municipal GPCD reduces between now and 2025? What if it doesn't? What if irrigation rights are extinguished and taken out of production more than - than they are now?

Our goal with the Water Resource's assessment is to show the water supply and demand trends, and to show projections for the future, and these will, hopefully, give us an indication of how close or how far from Safe Yield we're going to be based on these results, and we're hoping by the end of this year, that's going to lay the groundwork for the Fourth Management Plan. Using our best professional judgment, even with the best case scenarios, we can get - can we get to Safe Yield with the statutes and the rules the way they are? Probably not, but we're - we're going to show how close that we're projected to get.

If we're not going to get to Safe Yield by 2025 based on these projections, then what - we'll identify what are some of the biggest impediments to Safe Yield and what are some of the statutory changes that need to happen? Some examples of issues that were discussed in the Governor's Water Commission several years ago include groundwater users and uses that don't require replenishment. Grandfathered rights, for example, don't require - don't have a replenishment obligation. Critical area,

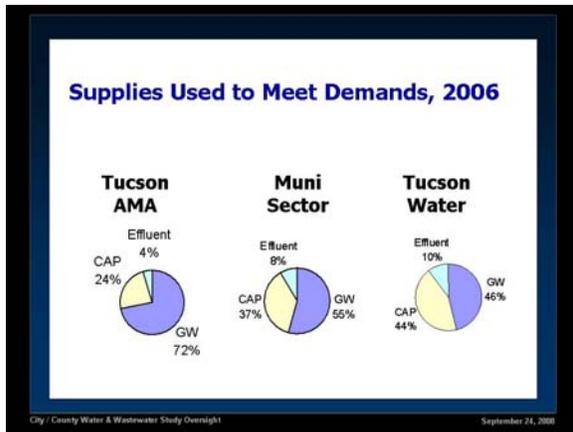
or sub-area management where, although AMA-wide, Safe Yield could be reached. What if there are certain particular areas, such as maybe Green Valley where there's more of an overdraft? How is that dealt with? Availability, reliability and utilization of renewable supplies. The full December, 2001, report with Water Commission recommendations - incidentally, that's available on



our Website, www.azwater.gov, and that's under the Publications area of our Website.

So, finally, I wanted to mention a little bit of where Tucson Water fits in with - with all of these numbers. Tucson Water is a designated provider. They are a member Service Area with the CAGR and, since 2001, Tucson Water has had CAGR replenish 5,000 acre-feet per year on its behalf.

And I wanted to give you a very quick and simple look at how the supplies used to meet demands fall out with Tucson AMA within the municipal sector and with Tucson Water. You can



see that, as far as Tucson AMA as a whole, groundwater for 2006 was used for 72% of the demands. Within the muni sector, 55% of demands were met with groundwater and Tucson Water deliveries were down - that was 46%. So, you can see that, in - in a sense, Tucson Water's ahead of the curve. I'll also mention that Tucson Water is definitely the - it's clear - the largest provider

within the AMA. They account for 72% of the water use for 2006 that is used within the municipal sector, so . . .

So, I hope this information's been helpful, and I'm sure you'll have a lot of questions, and I'm going to invite my colleague, Laura Grignano, up. Together we'll try and answer any questions that you've got and do our best to answer them. Thanks.

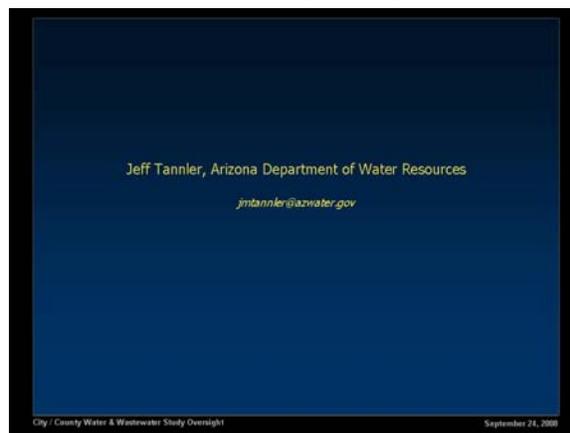
CHAIRMAN JIM BARRY: Let me do Bob, 'cause I stopped him from asking before.

ALTERNATE MEMBER BOB COOK: Yeah.

CHAIRMAN JIM BARRY: And this is a question, Bob.

ALTERNATE MEMBER BOB COOK: A question on - of the definition of lost-and-unaccounted-for water. Would you define that? There's - what water is that? Is that leakage or poor meters or . . .?

MR. TANNER: That is - okay - let's say you've got a provider that - just for simplicity - let's say a provider that withdraws groundwater from wells and that's their whole supply,



just for - for discussion purposes. They're required to measure with meters on the wells, how much water they withdraw. They're also require- - large providers are required to report how much water is delivered to customers, and the two numbers usually don't exactly match. What the difference is, that's lost-and-unaccounted for water -

ALTERNATE MEMBER BOB COOK: Between the two meters?

MR. TANNLER: Between where the withdrawals happen at the well and the total deliveries.

ALTERNATE MEMBER BOB COOK: Okay. Well, I noted that in your - your graph that in 2006, that lost-and-unaccounted-for water was 20 - almost 20% of total.

MR. TANNLER: Now, that - yeah, I can see if I can go to that - the - the graph showed lost-and-unaccounted-for water increasing steadily over time, and that's as a total volume of water, and it's proportional to the amount of water that's withdrawn by providers; that's not showing the percent of lost-and-unaccounted-for water; that's showing overall. As providers are serving more water, there's a higher lost-and-unaccounted-for water, but amount of volume of water, but that doesn't necessarily mean that -

ALTERNATE MEMBER BOB COOK: Oh, I see. I was comparing it to residential. So, it's basically - it's showing 20,000 acre-feet of lost and 100,000 -

MS. GRIGNANO: Add - add nonres and res together and then . . .

ALTERNATE MEMBER BOB COOK: So, it is a relatively large number?

MR. TANNLER: It's - it's significant, yeah, and that's - that's why there's a requirement to limit it to no more than 10% of your - of your total - total water use.

CHAIRMAN JIM BARRY: Tina?

TINA LEE: Yes, I know -

CHAIRMAN JIM BARRY: Microphone, Tina, please.

TINA LEE: Thank you. You had mentioned that exempt wells are exempt from the requirement of reporting. Is there any way to estimate what their relative proportional share is of the overdraft of the groundwater?

MR. TANNLER: That is - it's within the - that's within the Water Budget. Again, we've estimated one-half acre-foot per well, and then we'll apply that out by the number of wells.

MS. GRIGNANO: I think - I think the wells were about - what'd you say? 7,000?

MR. TANNLER: About 7- - let's say 7,500.

MS. GRIGNANO: Approximately 7,500 wells, and then multiply that by .5 acre-feet, so it's a relatively small amount of water in, you know, in the grand scheme of things.

TINA LEE: Thank you.

CHAIRMAN JIM BARRY: Bonnie, then Marcelino.

MEMBER BONNIE POULOS: Within the Tucson AMA, has any entity ever been refused an Assured Water Supply certificate?

MR. TANNLER: I'm trying to think. I am not aware of any.

MEMBER BONNIE POULOS: Why is that?

MR. TANNLER: There - well, let me say two things. Ultimately, I don't know of any that have been denied. There have been applications where there are a lot of questions on them, so we've got some back-and-forth with the applicant. But, ultimately, if they can show that the water is legally continuously and physically available, then they can qualify for a certificate of Assured Water Supply.

Now, there may be cases where - where a certificate is issued for less than the entity applies for. We use a model on interior and exterior use to calculate how much water would be - would be issued with the certificate.

CHAIRMAN JIM BARRY: Marcelino, then Sean.

MEMBER MARCELINO FLORES: Okay. One of the first questions I had is, perhaps, just a clarification. There was a slide showing the GWSI wells.

MR. TANNLER: Yes.

MEMBER MARCELINO FLORES: I wanted to just ask: Are these strictly monitoring wells, or do they actually - are they actually pumping out or consuming water?

MR. TANNLER: It could be both. Our groundwater site inventory database said there are some monitor wells, but a lot of the wells in that database are production wells. We've got a hydrology field crew that - there's got to be a less tedious way of doing this - we've got a hydrology field crew that one of their prime functions is to - there you go - is to measure water levels around the State. There are some wells that are referred to as "index wells," and those are measured at least every year. There are actually some wells that have transducers in them, and that's electronic equipment that take continuous water level measurements. There are other wells within the Active Management Area where water levels are - are measured maybe once every five years; they do a basin-wide sweep. So, it could be - it could be a monitor well; it could be a full-fledge production well.

MEMBER MARCELINO FLORES: Is there a way to kind of break out the percentage of which are monitoring or, like you mentioned, the index transducer?

MR. TANNER: There - I think there are ways of doing that, and I can - I can get you that information.

MEMBER MARCELINO FLORES: Okay. And then another question I had, it was regarding the - there was a slide showing the mining, slide number - there was no slide number I think - but -

MR. TANNER: Thank you, Michael.

MEMBER MARCELINO FLORES: - it shows the - the industrial water demand by sector and -

UNIDENTIFIED MALE SPEAKER: What slide number was that?

MEMBER MARCELINO FLORES: It looks like maybe 24.

MR. TANNER: Yeah, probably 20 -

MEMBER MARCELINO FLORES: Yeah, there you go.

MR. TANNER: - 20. Okay.

MEMBER MARCELINO FLORES: The - the top -

MR. TANNER: The supply or demand?

MEMBER MARCELINO FLORES: I think the demand.

MR. TANNER: Okay. So, it'd be the one right before that, so which -

MEMBER MARCELINO FLORES: The one right before that -

MR. TANNER: - I can -

MEMBER MARCELINO FLORES: And the - the top one is the mining; correct?

MR. TANNER: Yes, correct.

MEMBER MARCELINO FLORES: Is - is that a consumptive use, or does that come back in the monster to the aquifer as incidental recharge? What is - what - is that a consumptive figure and then -

MS. GRIGNANO: That's what they withdraw from their wells. So, some of that - in the mining process, they do recycle some of their wells, but each year this is based on the meter readings from the mine's groundwater wells.

MEMBER JOHN CARLSON: Well, he's asking: Does that even go back into the supply system?

MS. GRIGNANO: Yes, some of it - some of it does, as Jeff talked about incidental recharge for each of the sectors.

MEMBER JOHN CARLSON: But, you don't have a good figure on that?

MS. GRIGNANO: We do. We use - in the model, I don't know if Jeff mentioned it, but in the model we use 12% incidental recharge for the industrial sector.

CHAIRMAN JIM BARRY: Okay. Let me jump in here. I promised Sean was next. Go ahead, Sean.

MEMBER SEAN SULLIVAN: Okay.

MEMBER MARCELINO FLORES: Well, I still had just one last question, but . . .

CHAIRMAN JIM BARRY: Oh, I'm sorry. Go ahead, Marcelino.

MEMBER MARCELINO FLORES: The last question I had was just I - I - I - the - the natural recharge, I'm presuming, is just a small amount in - in the grand scheme of things, that's kinda why I wasn't - well, is it, in fact, a small amount in the Water Budget? And then, you know, as far as I understand it's a high level and it's really flat at - at the very top level but, I mean, is - how real is that figure, that assumption? 'Cause I can just imagine, you know, somehow rainfall plays into that and I don't know . . .

MR. TANNER: Sure. And, you know, flood events, like the flood of 1983, the flood of 1993, that will, obviously - well, that can increase the amount that year. We use an average figure of 60,800 acre-feet per year for the - for the entire AMA.

MEMBER MARCELINO FLORES: What assumptions are - is that figure based on? Or what year was the information drawn from for those assumptions?

MS. GRIGNANO: I - I actually don't know the actual years that they used for the averages. Our hydrology section has talked about possibly using - because, you know, just like it spiked you can have floods and drier years. In some AMAs, that makes more of a difference than others, such as in the Santa Cruz AMA where surface water and groundwater are - are linked very closely because of the shallow, I guess, groundwater levels and that could have more of an impact, say, in the Santa Cruz AMA in their budgets, and so I think they're looking into possibly being able to - to make that look a little more natural in the budgets, but right now it's just averaged out over time. But, we can - we can try to get that period of time that was used for the - the net natural recharge for you.

MR. TANNER: And that - that is derived from groundwater models, from modeling figures.

MEMBER MARCELINO FLORES: Thank you.

CHAIRMAN JIM BARRY: Sean and then -

MEMBER SEAN SULLIVAN: I want to -

CHAIRMAN JIM BARRY: - John and then Bob.

MEMBER SEAN SULLIVAN: I want to try to wrap my head around the way that the Replenishment District works. So, say a large development in the Cienega area, Green Valley area, the way that they can reach - get their 100-year certificates is through membership within the district, and then they would then pump groundwater outside of that basin; correct?

MR. TANNER: That is correct. If they - let's say they're applying for a certificate of Assured Water Supply, they would - one option is they would join the CAGR, they would

become member lands, and the G- - the GRD would replenish - within three years of when the water is withdrawn, they'd replenish on their behalf.

Now, there's some - you know, I mentioned extinguishment credits, let's say a developer or maybe a designated provider, let's say they have a large volume of extinguishment credits, they can use those also toward proving an Assured Water Supply, that would mean that they would have to have less water replenished by the - the CAGRD.

And if a - let's say if it's a provider, if they've got access to a renewable supply, such as CAP, again, less - less that they would need to have replenished by the - by the GRD. All the designated providers within the AMA are members of the GRD, including Tucson Water. Tucson Water's got all sorts of alternative supplies. I believe that the 5,000 acre-feet per year, that's - that's kind of a - to keep the - keep the membership active, in a sense.

MEMBER SEAN SULLIVAN: Okay. And so the - the Replenishment District itself has a 100-year water supply to replenish the water needed for all of its members?

MR. TANNER: They . . .

MS. GRIGNANO: They - they have to make a plan, I believe it's every ten years, of explaining - and I think Cliff Neal may have talked about that when he was here a couple months ago - about where those supplies will be coming from -

MEMBER SEAN SULLIVAN: Okay. And I think -

MS. GRIGNANO: - to meet the - the demands.

MR. TANNER: Michael, go to that very last slide, the one that's after the . . .

UNIDENTIFIED MALE SPEAKER: (Inaudible; not speaking into a microphone.) Okay.

MR. TANNER: Yeah. This is one I -

UNIDENTIFIED MALE SPEAKER: Is that it?

MR. TANNER: Yeah. I don't know if that's helpful. That's within . . . it's within the Phoenix, Pinal and Tucson Active Management Areas; that's the historic obligations that CAGRD has been required to meet. There's also a graph which I don't have that shows projected obligations in the future. So, they're saying that they're - CAGRD is going to take care of the replenishment for 100 years. So, slightly different than saying that they have 100 years' water supply, but I - I can - you're kind of on the right track.

MEMBER SEAN SULLIVAN: So, one - one follow-up on that. If there were to be a shortage, where is their priority? Would it - would the water and CAP go to direct users and no - and no more - and replenishment would stop, or would they

continue to have a priority in order to replenish the aquifer and the pumping?

MR. TANNLER: The - I know there is a - is - there is an order in which - who - who gets shorted first. Ken Seasholes with CAP actually might be able to address that question.

KEN SEASHOLES: Let me take the first part of your question - Ken Seasholes for CAP - and that is the 100-year supply through member lands is groundwater, so you have to demonstrate to ADWR (inaudible; not speaking into a microphone) reliable 100-year supply (inaudible) enrollment in the CAGR doesn't prove the 100-year supply, but it does (inaudible) make your contribution to - to Safe Yield. So (inaudible) all you have to do (inaudible) 100-year supply (inaudible) that does nothing but (inaudible) the legal requirement offsets (inaudible). The physical supply has to be on-site and that's done through the Department of Water Resources.

The CAGR, which is the different operating part of the Central Arizona Project has to have a current Plan of Operation that identifies current supplies for a 20-year period and potentially available supplies (inaudible) and if the mechanism that it uses (inaudible) the other supplies (inaudible).

CHAIRMAN JIM BARRY: John, you had your hand up -

MEMBER JOHN CARLSON: Yeah.

CHAIRMAN JIM BARRY: - and then we'll go to Bob and then move on.

MEMBER JOHN CARLSON: On your figures, the recharge was very steady over your 12 or 14 years that you showed us. I can't believe that. I mean, how do you get at this and how do you prove it, and - and maybe that's a good average, but it's - it's got to vary. Maybe it's good for three years, pretty steady, but it's got to change up or down, and I - it was a pretty steady line across there.

MR. TANNLER: Let's -

MS. GRIGNANO: That was the net - the net and the incidental recharge.

MR. TANNLER: Right. That is going to be slide 35. Yeah, the - okay, again, the top line is groundwater. You can see that fluctuates over time. That second line is the net natural and incidental recharge, and that's what we're talking with Marcelino about where that's - that's averaged over time and that cuts to the aquifer, which has to do with the amount of water that's left in the aquifer with certain types of recharge projects. Are you referring to that middle line, the - the blue one that looks pretty steady over time?

MEMBER JOHN CARLSON: Well, I'm confused by your definitions a little bit. But, my point is: Both of those

lines are pretty steady over a very extended period of time, and I just - just my natural instincts would tell me that it's got to show a trend; it might be steady for five years, but it's got to show a trend up or down and back again, or whatever, and I don't see it. So, I -

MR. TANNLER: It's -

MEMBER JOHN CARLSON: - maybe you don't - and I realize you're limited about how many places you can observe and keep track of it and so forth, but I just - you know, I just - that's my question.

MR. TANNLER: I think it's all - it's all within the scale. The - the blue line in the middle, GRD replenishment, that - that is just at zero up until about 2000, 1999, or so, and then you can see it's starting to deviate from the zero line, and that's all a matter of scale; that's - the GRD has begun replenishing, but that - that is a small amount in respect to the - the whole budget numbers.

MEMBER JOHN CARLSON: Okay. Now, with your figures on the Tucson Active Management Area - and you show the Pinal, a little bit about Phoenix, some of our water goes to Pinal, we get some water from down below, I didn't see anything that kinda reflected this, or is it unimportant, or is it equal or what?

MR. TANNLER: Oh, the amount of water that -

MEMBER JOHN CARLSON: Goes into TAMA from upstream and the amount that leaves us and goes downstream?

MR. TANNLER: Right. That's incorporated into the net natural recharge -

MEMBER JOHN CARLSON: Okay.

MR. TANNLER: - and that's within the 60,800 number.

MEMBER JOHN CARLSON: Yeah. And I didn't see - I don't know if you - you were talking about well levels a little bit but, you know, to me a trend is: Where are we? Have we kept track over the - a long number of years of depth to water in the various sub-basins of groundwater? And you didn't present anything, but is it not important in your presentation or where are we on that?

MR. TANNLER: It is important, yet - we - we do have that data and you're correct I did not present that tonight. Again, tonight we're focusing on Safe Yield, on an AMA-wide basis.

MEMBER JOHN CARLSON: Okay.

MR. TANNLER: But, you raise a very good issue. There are particular areas where groundwater levels have declined, let's say, Green Valley area for one. The Central Wellfield within the middle of Tucson, historically, that was dropping as more and more groundwater was withdrawn. Since Tucson Water has

been delivering a lot more recovered CAP, the water level has actually been coming up within -

MEMBER JOHN CARLSON: Yeah, I realize that.

MR. TANNLER: - the Central Wellfield. Yeah, I'm sorry, that's not presented in this, but that's -

MEMBER JOHN CARLSON: Well, that's your choice, but I had a question on it.

MR. TANNLER: Yeah.

MEMBER JOHN CARLSON: The final question -

MR. TANNLER: Uh-huh.

MEMBER JOHN CARLSON: - Indian water. Seems a few years ago there was some talk about being able to purchase water from Indians, especially up north. Where are we on that? I've lost track of - of - of any ability to trade with the Indians on water, or whatever.

MR. TANNLER: That's something that we're anticipating will - will be a possibility in the future. I don't have current status on - on what's being done in - in Tucson AMA, other than ASARCO.

MS. GRIGNANO: Well, I can - ASARCO is, through the Indian Right Settlement Act, able to lease up to 10,000 acre-feet of CAP. They started using that in the - in 2007, and I believe we're ramping up the use of that this year, more than they used last year, and can use up to 10,000 acre-feet. It will be similar to the in lieu - to the - the Groundwater Savings Facility Program that Jeff talked about, the farms. They will - ASARCO will stop pumping most of its groundwater and use the CAP water, but the credits will be accrued and go to the Nation that then - then can be pumped later, or leased to someone.

MEMBER JOHN CARLSON: Thank you.

CHAIRMAN JIM BARRY: Okay. I'll - we're going to do Bob, Bonnie, Vince, and then we're going to go to the audience.

ALTERNATE MEMBER BOB COOK: One - one more question on net natural recharge. What are the components of net natural recharge? And is - is it true that you're treating it like a constant?

MR. TANNLER: We're averaging out to a constant. The components are: Mountain front recharge, which -

ALTERNATE MEMBER BOB COOK: Say that again?

MR. TANNLER: Mountain front recharge, which - what that is, is let's say that you've got - I'm trying to think of the best way to illustrate that - the Tucson Basin, you've got the Catalinas - where the Catalinas meet the - where the sand and gravel starts, at that junction across the mountains, that's where mountain front recharge occurs.

ALTERNATE MEMBER BOB COOK: Uh-huh.

MR. TANNER: We've got inflow, which - that's what John mentioned a minute ago - inflow -

ALTERNATE MEMBER BOB COOK: Riparian.

MR. TANNER: Well, inflow into the - into the - into the basin through the Santa Cruz, from Santa Cruz AMA, outflow to the Pinal AMA -

MS. GRIGNANO: Streambed.

MR. TANNER: - streambed recharge, which occurs - water can recharge, potentially, anywhere within the - the Tucson AMA, but it recharges a lot more quickly and effectively within the streambeds.

ALTERNATE MEMBER BOB COOK: So, it is all rain; is that true?

MS. GRIGNANO: Snow melt. Snow melt.

ALTERNATE MEMBER BOB COOK: Snow melt -

MR. TANNER: Snow melt and rain.

ALTERNATE MEMBER BOB COOK: - snow melt and rain?

MS. GRIGNANO: Mountain, yes.

ALTERNATE MEMBER BOB COOK: Okay.

MR. TANNER: Ultimately.

ALTERNATE MEMBER BOB COOK: Okay. Okay. So, it - it - is it possible that that average could actually change given what we do with the way we catch water? I mean we could intentionally catch water and change that number?

MR. TANNER: That could change as water harvesting becomes more widely used then that could potentially - I'm not sure how much - but it could make a change to how much water eventually gets -

ALTERNATE MEMBER BOB COOK: So, you're actually -

MR. TANNER: - recharged.

ALTERNATE MEMBER BOB COOK: - saying water harvesting could be a source of water supply?

MR. TANNER: I - you could certainly say that, yes.

ALTERNATE MEMBER BOB COOK: Okay. You heard it here.

CHAIRMAN JIM BARRY: Bonnie and then Vince, and then we're going to go to the audience.

MEMBER BONNIE POULOS: I know we're harping on this net natural recharge, but if we could go back to slide number 30, I think it is, that says "Other Parts of the Budget." I think what several of us are having a hard time with is that in that slide riparian demand and net natural recharge are the other two constants that I've really seen in any of your slides. And, I guess, intuitively, it's difficult to understand that; I mean, granted, this is only a five-year time period, and if we looked over a 25-year time period, maybe that would change. But, with the destruction of riparian areas that's happening at an ever-increasing rate in Pima County, and with the paving over

of a lot of areas that normally would supply recharge, and the drought that we've been in for the last seven years, how can you really explain that those two numbers are remaining constant when everything else is changing? That's - I think that's the overlying question that all of us are - are having here, because I find that difficult to understand, and I'm wondering if it's because it's not really truly being monitored in a very accurate way.

MR. TANNER: It's - it's definitely tough to get a handle on. You - you've got very good points with increased - potential increased runoff with more paved surface area, less riparian use, global warming could have an effect, positive/negative. Let's say that there's - there's more rainfall in a particular summer; that definitely, in real life, that does fluctuate. I think for modeling purposes, they - they take an average. But - but you've got a good point. It is - it's tough to get a definitive figure for year by year on that; that - that is tough to - tough to monitor. So, not a satisfying answer, but I agree with you.

CHAIRMAN JIM BARRY: Vince?

MS. GRIGNANO: I would - just to add to that. That that's something that we can also use the interactive tool that Jeff was talking about, to run scenarios where we say: Okay. Maybe net natural recharge is only two-thirds of what we thought it was with global warming, you know, for - for projection purposes. What effect does that have on Safe Yield if we're really only getting 40,000 acre-feet. We can - we can run scenarios that change that number and see what effect it has on - on the overdraft.

MEMBER BONNIE POULOS: Well, I think the other thing that - that might need to be looked at is how you're making the assumption for those numbers in the first place, because if every single one of your other numbers that we're actively measuring (inaudible; not speaking into a microphone) wells changes, it's very difficult to believe that these numbers shouldn't change as well. (Inaudible).

CHAIRMAN JIM BARRY: Okay. Vince?

MEMBER BONNIE POULOS: (Inaudible; not speaking into a microphone) think the methodology change also needs to be looked at.

MEMBER VINCE VASQUEZ: The - what is the projected overdraft at 2025 in the contributing sectors proportion of that overdraft? Do you have that number by any chance?

MS. GRIGNANO: We have those numbers done for the Third Management Plan. We have not done the new - the projections with the data that we have to this date, and that's what we're working on and hope to have done by the end of the

year. But, if you go to the Third Management Plan, we projected in the Third Management Plan that we would get close to meeting Safe Yield, but that we'd be off by about 50,000 acre-feet. And if you look at the sectors' supplies, you can see that the industrial sectors is primarily groundwater, so that's contributing more than, say, municipal. Well, depending - it's all relative - depending on the total demand, but you have to then look at the supplies based on each sector, and I believe that's probably talked about in the Management Plan as well, so

MEMBER VINCE VASQUEZ: Quick - so, of the 50,000 acre-feet projection overdraft, what percentage industrial, roughly, is it like 80% -

MS. GRIGNANO: I don't -

MEMBER VINCE VASQUEZ: - 70%?

MS. GRIGNANO: - I don't have those figures off the top of my head -

MEMBER VINCE VASQUEZ: All right. Thank you.

MS. GRIGNANO: - yeah. We can - we can figure that out for you based on the TMP projections.

CHAIRMAN JIM BARRY: Okay. Let's go to the audience. Tracy, do you want to ask yours as a question?

TRACY WILLIAMS: I have some questions to this issue and then Call to the Audience, and I'd appreciate if Melaney would write the questions down for us.

CHAIRMAN JIM BARRY: Okay. Could you come up to the microphone, or - or bring the microphone to . . .

TRACY WILLIAMS: Okay. The - the first question that I have is about the levels of water that are declining. I think we need a graph of where those levels are declining in terms of what communities, what sections of the aquifer. We need to know where the pluses and minuses of the aquifer. So, I'd like to see that graphed out in very simplistic ways.

Number two, I'm really glad Bonnie and everyone brought up the natural recharge issue, because I have written down here: No way, not with the channelization of washes, not with - and, Hi, Arlan - not with Pima County allowing construction of residential happening in floodplains and washes, and then the community being asked to bail out over in Catalina, you know, homes that are right in the washes. So, I don't believe that figure either and I think, you know, in order for more credibility we need to look at that math and make it more real.

And, number three, three years it takes for them to replenish the members. Are they meeting it? And I think they're not. And so I'd like to know how far behind in that

three-year window of opportunity what that graph looks like, and I'd like to see that.

CHAIRMAN JIM BARRY: Okay. Anybody else?

MR. TANNLER: We can work on getting that.

CHAIRMAN JIM BARRY: Mr. Stagner?

CLYDE STAGNER: I . . .

CHAIRMAN JIM BARRY: Please get him the - the microphone.

CLYDE STAGNER: I could get up here for you. TMA Safe Yield can interpret it as a nine-entity gestalt TMA sustainability. Shrink it in, people, 'cause you're one Tucson boundary sustainability. The complexity of variable necessitates adaptive management for property, commodity and cost is applicable. For example, TMA budget cites an annual evapo-transpiration of 3,700 acre-feet, I believe you've heard (inaudible) through 2025, mainly in the Upper Santa Cruz. However, the Tucson Plumbing Code promulgated yesterday can cause an annual loss of 32,570 acre-feet of gray water evapo-transpiration - and the reference is quoted - quantity monitoring, quality monitoring and costs for prioritizing and allocation data are necessary to keep the sustainability, adaptive management system viable for evaluations of the Tucson Pima gestalt.

These variables require user identification for applicability. Tucson Water's Department designation of only two users, two users, nonresidential and total deliveries. How are going to break that down? (Inaudible) gestalt. You need more data. These variables require user identification for applicability. Tucson Water's Department designation of only two users, nonresidential and total deliveries - reference Tom Arnold, Tucson Water email, is inadequate for sustainability, adaptive management, as - an example of replaced input data, reference Pima County effluent generation utilities report 2004 annual acre-feet fluent (sic) from the Metropolitan Treatment Facility for calendar year 2004, Arthur Park (sic) Golf Course 581.4 acre-feet, Silver Bell -

CHAIRMAN JIM BARRY: Mr. Stagner -

CLYDE STAGNER: - 533.5 acre-feet -

CHAIRMAN JIM BARRY: - I'm going to have to ask you to wrap it up, please.

CLYDE STAGNER: - Kino Sports Complex, 329.92 at a cost of \$189,281 for an acre-feet cost of \$573.72 per acre-foot. Additional data's available in the above-cited reference. Note that similar data is required from the Tucson Water Department.

To obtain monitoring data from the Pima Wastewater Management, a records request is required; reference Jeff Provot (ph.), Pima wwm email. To view Avra Valley groundwater and

surface CAP monitoring data requires a physical presence at TMA headquarters on Congress Street. All quality, quantity and costs applicable to water sustainability require a comprehensive exclusive mandate for openness and availability to the public and governmental entities, preferably in a centralized data bank.

Mr. Jeff Tannler, Director, AWA (sic) Tucson AMA, has proscribed TMA's Water Budget for Safe Yield and sustainability. Today's sustainability and (inaudible) Institute, Rockefeller Philanthropy Advisors released their 2000 report card for 300 colleges and universities. The college sustainability report card gave Arizona State a B+. Stanford University -

CHAIRMAN JIM BARRY: Mr. Stagner, please -

CLYDE STAGNER: - received an A- and fourteenth ranking. Anybody here from Arizona, you're down much further with a B. The director's sustainability and energy (inaudible), Joseph Stagner, my son, was dubbed a sustainability czar by the university newspaper of Stanford.

What is the legacy of the Pima County Water Study Oversight Committee? The Committee present purview - present purview include paradox, auto-analysis, politically (inaudible) independence, situated in a (inaudible), governmental pay and positions, which is their sustainability. A Tucson Pima czar for sustainability and water management with authoritative accountability, responsibility and cost analysis is indicated. This czar and the staff should be independent of Tucson and/or Pima County managers and report to joint official sessions of the Tucson Council and Pima County Supervisors (inaudible) managers, implementation and subsequent action would be at the discretion of responsible and accountable electable officials.

An alternative is a contract for sustainability and water management with Kathy Jacobs, Director of the (inaudible) University of Arizona Water Institute. Respectfully, Clyde Stagner. I have the (inaudible; not speaking into a microphone). Thank you, Mr. Chairman.

CHAIRMAN JIM BARRY: Any other questions? Colette? A question, please. Where's the - where's the microphone?

COLETTE ALTAFFER: Thank you. Colette Altaffer. Can you tell me if there is any entity within the Tucson Active Management Area that currently does not meet its Assured Water Supply designation?

MR. TANNLER: I'm not aware of any, no.

COLETTE ALTAFFER: Other than that, I think there's a footnote in your Third Management Plan that there are four, including Surprise and Marana, are they still out of compliance?

MS. GRIGNANO: Surprise is not in the Tucson AMA.

COLETTE ALTAFFER: Right.

MR. TANNLER: Right, that's in the Phoenix AMA.

MS. GRIGNANO: Don't know.

COLETTE ALTAFFER: Okay. Second of all, we know that dams and recharge basins have a limited life span. What will happen when the two dams that we depend on for our water for the Colorado River silt up to the point that they are no longer usable? Will - will we be able to continue to meet our Water Budget? And, if not, how are we going to meet that?

MR. TANNLER: I'm going to defer to other agencies for - for that. I - my guess would be that there is a plan for - for dealing with storage at Lake Mead and Lake Powell.

CHAIRMAN JIM BARRY: Any other questions? Okay. Yes, one more and then we'll do Call to the Audience.

CAROL HELLER: Carol Heller of Central Tucson. I wonder if there are any measures that will appear in the next Management Plan that - that could be used - potential measures to address the prospect that Safe Yield will not be obtained by 2025?

MR. TANNLER: Very good question. Our - our hope is to identify, again, where - where we are with respect to Safe Yield, and where we're projected to be and look at - at some of the reasons why we're not getting there, hopefully identify some - some areas that can get us closer to Safe Yield. Some of those may require statutory change.

CHAIRMAN JIM BARRY: Sean has a request to make a staff (sic), and then we'll go to Call to the Audience.

MEMBER SEAN SULLIVAN: Very quickly. Jeff mentioned that there - some kind of body put together a report that had suggestions on statutory and rule change that would better help meet Safe Yield. Could we include those within the inventory section for this? And then also if ADWR has any other suggestions on how we could meet those at the local level through policy and such, those would be very welcome I think. And also - I'm sure you already have this in a map that has overdraft, Safe Yield geographically throughout the Tucson AMA as one of the speakers in the - in the audience mentioned.

UNIDENTIFIED FEMALE SPEAKER: Are you talking about the water levels?

MEMBER SEAN SULLIVAN: Yeah, that would great also.

UNIDENTIFIED FEMALE SPEAKER: Yes.

MEMBER SEAN SULLIVAN: Thank you.

CHAIRMAN JIM BARRY: Okay. Tracy?

TRACY WILLIAMS: Tracy Williams, lifetime residence. It's pretty obvious we all live in the desert, and the groundwater Management Act has systematically been weakened over the last 25 years which has been delaying our conservation efforts and our ability to control growth. It's a fact that

we've over-allocated our water supply. Recharge does not keep up with the rate of pumping. The cycle of unrestricted growth seems pretty cancerous to me; it's out of control.

Economic development drives water policy, and that's a given in this Arizona region and it's time that the water supply begins to drive our land use policy. The total water supplies in Arizona are likely to decrease when we look at all the changes that are happening. And my big question is: How are we going to achieve sustainability? And I think about this in a very common sense and practical way. We've got to control growth. We've got to deal with our population, which will deal with our demand and it's going to take a lot of effort to do that, but we need to also change our economy.

So, I'm very encouraged by your report and I'm hoping that your agency will start enforcing some of the rules, the laws so that we can all actually achieve sustainability.

CHAIRMAN JIM BARRY: I've done this again, and we've gone to Call to the Audience and I should've said: Thank you very much for your presentation.

MR. TANNLER: You're welcome.

(Applause.)

* * * * *

CALL TO THE AUDIENCE

CHAIRMAN JIM BARRY: Okay. Tracy?

TRACY WILLIAMS: Tracy Williams, lifetime residence. It's pretty obvious we all live in the desert, and the groundwater Management Act has systematically been weakened over the last 25 years which has been delaying our conservation efforts and our ability to control growth. It's a fact that we've over-allocated our water supply. Recharge does not keep up with the rate of pumping. The cycle of unrestricted growth seems pretty cancerous to me; it's out of control.

Economic development drives water policy, and that's a given in this Arizona region and it's time that the water supply begins to drive our land use policy. The total water supplies in Arizona are likely to decrease when we look at all the changes that are happening. And my big question is: How are we going to achieve sustainability? And I think about this in a very common sense and practical way. We've got to control growth. We've got to deal with our population, which will deal with our demand and it's going to take a lot of effort to do that, but we need to also change our economy.

So, I'm very encouraged by your report and I'm hoping that your agency will start enforcing some of the rules, the laws so that we can all actually achieve sustainability.

CHAIRMAN JIM BARRY: I've done this again, and we've gone to Call to the Audience and I should've said: Thank you very much for your presentation.

MR. TANNLER: You're welcome.

(Applause.)

CHAIRMAN JIM BARRY: Maybe before this phase is over, I'll learn to thank the presenters before we go to Call to the Audience. Anybody else? Thank you, Tracy. Anybody else?

(No response.)

CHAIRMAN JIM BARRY: Anybody want to adjourn? I'm sor- - okay. Adjourned. Thank you very much.

Next meeting is the 2nd? Thursday, at the Manning House. Thank you all.

MEMBER JOHN CARLSON: 6:00 p.m.

CHAIRMAN JIM BARRY: 6:00 p.m.

(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations) excerpts of the City/County Water & Wastewater Study Oversight Committee Meeting held on September 24, 2008.

Transcription completed: October 6, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF OCTOBER 2, 2008

List of Presenters:

1. *Sharon Megdal: Water Resource Availability in the Tucson Active Management Area*
2. *Chris Avery: Tucson Water 2050 Plan Update*

PRESENTER #1

**SHARON MEGDAL, EXECUTIVE DIRECTOR, UA WATER RESOURCES RESEARCH CENTER:
WATER RESOURCE AVAILABILITY IN THE TUCSON ACTIVE MANAGEMENT AREA**

MS. MEGAL: So, good evening. And, yes, it's Sharon again, but talking on a different subject than before. And I do appreciate the opportunity and the invitation to appear before you. And what Jim Barry asked me to do was talk about a study that I did over two years ago on Water Resource Availability for the Tucson region.



And if you've had a chance to flip through the Power Point slides, you see that what I'm going to do is actually go through the assumptions that were behind the spreadsheet analysis that I did, because many times it's said that nobody's talked about how much water is available to the region. How much water do we have that we know we have and might use? And

this study attempted to look at that.

And, as you'll see, what I'm going to go through, the details - and I have to admit, I haven't even looked at all those footnotes and found some editorial typos in them - but, what you'll see is, when I did the study, I attempted to detail every single assumption made so that, number one, if anybody

wanted to check the numbers, they could. And, number two, if things change over time, which they always do, you know, you could just slip in different numbers, and so forth.

So, I'm going to go through that and - but, let me just give you the context and tell you about the study. It is available online on our Website; it's about - the main text of it's about 40 pages and then it's got some appendices. And it really was attempted to answer the question of: If we use the water that's known to be available to the region, how many people can be supported by that water supply?

And this - there was great interest in the analysis. And I actually went back to my little tally of presentations and counted up - I was

2006 Study: Water Resource Availability for the Tucson Metropolitan Area

- Projected the population that could be supported by known water sources to the region under varying assumptions
- http://ag.arizona.edu/azwater/publications.php?rcd_id=12
- Have made over 25 presentations on the study since July 2006
- Metropolitan Pima County focus (not full AMA)
- Based on existing plans and projections, with some assumptions modified for the spreadsheet analysis
 - Tucson Water 2050 Plan as originally released
 - PAG Population Projections for 2030 (longest-term projection available at that time)
 - Other reports
- Study provided regulatory/institutional context
- Simple spreadsheet calculations that can be performed under different assumptions

surprised - over 25 presentations on this, or at least partly on this, sometimes this was mixed into something else. The area of focus was Metropolitan Pima County, not the full Active Management Area. And one of the things that's very important to point out is that, for the most part, I use numbers that came from existing projections and plans. Where I modified those, I was very explicit

about that.

So, for example, I used the PAG population projection for 2030 because, if I used something else, then people could argue, "Well, your population projection is off," and you get into an argument about that. This is the official population projection at the time, and 2030 was as far out as it went. So, that's as far out as this analysis went.

A lot of it was based on a look at the Tucson Water 2050 Plan, as released, and what was in existence at the time, and other plans and - and reports, including, at that time, Pima County Wastewater Management, as it was known at the time, was going through a Long-Range Plan and estimation of numbers and figures for the amount of effluent, and even within a few months, when I made a presentation at the Water Resource 's Research Center, somebody said, "Well, that number's too low; it's already been outdated." So, again, the - the exact numbers would vary, depending upon the point in time.

One of the things that I did insist on, when I agreed to do this study, was that I needed to provide the regulatory and institutional context. Well, you've been getting a lot of that over the last many months, so I'm not going to spend any time on that. Certainly, if there are any questions, I'd be happy to answer that. But, whenever I make presentations or do analyses, I always want to do it in the context of the - the regulation and institutions that govern decision-making. And the - these are simple spreadsheet calculations, and - and nothing more than that.

2006 Study: Water Resource Availability for the Tucson Metropolitan Area (cont.)

- WRRC study, funded by a consortium led by Metropolitan Pima Alliance (~\$30,000)
- Advisory Committee worked with me and research assistant Kelly Mott Lacroix, who now works for ADWR, with my control of final content
- Spreadsheet computations
 - Cost/public investment estimates not developed for the mechanisms to use the identified supplies
 - Not a safe-yield analysis; agricultural and industrial (mining) use of water not considered, nor are environmental demands

The study was funded by a consortium led by the Pima - Metropolitan Pima Alliance; it was about a \$30,000 study. The reason I'm telling you that is you look there was a consortium of community and business groups that funded it, and we had an Advisory Committee that worked with me on it. Kelly - I don't know that Kelly was able to make it from the

Department of Water Resources - Kelly Mont Le Croux (ph.), who was a Planning student at the time, was my Research Assistant, and I had full control of the final content. So, I got input along the way, but the final context, including any errors, are - are my responsibility.

And the spreadsheet computations really looked at water availability for people; it wasn't a Safe-Yield analysis; it doesn't include agricultural and industrial mining use of water, nor environmental demands for water, and we can talk about that later if you wish. I just wanted - the one institutional context I'll put up for you is the map of the Tucson AMA, with which you're very familiar. And just a reminder, this study focused on Metropolitan Pima County. As you know, the bulk of the - of the population of the County is in Metropolitan Pima County.

The Tucson AMA, however, you know - as you know, extends partly into Pinal County, some areas that are - are growing very rapidly, a tiny bit into Santa Cruz County where there isn't much population. And so at times there is not a perfect coincidence or matching of area of the numbers. Sometimes, like when we're taking things from the Active

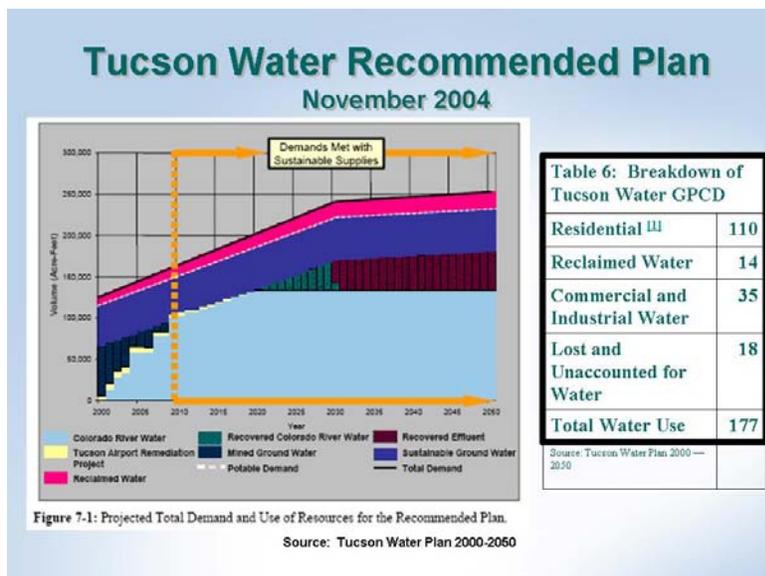
Management Area Management Plan, they're AMA-based, other times they're County-based, but that's about the best you can do when you do this kind of analysis.

Just wanted to point out that the context for the 2050 Plan was the one that was released at the time. Chris Avery will be providing an update today, and it's been updated numerous times, but remember this was done in the summer of 2006, and this is what the - the key figure for the Plan looked like at that time, and I - I



pasted in this - this was the assumption about per-capita water use for the Plan period by Tucson Water, which was 177 gallons per-capita-per-day, including all community uses. And, as we get into the assumptions, I used - you'll see that I used lower numbers than in the - in the Plan.

And the other thing I wanted to just point up - point out in context was we - we looked at CAP water available to the region. This shows the non-Indian water available to the Tucson



AMA, user existing CAP allocations; these were the pending reallocations, which - have they been finalized? Anybody from - Chris? Yes, they have finally been finalized, but they were pending at the time. So, this was the total for non-Indian water. This was the total for Indian water, and a grand total at the bottom. And, as you'll see as I get

into the analysis, I did not assume that the municipal use in the region would make use of any Indian water, so you'll see that's one of the assumptions.

So, this is the spreadsheet and Sandy, or whoever, has - has that. We're not ready to do the escape yet. But, what I'm going to do is talk about the assumptions behind it, and then come back to it, and I think the Staff here have indicated that they will post this one slide in Power Point version, as opposed to pdf, and you'll see behind it is a live spreadsheet. So, if anybody actually wants to go in and play with the numbers, you can do that.

So, I want to go through it I want to just highlight - I'm going to - I put these arrows kind of by what I consider some of the key numbers that determine the output, you know, the output of any spreadsheet or analysis depends upon the inputs. And so, obviously, the PAG population projection is very, very important.

Clearly, there are a lot of uncertainties about effluent

utilization, and I had a couple different scenarios included in the analysis that I'll talk about momentarily. And then what you assume as the total gallons per-capita-per-day for the community. And, as I pointed out in the Tucson Water Plan - and remember this is community wide - the Tucson Water Plan focused on Tucson Water Service Area. So, everything is incomparable here; this was not meant to be a replication by any means of the Tucson Water 2050 Plan, but it's a - it's a point of reference. We did - I did some calculations here with 165 and then with 150.

And so I'll go through, basically, what the calculations were and then go through the details. And so we

Table 1: CAP Current and Pending Allocations in the Tucson AMA

Allocation Holder	Current Allocation ¹	Pending Allocation ²	Total
City of Tucson	135,966	8,206	144,172
Avra Cooperative	0	808	808
Community Water Company (CV)	1,337	1,521	2,858
Flowing Wells Irrigation District	4,354	0	4,354
Green Valley Domestic Water Improvement District	1,900	0	1,900
Town of Marana	47	0	47
Metro Water	8,858	4,602	13,460
Town of Oro Valley	6,748	3,557	10,305
Spanish Trail Water Company	3,037	0	3,037
Arizona State Land Dept.	14,000	0	14,000
Vail Water Company	786	1,071	1,857
Total Non-Indian Water	177,033	19,765	196,798
San Xavier District	27,000	23,000	50,000
Schuk Toak District	10,800	5,200	16,000
Pasqua Yaqui Tribe	500	0	500
Total Indian Water	38,300	28,200	66,500
Total	215,333	47,965	263,298

Source: Tucson Water Plan: 2000 - 2050 and PL 103-451 sec 104 b.1

¹ These figures are current as of Oct. 3, 2005. Information taken from CAP website <http://www.cap-az.com/about/index.cfm?action=allocations&subSection=7>

² Information on pending allocations was taken from Tucson Water's Water Plan 2000 - 2050.

looked at the population projected for 2030, which is about 1.5 million. And just, again, for point of reference at that time, the most recent estimate was for 2005 at just over 900,000. We know that's increased considerably since then.

And then I tallied up the water supplies available in acre-feet, and so this line here is the Central Arizona Groundwater Replenishment District amount that they are projected to have to replenish in their Plan of Operation in the year 2030. And, again, I 'm going to go through the - the - the detailed assumptions in just a minute.

There's certain groundwater that is allowed to be used, according to Department of Water Resource's regulations. There's allowable groundwater that's allowed to be used by designated water providers, you know, there's an allowance in there. There's exempt well groundwater that's allowed to be used, and that was quantified. The undesignated groundwater - water provider groundwater use. Basically, if you're not designated, you can use groundwater to serve the existing pre-'95 population indefinitely. And these are all numbers that were taken from various reports from the Department of Water Resources.

Then there's the question of the effluent, and I want

Scenarios Spreadsheet

2030 Scenarios Worksheet*	M & I + DOI Effluent + Higher GPCD	Half (M&I + DOI) Effluent + Higher GPCD	M & I + DOI Effluent + Lower GPCD	Half (M&I + DOI) Effluent + Lower GPCD
See Notes for Assumptions	Year 2030	Year 2030	Year 2030	Year 2030
→ PAG Pima County Population Projection¹	1,496,045	1,496,045	1,496,045	1,496,045
Estimated 2005 Population = 916,026				
Water Supplies/Sources in Acre Feet				
CACRD with Tucson Water ²	35,600	35,600	35,600	35,600
Allowable GW ³	41,100	41,100	41,100	41,100
Exempt Well GW ⁴	4,000	4,000	4,000	4,000
Undesignated GW ⁵	22,000	22,000	22,000	22,000
→ Effluent⁶	67,409	33,705	67,409	33,705
Effluent DOI ⁷	28,200	14,100	28,200	14,100
Municipal & Industrial CAP ⁸	195,810	195,810	195,810	195,810
Total Annual Supply in Acre Feet⁹	394,119	346,315	394,119	346,315
Total Annual Supply in Gallons ¹⁰	128,424,070,269	112,846,926,140	128,424,070,269	112,846,926,140
→ Assumed Total GPCD¹¹	165	165	150	150
Water Per Person per annum ¹²	60225	60225	54750	54750
Scenario Population¹³	2,132,405	1,873,756	2,345,645	2,061,131
Scenario Population less Projected Population¹⁴	636,360	377,711	849,600	565,086
Ratio of Scenario Population to Projected Pop¹⁵	1.43	1.25	1.57	1.38

to come back to the assumptions behind that. And I separated out the effluent that's under the control of the water providers in the County from the effluent that's under the control of the Department of Interior through the SAWRSA settlement. And then you'll see I have a couple of different scenarios where you're assuming you use all that's available and half that's available, and the half is an arbitrary assumption; it was just what if it's less? And then these are the numbers for the municipal and industrial Central Arizona Project water, including those pending reallocations, which were fairly certain.

And so if you tally all those up, you get a total annual supply in acre-feet. And then, you know, an acre-foot is approximately 326,000 gallons. If you multiply this number by the number of gallons, you get this humongous number, but all of our minds work in different ways; it was easier for me to work in that number, and then divide it by how much you assumed a person used on an annual basis. So, you take the 165, you multiply it by 365, and then you divide this big number by that number and you get a population that can be supported under those assumptions by that water supply. So, if you have this much supply in acre-feet, you assume that community use, including all uses, and all service of municipal water providers, which can be commercial/industrial - this isn't per household use - this is total community use on a per-capita basis, you get that this many people can be served by the population.

So, the key outcome was what is the scenario population? And, obviously, if there's less water, the population that can be served is lower. And in - in this side, if you assume more efficient use, less use per-capita, then there's going to be more people that are able to be served by an existing water supply.

And then just because, again, these numbers all get big and what do they mean? Is if you take a ratio of the scenario population to the projected population - and that's greater than one - that means that you have some room to grow, you know, that - if - if it were just one that would say that the water supplies are exhausted by that projected population by 2030. If it's greater than one, obviously, you've got 2.1 million here, and 1.5 million there, the water can be stretched over more people. So, this just gives you, to me, an easier way to look at some of the different scenarios and look at how close do you get to one, if you fall below one, that means you're kind of bumping into your water supplies sooner.

So, before I go on - if it's okay Mr. Vice-Chairman - to see if there are any questions, because then I want to go into the assumptions in a little bit more detail. I'm trying to

go quickly 'cause - easily can take a lot of time going through this.

VICE-CHAIRMAN MARCELINO FLORES: Well, we have - sorry - we have - is this on? We've usually waited for after the presentations, both -

MS. MEGDAL: Yeah.

VICE-CHAIRMAN MARCELINO FLORES: - presentations for questions.

MS. MEGDAL: Yeah, I'm just asking for any questions of clarification at this point; otherwise, I'm just going to keep rolling.

MEMBER ROB KULAKOFSKY: I just have a quick question.

VICE-CHAIRMAN MARCELINO FLORES: Rob?

MEMBER ROB KULAKOFSKY: Okay. Just a quick question. On - on one of your slides you show like the - it's the Tucson Water Recommended Plan -

MS. MEGDAL: Yes.

MEMBER ROB KULAKOFSKY: - 2004; it says - it has an average of 177 -

MS. MEGDAL: Uh-huh.

MEMBER ROB KULAKOFSKY: - total water use, and you are assuming either 165 or 150. I didn't really quite catch the rationale.

MS. MEGDAL: Well, it - it was felt that - that maybe we could be a little bit more ambitious in our assumptions about conservation potential, knowing that, as you grow over time, housing stock changes and we're going to become more efficient in our use, and - and so it was attempting to be a little bit more aspirational in term of - in terms of community use because of conservation, but it's just an assumption.

And, again, you'll see in a few minutes there is a case where I assume it to be 175, which is exactly, or almost exactly in that. But - and, again, remember that this - that was Tucson Water's Plan. This is meant to be community-wide, and we know there 's growth occurring and, you know, low-flow fixtures and all that kind of stuff, so -

MEMBER ROB KULAKOFSKY: Okay.

MS. MEGDAL: - you know, again, you can argue about any of the numbers and say, "Why not this or that?" and they are just assumptions, and so you can look at - you can see the scenario, the sensitivity to - to these numbers as - as I - I go through this, because I did do some scenario analysis.

So, let me just go through -

VICE-CHAIRMAN MARCELINO FLORES: Okay. Were - were there any other questions for . . . ?

MS. MEGDAL: Oh, I'm sorry.

VICE-CHAIRMAN MARCELINO FLORES: Bruce?

MEMBER BRUCE GUNGLE: Sharon, you said that - you indicated that you were not dealing with the AMA, you were dealing with more Pima County Metro Area, but then the only geographic slide you showed was of the AMA. So, I'm a little confused of what the boundaries were -

MS. MEGDAL: Well -

MEMBER BRUCE GUNGLE: - for the study.

MS. MEGDAL: - my - my purpose in pointing that out was that certain numbers are reported only on an AMA basis in reports, like, from the Department of Water Resources, and there wasn't - I mean, we weren't going to go and dig into numbers that were from the Third Management Plan and try to separate that out. So, what I was pointing out is that there's not a perfect correspondence of every single number to the County, and that's really what I was trying to point out there.

MEMBER BRUCE GUNGLE: Okay. Thank you.

VICE-CHAIRMAN MARCELINO FLORES: If I can ask a question. The - the gallons per-capita-per-day numbers, what was - what is the actual number? How does it compare to Phoenix and - and nationally? How does that compare in the GPCD?

MS. MEGDAL: Oh, that might be a better question to ask the Tucson Water Staff when - when they come up. I do know that Tucson Water's numbers are looking lower, I think, than they were at the time of the Plan as well. Maybe Chris can -

VICE-CHAIRMAN MARCELINO FLORES: Yeah, and I know -

MS. MEGDAL: - answer that.

VICE-CHAIRMAN MARCELINO FLORES: - we're better than Phoenix, so . . .

MS. MEGDAL: Oh, we're - we're definitely well below Phoenix. Phoenix is still over 200, isn't it, Mark?

MEMBER MARK STRATTON: I think it's like - the last time I knew it was 234 I think; it's a over, I think.

MS. MEGDAL: Yeah, and they've been coming down so, yes. Now, we're - we're - we're looking pretty good. And I - actually, in the report, I believe we have a table that attempted to compare some western cities, but you never know in those reports whether people are really comparing apples to oranges. We took that from another report.

So, let me quickly go through this so not to take too much time. I already talked about the population projections. The first note by the asterisk, these calculations are meant to be illustrative only and I, you know, this is the kind of disclaimer, they're all based on assumptions, they're not meant to be forecasts, but they're meant to be illustrative.

The footnote 2, the CAGR number, that does merit some - or warrants some explanation. The Central Arizona Groundwater Replenishment District - I - I think you've had presentations on

it - they have to do a Plan of Operation every ten years. They submitted a Plan in November, 2004, and behind that Plan was a very extensive analysis - they called it "Outlook" - I think - "2003" - where they attempted to quantify what the projected replenishment obligations would be by individual member. And this is a case where we actually took a look at their numbers and - and their study numbers.

Notes to Table 7

*These calculations are meant to be illustrative only. They are based on many assumptions and are not intended to be forecasts or projections. The worksheet scenarios do not quantify the public investments required to actually utilize the identified water sources. Additional public investments may be required to utilize the resources.

1. The population projections are for Pima County and are based on Pima Association of Government Projects. PAG estimated population for 2005 was 916,026. The Tucson AMA has different boundaries but includes metropolitan Pima County.
2. The projected replenishment obligations are from the November 2004 CAGRDR Plan of Operation, The CAGRDR projections do not include replenishment for Tucson, but it is assumed that Tucson will need 12,500 af of replenishment for its AWS. The figure shown has added 12,500 replenishment for Tucson Water added Plan's projection for the Tucson AMA.
3. Allowable groundwater is an estimate of the groundwater pumping that is allowable under the AWS Rules, annualized. (ADWR Est.)
4. Some pumping is going to occur through exempt wells. This is an estimate of the annual pumping based on a 1999 Tucson AMA Task Force Report.

Notes Continued

5. Some water providers are undesignated and allowed to pump groundwater to serve pre-AWS Rules population solely using groundwater (ADWR Est.)
6. This figure is based on Brown and Caldwell's 2006 Metropolitan Area Facility Plan Update Pima County Wastewater Management Projection, accessed from <http://> on March 21, 2006. It includes the projected outputs of the three metropolitan wastewater treatment plants (95,286 af) plus the outputs of the non-metropolitan treatment plants (10,323 af) less the 10,000 af effluent set aside for the conservation pool less the 28,200 af of effluent held in trust for the Tohono O'odham Nation by the Department of the Interior. There are many uncertainties regarding the amount of effluent that will be utilized. They relate to the return flows from municipals uses, the manner in which the effluent is utilized (e.g. managed recharge at 50% credits or constructed recharge or direct utilization through the reclaimed system). The extent of future use of effluent to meet municipal demands may depend on technological innovations as well.

And notice that for certain water providers that really are anticipated to use the - the GRD for replenishment, there were often zeros. They listed it by designated water provider, and then they listed it by member land. And, in particular, the Tucson Water number was zero, and the contract that Tucson Water has with the CAGRDR has an upper limit of 12,500 acre-feet of replenishment obligation. Tucson Water, at the time, was going through its redesignation exercise, so it all wasn't done and whatever, but both Tucson Water officials and ADWR officials indicated that it looked very

likely that that 12,500 acre-feet would have to be included as replenishment obligation by the GRD. So, the number that's in the table, which is that 35,600 number, is the number in the CAGRDR plan for the Tucson AMA, plus the 12,500 acre-feet for Tucson Water, so that is a place where I deviated from an existing Plan and documented that.

As I indicated, the allowable groundwater numbers are often various projections and estimates from the Department of Water Resources, so that takes you through notes 3, 4 and 5. And then Number 6, the number used there was based on the - the posted number at the time by Brown and Caldwell as part of the Long-Range Planning effort that was going on by - then known as Pima County Wastewater Management. And - and the number in the report deducted the output to the Non-Metropolitan Treatment

Plants - no, it added the Non-Metropolitan, and then took out the 10,000 acre-feet of Conservation Pool effluent, so that wasn't assumed; that 10,000 acre-feet of Conservation Pool effluent was not included in there, so that was not intended to go to people, and it wasn't included in there.

And then, as I indicated, the

- the 28,200 acre-feet of effluent held in trust by the Secretary of the Interior for the Tohono O'odham Nation was separated out. And then I noted that there's great uncertainty about that number, and - and so it's like, you know, we could put in a zero for that number and see what the numbers look like, or - or some number greater than that.

Footnote 7 relates to the 28,200 acre-feet of effluent; it assumed that it would likely be used by municipal users in the Tucson AMA, and it always - that effluent was always expected to generate revenues to be used for the Secretary of the Interior to meet the obligation to the Tohono O'odham Nation. The Tohono O'odham Nation, over the years, indicated it did not intend to use that water directly, and so this is - this assumption is consistent with publicly-articulated expectations about the use of that effluent. However, it's possible the GRD might look to some of that effluent to meet its obligation. So, to the extent that the GRD is using that water, there could be some double-counting, if you assume the GRD is going to find it's 35,000, plus you've got that 28,000. So, again, I tried to be

Notes Continued

7. The manner in which the 28,200 af of effluent held by the Secretary of the Interior for the benefit of the Tohono O'odham Nation will likely be used by municipal users in the Tucson AMA, but many uncertainties surround this utilization, as indicated in note 6. In addition, the CAGRDR may use some of this effluent for its replenishment. So, there could be double counting involved.

8. This figure represents the subcontracts held by Tucson AMA M&I water providers and the Arizona State Land Dept. (14,000 af) and pending M&I reallocations. The Tohono O'odham Nation hold rights to 37,800 af, with another 28,200 non-Indian priority water associated with the recent federal water settlement. The scenarios assume no leasing of Indian CAP water for non-Indian municipal purposes.

9. An acre foot of water is 325,851 gallons.

10. Total Supply times 325,851

11. Gallons per capita per day is an assumed number that includes all customers and all water sources served by municipal water providers. It includes, for example, golf course use of effluent or reclaimed water provided through a municipal water system. The value of this number for the region will depend on the level of conservation across water using sectors, the mix of newer and older housing stock, the amount of outdoor water use, and other factors.

as explicit as I could as to where there were potentials for double-counting or, you know, uncertainties.

And then 9 and 10 are just calculation assumptions. And then 11 was just clarifying that - that the gallons per-capita-per-day is - includes all customers and water sources served by municipal water providers and, for example, if - if golf courses use effluent or reclaimed water, that - through a municipal water system, that's included in - in that figure; and then, of course, conservation would affect that number. And then the last slide is just the - the - the assumptions about the calculations.

So, Michael, is it - maybe we could just very quickly - and - and I don't have that many more slides - I just wanted to show you if that - if that slide is - if you do it in the spreadsheet, anywhere in the spreadsheet . . . just double-click - yeah, if you double-click on that slide, you've got a live spreadsheet behind it. So, if anybody wants to go in there and change numbers, change something to zero,

change it to some other number, you can do that. And I'm just not fancy enough to figure out how to do these interactive

Notes Continued

12. Annual water use per year, equal to the assumed GPCD times 365.

13. The Scenario Population is the number of people that can be served by the Total Annual Supply, based on assumptions. It equals "total annual supply in gallons" divided by "water per person per annum".

14. This is the difference between the population that the scenario assumptions show can be supported by the assumed water supplies less the PAG projected population. A positive number demonstrates that the identified water supplies can serve more than the PAG projected population.

15. A ratio greater than one indicates that the scenario population is greater than the projected population.

Sensitivity Analysis

Table 8: Ratio of Scenario Population to Projected Population	Full Use M&I and DOI Effluent	Half Use M&I and DOI Effluent
Base Scenario with a GPCD of 150 (Taken from Table 7)	1.57	1.38
Base Scenario with a GPCD of 165 (Taken from Table 7)	1.43	1.25
Base Scenario with a GPCD of 175 (All Other Calculations Same as Table 7)	1.34	1.18
10% Increase in PAG 2030 Pop. and a GPCD of 175 (All Other Calculations Same as Table 7)	1.22	1.07
No State Land CAP (14,000 aF) with a GPCD of 165 (All Other Calculations Same as Table 7)	1.37	1.20
No State Land CAP (14,000 aF) with a GPCD of 150 (All Other Calculations Same as Table 7)	1.51	1.32

things on the WR or C Website, so we never did it that way, but you can - you can get to it in case anybody would like to. So, we can go back now to the presentation.

And then in - in the report itself, I did do some sensitivity analysis; again, it's just illustrative. You could pick whatever you wanted to. In the red box were those two base scenarios and then I did do it, as I indicated. What if the GPCD is 175 in 2030, as opposed to that lower number? And notice that with half use of effluent - half use of effluent and higher GPCD, you're getting pretty close to - to the number one there. What if the population projection is - is - is off? What if the actual population is 10% higher in 2030, and you have a GPCD of 175? So, what if you grow more quickly than projected, and you have a higher GPCD, and you're only using half the effluent? Notice you get - you - you pretty much grow

into those water supplies, assuming again - this is the big assumption - that you actually figure out how to make use of all that CAP water. We're not currently utilizing all that CAP water. So, this is really

Scenarios Spreadsheet – Assumptions can be modified!

2030 Scenarios Worksheet*	M & I + DOI Effluent + Higher GPCD	Half (M&I + DOI) Effluent + Higher GPCD	M & I + DOI Effluent + Lower GPCD	Half (M&I + DOI) Effluent + Lower GPCD
See Notes for Assumptions	Year 2030	Year 2030	Year 2030	Year 2030
→ PAG Pima County Population Projection ¹ Estimated 2005 Population = 916,026	1,496,045	1,496,045	1,496,045	1,496,045
Water Supplies/Sources in Acre Feet				
CAGR with Tucson Water ²	35,600	35,600	35,600	35,600
Allowable GW ³	41,100	41,100	41,100	41,100
Exempt Well GW ⁴	4,000	4,000	4,000	4,000
Undesignated GW ⁵	22,000	22,000	22,000	22,000
→ Effluent ⁶	67,409	33,705	67,409	33,705
Effluent DOI ⁷	28,200	14,100	28,200	14,100
Municipal & Industrial CAP ⁸	195,810	195,810	195,810	195,810
Total Annual Supply in Acre Feet ⁹	394,119	346,315	394,119	346,315
Total Annual Supply in Gallons ¹⁰	128,424,070,269	112,846,926,140	128,424,070,269	112,846,926,140
→ Assumed Total GPCD ¹¹	165	165	150	150
Water Per Person per annum ¹²	60225	60225	54750	54750
Scenario Population ¹³	2,132,405	1,873,756	2,345,645	2,061,131
Scenario Population less Projected Population ¹⁴	636,360	377,711	849,600	565,086
Ratio of Scenario Population to Projected Pop ¹⁵	1.43	1.25	1.57	1.38

just - just as I've said, a spreadsheet calculation.

The State Land Department has a 14,000 acre-foot allocation of CAP water; that's included in that total on that slide I showed you earlier of CAP allocations available to the region. What if you take that out? What do the numbers look like? And then what if you take that out and you have a lower GPCD? So, again, it just gives you an idea of the - of the sensitivity of the numbers to some of those different assumptions.

So, that - that was the nature of the analysis. Not rocket science, but interestingly enough, I've never seen anybody else do this and people haven't done it since. So, it's more like a calculator. Some, you know, barometer or something to - to measure things against. And it also, I think, is useful from the perspective of knowing that there are some water supplies available to this region under subcontract or produced in this region, such as effluent, that is here in the region or available to it already, and so as people generally talk about, "We need to find more supplies. We need to go out and do this and that." Well, maybe some of the less expensive options will

be to figure out how to use some of the supplies that already are here for the - for the region. Something, you know, to think about as - in some of these broader discussions.

So, what good would a report be without recommendations? So, there were some recommendations that I included in that, and one of them - I'm glad to say that, you know, we did do some follow-up on - and - and this Committee has helped keep that going - and that is: What's the state of the AMA? What are the state of our numbers and so forth? Let's all get on the same page with information. And I think we - we started some of that last October with the

community conversation and, certainly, this Committee has - has helped that process along. That common set of facts is very, very important.

Recommendations/observations

- Periodic State of the AMA Forum. The effort would involve the Arizona Department of Water Resources, water providers, government entities, the business community and others. It will take time and resources, but the importance of sound planning for our water future requires the effort. (October 2007 Community Conversation)
- Common set of facts important to informed decision making
- Collaborative approach to resolving water challenges is important

Additional Selected Recommendations

- Monitor growth in the CAGR and consider the implications of that growth on the future availability and cost of water for the Tucson region.
- Develop some understanding the implications of shortages on the Colorado River on the cost and availability of CAP water.
- Support continued efforts to meet the safe-yield water management goal established in statute.
- Encourage regional efforts to explore innovative approaches to water supply treatment, infrastructure investment, and securing additional water supplies.

One of the other recommendations is to monitor the growth in the Central Arizona Groundwater Replenishment District; that's kind of a rallying cry of my own, having watched it grow, watch its Plan of Operations change so dramatically from the - the first Plan in 1994, when it really hadn't done anything yet, to 2004. And, again, this Committee has done a number of these things, developed some understanding of the implications of shortages in the Colorado River; again, these are recommendations made in 2006, of course; it's almost part of daily conversation now to talk about shortages on the Colorado River. But, quite honestly, it - it wasn't daily conversation a couple of years ago.

Because this wasn't a Safe-Yield analysis, I didn't

Additional Comments

Many of the suggested actions are associated with participation in collaborative, broad-based efforts.

Understanding of the nature of the region's water supply challenges requires looking toward the long-term.

Water management is not just the concern of water managers.

want to lose that connection to Safe-Yield, so recommended support for continued efforts to meet the Safe-Yield management goal established in the statute, and then to encourage regional efforts to explore innovative approaches to water treatment, infrastructure investment and securing additional supplies, because it's going to

take a lot of decision-making, investment, and collective action to - to use some of these water supplies that were not utilized.

So, my last slide were just some - some observations at the time that I made in - in - in some of my presentations, and that is that many of the suggested actions are associated with collaborative broad-based efforts. And the community, over the last year or so, has certainly gotten more collaborative and - and broad-based than it was a couple years ago in terms of looking at water supply issues. We have to look to the long-term, you know, speaking to the choir here regarding that.

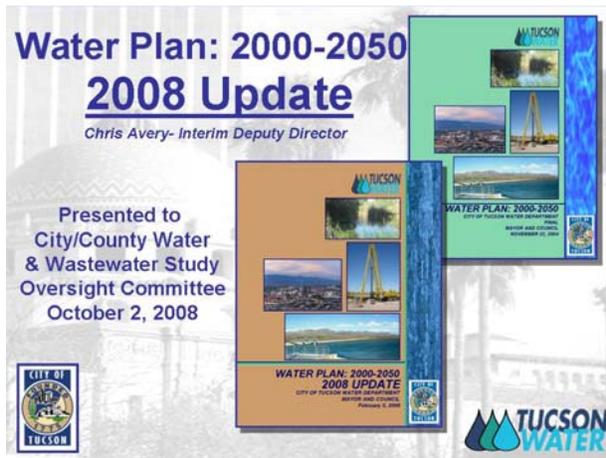
And that - you know, this may sound trite, but it really is something that I had to try to drive home at the time to many of the audiences that I spoke to, because part of my purpose in speaking was to generate interest in some of these water management issues. I mean, it wasn't on the top of everybody's list of concerns at the time, and that water management is not just the concern of water managers.

So, with that, I thank you for the opportunity to be here today, and I understand I'll be open to questions after the next presentation. Thank you.

VICE-CHAIRMAN MARCELINO FLORES: Thank you.
(Applause.)

VICE-CHAIRMAN MARCELINO FLORES: Our next presentation is scheduled to be on the Water Plan for the City of Tucson, and Chris Avery we've heard from before, and so we'll go ahead and - and get into his presentation.

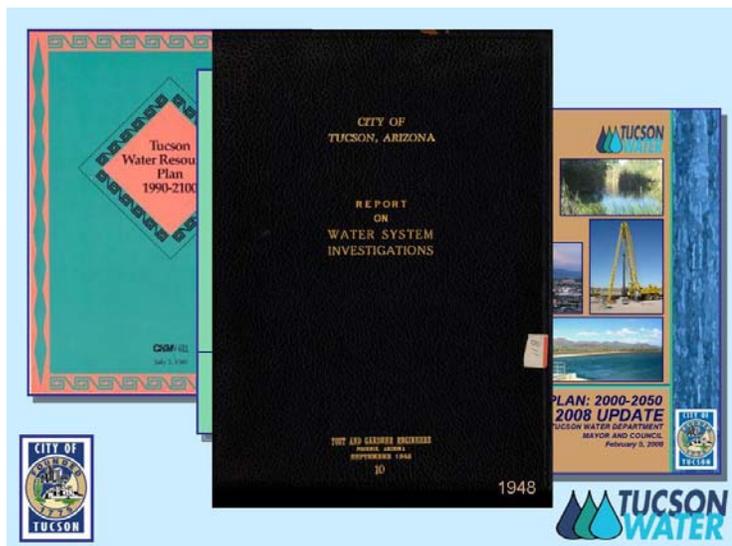
PRESENTER #2
CHRIS AVERY, INTERIM DEPUTY DIRECTOR OF TUCSON WATER:
TUCSON WATER 2050 PLAN UPDATE



MR. AVERY: Good evening. I'm Chris Avery, and I'm still the Interim Deputy Director of Tucson Water. This evening, it's my great pleasure to talk to you about the way Tucson Water assembled some of the building blocks that we've been talking about since the 11th of June. Any Water Plan is a combination of assessing the current resources that are available to the water utility or the planner, as well as

making a set of assumptions about what the future will look like and moving those assumptions forward.

Tucson Water has a pretty long history of water planning. In looking through some of our historical records, we found reference to a 1910 Plan and a 1932 Water Resources Plan that was done by what I think was then the young engineering firm of Black & Veech (ph.). But, the first one we were able to find is from 1948.



This is the report on Water System Investigations by Yost and Gardner Engineers out of Phoenix, and it was a pretty sophisticated look at the future water resource needs of the City of Tucson in 1948, and it contained a set of recommendations about how to reach - reach those needs; that the utility later followed one of the recommendations, for example, from the 1948 study was to look at Avra Valley as a future source of groundwater supply. The modern history of water planning in Tucson really starts with the 1990 Long-Range Water Plan, and it continues through the 2004 Water Plan, 2000 to 2050, and a recent update that was developed last spring by Tucson Water Staff.

And it's at this point that I think it's appropriate to give the recognition to the Tucson Water Staff that were intimately involved in the development of this Plan, Ralph Marra is here, Dennis Rule is sitting in the back row, Tim Tom (ph.), who used to work for Tucson Water was an integral figure in developing the Plan, and there's a wide variety of folks at Tucson Water who put Water Plan 2000 to 2050 together, and also the update. You'll see that there is a little difference in these two Plans. The 1990 Plan was done by CHM Hill, an outside



consultant, but internal Tucson Water resources were used to develop these later versions.

So, what - what's planning all about? Well, first, you have to establish a set of goals, or - or principles to drive your Plan. And, for Tucson Water, those goals and principles are generally consistent with the larger goals of the utility as a whole.

First, it's absolutely imperative that we meet the water demand needs of our customers into the future. Second, that we use renewable resources in order to do so. Third, that we ensure that not only do we have a sufficient quantity of water to deliver to our customers, but also that the water we deliver to customers meets the water quality goals and standards, some of which are permissive, and some of which are mandatory and set by the Federal Government and the State.

Fourth - and this is especially important for - for the Tucson region - is to obtain sustainable pumpage. It's unlikely that Tucson Water will ever be at a state where it doesn't pump any groundwater at all, but it is important that if pumping is done that it be done in a sustainable manner.

Fifth, as we've talked about in the - in the financial presentation in August, it's important that we be able to manage the costs and the rate impacts of putting water to use in the future, and that's also important because if we spend all of our - our money and our efforts on developing water supplies and forget to maintain the system, or forget to meet our customers' expectations for service, then we've probably failed.

So, what are - were the key conclusions from 2004? Well, first of all, it became readily apparent that one of the



things that the utility needed to do was increase demand management or conservation, and try to go after finding ways of reducing water demand to serve the same population as we move forward.

Second, again, you'll see this often through - through this process - and it's something we've talked about virtually every time

that we've been here - and that is fully use existing renewable supplies.

Third, at some point, it's going to be necessary for us to acquire additional renewable supplies, and it's also important that we continue to discuss these issues with the community and keep moving forward.

In 2008, just four years after that first Plan, there was some significant differences already that made themselves apparent in just four years' time. The first thing we did in 2008 was update the population projections, and we'll get into that a little bit further when we talk about the Obligated Area.

Second, even between 2004 and 2008, we had updated and increased our Colorado River allocation largely as a result of the Indian Water Rights Settlements that took place at the end of last year - actually, the end of 2006.

Third, it became increasingly important after 2004 - this issue was just starting - but, by 2005 and 2006, it was clear that we needed to pay more attention to drought and shortage on the Colorado River, and also to be able to assess the impacts of climate change on the future Water Resource Portfolio for the utility.

In addition, we had been doing some substantial work on looking at what our customers expected of us in terms of

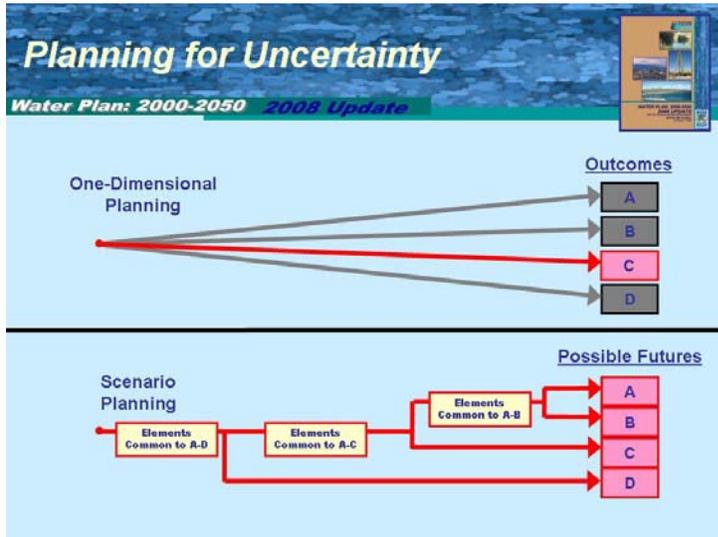
Changes in the 2008 Update
Water Plan: 2000-2050 2008 Update

- Updated Utility's Population Projections
- Increased the City's Colorado River Allocation
- Planning for Drought & Shortage on River
- Potential Impacts of Climate Change
- Decision H2O: Mineral Content of Blend
- Potential Change in Service Area Size
- Role of Conservation on Future Demand

water quality, and we're still working on the results of those decisions, but are prepared to start engaging in some dialogue with the community on that issue.

Finally, we have some - some potential changes in the Service Area size, which we accommodated in the 2008 Update, and we realized that conservation was going to play an increasing role in the size of our future demand.

One of the important things about Tucson Water's Plan is that we've tried to get away from the old way of planning,



which is sort of one-dimensional; that is, you shoot for a particular target and you spend all your time and energy trying to get there. The main, almost invisible background of the 2004 Plan and the 2008 Plan is a reliance on what we call "Scenario Planning," and that means what we're trying to do is find the elements that are common to all of, or

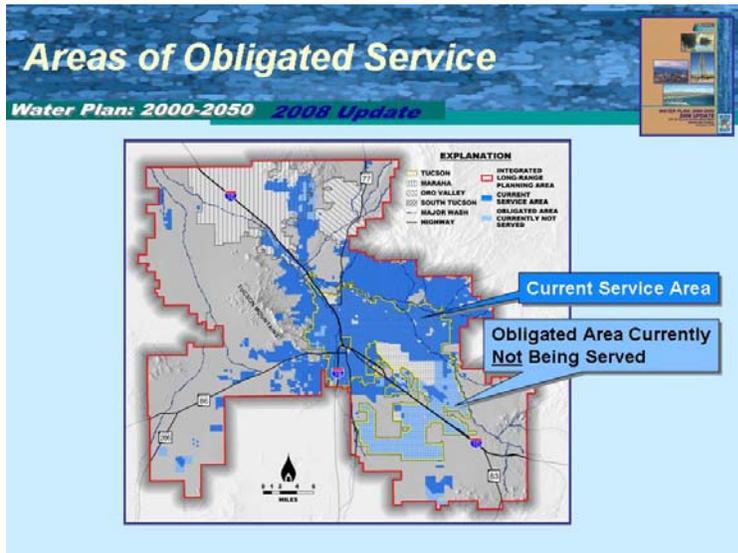
most of, the possible outcomes, and then try to implement those elements that are - are shared in common and be able to maintain as much flexibility as possible as we move forward. So, Scenario Planning, rather than sort of picking a target and - and trying to go after it and, perhaps, being wrong, what

Scenario Planning does is try to find common elements or areas where there is some consensus about where to move forward and still be able to maintain flexibility if things change in the future.



So, one of the first variables in any Water Plan is what's the area you're looking at? In the 2004 Plan, we were looking at more of a Long-Range Planning area that included what Tucson Water historically viewed as its potential Service Area, much to the chagrin I think of the Town of Marana and Oro Valley and a few other

folks in the region. But, essentially, in the 2008 Update we're looking a much smaller area in terms of the geographical extent of the Planning Area.

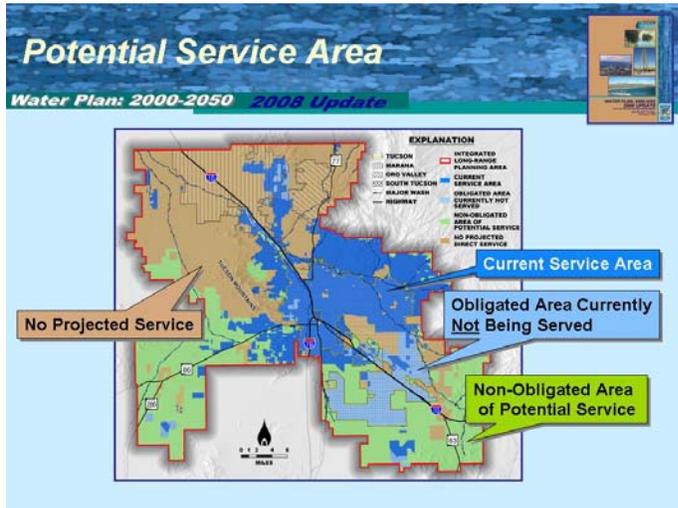


So, what you have here is this current and Obligated Area that we've been talking about since the beginning of June. The existing areas denoted in dark blue by where we have existing customers, and in the light blue by the City limits and the Obligated Area where Tucson Water has legal obligations to provide service.

In addition, in the - in the 2008 Update, we also looked at a potential Service Area that's outlined in this diagram in light green, which includes areas generally south of the existing Service Area, and partially west, but largely recognizes that service in northwest Pima County is likely to be provided in the future by the Town of Oro Valley, the Town of Marana, or other water providers.

This is what the projected Service Area was in the 1948 Plan, and you can see that one of the mistakes they made in

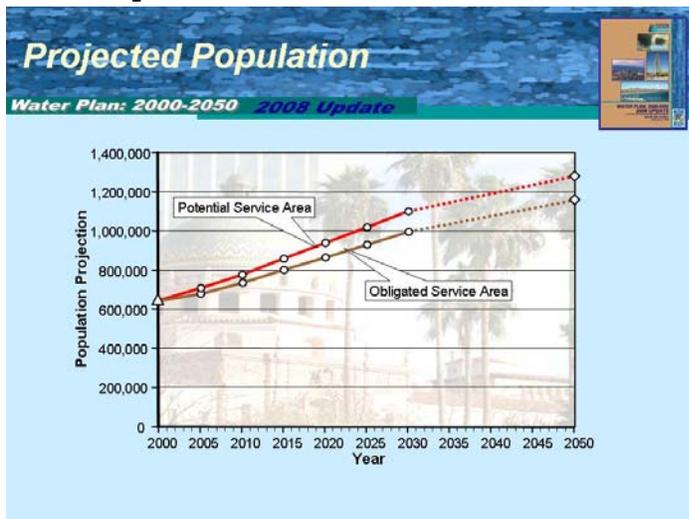
the 1948 Plan was limiting the Service Area for the City. This was the City limits in 1948, with some small area of potential service around it. The planners in 1948 predicted that by 1970 the City limits would include this area, essentially to Columbus, and - and ending just a little bit north of Fort Lowell. So, it's important that you get the potential area correct, or at least partially correct, because it makes all the difference in the outcome of the Plan.



In the - in the case of Tucson Water's 2008 Plan, the difference between the potential Service Area, which is outlined in the light green in the maps, and the Obligated Area, which is the dark blue and the light blue in the maps, is about 10%, so that by 2030 the population of the Obligated Area is expected to be

about a million, and the population of the potential Service Area is expected to be about 1.1 million.

In - in the 2008 Update, there are - as Sharon just showed you - there are almost infinite possibilities for a

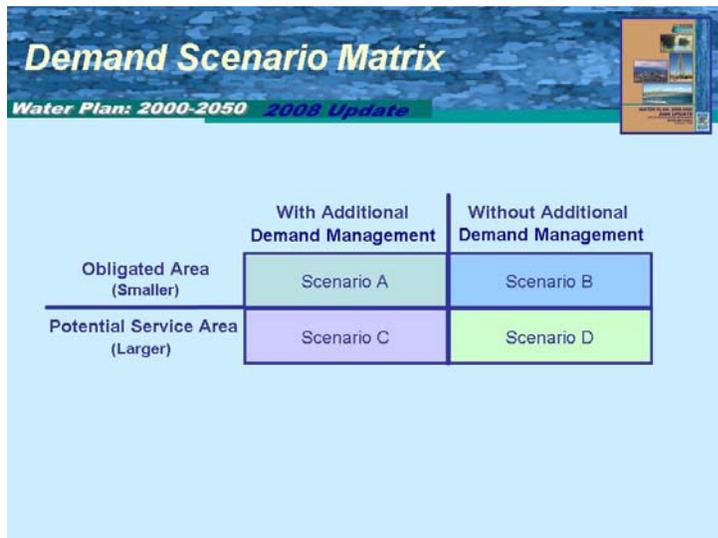


Long-Range Plan, depending on how many different scenarios you want to consider, sort of like deciding how you want to order your Whopper. But, in - in this case, we looked at four and, basically, it's a combination of two different variables. One is: Are you going to look at the Obligated Area, or are you going to look at a larger potential Service

Area? And are you going to look at those areas with additional conservation or without? That leads to what we call the four scenarios in the 2008 Plan. As Sharon showed you earlier, there - there are so many different ways that - that other potential outcomes could be combined. But, we felt like, based on the

differences between 2004 and 2008, these were at least four likely places to look.

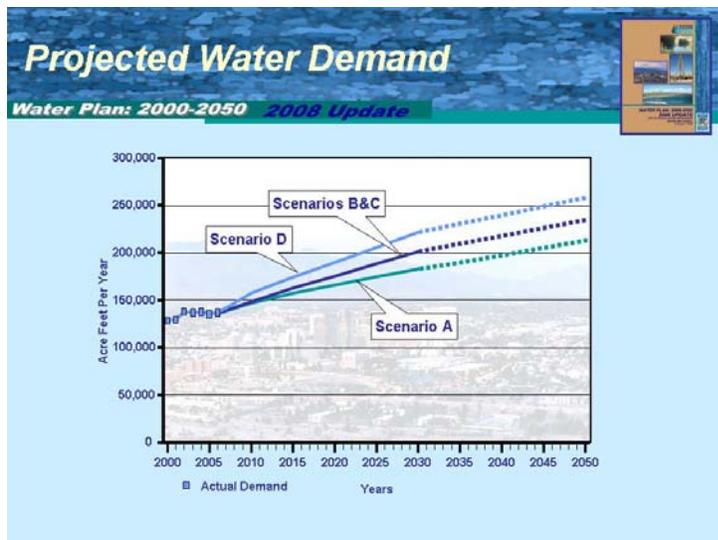
Well, what does - what does that do? When you combine the conservation assumptions with the population assumptions, you end up with, essentially, three different outcomes. Scenario A at the bottom is the outcome that has the Obligated Area plus conservation. The - the commonalities between Scenarios B and C are so much the same, that it was really not



important to graph the differences here. But, essentially, if you either decide to serve a larger area of population and conserve, or you decide to serve the same area of population and not conserve, you essentially get the same outcome. And, finally, Scenario D, if you decide to serve a larger area of population, and if you assume that that population is not going

to make any conservation changes in the way they use water, you get a much higher demand scenario.

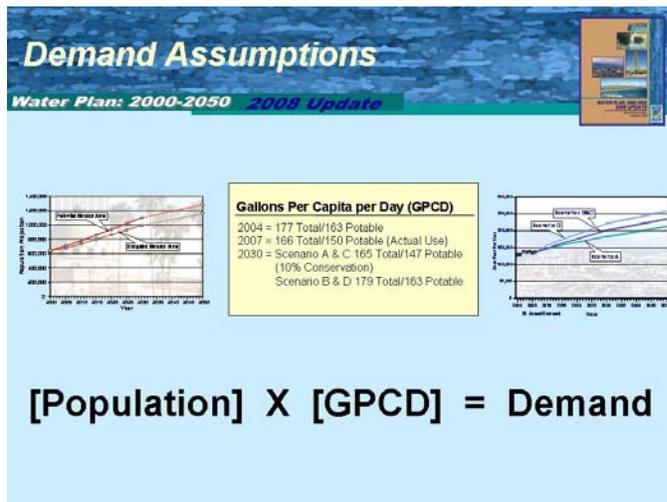
What were the variables that we considered in making the demand assumptions? Sharon talked about these a little bit



earlier. In 2004, we used an assumption of 177 gallons per-capita-per-day. Of that 177, 163 is potable demand, and 14 is reclaimed. Of the 163 acre - gallons per day per person in potable demand, about 10% of that is lost-and-unaccounted-for water, about a quarter of it is commercial demand. Again, that - this tracks with the customer

demographics presentation that we made earlier in June which shows about a quarter of our water usage occurs in the commercial sector, and about three-quarters of it occurs in

apartments or houses. And that leaves a residential GPCD in the 2004 Plan of about 120 gallons per-capita-per-day.



In 2007, our actual GPCD has dropped dramatically. In 2007, we calculated our total GPCD at 166, and our residential gallons per-capita-per-day at 150, which brings - if you subtract out lost-and-unaccounted-for water, and assume approximately 35 gallons per-capita-per-day in residential use, you're getting residential per-capita use down close to

100 gallons per-capita-per-day.

In 2030, under Scenarios A and C, Tucson Water assumed that the total gallons per-capita-per-day would be 165; 147 potable with 10% conservation. And in Scenarios B and D, Tucson Water assumed that there would be 179 gallons per-capita-per-day; 163 potable. And, essentially, the difference is if you spread the population out across a larger area, but you assume that the Reclaim System is serving approximately the same number of golf courses, you - you realize slightly higher usage on the Reclaim System.

Well, what's the outcome when you factor all those numbers together: population, projected demand, and water resources? You get a couple of different tables. This is the first one; this is Scenario A. Basically, the first water resources that - that we're graphing here is reclaimed water, and it's discussed many times during the previous few weeks. We assume, essentially, that reclaimed water will amount to between eight and 10% of our total water use as we move forward; that leaves potable demand below the line. By far the largest component of our future water supply is the Colorado River allocation. And, again, this graph assumes that we will put our Colorado River water to use by 2015 or so, and we've actually been able to start recharging our full allocation as of this year.

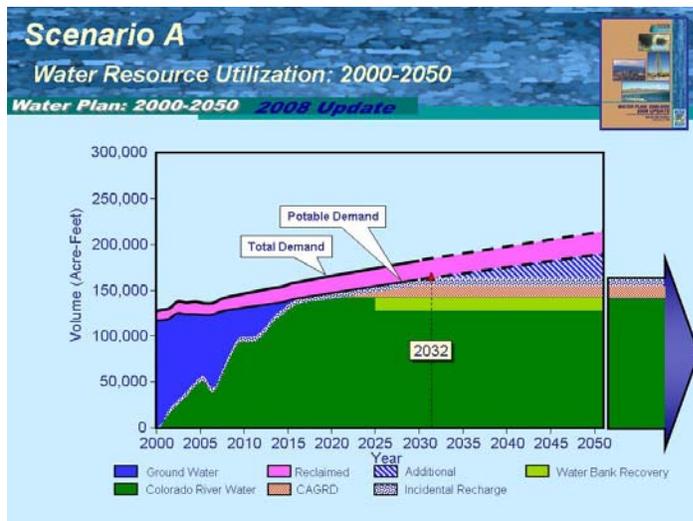
One of the ways to look at that Colorado River resource is to assume that there may be some shortage on the river in the future, and just - this is just one way to graph it. One way to graph that shortage is to assume that there may be some shortage starting about 2025 or 2030 but, because of the shortage criteria that we've talked about extensively and,

because of the Water Bank water that's available to the Tucson region, we think that the effects of the shortage on Tucson's Colorado River supply are likely not to occur before 2050, and that - for example, in this case, it's possible, and quite probable, in fact, that a shortage will be met by Water Bank water.

The next projected demand - and Sharon talked about this a little bit in her earlier presentation - is the 12,500 acre-feet of supply from the Central Arizona Groundwater Replenishment District. And if Tucson can put its CAGR allocation to use in its recharge facilities and deliver it to its customer, it's using CAGR water in - in a hydrologically-sustainable fashion; it's using CAGR water as wet water and a component of its supply.

The next water supply that we considered in putting these scenarios together is the incidental recharge of 4% that we've talked about several times during these presentations. And, finally, you get a groundwater supply that we intend to use for the next few years to bridge the gap between our past practice of relying on groundwater, and the future of using Colorado River as our main source of supply.

What does that get us? That gets us a renewable Water Supply Portfolio that extends - essentially extends throughout the duration of Tucson's existence as a city. You can maybe



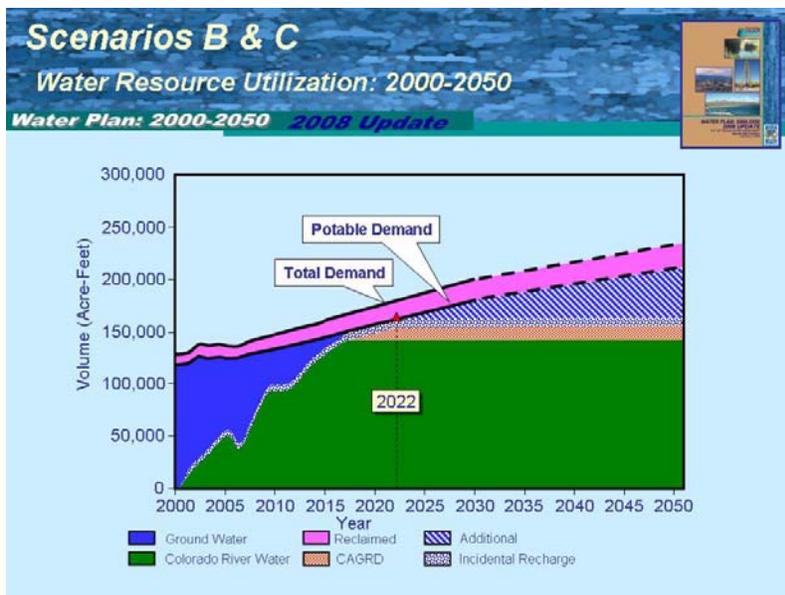
make some assumptions about large-scale droughts. You can make some assumptions, perhaps, about dramatic climate change, but those resources that we talked about earlier as part of Tucson's water renewable water checkbook, essentially, last forever. The Colorado River allocation is a secure allocation on the Colorado River water, the CAGR - the CAGR allocation is

secure, and the incidental replenishment credits we expect to continue for a long time. What this means is that if Tucson Water makes moderate changes in the area in which it provides service, and obtains moderate gains in conservation potential, that we will not exhaust that strong portfolio of renewable supplies until somewhere around 2032.

And one of the things to point out in - in this graph is that we have not graphed other resources to fill this gap, but when we talked about water resources on June 25th, you'll note that there are still groundwater credits that are available to the City of Tucson. We expect that, by 2020, that available portfolio of groundwater credits will be about three and a half million acre-feet, and that providers for Assured Water Supply purposes, a long-term supply of an additional 35,000 acre-feet per year of groundwater. There are also other available supplies that we'll talk about later in a few weeks that may be available to the region and to Tucson Water, in particular.

So, there's the fact that we show that in 2032 Tucson Water needs to acquire new renewable supplies doesn't mean that in 2032 Tucson Water has exhausted its Assured Water Supply Portfolio of water. And it's important to - in all of these scenarios, to remember that, as a municipal provider, Tucson Water is subject to the Assured Water Supply rules. And what that means is that the Assured Water Supply rules act as a break on increased demand. If Tucson ever exceeds its portfolio of Assured Water Supplies, the Assured Water Supply rules prevent subdivisions from taking place within Tucson Water's Service Area, and that means that future growth on Tucson Water's system is limited to smaller-scale lot split type subdivisions and/or future commercial build-outs that don't require subdivisions or - or Master Plan developments. So, the - the Assured Water Supplies act as a break to sort of bend this demand curve down toward the available portfolio resources that may be available at any given time.

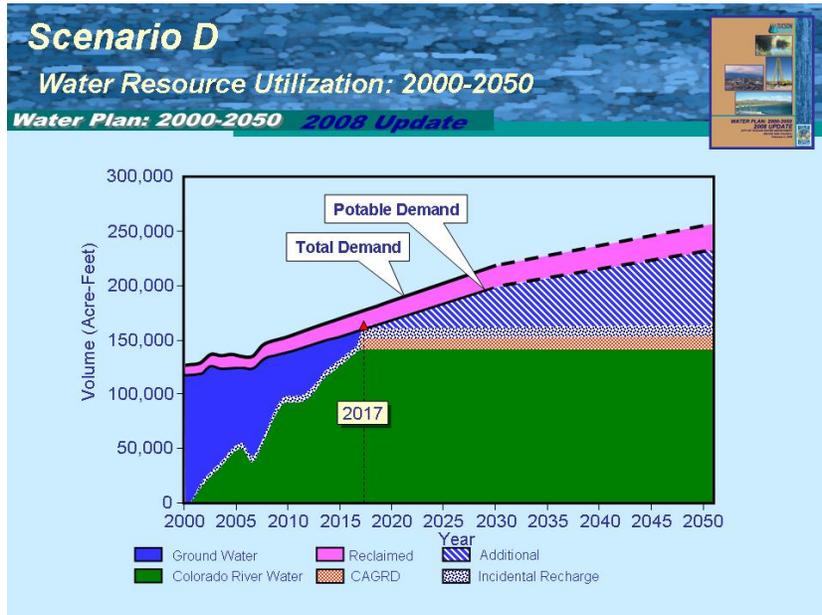
This is what it looks like under Scenarios B and C.



So, in - in Scenarios B and C, the assumption is Tucson Water hasn't done anything about either the size of the Service Area that it expects to serve, or about the demand that its customers use. And, in that case, the available portfolio of supplies starts to get difficult about 2022, and you have to bring those - that

additional portfolio of supplies on earlier and use more of them in order to meet your future needs out to 2050.

And the worst-case scenario, or - or at least the - perhaps, what we might also think of as - in some cases, the - the most likely probable scenario if no one decides to do anything, is Scenario D, which means that the portfolio of - of readily-available Assured Water Supply starts to become

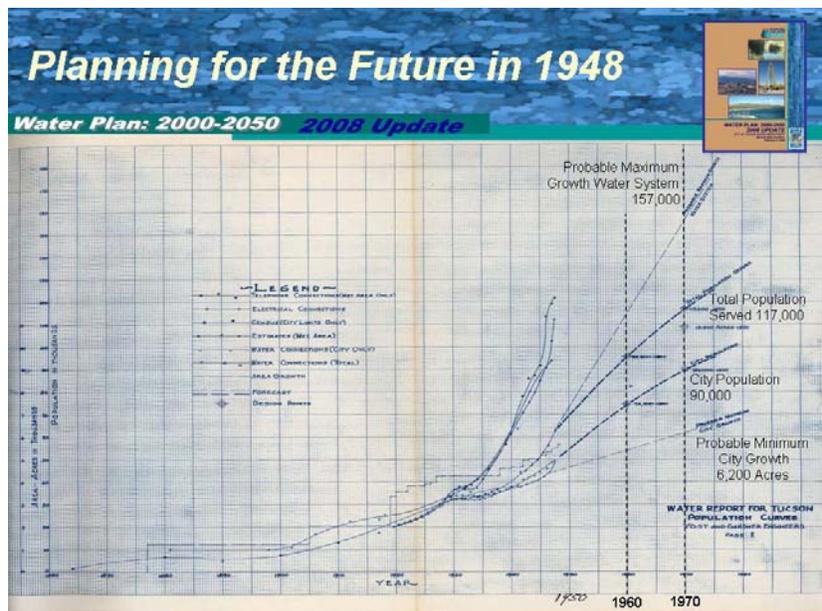


difficult about 2017, and that Tucson Water would be required to use its long-term groundwater storage accounts and other resources earlier than otherwise.

Well, how did it all turn out for the 1948 Plan? In 1948, the planners expected that the city population in 1970 would be about 90,000, and that the

total number of customers served by the water utility in 1970 would be 117,000, and their maximum growth in 1970 was expected to be 157. You can see - here's 1950, 1960, 1970. By 1960, Tucson Water had served 171,000 people, so that dot goes about

here. And by 1970, Tucson Water served 290,000 people, and that puts the dot somewhere up in the ceiling somewhere.



So, when we look at putting a Water Plan together, one of the - one of the easiest things to do, I think - and it's belied by Tucson's past history - is to assume that the growth will not come; that in 1948

it was almost inconceivable to assume that the City would grow beyond Columbus; that Wilmot and Kolb were, essentially, *terra incognita*, and it just didn't happen that way.



So, a Water Plan, rather than just sort of putting it on the shelf, has to be looked at, has to be revised. The assumptions that one makes in putting a Water Plan together have to be constantly tested against the available data because, as you see from the 1948 Water Plan, one of the things that they

looked at was electrical connections and telephone connections in the City of Tucson. And what the telephone connection data and the electrical connection data showed 'em was a future population increase that was far beyond what they expected.

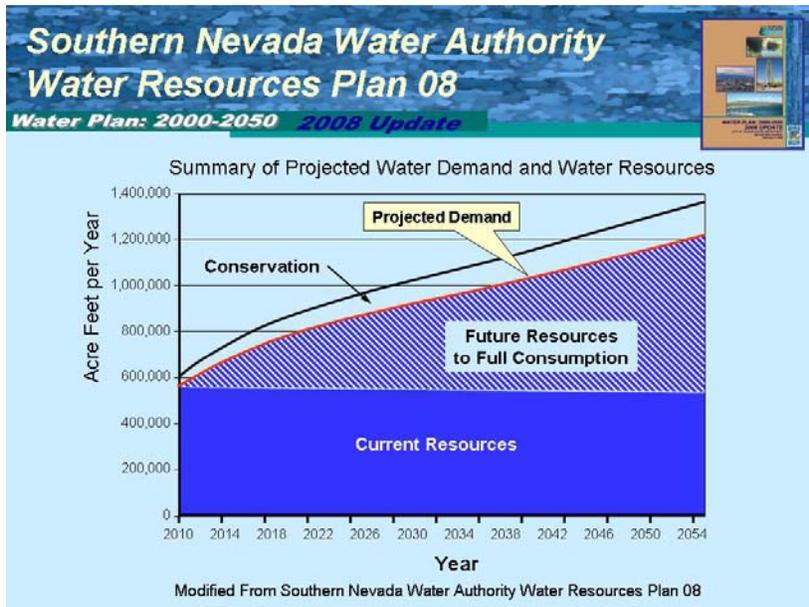
Okay. Where does the City of Tucson fall with respect to other western cities? Well, what we tried to do here was take a look at kind of a grab sample of other western cities that are included in the - in the 2004 Plan - the - the Plan talks about the GPCD usage rates in some other western cities. And so if you take a look at the Water Supply Plans for those western cities, you start to see some interesting things happening.

This is the Water Supply Plan for the City of Phoenix, and this assumes from the City of Phoenix - it has a wide variety of different scenarios - this is the City of Phoenix's scenario with development occurring at about the same level of density that has occurred in the past in Phoenix, and with water use occurring about the same way that's occurred in the past in Phoenix. So, no dramatic changes in either population densities or conservation usage. And what that shows is the City of Phoenix starts to have a difficult time with its current supply of water by the year 2020.

Just to note, the City of Phoenix's residential GPCD in 2004 was 169, and that means if you add in a portfolio of commercial water, you add some reuse water and you add 10% lost-and-unaccounted-for water - which is a pretty standard

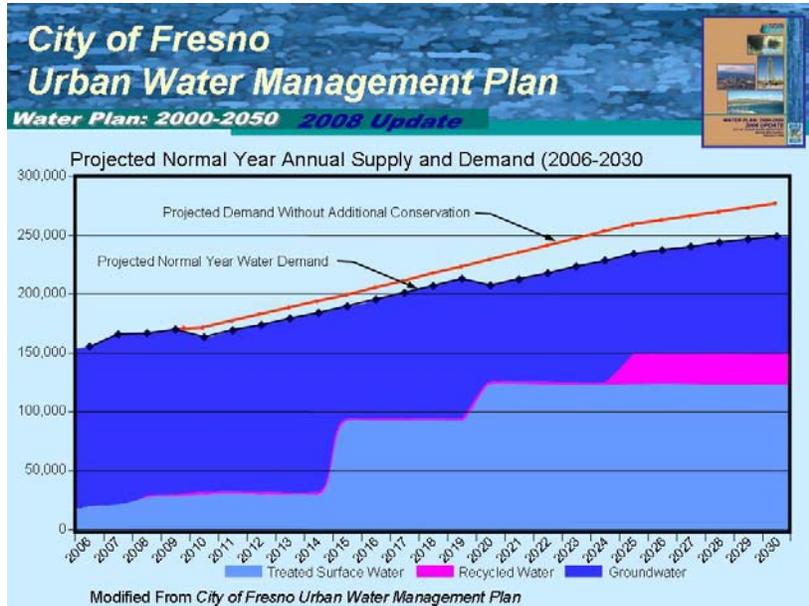
figure across the water industry - Phoenix's total GPCD is probably somewhere around 220, plus or minus.

Here we go. This is Southern Nevada Water Authority -



essentially, Las Vegas. Las Vegas doesn't have a whole lot left, and what this means is this - this is reflected in - in some of the urgent conservation measures that Las Vegas is implementing and in their willingness to seek water supplies far and wide to meet their future demands.

You can see, though, that the basic shape of - of this - of the - the Southern Nevada Water Authority's demand curve essentially looks like the



difference between our Scenarios B and C and Scenario A. In other words, conservation, essentially gets you approximately 10% savings in terms of your Water Supply Portfolio. By the way, Las Vegas' per-capita residential GPCD in 2004 was 220 gallons per-capita-per-day, so that puts their total cumulative GPCD probably a lot

higher than ours.

This is the City of Fresno and, if you look at Fresno, there are a couple of interesting things. First is their - they - their Water Supply Portfolio looks a lot like our Water Supply Portfolio from 20 years ago; lots of groundwater, very little surface water, and almost no reclaimed. The City of Fresno,

again, has a normal projected year water demand, and projected demand without increased conservation. They've got some major infrastructure investments in their future. They've got some conservation potential. And, according to our 2004 Plan, the City of Fresno's GPCD in 2004 residential was 260 gallons per-capita-per-day, so it was about double the City of Tucson's.

Well, where are we? The - the common set of conclusions from the 2004 Plan and the 2008 Plan, and moving on to - to the future for Tucson Water is: Number one, continue to emphasize hydrologically-based water management; this is short for wet water. And, as we've talked about Tucson's Water Supply Portfolio, its customer demographics, and its infrastructure



Recommendations
Water Plan: 2000-2050 2008 Update

- 1. Emphasize Hydrologically-Based Water Management**
- 2. Limit Groundwater Pumping to Sustainable Rate**
- 3. Reserve the City's Groundwater Credits for Long Term**
- 4. Reassess Water-Quality Target For Clearwater Blend**
- 5. Fully Utilize City's Colorado River Allocation by 2009**

needs, Tucson Water has been active in trying to make sure that we're able to connect the Water Supply Portfolio that we have with our customers through wise infrastructure investments.

Number two, try to limit groundwater pumping to a sustainable rate so that we can have that bank of groundwater supply that's available to

meet Tucson Water's needs in the future, whether those needs be - may be occasioned by drought, may be occasioned by unprecedented population growth, or by an unexpected unwillingness by our customers to conserve water at the forecasted rates. And that - when you limit your groundwater pumping to a sustainable rate, you also preserve the City's groundwater credits for the long term.

Finally, we've continued with efforts to try to make sure that as we change from a portfolio of groundwater to a portfolio of surface water that we continue to maintain our water quality criteria and parameters so that the customers are satisfied with the water that we deliver.

And, finally, continue to fully utilize the City's Colorado River allocation by 2009. And one of the things that we have been reporting all along is that we have the infrastructure available now to do so and expect - I think it's

now, I guess - Dennis, am I correct? Now we've placed our water order?

DENNIS RULE: Yes.

MR. AVERY: The water order for the City of Tucson has been placed for - in its entire allocation for next year.

We are also continuing to try to acquire additional renewable water supplies. As we've talked about on a few - on a few occasions earlier, the ADD water process is continuing to proceed in - in Phoenix, and Tucson Water Staff for their last week and also this week in participating in that ADD water stakeholder process.

Finally, invest in additional demand management and conservation. We've talked about this earlier but, as of last year, Tucson Water, through whatever reasons - and we still don't fully understand them - but Tucson Water customers over the last few years have, essentially, implemented the conservation measures in - in two or three or four years -

depending on where you want to start the clock ticking - that the 2008 Plan assumed would occur by 2030. So, basically, we're almost 20 years ahead now if - if these recent reductions in Tucson Water's per-capita use continue, if they hold steady, we're essentially 20 years ahead on our water conservation projections from



Recommendations
Water Plan: 2000-2050 2008 Update

- 6. Acquire Additional Renewable Water Supplies**
- 7. Invest in Additional Demand Management/Conservation**
- 8. Evaluate Effluent for Future Uses**
- 9. Continue Shifting Cost of Growth to New Customers**
- 10. Continue to Expand Regional Cooperation**

where we expected to be, even in the projections that we did this spring.

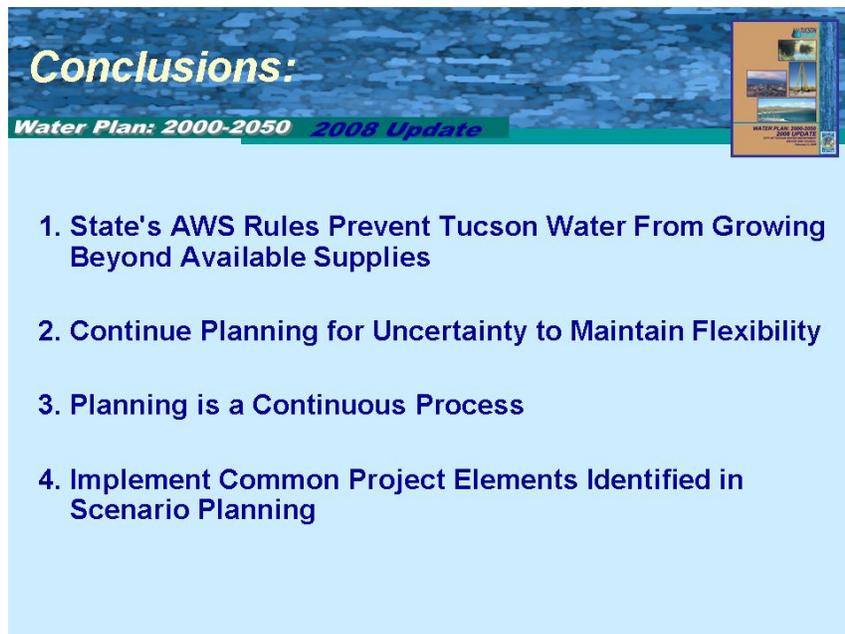
So, as you can - and as you - as you pay attention to the news, you can see the City of Tucson is ready to - has adopted a gray water ordinance, is preparing to adopt the rainwater harvesting ordinance, and is preparing to just begin to roll out the conservation programs that were contemplated that would occur in the 2004 Plan, and that were recently approved by the Mayor and Council as a consequence of that effort.

We - we are going to continue to evaluate effluent for future uses in - and especially in making sure that we have an abundant supply of effluent that's available for environmental and reclaimed water needs.

Number 9 - we've talked about this also before - continue shifting the cost of growth to new customers; that helps with a sustainable portfolio of water supplies and helps us to be able to meet our customer service needs and our existing maintenance requirements for the utility.

And, finally, continue to expand regional cooperation; that's what we hope we've been spending the last several months trying to do as part of this process.

So, here's some - here's some conclusions to think about: First of all, I want - as - as you do a Water Plan, one of the things that we rarely show is: What's the effect of the Assured Water Supply rules? And, as discussed earlier, what the Assured Water Supply rules is essentially start to reduce the slope of those demand curves as you get toward your Assured Water Supply obligation. So - so that - it might be easy to talk about the City of Tucson running out of water, or the Tucson Water Service Area running out of water, but the Assured Water Supply rules, essentially, as much as you can consider it to be regulatory pos- - regulatorily possible, prevent the City



Conclusions:
Water Plan: 2000-2050 2008 Update

- 1. State's AWS Rules Prevent Tucson Water From Growing Beyond Available Supplies**
- 2. Continue Planning for Uncertainty to Maintain Flexibility**
- 3. Planning is a Continuous Process**
- 4. Implement Common Project Elements Identified in Scenario Planning**

of Tucson's Service Area from running out of water. What the Assured Water Supply rules do is constrain growth if renewable water supplies or - and that portfolio of renewable water supplies or Assured Water Supplies is exceeded.

Number 2, continue planning for uncertainty to maintain flexibility. We've continued to do

that, even after the 2004 Plan. The 2008 Update has some significant changes from the 2004 Plan. If that continue - and one of the things that we may need to do in the near future is try to figure out what's happening with our demand side. Are these changes in demand from Tucson Water's Service Area likely

to continue? If so, you need to plan for those and you need to integrate those assumptions into a future plan.

Number 3, planning is a continuous process. Things change all the time. Last year at this time, it looked - the - the situation on the Colorado - Colorado River looked pretty dire; it looked to most people who had carefully considered these things that it was possible that a shortage would occur on the Colorado River in 2011. We had a lot of snow pack last year; that means that the possibility of a shortage on the Colorado River is essentially forestalled for another few years, just based on one year of snow pack.

And, finally, implement the common project elements identified in this Scenario Planning process, and Tucson Water has tried to do that over the last four years. The - the - the recent completion of SAVSARP, the effect that we're placing the water order for our entire allocation of Colorado River supply, and the increased efforts in conservation, and some of the outreach efforts that we've made in terms of water quality are all consequences of the Long-Range Plan. So, it's not enough to just plan, it's also important that you implement the elements of the Plan, even as you realize there's some uncertainty when you move forward.

With that, I'd be happy to take any questions.

(Applause.)

VICE-CHAIRMAN MARCELINO FLORES: Thank you, Chris. And I think we can also welcome Sharon back in case we receive questions regarding her presentation.

But, Bonnie first, then Sean.

MEMBER BONNIE POULOS: Chris, on the Planning and Zoning Commission and other places, we've been hearing projections that in 25 years, Pinal County - if they grow at the rate that they're projected to - will be larger than Pima County. If they go on their own path in terms of groundwater pumping and other uses of groundwater, will that affect the Tucson available water supply in the Tucson Basin? Will it affect, hydrologically, what happens to the groundwater we currently have and that we've currently banked? Does anybody know that?

MR. AVERY: I - I think it's fair to say the - there - there may be some effects near Pinal County, but the - the - and it's not so much Pinal County that matters for water-planning purposes; it's the Pinal AMA, which isn't exactly concurrent with the Pinal County line. But, I do think it's fair to say - and I - there are a lot of people in the room who know the answer better than I do, so if Ralph jumps up or Dennis jumps up to throttle me, please take some heed from that - but, I think it's fair to say that Tucson's groundwater resources are located

in - in such a way and such a location that it's highly unlikely that groundwater pumping in Pinal County can have an effect on us.

I do, however, think that, as we've tried to make this point before, in some ways all of us in - in the CAP Service Area, even Pinal County with what - what is, in my opinion, an absurd management goal, are connected to the Colorado River, and we are connected in some common way through the CAP canal to the same source of supply.

And so one of the concerns I think that can be shared about unbridled growth anywhere in Arizona is the pressure that it puts on the CAGR and its portfolio of available resources, and the pressure it puts on Colorado River resources, or other resources that might be delivered through the canal.

VICE-CHAIRMAN MARCELINO FLORES: Okay. Sean, and then Bruce.

MEMBER SEAN SULLIVAN: I've got two questions for you, Chris. First, the - within the various scenarios, do the water portfolios that you spoke about give consideration to the - the effluent that would be needed in order to carry out the various riparian - riparian restoration projects that are being planned right now?

MR. AVERY: They do almost by a mission. If you - if you look at the current portfolio of water that we talked about from June 25th, you'll see a certain amount of effluent that's dedicated to the Reclaim System, and a certain amount of effluent that's dedicated to the Conservation Effluent Pool. If the reclaimed water use for the City of Tucson continues to grow at the rate we expect it to - that is, no sudden and dramatic increases in reclaimed water use, but fairly steady eight to 10% - then there is water available for the Conservation Effluent Pool.

To the extent that environmental use of - of effluent or reclaimed water starts to exceed the Conservation Effluent Pool, or starts to cut into the amount of water that's needed to supply the Reclaim System, then those assumptions will change, and the way you'll see it change is that the slope of that curve will increase, your - your - because we try to account for non-potable, as well as potable use in that GPCD calculation.

MEMBER SEAN SULLIVAN: Okay. And then moving on to future water supplies. Back when we first started, we had an official from CAP come in and give us his ideas on new water sources, which included cloud seeding, desalinization plants, and my favorite, bringing water from the Mississippi River over here.

Is Tucson Water looking at anything that the CAP is putting forward as real viable options for additional water sources?

MR. AVERY: I think it's fair to say that when - you can that when - when Tucson Water has put together both the 2004 Plan and the 2008 Plan Update, you can see that we've been very conservative about the portfolios of water that we're willing to commit to our - our Long-Range Plan.

One of my favorite ways to talk about it - talk about the issue is - and it - it may be something that you can enjoy or it may just not make any sense to you at all - but - but, I like to talk about it in terms of what I call "magic water." There's a difference between readily available water supplies that are sort of within our common experience would be available to us, and then there's magic water that just is kind of out there that, you know, towing icebergs down from Alaska. And - and it's important that you - that you - you also consider the technology and other things, because what was yesterday 's magic water might be tomorrow's water supply of the future.

But, I think it's fair to say that the - the Tucson Water portfolio that's in this Long-Range Plan is fairly conservative is based on actual water in the Colorado that's available to the CAP Service Area and, as we move through the ADD water process through the - some of the other allocations through - as CAP moves toward developing other water resources then, as those look to become more certain and less magic, then you can incorporate them in future plans. But, Tucson Water's planning has been fairly conservative in that regard.

VICE-CHAIRMAN MARCELINO FLORES: Okay. Bruce?

MEMBER BRUCE GUNGLE: Chris, could you go back to your demand assumptions slide?

MR. AVERY: Sure. I'll try to do it fast here. Here we go.

MEMBER BRUCE GUNGLE: Too many (inaudible).

MR. AVERY: Yeah. There we go.

MEMBER BRUCE GUNGLE: You went by it. All right. I'm going to steal a little of Bob Cook's thunder here.

To get this calculation, you - the - the unknown actually in this equation isn't the demand or the population, it's the GPCD, and so that's based on those two items. What are you basing your population numbers on? How - how are those being calculated?

MR. AVERY: I'm glad you asked, 'cause I sort of forgot - I skimmed over that - and the reason is: We were - we - both the City of Tucson and Pima County Regional Reclaim - Regional Water Reclamation Department - almost got - I got it finally - used the same planning assumptions, and those are - are Pima County's Traffic Analysis Zone assumptions; it's a more sophisticated way of looking at population data than using census track data; it's not quite as sophisticated as some of

the planning tools that might be expected to come out in the future, but it is a common set of data that are used to inform the region's Transportation Plan, the Wastewater Planning, and Water Planning all at the same time. And -

MEMBER BRUCE GUNGLE: So -

MR. AVERY: - basically, you overlay the TAZ projections and Tucson Water Service Area to get your expected population.

MEMBER BRUCE GUNGLE: So, are - are those related in any way to - to housing starts?

MR. AVERY: The - the TAZ projections, as I understand it, start with the latest census data, then - if you'll remember Dave Taylor's presentation - the - the Department of Economic Security also factors in some population projections, and then Pima County uses an analysis to look at where the population is expected to move in - in the future, and - and they essentially go to 2030.

MEMBER BRUCE GUNGLE: Right.

MR. AVERY: And that's why when you talk - when you look at, for example, our population graph, you see that we've got solid lines to 2030 -

MEMBER BRUCE GUNGLE: Right.

MR. AVERY: - and then dash lines after that, and that's because the TAZ analysis starts to break down after that 2030 point.

MEMBER BRUCE GUNGLE: Right. My - my concern is probably obvious - and it's the same that - that Bob's has been, which is that if - well, there's been some concern that the DES numbers have been inflated over the last few years and, if that's the case, then our GPCD number here is overly-optimistic for where we're at. So, that's - that's just -

MR. AVERY: We - we also look at - one of the ear- - one of the earlier graphs that we showed you in - on June 25th, though, showed our water uses per service, and that's - you know, that's a real number; that's our actual customers, and you take our actual number -

MEMBER BRUCE GUNGLE: Oh, right.

MR. AVERY: - of customers, existing meters, you divide by your water usage -

MEMBER BRUCE GUNGLE: Sure.

MR. AVERY: - and you get the same kind of dramatic decline.

MEMBER BRUCE GUNGLE: Yeah. Okay. Well, good.

I - I have a second one for you. A couple of places, including on your recommendations slide at the end, you used the term "sustainable" - in this case, it's limit groundwater pumping to sustainable rate -

MR. AVERY: Yeah.

MEMBER BRUCE GUNGLER: - and I - this is something that this Committee's going to have to grapple with at some time; what - what our definition of sustainable pumping is. What's yours in this case?

MR. AVERY: Our - our definition of - of sustainable is - is, essentially, that you can pump a supply of groundwater that's likely to be renewable in the future.

MEMBER BRUCE GUNGLER: So, Safe-Yield?

MR. AVERY: It's - it's - I - I think -

MEMBER BRUCE GUNGLER: Are you using it equivalently?

MR. AVERY: I think you're talking about a Safe-Yield concept. One of the reasons that we don't put the actual groundwater number in the Long-Range Plan is because there is - we - we tried to put that number in the 2004 Plan, and there's just some differences in opinions about what that number actually is.

So, the - the trick is: You try to limit it now, increase your - the one thing we can do is try to limit groundwater pumping now, and the way you do that is by using as much renewable supplies as you can, and - and then you look in the future to see what you need once you start to get past the 2032 point, or the 2022 point, and - and see where you are.

MEMBER BRUCE GUNGLER: Right.

MR. AVERY: But, one of the things I can say is - is that we've grappled internally with this idea of sustainable, and you're going to be grappling with it -

MEMBER BRUCE GUNGLER: Yeah. Right.

MR. AVERY: - pretty soon here; it's not that easy -

MEMBER BRUCE GUNGLER: Yeah, if -

MR. AVERY: - to put a number on it.

MEMBER BRUCE GUNGLER: I - I - I think if - if you limit it to something like Safe-Yield, that's far too narrow, you know, for what we truly mean as a community by sustainable, because there are a lot more uses that, as a community, we feel water needs to be - be put to -

MR. AVERY: And I -

MEMBER BRUCE GUNGLER: (Inaudible; speaking over one another.)

MR. AVERY: - and I agree.

MEMBER BRUCE GUNGLER: Yeah. And one - one quickie at the end. Is this the same presentation you'll be giving at the AHS Chapter meeting in a week or two?

MR. AVERY: It - it's pretty close . . .

MEMBER BRUCE GUNGLER: Yeah. Okay. Thanks.

MR. AVERY: . . . with someone who knows a lot more about it.

MEMBER BRUCE GUNGLER: Yeah.

VICE-CHAIRMAN MARCELINO FLORES: John, and then Rob.

MEMBER JOHN CARLSON: I'm going to eventually bring Sharon in on this with a couple of questions, but you first. We're studying a bigger area than you cover, and I'm wondering about your - your - your relationships and your checking and - with the other water districts that's - that's within the scope of what we're looking at. Is there ongoing - I'm sure it is - but to what extent? Is there any differences? And you indicated that they were chagrined at you at one time, but whatever.

MR. AVERY: I think that there is some common elements between general water usage patterns in Tucson. Everyone's portfolio is a little bit different -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - but, as - as this Committee - mine - my understanding is that, in this first phase, you're going to be looking at Tucson Water Service Area and Pima County's current Service Area for - for wastewater treatment and then, as - as the - as the process expands, you will bring in those other areas in a more comprehensive part of the study.

MEMBER JOHN CARLSON: Well, thank you. And - and, Sharon, it's incredible what you all are wrestling with, and I know it takes time and a lot of money, are you all limited by what you can do because of money now? And, again, are you at odds with Tucson Water on - or where are we on that? You have to constantly revise that stuff, and it might be where we got to end up in Phase 2. That's one reason I'm interested.

MS. MEGDAL: Well, if you're asking me. I can't speak on behalf of the University. Bonnie's also an employee at the University. Money is a limiting factor for us all, and - and that's why, you know, I pointed out that the study I did was funded through a consortium put together by the Metropolitan Pima Alliance. And what I didn't say then was a part of the - what generated the work, or the desire for me to help, was some people wanted some help in understanding that 2050 Plan. For example, that bar that was on that original one of reclaimed used, some people thought that that meant that was all the utilization of effluent that would ever occur, as opposed to the amount used through the Reclaimed System, you know, delivered to turf facilities. And so that study was done for \$30,000; that's not a lot of money for, you know, to get a - get a report done and a - and a lot of follow-up.

And part of my job - I'm part of Arizona Cooperative Extension - and part of my job is to do education and outreach and take my work out, so these are the kinds of studies we like to do. I - I don't consider there - this being at odds. In

fact, you know, I - I made my best judgments on assumptions. Some of them were different than the 2050 Plan, and I just felt gratified that the numbers 166 and 165 now, and that's pure chance. But, you know, we did think, "Let's be a little bit optimistic about per-capita demand." So, it 's not a - it wasn't ever us versus them, or anything like that; it was a matter of - we have some questions. "We" being some of the community folks. We'd like some help in answering them.

It took - you know, that Plan was first released, it was in, like, March, 2004, that there was a luncheon right here at - is that the time, Ralph? Dennis? There was a - there was a luncheon, I think, right here at the Manning House at which the - the 2050 Plan was presented, and it probably took nine months or a year to work out the scope of work, and that's why it didn't get done till 2006.

But, if - if people would like the University to help, whether it's through the Water Research - Research Center or others, there are people there who would like to help, but it will take some resources.

MEMBER JOHN CARLSON: Yeah. Well, just for efficiency in the future - beyond me - I hope that - that somebody from your outfit is practically sitting with City Water, and I hope somebody with City Water is practically sitting in yours just to make sure that fruition of ideas go back and -

MS. MEGDAL: Well - and we do have a lot of interaction, actually, that - I've - I've got to remind Chris that he said he'd write a paper with me together, and I've got to talk to him about that.

MEMBER JOHN CARLSON: Thank you.

VICE-CHAIRMAN MARCELINO FLORES: Rob?

MEMBER ROB KULAKOFSKY: I'm sure John will be happy to finance that study.

Just a couple questions. On your Demand Scenario Matrix, you have your Obligated Area and Potential Service Area and all that. Did you ever think about looking into the possibility of reducing the Obligated Area? And, if so, ways to come up with -

MR. AVERY: I never did.

MEMBER ROB KULAKOFSKY: - if not, why not?

MR. AVERY: And let me - let me say I've - it's - it's my opinion that the Obligated Area is a fairly certain obligation. The Obligated Area includes the City limits of the City of Tucson, which, as a matter of - of some long-standing law in the State of Arizona, the City's obligated to serve, as long as it continues as a water utility, and until it runs out of available supply. And it also includes an area where the City has long-term and - and pretty ironclad contracts to

provide water service. So, looking at reducing the Obligated Area is something that would have to be done with - without the advice of legal counsel, at least current -

MEMBER ROB KULAKOFSKY: Right.

MR. AVERY: - legal counsel.

MEMBER ROB KULAKOFSKY: 'Cause, basically, I'm asking about de-annex- - de-annexation, and - and so you didn't look at that at all?

MR. AVERY: I think it's hard enough to annex; that the concept that we de-annex is just beyond the pail at this point.

MEMBER ROB KULAKOFSKY: Okay. Just - just thought I'd throw it out there.

The other thing is - it's probably an unfair question at this point because we've just had the gray water ordinance - but, what effect do you think the larger use of gray water for homeowners will have on the availability of effluent in the future? And, once again, I know it's a little unfair, 'cause you really know what's going to happen.

MR. AVERY: We - one of the outcomes from the 2004 Plan was the development of the Conservation Task Force that resulted in generating some recommendations to the City about implementing a stronger Conservation Program and some specific demand management goals, and one of those goals was increasing the amount of gray water usage and low-flow fixtures, and some other things. And so included in those outcomes are some diminishment in available effluent from Wastewater Treatment Plants, and also diminished revenues in the future from water conservation. And so I think it's fair to say that the assumptions of that Task Force are that if gray water use is used to largely supplant outdoor irrigation that would otherwise be either part of the peak summer demand portfolio or, perhaps, something that reclaimed water might be used for in the future, that - that the effects are not significant.

But, again, one of the benefits of doing this Scenario Planning - and its kind of continuous planning - is that if you see some interesting things happening with gray water, then you can incorporate those interesting observations into - into the future variations of the Plan.

MEMBER ROB KULAKOFSKY: Thank you.

VICE-CHAIRMAN MARCELINO FLORES: Are there any other questions from Committee members?

I have a question for Sharon.

MS. MEGDAL: It's hard when you're tall and short using the same microphone.

VICE-CHAIRMAN MARCELINO FLORES: In - in your presentation in the Sensitivity Analysis, you - you had said

that there was an assumption that we're going to be using all of our water in - in - in - in the Sensitivity Analysis but, you know, I - I got the feeling that there might be a limit out there in terms of how much water can actually be - be used.

Is there - is there a hydrological limit for how much can be, you know - of CAP water, renewable sources, can be brought into the region? I - I guess the - the question is, is like also: If - if we recharge to a point, will the river start flowing again, you know?

MS. MEGDAL: Well, that's better to ask of Ralph Marra than me because I'm not a hydrologist. But, I think what I was trying to convey is that the assumption behind that when I said, "You could use the water" is that you - actually, if you get the water to where the demands are, or you could treat the water so that it could be used, you know, we're not going to use all of the effluent on outdoor irrigation. I mean, nobody's proposing to do that. So, if you look at a scenario that includes utilization of effluent, that suggests that it's either supplanting, as - as Chris suggested, some existing outdoor watering that's being done at the neighborhood level or household level, or it's being treated and recharged and then delivered into the potable system. And these things take investments, you know, we don't - we're not a new community where you can double-pipe everything for, you know, purple and - and potable water. So, that's what I meant by it's assuming that we're using it in some manner.

And I'd leave it up to the Tucson Water people to talk about the - the recharge and recovery, but the fact - I would just offer the fact that they're recovering a whole bunch of what they're recharging makes it be a very stable process.

And in the other areas that I'm familiar with where recharge is going on, you know, water tables have been low and they're rising, but the Department of Water Resources watches that and if there's mounding, or things like that that occur, such as I think happened in Pima Mine Road, they'll slow down the recharge for a while, and so there's quite a bit of monitoring by the Department of Water Resources.

And, in fact, I think that's another important point to make: Is not only is the Assured Water Supply Program a heavily-regulated program - it is a regulatory program - but, the Recharge and Recovery Program is also a regulatory program; it requires permits; it's monitored annually and everything gets reported, so -

VICE-CHAIRMAN MARCELINO FLORES: Okay.

MS. MEGDAL: I don't, Chris, if you want to add anything to that.

VICE-CHAIRMAN MARCELINO FLORES: Okay. Bonnie?

MEMBER BONNIE POULOS: I'm not sure who to direct this to, but in light of recent economic situations, do any of the scenarios take into account whether or not the community, as a whole, will have the economic ability to make improvements and replace infrastructure? And, if not, are those things that can be incorporated into future scenarios about whether or not those funds will be available in order to be able to do those things?

MS. MEGDAL: Well, I can quickly say my analysis was not an economic analysis, so did not factor that, and I think Chris probably . . .

MR. AVERY: Yeah. Well, one - one of the components of - of the GPCD calculation - and - and we kind of use a larger number, 'cause we use a number that not only has residential but commercial and reclaimed - but the kind of hidden component of GPCD is lost-and-unaccounted-for water. And so if you fail to make those infrastructure investments so that you've got abundant main breaks, leaks, deteriorating piping, et cetera, then, theoretically, that failure to maintain your infrastructure is going to show up in lost-and-unaccounted-for water, or in some other way increase your GPCD. So, as long as you're keeping track of it and comparing your actual GPCD usage rates with your projected GPCD - GPCD usage rates, then the planning should work.

And one of the things I want to point out - forgot to - when - when you look at that 1948 demand scenario, they used the GPCD in 1948 of 170. So, again, you're not talking about huge variations here in terms of - if you look at the 1948 Plan, they had a much higher peak-day factor, which means kinda we can all assume that what that means is they were irrigating more lawns in the summer, and probably had a lot fewer washing machines, dishwashers, et cetera, in their homes, but the GPCD in 1948 was pretty close to what it is today.

VICE-CHAIRMAN MARCELINO FLORES: Okay. Sharon, I understand you had a question for Chris?

MS. MEGDAL: Yeah. I had a question for Chris - and I'll try to ask it in a general way. Chris, when you had your slide where you showed the supplies and talked about the security of the supplies. You had that arrow going outward. And you made actually the same assumption I did and that was - is that the GRD is going to find the water to do its replenishment. And I just wondered, you know, if you feel comfortable in what supplies you think the GRD will use in the future, because - as I think probably has been discussed - and certainly I have concerns about the - the security of those future supplies to meet the replenishment obligation, and we're kind of all in this together with the other two counties in the

GRD Service Area. So, I was curious if you had anything to say about that?

MR. AVERY: We - I think it's a fair assumption that the - the size of this GRD obligation is likely to remain intact in the future. The cost of that slice is what I think causes fear in the - in the - in the hearts of most people who think about CAGRDR continuing to incur obligations without having the same kind of breaks on its future obligations that the Assured Water Supply rules impose on the municipal providers . . . and - and we expect anyone who might be a candidate for the CAP Board to seriously consider that issue.

VICE-CHAIRMAN MARCELINO FLORES: Well, we've entertained a longer time period for questions from the Committee. Are there any other questions from Committee members?

We'd like to open up the questions for any public. If you would please come up to the microphone. We - we made up some time. We lost some time. If you could please ask a straightforward question and see - see if we could -

TRES ENGLISH: Sure.

VICE-CHAIRMAN MARCELINO FLORES: - stay within a minute.

TRES ENGLISH: Okay. My name is Tres English. And I had several questions. I'm unclear of - of some of the things that we talked about this evening. You referred to "12,500 acre-feet" that had something to do with the Assured Water Supply and Tucson's obligation, and could you just sort of review that a little bit?

MR. AVERY: Yeah. Sure. If you look at these numbers, the way they stack out is this is Tucson Water's CAP allocation, 144,000 acre-feet. This is 12,500 acre-feet of CAGRDR obligation that the City of Tucson obtained by contract from the Central Arizona Groundwater Replenishment District - thanks - Dennis, raise your hand, this is - this is yours - thanks to Dennis' foresight, the City of Tucson obtained in 1997.

TRES ENGLISH: Is that water that's in addition to our - Tucson Water's ob- - application?

MR. AVERY: Yes, it's a different portfolio of water than - than is obtained through the CAP subcontract; that's designated in the green.

TRES ENGLISH: Okay.

MS. MEGDAL: And if I could just add - this may be a little bit of - kind of education, because this is kind of past history - but, when the City of Tucson turned off direct delivery and that was in, what? 1993, and the rules - the Assured Water Supply rules were approved in 1995, and folks had

to come in pretty soon after that with their request to be designated under those rules. And so Tucson Water, at that time, joined the Central Arizona Groundwater Replenishment District, as did Metro and most of the other municipal - large municipal water providers because the - if you remember, the CAGR, by rule, that establishes that your water use will be consistent with the management goal, because the GRD has that obligation to replenish. Unlike some of the water providers, the - the City's agreement at that time was very special; it had some minimums and it had that maximum of 12,500 acre-feet of a replenishment obligation; that's, I believe, the maximum that the City could ever ask the GRD to replenish. And, in the Assured Water Supply calculations, when they did that at ADWR - which I wasn't part of that at all - they included that. So, that's included in the number - what is it? 183,000 or 4,000 of the - of the Assured Water Supply includes 12,500 acre-feet that the GRD would be obligated to replenish.

TRES ENGLISH: Okay. But, just to clarify: That 12,500 is wet water that is in addition to Tucson's CAP share?

MR. AVERY: Yes, and that's why we've -

TRES ENGLISH: Okay.

MR. AVERY: - included it in this pretty conservative portfolio of supplies.

TRES ENGLISH: The second thing is the issue of this sustainable pumpage. To me, for it to be sustainable it means that over time, as you either take more or less out of the ground, that your net pumpage is zero; that's the only thing that's sustainable?

MR. AVERY: And - and that's

TRES ENGLISH: It's - or is there a difference between that and your definition?

MR. AVERY: When we talk about sustainable pumpage, we understand it's difficult to define it, and that's why we didn't put it in the - we didn't put it in this - this scenario. If you look -

TRES ENGLISH: Okay. If you have a net pumpage, if you're continuing to draw water out of the groundwater table, that's not sustainable.

MR. AVERY: Okay. Let me - let me - let me try to explain this the way I think about it and see if it works. This is what I think most people would consider sustainable pumpage and that is: The 4% incidental recharge that's granted by DWR, assuming that 4% of the water we deliver to our customers recharges the aquifer through irrigation, other uses, et cetera. In - in addition then, there's some number - probably greater than zero and less than, let's say, 50,000 acre-feet a year that could be pumped from Tucson's local aquifers and - and available

groundwater supplies that equals more or less on a long-term rolling average the amount of natural recharge that occurs in those aquifers; that's a different number than the amount of credits in Tucson's groundwater account; that's a different number than you get in terms of Assured Water Supply purposes; and it's not a number that - that you can identify readily. You put five hydrologists in a room, and - and a lawyer and you'll get seven different opinions.

TRES ENGLISH: Get six different opinions, right.

MR. AVERY: So, that's one of the reasons why, when we did the 2008 update, we took it out; it's not - it doesn't exist; it's invisible. There's groundwater pumping here and invisible here and that's because, for the short-term, the - the importance for us is not so much trying to figure out how much water you can pump in 2020 - in 2035 or 2045 and be sustainable for the short-term. The goal is to try to in- - decrease the amount of this blue transition water that you're delivering to your customers, because the less water you pump here, the more water you have here.

TRES ENGLISH: Okay. All right. Thank you.

VICE-CHAIRMAN MARCELINO FLORES: Thank you. Again, for the sake of brevity, a question, please.

ALTERNATE MEMBER BOB COOK: Yeah, I've got a couple questions. You mention that in recent years we're seeing actually a slight per-capita decrease in consumption?

MR. AVERY: Yeah, it's right here.

ALTERNATE MEMBER BOB COOK: Okay. So, how much of that would you account for - for the impact of rate increases?

MR. AVERY: We - we talked about this extensively this summer among Staff and, when we modeled what was happening to our GPCD rates, there are a couple of different models that we look at. One is a basic economic price elasticity model; it failed to predict this dramatic decline. One was a temperature-based model. In other words, in the past, if you've got a certain number of days over 100 degrees consecutively with no rainfall, we saw a response in our peak day; that didn't happen this summer. When we tried to model for expected conservation increases, you know, replacing older fixtures with newer fixtures, new housing stock versus old housing stock, it didn't match up.

The - the best guess that we have among Staff - and there's some variations between Staff on what they think is more important or less important - but, the best consensus among Staff is that there are two factors: Number one, we see this pattern occurring across the west; it happened permanently in Denver after 2002 - and I was reading some articles online just the other night - they're looking - they - they think that their

conservation patterns and their use patterns had never changed so dramatically after the 2002 drought, that they're reformulating their projections for the future.

So, one is that we think long-term water consumption patterns are changing across the west as people become aware of the issue, and we also think the economy has to play some role in it, but we don't know. We - we've looked at it a couple of different ways, but to answer your question succinctly, the - the price elasticity models that we have used in the past successfully to predict water demand don't predict what's going on over the last couple years.

ALTERNATE MEMBER BOB COOK: Okay. Thank you. You showed the projected demand in Phoenix, comparing it to some of the other cities, and I noticed that their demand curve actually flattens out. Are they anticipating a build-out of population, or -

MR. AVERY: No.

ALTERNATE MEMBER BOB COOK: - are they looking at some other phenomena that you're not looking at?

MR. AVERY: When you look at Phoenix - and, first of all, Phoenix, unlike the City of Tucson, Phoenix does not provide water outside the City limits. So, you - you reach, you know, when you - when residential development occurs in the City of Phoenix, you're - you're finished.

ALTERNATE MEMBER BOB COOK: So, it's a build-out.

MR. AVERY: But - but, one of the other - one of the assumptions that we didn't put up here - 'cause there are a lot of 'em, and you can find 'em readily on the web - is - is there were some assumptions in Phoenix that density of development would occur at a higher rate than past historical pattern and, when that happens, their demand curve, it becomes steeper. You know, if you assume that the City of Phoenix has a certain areal extent that's not going to expand, but there are going to be a lot more four-story condominiums built in the City of Phoenix, then their demand curves go up, even though their GPCD may come down.

ALTERNATE MEMBER BOB COOK: Okay. You - you point out that - or it was noted that approximately 10% of our water is lost-or-unaccounted-for, is that a long-term trend?

MR. AVERY: That's remained fairly consistent throughout the department for the last couple of decades, and it's fairly consistent with the - the patterns of other water utilities in the country, actually 10% lost-and-unaccounted-for water, we're moderately to, you know -

ALTERNATE MEMBER BOB COOK: Oh, yeah.

MR. AVERY: - to better in terms of comparison with other -

ALTERNATE MEMBER BOB COOK: Yeah, I understand -
MR. AVERY: - water utilities.

ALTERNATE MEMBER BOB COOK: - the dynamics of, say, of Philadelphia compared to Phoenix.

MR. AVERY: Yeah.

VICE-CHAIRMAN MARCELINO FLORES: Bob - Bob, can I interrupt? How many more questions do you have and -

ALTERNATE MEMBER BOB COOK: Two.

VICE-CHAIRMAN MARCELINO FLORES: Two more.

ALTERNATE MEMBER BOB COOK: These are actually short questions. I'm not giving the long answers.

VICE-CHAIRMAN MARCELINO FLORES: Okay. Thank you.

ALTERNATE MEMBER BOB COOK: One of the - one of the reasons for - for lost-and-unaccounted-for water is the fact that we have deferred maintenance issues.

What is the - the estimated cost of our deferred maintenance budget, and how does that compare to our annual capital improvement plan for water?

MR. AVERY: We talked about that a little bit in the first part of July. But, essentially, we think that we could, you know, readily double our CAP and try to deal with it, so another \$10 or \$20 million a year.

The question is in terms of conservation: How much do you get in return for spending the - the dollars? And we're trying now to spend the money in the most efficient places possible. One of those is meters, in making sure that we replace meters because, as they become older, they - they dial down in favor of the customer and we think that . . . unfortunately. So, one of the - we're - we're trying to make prudent infrastructure investments to try to reduce lost-and-unaccounted-for water, and that's a significant component of the 2008 Update to the Plan.

ALTERNATE MEMBER BOB COOK: Okay. The CAGR is - is undergoing a process now that may - may change some of the rules. Have you included that - anticipated any rule changes in your scenarios -

MR. AVERY: No.

ALTERNATE MEMBER BOB COOK: - with a - with a - with - with reference to the way new developments are permitted?

MR. AVERY: We - we haven't.

ALTERNATE MEMBER BOB COOK: Okay. My last question is really - 2010 census is coming up -

VICE-CHAIRMAN MARCELINO FLORES: That's -

ALTERNATE MEMBER BOB COOK: Huh?

VICE-CHAIRMAN MARCELINO FLORES: That's a third question. I thought you said two.

MEMBER JOHN CARLSON: You said two.

VICE-CHAIRMAN MARCELINO FLORES: Go ahead.

ALTERNATE MEMBER BOB COOK: Okay.

VICE-CHAIRMAN MARCELINO FLORES: Please - brief -

ALTERNATE MEMBER BOB COOK: 2010 census is coming up in a year; it's within the - it's within the time period of this

-

MR. AVERY: Yeah.

ALTERNATE MEMBER BOB COOK: - particular study. Are you going to recalibrate your population projections based on those counts?

MR. AVERY: When the 2010 census comes out, it will affect Pima County's TAZ projections. When those TAZ projections change, that will affect our population data.

ALTERNATE MEMBER BOB COOK: Okay. Thank you.

VICE-CHAIRMAN MARCELINO FLORES: Thank you, Bob. Other questions from the public? And - and then we still have the Call to the Audience to go to, so are there any questions first?

TRACY WILLIAMS: Yeah, one question. Thank you. Mr. Chair, I'm interested in Chris' response to the Painted Hills and Tumamock area. I've been privileged to receive an email from Council Member Regina Romero saying, essentially - and this is a lay person's interpretation - we're not going to give the developer the water for that land. We're going to try to use our City water as a leverage to not give 'em water. Is that really going to work so that we can preserve that land as it was set aside in the Pima County bond election years ago? So, I'm seeing a lot of neighbors out in the Tucson Mountain very encouraged by her effort to preserve that land, but knowing what I know about water and the CAGRD, it doesn't seem like that is actually going to happen. Could you explain what's going on there, please?

MR. AVERY: From Tucson Water's perspective - we have seen a copy of the letter from the Ward 1 Office, and from Tucson Water's perspective, what the - Council Member Romero was asking for is that water usage be - be conforming with, in this case, the City's General Plan so that when the City's General Plan designates areas as open space, or having large habitat potential, that the water usage patterns or predictions, the transportation patterns and predictions also track that.

And you're seeing some of that start to happen with Pima County's Conservation Land System. We're working within the City on an Update to our General Plan, and I read Council Romero's Memo as requesting, at least in part, that we, as a City, synchronize our General Plan with our Water Resources Portfolio, our transportation portfolio, our neighborhood portfolio, et cetera. And from - from my perspective being able

to integrate water usage and the General Plan in - in some concerted planning effort is one of the ways to deal with some of the issues that are posed by the City limits Obligated Area issued that we've talked about several times during this process.

And I think that there's some role for this Committee to play in that sort of ongoing effort to try to integrate the County's Comprehensive Plan, the City's General Plan, and these particular resources. That's not an exact answer to your question, Tracy, but it's as close as I'm going to get in a public forum.

VICE-CHAIRMAN MARCELINO FLORES: Yeah. Okay. So, how many questions do we have our there remaining? Just one question each, please.

COLETTE ALTAFFER: Okay. I'm going - I'm going to try and roll all this into one question.

VICE-CHAIRMAN MARCELINO FLORES: Okay.

COLETTE ALTAFFER: Bear with me. I'm just sort of -

VICE-CHAIRMAN MARCELINO FLORES: Can you state your name?

COLETTE ALTAFFER: This is Colette - Colette Altaffer.

Just sort of some red flags that are showing up in some of this stuff. When we talk about water conservation, no mention is made of the fact that our entire sewer system is operating at a water deficient of 4.9 million gallons, and every time we take potable water - every time we take gray water out, we're substituting potable water back in. My understanding, of course, is that that is based in part on the way we designed the system. We designed it so that it would have a certain amount of water and work in conjunction with gravity, so we can't really change that, and I didn't see that mentioned.

As far as replenishment goes, we have been told by some of the people from CAGR D that they have more replenishment obligations today than they have water to fill those obligations, and I didn't see that mentioned.

And then, as far as the Assured Water Supply designation in the Third Management Plan, there is a footnote indicating four communities throughout Arizona did not meet their Assured Water Supply designation, one of which was Marana, and the response was to allow Marana to continue to grow - or extend the Plan for another ten years. So, saying that that somehow is a break didn't seem to work there.

And it seems, finally, the big Achilles heel in all of this are the two dams that form Lake Meads (sic) and Lake Powell, and we all know that dams eventually silt up and, eventually, we can't use them. And what I'd like to know - and see whether we can find this information - is: Do we know how

much longer we have on those dams and, if those dams were to go tomorrow, what kind of a population could we support?

MR. AVERY: Okay. I'll try to get those questions in order, and I think I'm - I might miss one in the middle. But, in terms of the - the sewer flushing program from Pima County, I can say that 4.9 million gallons is about 15 acre-feet, and we are trying to work with Pima County to try to get a reclaimed connection to their service yards so that even if you can't ensure that all of the water that Pima County uses is potable or is reclaimed that at least some of it is.

Second, in terms of the CAGR, I think - well, as I talked to you about before, I think it's more likely that the CAGR water will become very expensive than that it will disappear in any substantial way, because some of the economics that we talked about earlier about how municipal and industrial interests generate large economic returns per volume of water delivered compared to other users of water in - in Arizona.

In terms of Lake Powell and - and Lake Mead in the silting, again, one of the benefits of doing Scenario Planning and Long-Range Planning, and doing it on an almost continuous basis is that when anomalies start to show up, like storage capacity in those Colorado River reservoirs, you can adapt your Plan to deal with it.

And, finally, in - in the absolute worst-case scenario, dam failure on the Colorado River, or some other dramatic catastrophe on the Colorado River, I'd like to remind the Committee and the public that the City of Tucson and, indeed, most of the water providers in the Tucson area still have access to a relatively clean, relatively abundant, relatively secure source of groundwater.

Now, you don't want to do that forever, but in the case of - of - of a critical situation on the Colorado River, you could certainly use those groundwater supplies that we've been trying to preserve as a bridge toward whatever uncertain future might be out there. And, again, that's what Scenario Planning allows you to do, and that's what reducing groundwater pumping today allows you to do in terms of preparing for the future.

Did I get all your questions? Marana.

VICE-CHAIRMAN MARCELINO FLORES: Marana.

MR. AVERY: I think that the point is with the Assured Water Supply rules is that if you ask someone from Prescott whether the Assured Water Supply rule consequences are severe, they will tell you that they are. There the - the new subdivisions in Prescott have dropped dramatically since their designation was essentially revoked for that AMA, and there was an effluent credit sale out of Prescott largely intended to

provide a renewable source of water for some new development that - that went for - I think it was \$67 million for a few thousand acre-feet. Yeah, it - it was a fairly astronomical sum, again, leading to kind of a general conclusion that, as water becomes scarce, it's more likely that the price goes up dramatically before it goes out - away altogether.

VICE-CHAIRMAN MARCELINO FLORES: One last question from the public, and then we'll move into Call to the Audience. Call to the Audience is limited to three minutes. We have one speaker card thus far. If there are any others, please (inaudible).

CINDY BREWER: Okay. Thank you. My name is Cindy Brewer, and I have a three-part question in the area of water harvesting and conservation. One, I - I attended a wonderful presentation of Sustainable Tucson which, I understand, you - most of you people also heard from a retired couple who moved here five years ago that used to work with the Museum of Natural History in New York and then traveled the world. And, when they came back, they built a home with a 5,000-square-foot roof and a - and a 26,000-gallon cistern. Their demonstration proved to me that enough - oh, so with their 26,000-gallon tank, they had enough water to have for their own personal needs, for their swimming pool, for their garden, and it even overflowed at times. So, to me it's quite fascinating; it essentially says that all of us, under the skies of Tucson, receive enough water wherever we are, at any given year, to sustain our own needs.

So, my question in - in number one has to do with: Does this inspire the City of Tucson in any way to dream and consider about what comes to us naturally along those lines?

And, number two, you know, I had a conversation about cisterns with Mayor Walkup sometime back and he, essentially, said, "Well, the City of Tucson is a cistern" and, you know, all this water that comes to Tucson, and making it sound like it just could be harvested in this cistern.

And I've since learned that really only - and you - you can tell me - maybe from you people I learned this - I'm not sure - but that only 10% of that water are we able to capture and 90% of it flows through to God only knows where, maybe you know where. I don't know where. And what can be done to harvest this water?

You know, an engineer I knew - I know who recently moved here from Alaska talks about, you know, creating dams along some of these arroyos that we have to save the water there. I understand Reid Golf Course has a retention basin to prevent flooding in that Arroyo Chico Neighborhood, et cetera.

And so could we possibly do more to retain the water in the rivers? Number two.

And, number three, I, as a citizen, I don't, you know, feel that I'm hearing so much about water conservation on a daily basis, you know, how I take my showers. How I water my garden. Am I using effluent water from my washing machine, and all those kinds of things. And it seems to me a - a lot more could be done, unless, you know, I'm just walking through the world, you know, missing whatever's being done here. So, I would like to hear a lot more about the subject of water conservation.

MR. AVERY: You're going to get that opportunity in a couple weeks when we talk about water conservation in some detail.

In terms of rainwater harvesting, I think the answer is that rainwater harvesting has become more prominent in recent years in - and the City of Tucson, and other water providers in the region, are a lot more conversant with rainwater harvesting issues now than we were a decade ago, and - and we have included in a previous presentation the fact that we think rainwater harvesting will be an important component of our water supply future in this town.

The example of - of living uniquely off of rainwater without potable water supplies is yet another illustration of the fact that some of the water resource issues that we have are susceptible to being solved with the application of a lot more money. If you look at the - the cost for those rainwater harvesting systems, amortize it in a mortgage, et cetera, those rainwater harvesting systems, you know, could cost somewhere in the neighborhood of several hundred dollars per month in terms of capital costs per - per homeowner.

The City of Tucson's, you know, average residential water bill is somewhere in the neighborhood of \$20 to \$25 a month. So, when you increase the amount of money that you're willing to pay for water supply by order of magnitude, the amount of options that are available to you in terms of solving the problem also probably increase by an order of magnitude or more.

And, finally, in terms of conservation, one of the outcomes of the 2004 planning process was the recognition that there needed to be increased emphasis placed on conservation, and you're starting to see that in the 2008 Update and in the new Water Conservation Programs that were approved last spring by the Mayor and Council, the conservation surcharge that was approved by the Mayor and Council, and in the rainwater and gray water harvesting ordinances that the City just adopted, or is in the process of adopting shortly.

VICE-CHAIRMAN MARCELINO FLORES: Okay. We're going to move to Call to the Audience. But, before we do that, can we please give a round of applause for our presenters?

(Applause.)

VICE-CHAIRMAN MARCELINO FLORES: Also, Committee members, thank you for - for letting me go over. This is my first rodeo.

CALL TO THE AUDIENCE

VICE-CHAIRMAN MARCELINO FLORES: Call to the Audience, we have Tracy Williams, and it's a subject regarding privatization of water.

To the extent possible, can you limit your - your time to three minutes or so?

TRACY WILLIAMS: Yes, Mr. Chair. My name is Tracy Williams, and I'm a lifetime resident of Tucson. I've got a couple of housekeeping issues this evening, and one is I'm really glad to see everyone here in light of the national issues going on; it shows me how critically important this is to Tucson, and I'm glad I wasn't the only one here tonight.

Reading the newspaper, I see that Pima County has a sewer cam that is in its three - third year of visiting the sewers and taking pictures; it's a ten-year program and Mr. John Warner is the Director of Wastewater Reclamation Department's Conveyance whatever Division.

I think we need to know what's going on with the camera. So, I'd like to have that put up on the board, please, Melaney, so that we can get an update of what we are seeing with the sewer cam. And if you could, please, put Colette's question regarding the dams and the issues on that infrastructure, since we go back to our original mission here, which is infrastructure, and I think the dam issue deserves some attention so we know how those structures are doing.

Also, for Chris, for your magic water and the same newspaper, same page, we find that Mars finds more signs of water. So, add Mars, Chris, to your list of magic water. And I'd like to see Larry Dozier up there with his dozers harvesting it and shipping it back. So, that's a cartoon for Fitzsimmons, if anybody knows Fitzsimmons for me.

Regarding the privatization issue. I receive a lot of emails from people all over this region saying, "What's going on with these meetings you're going to, Tracy? And here's some emails about what's happening in the rest of the country." And I'm very concerned about this trend I'm seeing with the comments, which is water, and that's a resource that we all have for our - our life. And I would like to suggest that this

Committee make this assumption that we are not leaning towards the planning and eventual privatization of water, and I hope that becomes one of your recommendations that: No way. We do not want to give up our control of this natural resource to any privates, and that also hooks us up with the idea of the regionalization idea. And I hope we include that as a recommendation that we do not regionalize water, and that finishes me for tonight.

VICE-CHAIRMAN MARCELINO FLORES: Thank you, Tracy. Thank you everyone for your patience.

I've received one more Call to the Audience request. Tres English, demand versus need.

TRES ENGLISH: Thank you, Mr. Chairman. I just wanted to make a comment that - from my perspective. The - the basic presumption underlying, basically, the whole work of this Committee is deeply flawed at a very important level, and it relates specifically to the discussion tonight. All the discussion tonight is about demand for water. Demand is an economic term; it is a combination need or want, combined with money.

There is another word that I have never heard used in any of our discussion of water and that's: What is need? What do we need our water for? If we don't need our water for anything, we can conserve - you know, 165, 150 gallons per person per day are large numbers; I mean, that's a lot of water. If we don't need it for anything. If we don't need it for consumption of any - of any purpose, we could probably decrease that by a factor of ten without any real technical problems.

So, underlying all of the discussion that we have here, is an assumption that the need for water really isn't - doesn't exist. What we have is demand, and we can reduce that demand by conservation measures, by increasing the amount we charge for water, a variety of things of that nature.

From my perspective, we have desperate needs for water, which may actually mean that our per-capita water use needs to increase, not decrease because, as I look at it, we need to provide at least a basic subsistence of food supply here in Tucson; that's a consumptive water use. If we are going to provide emergency food, basic food supplies, things of that nature. If we are going to have industries that are capable of meeting some of our corn, industrial needs, and other things of that nature, we may not be able to reduce water per-capita. We may actually need to increase it.

So, at some point, I would really like to hear a discussion of what are our needs for water? Because I have never heard a discussion of that.

VICE-CHAIRMAN MARCELINO FLORES: Thank you. Any other members with a Call to the Audience?

(No response.)

VICE-CHAIRMAN MARCELINO FLORES: Is there a motion to adjourn?

UNIDENTIFIED MEMBER: Yes, there is.

VICE-CHAIRMAN MARCELINO FLORES: Thank you guys for

. . .

(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Call to the Audience) of the City/County Water & Wastewater Study Oversight Committee Meeting held on October 2, 2008.

Transcription completed: October 13, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF OCTOBER 8, 2008

List of Presenters:

- 1. Melaney Seacat, Regional Wastewater Reclamation Department*
- 2. Dennis Rule, Strategic Planning Administrator*
- 3. Mitch Basefsky, Public Information Officer*

**Presenter #1:
Melaney Seacat, Regional
Wastewater Reclamation
Department: City/County Water
Conservation Efforts**

CHAIRMAN JIM BARRY: All right. Let's move on to presentations. We're going to concentrate on Conservation Efforts. We don't have anybody from the County, but Melaney is going to give a brief overview of the County, and then we will - we will turn it over to the City.

MS. SEACAT: Thank you, and good evening, Committee and members of the public. I do apologize that we don't have a water conservation expert from the County. There was a last-minute change in our designated speaker for tonight.

I did speak to a number of County experts and gathered up some information for the Committee. A one-page Summary Sheet that highlights the key areas of emphasis and water conservation in the County is out on the table for the public and is here on your table for the Committee along with a packet of information with some handouts that give you a little bit more information.

I'm just going to go over this real briefly. Although I was a Water Conservation Specialist in a previous life for Tucson Water, I have not worked in water conservation in the County. So, I am not the expert. If you have questions, or you'd like to have additional presentation from any of the people that I talked to, we can certainly arrange that.

So, although the County does not supply domestic water to the general public, we do promote water conservation in many ways, and the handout really covers several different ways in which we promote water conservation. One of them being in the policy area, and I'll talk about the sustainability resolution; another is through regulations; and another is through projects, demonstration projects, recharge projects, and also partnerships within the community.

Speaking to the Pima County Resolution on Sustainability, this was adopted in May of 2007, unanimously, by the Board of Supervisors, and it establishes a series of far-reaching sustainability initiatives, and many of them address water conservation. They cover a variety of issues: Green building, renewable energy, alternative fuels, waste reduction. But, specifically, relative to water conservation and management, it calls for reducing water use in all County facilities, 15% by 2025; it calls for doubling the number of County parks served by reclaimed water by 2018, so in ten years; and, thirdly, maximizing County water resource assets, including groundwater rights, surface water rights, and effluent to sustain and protect natural environments.

To implement the Resolution, the County formed teams made up of representatives from a range of disciplines and departments and prepared a Sustainable Action Plan for County operations. This was completed in 2008 and it includes something, like, 30 separate actions to promote water conservation and protect natural resources. I do know that the Action Plan is focused primarily on County facilities; it includes guiding principles, and it includes a number of success indicators, which are precise measurable objectives for achieving the water conservation goals. And you can go to www.pima.gov for both the Resolution and the Action Plan.

Moving on then to the Water Conservation Regulations, the statutory requirements. Back in 2000, as many of you know, Growing Smarter Plus legislation was passed that requires jurisdictions above a certain size, which includes the County, to have a water resource element that consider water resource impacts when approving land use plans. So, this was kind of a seminal piece of legislation.

And, in 2007, the Pima County Board of Supervisors adopted an updated water resource element to the Regional Comprehensive Plan Policy. This is online, so I'm not going to go into detail, but this is a pretty progressive piece of policy that integrates land use and water resource planning by requiring Comprehensive Plan Amendments that are greater than four acres and rezoning applications to include a water demand and supply assessment, and also water conservation measures; it allows the Board of Supervisors and Pima County Planning and Zoning Commission to fully consider the water resource impacts of new development before major land use changes are approved.

And then, in 2007, the Board also adopted a Drought Response Plan and Water Wasting Ordinance. I want to mention the Staff people in the County that helped identify all of these. Kathy Chavez worked on the Drought Response Plan, and she 's a

point person for that, and Tedra Fox is the Sustainability Manager, and she did the work on the Sustainability Action Plan.

Then, in 2006, drilling into the actual Codes, the Landscape Code and the Plumbing and Residential Codes were all amended to include a variety of water conservation measures, including new construction to have separate reclaimed-ready irrigation and plumbing and irrigation with seasonal adjustment to rain sensors, restrictions on water fountains and water features, allowing turf only for functional purposes, use of waterless urinals and automatic faucets in commercial buildings, sub-water meters in multifamily construction, pool covers et cetera. Websites where you can find those Codes are listed in your handout.

And, in 2006, the Board also adopted a change to the Golf Course Zone Ordinance prohibiting use of groundwater on new golf courses.

Moving on to the project arena, Pima County has statutory authority for floodplain management under the Regional Flood Control District and, in that role, they can build large-scale urban water harvesting projects to capture storm water. An example of one of these is the Kino Environmental Restoration Project, which is a 120-acre flood control basin that captures urban storm water and uses it to support riparian habitat, and it also is used to irrigate the Kino Sports Complex. They also work with other jurisdictions to improve smaller-scale water harvesting opportunities to decrease the need for irrigation, and they also have a Recharge Program, and that includes construction of Recharge Facilities for CAP and effluent.

And, last but not least, we are involved with Water Casa and Tucson Water, and a variety of community outreach partnerships. We participate in events, Project Wet, Earth Day, et cetera, et cetera. We also fund research. Staff participates on Tucson Water's Community Task Force and they participate on ours. So, there's a lot of collaboration in the area of water conservation, and that's essentially it. Thank you.

CHAIRMAN JIM BARRY: Questions?

MEMBER JOHN CARLSON: Yeah. Under your third - or second white bullet, 2007, first dark bullet at the end, this allows the BOS and PC Planning, et cetera, to fully consider water resource impacts of new development before major land use changes are approved.

Are there any quantifying things that allows them to deny it? Well, I mean, what's the criteria?

MS. SEACAT: That's attached in your packet, the specifics are attached, and I would prefer to defer to the technical experts. There is a water demand calculator.

Basically, I'll tell you in a nutshell that the requirements for the Comprehensive Plan Amendments are more general than for the rezoning and, in the Comp Plan Amendment, they're looking at five different issues, they're looking at depth-to-groundwater and groundwater trend data. They're looking at renewable supplies in water service. They're looking at proximity to subsidence areas, and proximity to groundwater dependent ecosystems, and things of that nature.

And then, when you get into the rezoning, if there's a site analysis required, there's a much more specific calculation that's required: Water use studies and assessments, hydrologic impact analysis, those kinds of things, and there is a demand calculator at ADWR that is being used for this. The actual implementation of this - the standards for implementing this - are under development, and Pima County Development Services, Carla Blackwell is the point person for that.

MEMBER JOHN CARLSON: Well, I, obviously, approve and think they should be looking into these thing but I'm wondering, from a legal standpoint, what authority they have, at what point to deny, or to require, et cetera, et cetera?

MEMBER BRUCE GUNGLE: Whenever they feel like it.

MEMBER JOHN CARLSON: Yeah, well, that gets pre-arbitrary and capricious, and that's -

MS. SEACAT: This is a tool to raise awareness about water resource impacts that decision-makers can then consider in their decision, essentially.

MEMBER BRUCE GUNGLE: They can approve or deny on rezoning on anything they want.

MEMBER JOHN CARLSON: Well, then you have no recourse to the Courts?

MEMBER BRUCE GUNGLE: If it is arbitrary and capricious you do, but that's pretty difficult (inaudible).

MEMBER JOHN CARLSON: Not in my mind, but I'm sure the Judge's mind can be . . .

MEMBER BONNIE POULOS: Melaney?

CHAIRMAN JIM BARRY: Bonnie?

MEMBER BONNIE POULOS: Just a point of clarification, since I'm on the Planning and Zoning Commission. It seems to me, although information is gathered and things are being worked on right now, to my understanding, the resolution that was passed really doesn't have any concrete paths for politicians or decision-makers to follow if certain criteria are met; is that correct?

MS. SEACAT: I'll need to defer that, yeah.

MEMBER BRUCE GUNGLE: What this does is it requires that the people who want to develop the parcel or change the rezoning or Comp Plan designation to do these studies so that this information's available; previously, this information was not available. So, it's basically filling a data gap; it's not necessarily a method for decision-making, ultimate decision-making.

CHAIRMAN JIM BARRY: As we get into Phase II, it strikes me as that's an issue that we ought to address then. If there are changes that we want to recommend to these Plans, and whatnot, I envision getting much more information about this for Phase II.

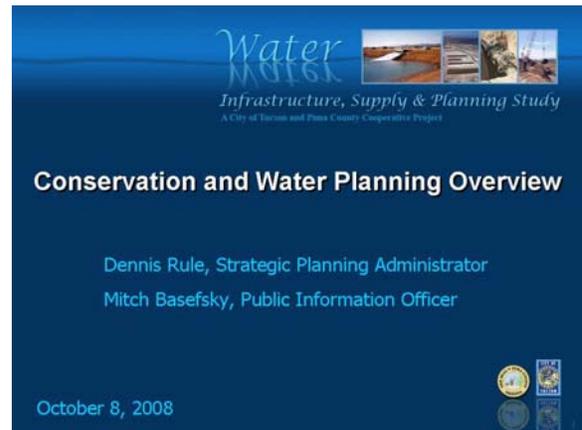
Any other questions for Melaney? Anybody from the audience?

(No response.)

**Presenter #2:
DENNIS RULE, STRATEGIC
PLANNING ADMINISTRATOR:
CITY/COUNTY WATER CONSERVATION
EFFORTS**

CHAIRMAN JIM BARRY: Okay. Let's move to the City. And we've got Dennis Rule, and is Mitch here, too? Mitch Basefsky? Okay. Dennis? Thank you, Melaney.

MR. RULE: Thank you. My name is Dennis Rule, and I do strategic planning for Tucson Water. I haven't had the pleasure of addressing this group before. So, just to let you know, I'm involved in a lot of the water resources management issues for the utility, a lot of the water rights issues, the regulatory issues with the Department of Water Resources. I spend a great deal of my time interacting with the Department of Water Resources, the Central Arizona Project, the Arizona Water Banking Authority, and the Central Arizona Groundwater Replenishment District on behalf of Tucson Water. So, on any given week, you know, there's a high probability that I spend at least half of my time in Phoenix, and then on about half of your Committee meetings about this



time, I'm somewhere around Casa Grande on my way back home, so I'm pleased to be here tonight.

So, I'm going to talk about the water conservation issues that we look at in kind of broad, general planning concept as we look at the kinds of program that we want to target and that we want to implement, and what they mean within the context of our Service Area, and Mitch will come in after me and will talk more specifically about the programs that we do have in place.

But, first, just to kind of set the background a little bit, and I think you heard this at the very first meeting, Tucson Water has been involved in water conservation efforts for a very long time. In fact, in 1912, Tucson had a \$50 fine for water waste, which, again, in 2000-dollar equivalents is the equivalent of \$1,000. I'd like to see us try to implement that kind of a fine for water waste today. I think it would be a very interesting process.

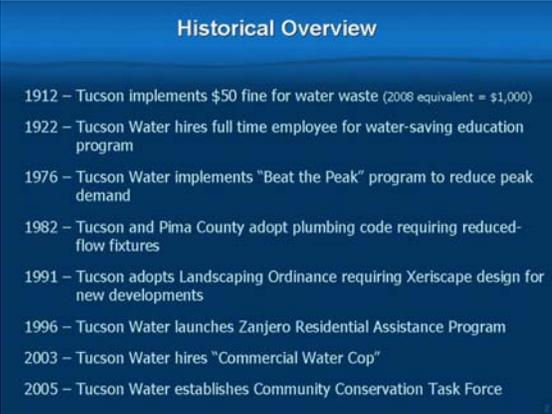
In 1922 was when the utility hired it's first full-time water conservation person. And we're just going to hit some of the highlights here, obviously, these are not all of the aspects of our water conservation history.

In 1976, we implemented the infamous "Beat the Peak" Program, which was really a Peak Management Program. What really drove that program to begin with was problems in meeting peak demand during the summertime in infrastructure delivery capacity problems. But, it was a very successful program, and it actually resulted in significant reductions in our overall gallons per-capita-per-day usage within our Service Area.

In 1982, both Tucson and Pima County adopted low-flow plumbing ordinances that required installation of low-flow fixtures in new construction. This is over a decade prior to the Federal Government implementing these kinds of Plumbing Codes throughout the country.

In 1991, we adopted the Xeriscape Landscape Ordinance.

In 1996, we launched the Zanjero Residential Assistance Program, which is a group of employees that will go out to residences and do water audits; will inspect irrigation systems; will look for leaks on the systems; will give residents tips on how to reduce water usage; it's been a very, very well-received popular program.



Historical Overview	
1912	Tucson implements \$50 fine for water waste (2008 equivalent = \$1,000)
1922	Tucson Water hires full time employee for water-saving education program
1976	Tucson Water implements "Beat the Peak" program to reduce peak demand
1982	Tucson and Pima County adopt plumbing code requiring reduced-flow fixtures
1991	Tucson adopts Landscaping Ordinance requiring Xeriscape design for new developments
1996	Tucson Water launches Zanjero Residential Assistance Program
2003	Tucson Water hires "Commercial Water Cop"
2005	Tucson Water establishes Community Conservation Task Force

In 2003, we hired our first commercial water cop. This isn't the first water cop that we had, but this was our second one that then allowed this individual to focus specifically on commercial properties. And we'll talk a little bit more about the characteristics of our Service Area in that regard.

And, in 2005, we established the Community Conservation Task Force and Mitch will discuss that in much more detail later.

But, just in general, as far as planning for our Conservation Programs, in the broad perspective of how we look at these things, some of the factors that we look at, basically, across the industry, as well as specifically within Tucson Water, are issues of local



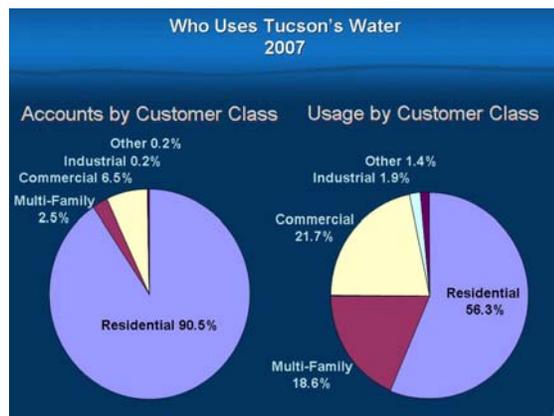
Conservation Program Development

Factors to Consider

- Local Climate
- Service area characteristics
- Water supply characteristics
- Customer response
- Regulatory requirements

climate. I think we're all familiar with Tucson's local climate, you know, very high summer temperature, with very high water demand peaks in the summertime. But, our climate also means that we have, essentially, a year-round growing season. So, compared to a lot of other communities in higher, cooler elevations, where they see their outdoor water demand going to practically zero, or practically zero in the wintertime, Tucson still has a fairly significant outdoor water demand even in the middle of the winter. So, these are some of the kinds of things that we look at that other utilities look at as those, you know, the impact of the climate and on the pattern of use.

You know, again, here the summer monsoon, this past summer, we saw very significant reductions in our water demand.



In the wintertime, we can see actually very significant increases in our water demand during the winter if it is a warm, dry winter, as opposed to some of the cooler, wetter winters that we can have in this region.

We look at our Service Area characteristics, questions of how much industrial use that you have within the utility. You could have a very small Service Area, with a very large industrial use, an economic use of water within that Service Area, and that's going to change your calculations of gallons per-capita-per-day usage within the area.

You look at issues of how much residential; how much commercial. What's the age of the housing stock? Do you have a lot of older houses that have higher-flow fixtures? A lot of newer houses that have lower-flow fixtures? - those kinds of characteristics for the Service Area.

We look at the water supply characteristics. You know, some communities in Colorado, say, in particular, what they have, as far as the water supply, is they have a snow-melt-driven system so that when the spring runoff occurs, all the water that they're going to get that season goes into the reservoirs, and that's what they have to last them until the next runoff season.

In Tucson, we have something like that with the use of the CAP water, Colorado River Water, we're attached to the runoff, and the flows in the Colorado River, but we also have a system where there's up to 60 million acre-feet of storage behind two very large dams in this system. Within the CAP itself, we also have lower-priority users of CAP water that get reduced in their water usage in - in - in conditions of shortage before the City's and the Native American communities get reduced. So, all of these kinds of issues of, you know, how does the water come?

We also have an advantage now that we've constructed our recharge facilities, and we have excess capacity for storing water in those recharge facilities. We also have the capacity to be able to take extra water, when it is available to us, and store it underground and then be able to recover it in the future. And, again those kinds of considerations are some of the things that we look at as we look at targeting our Conservation Programs and what kind of effect and what kind of emphasis that we want to put on that.

One of the issues that you have to look at is customer response, you know. How likely is it that the customers are actually going to respond and implement these programs? That's where hard-wired-type programs, where you're actually putting in low-flow fixtures, where you're not depending upon the customer to remember to change their irrigation timer, or to turn the faucet off when they're brushing their teeth but, you know, based on their action, they're actually reducing their consumption no matter what they do.

And then also we have to look at regulatory requirements. And, in 1980, the State of Arizona implemented the Groundwater Management Act and, within the Tucson AMA, they began programs for conservation requirements for water utilities within the AMA, including at least starting off with a total gallon per-capita-per-day program, which is now converted to what's really referred to as a "Best Management Practices

Program" that we're required to comply with and implement. In actuality, our current water usage of about 150 gallons per-capita-per-day, total potable usage, or less than 100 gallons per-capita-per-day for indoor single-family residential, or single-family residential usage, is much lower than any of the total gallon per-capita-per-day requirements that the State of Arizona might implement for our Service Area, so we're very proud of where we are.

Again, going a little bit further, you've seen these before, looking at the Service Area characteristics, we really pay attention to the fact that 90% of our customers are residential customers, and 56% of our total water use is within the residential sector. So, looking at this, obviously, the residential sector is where you can target a lot of your programs, because you've got a lot of use in those areas.

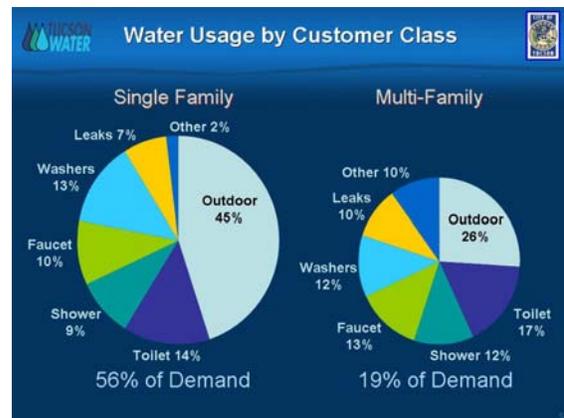
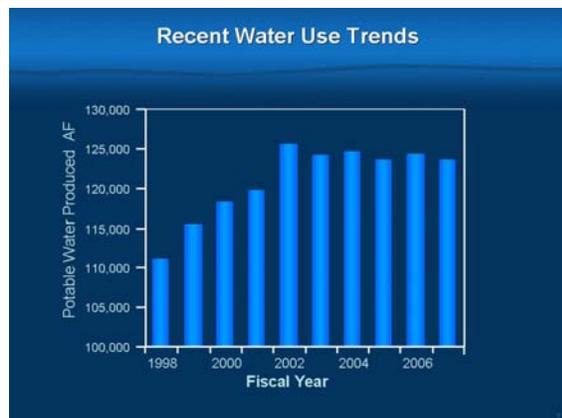
Looking a little further in it, in single-family residential, 56% of the total demand, 45% of that is outdoor.



In multifamily, 26% of that is outdoor. And then even in commercial and industrial, 35% of that is outdoor usage. In each of these, bathroom usage is, perhaps, the next highest so, again, looking at programs where you're implementing low-flow toilet replacement, that kind of program, that's where we can really see some real effective use of our

conservation programs.

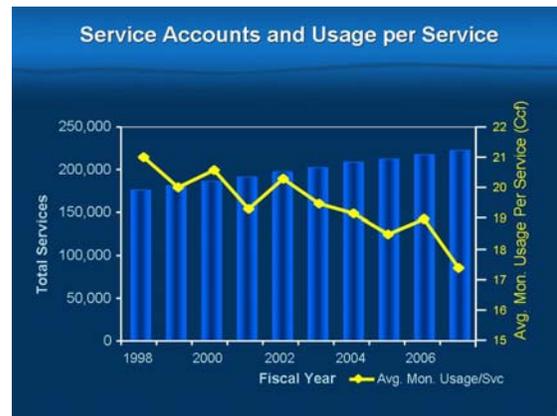
And then, again, I think this is a slide that you've seen. What we have seen in



particular over the last several years is we've seen a real flattening off, or a tapering off, of our total water usage within our Service Area, in spite of the fact that we are continuing to add customer accounts. Thank you. Part of this is, obviously,

because of drought awareness within our customers. You'll see that the tapering off begins around 2002, which was the really severe drought year in the west. I think part of it is also due to new housing stock going in. If you look at the new subdivisions that are going in, the lots are much smaller, there are virtually no lots that have grass in the backyard and, essentially, you get a stick in the front yard that doesn't use very much water. So, we're seeing this very significant trend right now of a flattening of our demand, in spite of an increase in customer accounts.

Again, this chart shows that we do have an increase in service accounts but, again, what we've seen over about the last decade is we've seen a very significant reduction in the average monthly usage per account within our Service Area. And what you're seeing here on the right-hand side is a measurement in Ccf, which is a 100 cubic feet of water. Each Ccf is about 700 gallons of water. You're seeing more than a four Ccf reduction over this time period. So, this represents approximately 3,000 gallons per month reduction per connection within our Service Area over this time.



So, Mitch is going to talk a little bit more specifically about the programs that we have that have accomplished this kind of reduction. Thank you.

Presenter #3:
MITCH BASEFSKY, PUBLIC INFORMATION
OFFICER: CITY/COUNTY WATER
CONSERVATION EFFORTS

Current Conservation Programs		
Level 1	General Public Information	Beat the Peak, bill inserts, general advertising/promotion
Level 2	Education and Training	WaterSmart Workshops, SmartScape Professionals, Classroom Programs
Level 3	Direct Assistance	Zanjero Program, Commercial Audits
Level 4	Incentives	Rebate Programs, Rate Structure
Level 5	Ordinances	Water Waste, Plumbing Codes, Xeriscape Landscaping, Mandatory Conservation, Rainwater Harvesting, Greywater Stub-outs, Drought Response

MR. BASEFSKY: Thank you very much for the opportunity to (inaudible) the Conservation Programs that we're very proud of at Tucson Water. As Dennis has given you the impacts of our Conservation Programs, I'm going to take you through some of the Conservation Programs that we currently have, and then also looking out into the future.

We tend to look at Conservation Programs - first of all, the philosophy behind our Conservation Programs is that we would have Conservation Programs that the people who pay for those programs, the ratepayers, the classes that pay for those programs, would derive benefit from those programs. So, we try and have both broad programs that reach the general public, reach our residential customers - as Dennis mentioned about 90% of our customer base - but, also targeted programs that specifically benefit certain areas, certain business, businesses, commercial properties, multifamily, those kind of things.

And we kind of have a hierarchy of how we look at conservation. Level 1, general public information. You can think of this as we ask you to conserve. Tucson Water asks you to conserve. And these are the kind of public information programs, like Beat the Peak, like the Conservation Corner that we always have in our monthly bill inserts, general advertisements and promotions. We do different types of promotions different times a year. But, these are what we're out in the community - giving people information, asking them to conserve.

Level 2, the next level up, is where we actually train you or we teach you how to conserve, and these are more formalized programs for the most part. The WaterSmart Workshops are a monthly workshop that we sponsor through the Cooperative Extension Service where people can go in and actually get hands-on training in terms of doing outdoor landscaping; it gives you a way to pick your plant pallets; it gives you a way to design and maintain efficient irrigation systems; how to use a irrigation timer. And we are instituting a class in rainwater harvesting as well.

So, the SmartScape Program is the same kind of thing on the professional level. This is really for the green industry, the landscape industry, where we have people go through - it's a very intensive - nine classes - that when people - when professionals come out of that, they are certified both by us, and they're well on their way to getting certified by the American Landscaper Association, and some other types of associations in that field, to be professionals in terms of designing and maintaining Xeriscapes or desert-adapted landscaping.

And then we have Classroom Programs. These are our schoolroom programs primarily where we have grade-appropriate and age-appropriate activities that we take into the classrooms. They are set up to be an adjunct to the Arizona State Education Standards in Environmental Education; in fact, we work very closely with the teachers and the science coordinators for a variety of the districts within Tucson Water's Service Area.

And those programs, essentially, start at kindergarten, first grade and move all the way up through high school where students are really learning about the importance of not just water conservation, but other water-related aspects, water cycle, water quality, environmental uses of water, those kind of things.

Level 3, that's where we help you to conserve. So, we have asked you to conserve; we've taught you how to conserve; and now we're helping you to conserve. And the Zanjero Program, which Dennis mentioned, is probably our most popular program; it's been around since '96. And when we look at the water use in these homes, there is a reduction in the water use in the homes that have been visited by a Zanjero. Now, depending on what the nature of the home was and what kind of problems they had, that water use savings can be significant. We've seen, in some cases, that water use savings as much as 80 gallons a day from after a Zanjero visit.

So, on the other hand, sometimes we go into houses and people are doing a great job as it is, and maybe all they need is a low-flow fixture, or somebody to help them learn how to maintain their toilet more properly.

And we do the same thing on the commercial side where we will go in and help commercial properties and multifamily properties look at their water-use patterns, look at their irrigation systems, look at their indoor opportunities for greater efficiency.

Then Level 4, we pay you to conserve. Rebate Programs - we had a Toilet Rebate Program back in the late 1980s, early 1990s, primarily driving towards getting people to switch out their old standard toilets. The standard that was set in the '80s - that Dennis mentioned - was for three-and-half gallons per flush or less. The technology evolved, we could get 1.6 gallons per flush or less, and so our Rebate Program back then was primarily designed to convince people who were otherwise getting a toilet to get a low-flow toilet rather than a standard toilet, or to accelerate their changeover from a standard toilet to a low-flow. Now, we have Rebate Programs - 1.6 was made the standard back in 1991, and our Rebate Programs - which I'll talk a little bit more about - are dedicated to those toilets, changing out those - even those 3.5 toilets for something a little bit more efficient than even the 1.6.

And then, of course, our biggest incentive, the biggest payment, the biggest bang for the buck that people get from saving water is the Water Rate Structure, both for commercial/industrial side, and then also on the residential side, we have a conservation overlay on our cost of service. Our rates, like many other utilities, are set by cost of

service. We go out and figure out how much it costs, and then we calculate out how to apportion that, and then an overlay on that is the conservation Rate Structure, which says, "We could charge everybody \$2.50 per Ccf and that would collect all of our revenue that we needed. Instead, if you're conservative and you're a resident and you use less than 12,000 gallons a month, or 15 Ccf, you will pay about \$1.25 per Ccf. On the other hand, if you're a very high user and you're using more than 45 Ccf, you're paying \$9.00 per unit for each of those units. So, it's a very steeply-inclining rate block structure.

On the commercial/industrial side, we have a summer surcharge; it's a tiered charge. They pay a base rate all year round and then, during the summer months, anything they use over that base usage, that winter average, there's an additional charge imposed, a tiered surcharge imposed.

And, finally, ordinances. We make you conserve. We tell you that you need to conserve. The Water Waste Ordinance, we have the water cops that Dennis mentioned. It's illegal to allow water to flow off property or into non-irrigated areas, or to have a controllable leak that you allowed it to extend on.

We also have the Plumbing Codes, which Dennis mentioned, the Xeriscape Landscaping, Mandatory Conservation. We have a Mandatory Conservation Ordinance, Emergency Conservation Ordinance. We've never had to impose that, but it was established in 1994. Just in case we got into a situation where the supplies could not keep up with demand, Mayor and Council would have the authority to declare an emergency and actually prohibit or restrict non-essential water uses.

More recently we have Rainwater Harvesting and Gray Water Stub-Out Ordinances. And then we have the Drought Response Plan - and I do want to spend a little bit of time on that - because that, as a State mandate, all municipalities had to create a Drought Response and Mitigation Plan.

**City of Tucson
Drought Response Plan Stages**

STAGE 1 – Regional Drought

City Actions

- Public Information
- Mandatory Water Audits of City Facilities

Community Actions

- Voluntary Reductions
- Incentives for Efficiency Improvements

August 2009 Long Term Drought Status
See through July 2009
Arizona Drought Preparedness Plan
Monitoring Technical Committee

**City of Tucson
Drought Response Plan**

PLAN ASSUMPTIONS:

- Leadership from City of Tucson
- Address Non-Essential Uses of Water and Identify Efficiency Improvements
- Minimize Impacts to Community
- Work with Large Customers in Advance of Curtailments
- Proactively Educate Customers
- Consider Health and Safety Concerns

Tucson Water and the City of Tucson and others, in partnership with Pima County later on, we came up with a

Drought Response Plan that's, essentially, unique to our Service Area. We have service characteristics, as Dennis was saying, you really have to look at what your Service Area is; what your characteristics are; what your supplies are. So, our Drought Response Plan is driven in a way that's very much different than the Drought Response Plans for, say, Pima County or Oro Valley or Metro Water, because we are directly using Colorado River Water as part of our supply. We're much more aware, and have to be much more aware, of what's going on in the Colorado River Watershed, because if we were to lose access to that it would have a significant effect on us. So, drought on the Colorado River Watershed is important to us.

So, we made some assumptions as went into this planning process. Essentially, we wanted to say that the City of Tucson was going to be the leadership by example. We're going to be the ones that go out there. A lot of times when we're promoting conservation, we get a lot of calls in our office saying, "How come you're asking me to conserve? I've seen the parks doing this, or the police officers doing that, or the Water Department doing the other thing, and you're asking me to conserve?" We really want to have leadership by the City of Tucson, so a lot of the steps that we go through in the Drought Response Plan, the City of Tucson tends to do those steps at one stage earlier than we're asking the general public to do that.

We wanted to address non-essential uses. We really want to preserve that water that we need for essential uses, but there are some efficiency improvements that can happen on both sides. So, we do address some of the efficiency improvements that can happen on the essential uses as well, but we really want our cutbacks to come in the non-essential areas.

We want to minimize the impacts to the community. Obviously, drought's important, but we want to make sure that we're protecting our citizens as best as possible. We work with large customers in advance of curtailments. We have multifamily and commercial customers who use an awful lot of water. As Dennis mentioned, they use about 25% of the water in, say, the commercial area, and they're less than 10% of our customer base, and so we want to work with them in advance, so give them an opportunity to do some voluntary things before we actually mandate them.

We want to proactively educate customers; that's something that we do in all of what we do at Tucson Water. We are into proactive communication. And we want to consider health and safety concerns so that any drought mitigation that we do, or restrictions that we do, we want to ensure that we're protecting water uses for health and safety.

So, Stage 1, that's where we are now. That's, essentially, a recognition that we're in a regional drought; that we've been in a long-term drought. This map on the side - you've probably seen it before -- it's put out by the State of Arizona and the University of Arizona and CLEMAS and, essentially, looks at short and long-term drought conditions in the State of Arizona. And we want to be aware that we're in a drought, and so there are things that are appropriate, and one of the most appropriate things is to let people know, "We're in a drought," and not only us but the Colorado River Watershed is in a drought. We've had some good snowfall this year, and fortunately for us, Lake Mead and Lake Powell have gone up slightly because of that, but we're still in a long-term drought and the climatologists continue to tell us that we're probably in a long-term drought. And so one of the things we want to do is let people know that so they can take appropriate voluntary action.

And then we're developing a program to do mandatory water audits of all City facilities. What these water audits do is it's basically a very thorough look at how water is used both indoor and outdoor at all the City-owned properties, and then identifying those areas where efficiencies could be found, and then programming those efficiencies into future budgets. So, it's not just enough to go out and say, "Boy, you know, we should really have no water use - waterless urinals in TCC;" it's another thing to say, "Now the City is going to start budgeting those kinds of things in future years." On the community side, again, awareness of drought should call for voluntary reductions and incentives for efficiency improvements, and I'll get into those incentives.

Stage 2 would be triggered for us, primarily by a declaration of shortage on the Colorado River. You're probably all aware the Colorado River was allocated out to the different states at a time of historic high flows; it's over-allocated. There is a potential over the next few years, if we continue in this long-term drought, that Lake Mead will fall far enough that the water master of the river, in this case the Secretary of the Interior, would declare a drought or a shortage on the Colorado. If that happens, a shortage is declared, it would not immediately impact our ability to import Colorado River Water. What would happen is the lower-priority



**City of Tucson
Drought Response Plan Stages**

STAGE 2 - Declaration of Shortage on the River

City Actions

- Water Use Restrictions
- COT Implementation of measures found during audits

Community Actions

- Mandatory Audits for MF, C/I Facilities
- Irrigation Restrictions for MF, C/I Facilities

**Opportunity: WaterSmart
Businesses may obtain
waivers**

users on the CAP system would be impacted first (municipal users are very high on the priority list for CAP water). And any excess water in the system, water that's not already allocated and used by somebody who has a contract with the CAP, would be cut first. It's one of the reasons why we've accelerated our use of Colorado River Water and we're going to be using our entire allocation of 47 billion gallons, because we want to be in a position if a cutback does come, we don't want any of our water to be considered excess water. We want to be using it actively so that it remains as part of our allocation during a time of shortage.

So, what would we do to address that? Well, there would be water use restrictions facing the City facilities. We would change the way we operate some things. There might be some restrictions in terms of swimming pools, in terms of some of the parks' uses, those kind of things. Then we would start implementing those things found in our water audits. So, if went to Stage 2, we would basically be mandating that those improvements be budgeted for, and accelerated, into the budget process.

On the community side, this is where mandatory audits would be required for multifamily and commercial/industrial properties. You can see on the side over here where it says "Opportunity," those businesses who are doing it voluntarily now, who do it voluntarily before we go to Stage 2 could obtain waivers or some kind, or not have to do the kinds of restrictions that are facing those businesses, commercial properties and apartment complexes, that don't do it voluntarily ahead of time.

And then there would be some irrigation restrictions, probably in the form of setting some kind of water budget, or some restrictions or scheduling of irrigation. So, you can only water based on your, you know, every other day, or every third day, or something like that, based on your address, or whatever it happened to be.

The image is a presentation slide titled "City of Tucson Drought Response Plan Stages". It focuses on "STAGE 3 - Cutback of Tucson's Colorado River Water Allocation". On the left side of the slide, there is a photograph of a long, straight canal or pipeline stretching across a dry, desert landscape. To the right of the photo, the slide lists "City Actions" and "Community Actions".

**City of Tucson
Drought Response Plan Stages**

**STAGE 3 - Cutback of Tucson's Colorado River
Water Allocation**

City Actions

- Restriction on Outdoor Non-Essential Uses
- Mandatory Reductions on All Potable Use

Community Actions

- Restrictions on Outdoor Non-Essential Uses
- Plumbing Retrofit on Resale for All Customer Classes

Stage 3, that's where the cutback on the Colorado and on the CAP system actually hits Tucson, say, a 5% cutback, a 10% cutback. So, we're actually losing water that we import. We're losing the access to our allocation to import that. So, it - obviously, that's much more important to us because then - depending on how much we're actually using of the Colorado, at

the very least, it cuts our ability to store excess Colorado River Water today for use in the future. And, quite possibly, if it happens at a time when we're actively using our entire allocation, it could actually cut back on our ability to use that water for delivery. So, there would be a restriction on all outdoor non-essential uses on the City side, no fountains, swimming pools would be an issue, those kind of things.

Mandatory reductions on potable use, those would be the kinds of things that, again, if you're using potable use to wash off sidewalks, if we're washing cars, if we're doing those kind of things as a City, those kind of things would be restricted, or reduced, or prohibited.

And, finally, on the community side, there would be restrictions, again, on non-essential uses. This might be irrigation schedules even for residential customers, and Plumbing Retrofit on Resale for all customer classes. A Retrofit on Resale Ordinance would be passed, and what that means is that when you sell a property, you're required to bring it up to the current Plumbing Codes with low-flow fixtures. Then other kinds of things that we would require in terms of outdoor irrigation upgrades, smart timers, those kind of things. But, certainly, this would hit a lot of people in the pocketbook. So, again, it's pretty drastic once we get up to Stage 3.

And, finally, Stage 4, this is where we're really losing the ability to serve. We're really getting to the point where the amount of water that we have available to us is starting to bump up against the amount of water that we actually need on a daily basis to meet peak demand or throughout the year. And this would be, essentially, an implementation of that Emergency Conservation Ordinance. We would prohibit outdoor non-essential uses. We would mandate reductions on potable use.

On the community side, we would enforce those provisions, no filling pools, no fountains, no washing sidewalks. There are a number of different aspects of this that are some stages that you can go through. You can, again, do restrictions. We don't want to kill all of our landscapes, but there would be very severe restrictions during this, because this is really when our water supplies - our ability to supply water becomes a threat to public health and safety. So, that's what we're doing; that's our plans.

**City of Tucson
Drought Response Plan Stages**

STAGE 4 – Additional Cutbacks of CAP, Deteriorating Local Conditions

City Actions

- Prohibit Outdoor Non-Essential Uses
- Mandatory Reductions on Potable Use

Community Actions

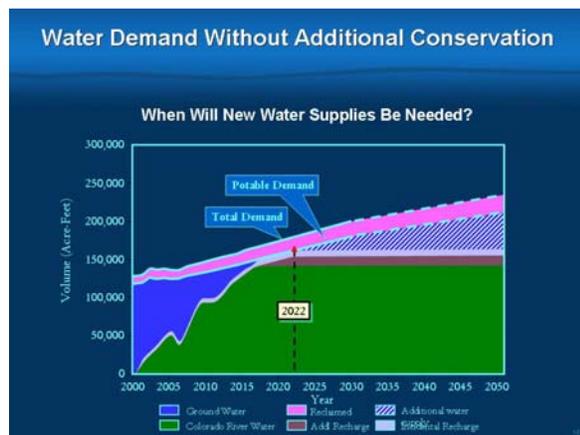
- Enforce Provisions of Emergency Conservation Ordinance



Now, how do we address the future? How do we get to the future? And what are our plans for enhancing our Conservation Program? You've seen this chart before; it's a representation of how we plan to meet water demand in the future. The green here is Colorado River Water, the blue is groundwater, and you can see as we ramp up our use of Colorado River Water, we're ramping down our use of groundwater. The pink or magenta is reclaimed water, and then there's some other recharged water that we have available to us.

If we just stay where we are today, if we were not to implement any new conservation efforts, we were to stay at the gallons per-capita that we use today - and, in fact, we were very conservative in plotting this out in the future - we're using the gallons per-capita that - we know we're lower than that. Our 150 gallons per-capita on the residential side, our 16 gallons per-capita on the reclaimed side, so a total of about 166 gallons per-capita. This curve is actually based on a 177 gallons per-capita-per-day. So, we're planning in a very deliberate manner and using very conservative figures to calculate how much water demand we're going to have.

But, based on this, if we were not to do any more conservation, then we would need to find the next bucket of water in around 15 years. That bucket of water could be a variety of things; it could be additional CAP water; it could be leases from the Native America Nations; it could be additional groundwater importations; it could be effluent that's treated to potable standards and indirectly used through recharge and recovery. There's a variety of different things that we could fill that bucket with. And, in fact, we have some resources that are not represented here that we could use as well, but that next bucket does appear.



If we were to, on the other hand, increase conservation, increase efficiency in the community by about 10% (And we think that's possible) we think that's a very feasible figure. Part of it is going to come from what we do as a utility in becoming more efficient in how we use water in doing the kinds of things with infrastructure replacement and rehabilitation

that allow us to reduce the water that we lose in the system as it flows through the system before it goes through people's meters.

And then on the side of people doing more, our customers doing more, becoming more efficient, new technologies, we think a 10% reduction in demand. And, if we do that, we think we can stretch that need for the next bucket of water an additional ten years into the future. So, this is really kind of the crux of how conservation impacts your water resource planning. Conservation lowers the curve of demand and as you lower the curve of demand, you increase the flexibility of the system. You delay the need for new resources and, in fact, new capital expenditures associated with those resources. So, you actually also prevent having rate shock where you have to have big capital improvements very quickly. You can spread them out over time, and have those future customers pay a higher portion of the cost of those.

How do we get there? Well, Dennis mentioned the Community Conservation Task Force; this was established in 2005. They worked through 2006. We reviewed with them 123 conservation strategies. We consider it the Universe of Conservation Strategies. It's strategies that some other place uses and it's successful somewhere in the world; this is this universe. So, it could be anything from low-flow toilets, to cash for grass programs, to mandated rainwater harvesting, whatever it happens to be.

And we looked at those and we took out of those strategies the ones that would actually have measurable water use reduction. They're primarily technology driven because, if you put in a low-flow toilet, you replace a 3.5 gallon toilet with a 1.3 gallon toilet, you know you're saving 2.2 gallons per flush. You can count on that, nothing can change that, as opposed to education programs, as opposed to demonstration programs where you can see the awareness, we can measure awareness, but we can't actually attribute a gallons-per-capita reduction to awareness programs directly. And so we wanted them to be driven by reductions that could be monitored and measured.

And the Task Force selected 48 strategies for further evaluation; that evaluation, essentially, a cost-benefit analysis; that was done by a consultant that is an expert, an acknowledged expert, by the American Waterworks Association and others, who looks at evaluating the cost of the program, a Rebate Program has a certain cost. Who pays the cost? And what proportion do you pay? Let's use a Toilet Rebate Program. If

Enhancing Water Conservation

- Community Conservation Task Force
 - Reviewed 123 Potential Conservation Strategies
 - Strategies Must Reduce Water Use
 - Selected 48 Strategies for Further Investigation
- Cost/Benefit Analysis
 - Evaluate the Cost, Who Pays, Potential Water Savings
- Task Force Recommended 22 Strategies
 - Approved by Mayor and Council Feb 2008

we're rebating half the cost of a toilet, then our customers are paying for half the cost of that toilet, plus the administrative costs. The participant is paying the other half of that cost and the installation costs. So, who pays is important to figure out, and then the potential water savings for each of those. And it wasn't just done in an individual basis. Here's the potential water savings for our Toilet Rebate Program, and here's the potential water savings for an irrigation upgrade.

What was done is putting these - and they patterned them and linked them together to get the synergies, because some programs will mitigate the effect of other programs and some will enhance the effect of other programs. So, we wanted to pick programs that enhanced each other's effect. So, as you add programs over time you're also improving the efficiency, or improving the ability for the initial programs to work even better in the future.

And, ultimately, the Task Force recommended 22 different strategies, 19 technologically-driven strategies, and three demonstration projects, that were approved by Mayor and Council early this year. So, what were they? The primary ones that we're implementing this year are Toilet Rebate Programs. One of the things that we looked at, initially, was ultra-low-flush toilets, or 1.6 gallons per flush. In concert with the Mayor and Council, we determined that it would be better for us to rebate high-efficiency, or HET toilets, which use 1.28 gallons - about 20% less - 1.28 gallons or less. The reason for that is because, one, by increasing demand, we can increase the number of those kind of toilets and the - and the number of brands that are carried in Tucson so we can, a little bit, drive the market towards making those more available and getting some more competition so we can drive the cost down a little bit, but also 1.6 gallons are standard today.

We would like to - just as we did back in the late 1980s - driving a new standard, we want to see what we can towards driving a new standard. And we know Tucson Water is working in partnership with the Alliance for Conservation, and a number of other partners that are working with manufacturers of toilets and appliances, water-using appliances, to drive more deliberate and more stringent standards, both on the water and the energy side.

We also have commercial/industrial high-efficiency toilet rebate, and

Programs for 2008-09

- Single Family targeted HET toilet rebate
 - 1/2 the cost of a new toilet up to \$120 (\$200 max/home)
- Commercial/Industrial HET toilet rebate
 - 1/2 the cost up to \$100/unit
- Low Income HET replacement program
 - Selected senior homes and City-owned multi-family complexes



then a Low-Income, High-Efficiency Replacement Program. There are a lot of people in Tucson who would never be able to take advantage of a Rebate Program because they simply can't afford the up-front cost for half the toilet and the installation. So, Tucson Water is working in concert with the Community Services Department, the Pima County Community Action Agency, and with the Pima Council on Aging to determine a number of selected homes of low-income seniors and a couple of City-owned multifamily apartment complexes that are run by community agencies as low-income housing and, essentially, paying the cost of replacing those - those standard toilets with high-efficiency toilets. That benefits - that kind of has a double bang for the buck. It not only helps out those people who could not otherwise take advantage of this, but because those people are often being supported by public monies through other programs, this cuts down their water bills, and so that takes some of the pain off of the other support that they might need. So, it's kind of got a double bang for the buck.

An Irrigation System Upgrade Rebate. One the things that our water cops have found out in the commercial and multifamily side is that most of these systems that were designed, particularly in the '60s and '70s, are poorly designed. They have things like grass on a slope, a very steep slope. There is no way you can keep the grass up here and the grass down here green without having runoff; you just get over-watering down here and you get runoff. So, they're poorly designed, they're poorly maintained, a lot of them. We know that we can establish a lot of savings, a lot of efficiency on that side. So, this Rebate Program would provide one-third of the cost of an audit prior to what's going on.

The properties that would be eligible for this have a distribution efficiency or, essentially, an irrigation efficiency of less than 45%. What that means is that less than 45% of the water they put on the ground is actually being adequately used; it's actually supporting a landscape; 55% is kind of over-watering; it's watering too much in one area and not enough in another; it doesn't distribute the water evenly. And so those that have a pre-audit and are low enough then can be eligible for one-third the cost of sub-metering their irrigation system so that they can know exactly how much they're using on the outside, as opposed to the inside, and a Smart

Programs for 2008-09

Irrigation system upgrade rebate

- 1/3 cost of pre- and post- audit
- 1/3 cost of indoor/outdoor sub- meters
- 1/3 cost of smart irrigation timers

Up to \$5,000 per property

Irrigation Timer. And then on a case-by-case basis, we'll work with these customers up to \$5,000 per property.

And so this is - this is a way of getting after those multifamily properties that really have a big problem. They're continually being visited by the water cops. They've actually - a lot of them have gone to Court with citations, but they simply don't want to make that initially investment. This is a way, again, for them to do it and let's us help them out, as opposed to waiting until drought Stage 2, and they would be mandated to do it and not get any help from us at that point.

Those of you who are involved with kitchens, commercial kitchens of any kind, know that one of the highest water users is the pre-rinse spray valve. This is the rinser that you take all the food off the plates before you put them in the dishwasher so that your dishwasher filter doesn't get clogged too quickly. That valve uses a lot of water; it's one of the primary users of water in the kitchen, in a commercial kitchen.

So, we had a program established where we actually went in and piloted this with a lot of the Tucson original

Programs for 2008-09

Pre-rinse Spray Valve Replacement Program

- Spray valves account for the greatest use of water for most commercial kitchens
- Valve uses 50% less water
- Valve and installation totally free to the customer
- Partnership with State and Southwest Gas as part of water/energy reduction program

restaurants and they loved it; it cut their water use; it also cuts energy use. And, serendipitously, the State and Southwest Gas started up a program in the Phoenix area to, essentially, provide these at no charge, because they were both water saving and gas saving or energy saving. And so Tucson Water entered in a partnership into that partnership - Rinse Smart Partnership - and now Southwest Gas is paying for the

- the valves themselves, and Tucson Water is covering the cost of installation and - but, we're also getting a lot of good data out of that. Tucson Water's participation in that is allowing us to track the water savings so we can really see that this is working, and whether or not it's worth continuing in the future.

And, finally, there are two Ordinances, the Gray Water Ordinance, which just was recently passed by the Mayor and Council; it 's effective on new residences built in 2010, or

Programs for 2008-09

Greywater Reuse Ordinance

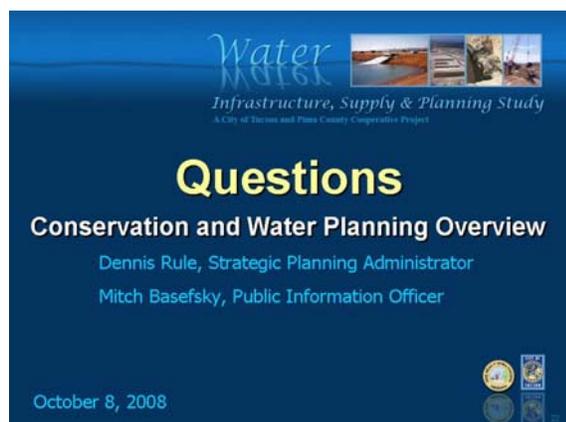
- Effective 2010
- New Residential properties
- Provide 'Stub-outs' for future use

Rainwater Harvesting Ordinance

- Under development
- New Commercial & Multi-Family facilities
- Reduce Potable Use by 50%

thereafter. And, essentially, it requires builders to put in stub-outs to take gray water from the bathtub and the bathroom sinks and the shower and the clothes washer and plumb it - put in the interior plumbing that allows it to be stubbed-out outside the home so that then the homeowner could choose to use that gray water resource for irrigation.

And the Rainwater Harvesting Ordinance, which is under development now, but Mayor and Council, I believe, are voting on this next week, or they discussed it, and they'll be voting on it next week, probably is going to require new commercial and multifamily properties to make up at least 50% of their irrigation needs with rainwater, and that's a process that will go forward. I'm not really sure what the implementation date on that will be; it might also be 2010. But, certainly, those are two different ways that we're moving forward on becoming more efficient as a community.



And that's our Conservation Program, so Dennis or I would be happy to take any questions at this point.

CHAIRMAN JIM BARRY:

John first, and then Bruce.

MEMBER JOHN CARLSON: I was pleased to hear you talk about educating school children clear down kindergarten. It must've been a year and a half, two years ago at a meeting of the - I'm on

the Wastewater County - and they said that - that kids, you can really get 'em fired up and they go home and really nag the parents and, of course, wastewater, they don't want you putting fat in the toilet and - and you'd have a little different orientation now.

MR. BASEFSKY: Grease monster.

MEMBER JOHN CARLSON: Yeah. Now, switching to low-flow, I've heard that there's problems where the slope of the sewer line isn't big enough to carry what you have, and all this brings to mind is you got to work with the County, and I wonder - you didn't mention that, or how close you are or have a person in their office, or do they have a person in your office, because we've often heard of an idea that it ought to be one utility district, both the water and the sewer, but -

MR. BASEFSKY: Yeah, as Melaney mentioned, we work very closely together with Kathy Chavez, and some of the other people who are working Water Resources, and so we sit on their Conservation Committee, we sit on their Drought Response Committee, the local Drought Implementation Group, and then they

also are involved. Kathy Chavez was actually in the Conservation Community Conservation Task Force. So we do work together. And keep in mind for the lower-flow on these ordinances, for the gray water in particular, it's going to be in newer areas, new developments, and so Pima County, being aware of that, will be designing sewers that have the capacity - the potential to carry that in a low-flow situation.

MEMBER JOHN CARLSON: Yeah, yeah. Okay.

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: I'm sure you've been asked this before, but it's still boggles my mind somewhat. If it's against the law in Tucson for any water to run off of your property, or onto an impervious surface - is that right? Did I get that right?

MR. BASEFSKY: Yes, this is - we primarily look at the commercial or multifamily side.

MEMBER BRUCE GUNGLE: Sure. Then why are commercial entities - the one that strikes me the most is the Marshall Foundation near the U of A - allowed every morning to power wash their sidewalks?

MR. BASEFSKY: Well, the U of A is a special case because the U of A is a different water - what do you call it? A different water -

MR. RULE: Special water provider.

MR. BASEFSKY: so we don't actually have the authority to go onto the U of A campus -

MEMBER BRUCE GUNGLE: Yeah, it is the -

MR. BASEFSKY: - the campus buildings -

MEMBER BRUCE GUNGLE: - Marshall Foundation, though, on -

MR. BASEFSKY: - which is on the north side of Speedway -

MEMBER BRUCE GUNGLE: - it's -

MR. BASEFSKY: - that one?

MEMBER BRUCE GUNGLE: - where - south side of Speedway, actually. But, the Marshall Foundation property, in particular I 'm thinking of, is along University between Euclid and Park -

MR. BASEFSKY: Uh-huh.

MEMBER BRUCE GUNGLE: They power wash those sidewalks every morning.

MR. BASEFSKY: Again, if we could enforce that, it would not be something that we would - power washing - let me put it another way: You can power wash if you're using a high-pressure, low-flow power washing device. We allow that. We encourage that. And for a lot of the restaurants and the other kinds of commercial properties, we do encourage them if

they're going to wash their sidewalks to do power washing. So, that is a useful - and, in some cases, public health and safety kind of thing - but we do try and work with those customers because if they don't need to be washing their sidewalks at all, then they shouldn't be washing their sidewalks. If they can do it with a broom that's, obviously, you know, be a lot better.

But, the University really - University-owned buildings are kind of a special case and we often get calls about them, and we really don't have the authority to enforce the Water Waste Enforcement.

MEMBER BRUCE GUNGLE: This is not University property. This is the Marshall Foundation.

MR. BASEFSKY: I - I - if they're using - if they're a Tucson Water customer, we can certainly go out and check it again. But, again, power - we would much rather have them power washing with appropriate equipment than doing it in a less-efficient way.

MEMBER BRUCE GUNGLE: What you're implying then is that it is legal to power wash, even though it . . .

MR. BASEFSKY: What we're really talking about with the Water Waste Enforcement Ordinance is water that's not being used for its intended purpose, so it's irrigation water that's pouring off property; that's what we're really concerned about. And if somebody's washing down a sidewalk with a hose, we've been very successful in getting people to change to a high-pressure washer that uses much less water. But, again, we're not in a position of prohibiting power washing for appropriate purposes. So, we're trying to get them to use water efficiently and use it for what it's intended.

CHAIRMAN JIM BARRY: Marcelino's next, then Bonnie.

MEMBER MARCELINO FLORES: I have a couple questions. I think with the Drought Response Plan, the notion of non-essential use is introduced. Are there definitions at the various stages that can be elaborated upon? What basically is a non-essential use?

MR. BASEFSKY: It's probably easier to define an essential use. An essential use would be for public health and safety. It would be sanitary water; it would be drinking and cooking water; it would be water for, say, evaporative coolers during the summer when there's homes or other facilities don't have refrigerated air. So, it's really probably easier to define what an essential use is, and it's an essential use is really if you don't have that use, then there are public health and safety consequences to it. So, non-essential use is, essentially, everything else.

MEMBER MARCELINO FLORES: So, if there were to be a public benefit or health benefit for maintaining a riparian

area, or some sort that wouldn't constitute the definition or the - is there an arbitrator of the definition? Is there an appeal process that exists?

MR. BASEFSKY: There is an appeal process, and there are actually set up in that Emergency Conservation Ordinance. It's at the discretion of the Mayor and Council and the City Manager as to how those restrictions are applied. So, if somebody can demonstrate that there's a public health and safety aspect to a riparian project, then that would be considered as part of a case-by-case study. But, certainly, what's intended by this is the water that flows into your home that you actually need for cooking, washing, sanitation, you know, those kind of things.

MEMBER MARCELINO FLORES: And you also had defined a little bit of an appropriate use; is that also another terminology that is defined?

MR. BASEFSKY: Appropriate - well, appropriate use, I'm not sure if there's a definition. There may be, Chris. I don't think there's a specific definition laid out in the Ordinance. Again, it was laid out to broadly cover these kind of uses that are not used as intended, or that would be considered a lower priority than public health and safety.

CHAIRMAN JIM BARRY: Marcelino

MEMBER MARCELINO FLORES: Okay.

CHAIRMAN JIM BARRY: May I interrupt one second?

MEMBER MARCELINO FLORES: Sure. Yep.

CHAIRMAN JIM BARRY: You used the term "outdoor non-essential uses," and I was thinking, well, maybe there are outdoor essential uses and outdoor non-essential, but that's one term, outdoor uses are all, by definition, non-essential, or -

MR. BASEFSKY: No.

CHAIRMAN JIM BARRY: Are there essential outdoor uses?

MR. BASEFSKY: There are essential outdoor uses.

CHAIRMAN JIM BARRY: Like what?

MR. BASEFSKY: For instance, a Fire Department washing off their equipment - washing off, you know, blood off their fire truck, and things like that; that would be an essential outdoor use. Fighting fires would be an essential -

CHAIRMAN JIM BARRY: Well, I'm sorry I asked.

MR. BASEFSKY: Fighting fires would be an essential outdoor use, washing off in front of an Emergency Room or taking an oil slick off of a public walk- - a public way - might be considered an essential use, yeah.

CHAIRMAN JIM BARRY: Marcelino, continue.

MEMBER MARCELINO FLORES: Okay.

CHAIRMAN JIM BARRY: Thank you.

MEMBER MARCELINO FLORES: In the stage planning, or - or even within the conservation planning, does the reliability of CAP delivery come into play in the scenarios? Is the CAP a reliable source of water and..

MR. BASEFSKY: I can probably let Dennis talk a little bit more about that but, absolutely, in terms of our conservation planning, in terms of the Drought Response Plan, we're very aware of the importance of the Colorado River and, therefore, a lot of our plans. You can see as our stages are really driven by what happens more along the Colorado River, than what happens locally, although local conditions can impact what stage of Drought Response we're in, we're primarily concerned with what happens along the Colorado because it is such an important supply for us.

So, yes, we do take the Colorado River Water in terms of our long-range plan, in terms of maintaining flexibility, we're doing a lot right now, we're storing excess Colorado River Water, we're working with the State, we're looking at ways to add additional water, acquire, and deliver additional water through the CAP system, so in a lot of things.

MEMBER MARCELINO FLORES: What I'm referring to is the statement that I believe Larry Dozier had made at one of the previous presentations, that is, you know, we are at the end of the line, and we're uphill quite a ways as well.

MR. BASEFSKY: Yeah. Well, obviously, we're more vulnerable to losing Colorado River Water than somebody who lives along the Colorado, but there are a number of different aspects we're taking. I think I will let Dennis talk about this.

MR. RULE: Yeah. Thank you. Marcelino, if you're talking about the operational reliability of the canal. Yeah, obviously, that's something that we're concerned about. But the Central Arizona Project, you know, is kind of like other water utilities where they have spare parts, they have emergency plans in place to deal with any kind of malfunction that they may have in their pumps, canal lining failure. In many cases, you know, bluntly what they've said is if they have a major failure in the canal lining, they'll dig a ditch around it and continue to deliver water, maybe at a reduced capacity, but they'll continue to deliver water until they can repair that.

So, you know, again, not to say that there are no issues, there are no concerns, but most of these kinds of repairs, they're confident that they can take care of in a relatively short period of time, and either get back to full delivery, or at least partial delivery; again, pretty much like any water provider, any water utility.

MEMBER MARCELINO FLORES: Okay. Just the last question, and I guess this is kind of related to CAP. CAP does not do water quality. Do you, the City of Tucson, Public Information Office, receive many calls or any issues, concerns about water quality?

MR. BASEFSKY: Yes, we do hear about water quality. We test the Colorado River Water that we get, and the other municipalities that are further up the line test the quality of the CAP water, the raw CAP water, before they treat it and then after they treat it, and we test it before it goes into our recharge basins and then after it comes back up.

So, we're very fortunate in Tucson that we have a State EPA-certified laboratory that actually is part of Tucson Water and so we're very able to monitor the water supplies, and we're very confident that if there are any problems with CAP water quality that, one, we'll know it before it gets here and be able to take steps; and, two, we'll be able to address it if we need to.

CHAIRMAN JIM BARRY: Bonnie?

MEMBER BONNIE POULOS: Couple of questions for Mitch and then a question for Dennis. Mitch, you talk a lot about the City has been concerned a lot about high-efficiency toilets, but there are a lot of other uses of water, such as running water so that it's hot in your house and there are on-demand water heaters that are used all over the world, high technology. There are also showerheads that have very low-flow and they run air along with the water, and then there are a lot of surfactants that are very low-sudsing, so they require a lot less rinsing.

Does Tucson Water have a shopping list of these kinds of methods and the kinds or amounts of water that you would save by being able to install these on a massive scale within the City?

MR. BASEFSKY: That's a great question. We do. We actually do showerhead replacement. Part of the Zanjero Program is they go in and they measure the flow of the shower and, if it's not a low-flow fixture, we actually provide a low-flow fixture to that customer. Part of the education program is the same thing. The kids in junior high go home and do a water audit and they measure the flow, and they come back and if they have a standard fixture, then they get to take home a showerhead, a low-flow showerhead.

So, I kind of gave you the high view, and so there are a lot of programs like that. And, in fact, the three demonstration projects that were recommended by the Task Force I talked about the technologically-driven ones, but one of the three demonstration projects was a hot-water recirculation or

instant hot water, essentially, not rebating it at this point, or anything, but showing that that technology exists.

And the Conservation Program works very closely with a lot of the vendors. We have a very good relationship with Kohler and with Rainbird and with the stores, the Home Depots and Lowe's, and those kind of places. So, we do participate in kind of promotional activities for those kind of things. A lot of them are either technology that wouldn't be cost-effective for us to actually rebate or provide, because the savings is either not measurable savings, or there's not enough of a rebate that we could give that would actually impact the usage of that, 'cause they tend to be expensive. Instant hot water heaters tend to be \$1,000, \$1,200, as opposed to a standard hot water heater of \$300 or \$400, and so for us to rebate on that kind of level, you'd still have to have a huge chunk of change in your pocket to participate,

And our homeowners' guide - our website has a lot of conservation information - and the homeowners' guide to using water wisely, we actually look at and have a chart, a table, that says if you change to a low-flow fixture you'll save this much water. If you change to a low-flow toilet, you'll save this much water. If you don't - if you use a broom instead of a hose, you'll save this much water. So, we do give out all that kind of information.

MEMBER BONNIE POULOS: And one more question. If Tucson Water is economically dependent on their customers' use of water, how do you foresee the future in terms of remaining solvent as a water provider?

MR. BASEFSKY: Well, another great question. And, essentially, for each of these programs that we implement, part of that analysis that we do is: How much water savings is there likely to be? And then we program that into the budget process. So, as we look at the financial plan for the future, for 2010, as we're looking for building the budget for fiscal year 2010, we're actually saying, "If these programs are implemented as we're intending to implement them, we may cut our water use by 230 acre-feet this year." If that happens, we're going to sell 230 less acre-feet. So, what does that do to our budget? And so it's part of our financial planning, part of our budgeting process to address the fact that, as we promote conservation and it's successful, we are going to sell less water.

So, there's a certain truth to say that if we don't sell as much water as we anticipate, that puts upward pressure on rates, but there's a hierarchy of our response to that, too. If we don't sell; if we have a really good storm season like we did this year, and so far this year just as a ballpark figure, we've sold about a billion gallons less than we sold to date

last year, and some of that was programmed in, some of that we knew would happen, but some of that we didn't know would happen, and so our hierarchy of responses are, first, find efficiencies, find further efficiencies. Second, where can we cut back? What programs can we not do? Maybe we don't do that home show. Maybe we - you know, or maybe, on a larger aspect, maybe we delay that capital improvement project by a year, or something like that. So, we cut back on our budget.

And then, ultimately, we have to account for - it's a cost of service utility - we have to account for what we sell. But, primarily, conservation is not a driver of rates in terms of increasing rates; it can have an effect if there's unexpected low use. But, for the most, part we're trying to program in what we anticipate, and our models tend to be pretty good.

MEMBER BONNIE POULOS: Thank you. I have one more question for Dennis. One of the big issues with the CAP and other similar types of water conveyance systems is the issue of evaporation. When you have a shallow body of water and it's constantly exposed to high temperatures and sunlight, how do you measure the amount of evaporation off the CAP? And what plans are in place to try and reduce that as a way of recovering or keeping some of the water that's being taken out of the Colorado for this purpose?

MR. RULE: Again, that's an excellent question. I know it's one that a lot of people are concerned about. We don't operate the CAP canal, so I can't really speak to you in real in-depth. But, it's interesting, the canal itself is actually fairly narrow and fairly deep and it flows fairly quickly. I think that they estimate that they get about a two to 3% loss of quantity from the take out at the river to delivery all the way to Tucson; I mean, it's fairly minimal in that context.

Now, when you have a standing body of water, like a reservoir in this kind of environment, then you do get up to six, seven, eight feet per year of evaporation off of that standing body, but just because of the way that the canal is constructed and with the flow, they actually don't get as much evaporation as you might expect, or as you might reasonably expect, but that's something that we could actually ask them directly. I'm not clear on exactly what it is, but I know it's not nearly what you might expect, given the circumstances.

CHAIRMAN JIM BARRY: Tina? John, do you have a question then? Okay. Then Sean. Okay.

TINA LEE: I'm not sure if this is better answered by ADWR, but it's clear that, you know, the Drought Response, in terms of the shortage called on the river mandates certain conservation measures levels, towards sustainable yield, does ADWR anticipate sort of mandating various additional

conservation measures if we're not making progress towards sustainable yield?

MR. BASEFSKY: Well, I can address that, partially at least. ADWR has gone kind of back and forth in terms of conservation mandates. In the 1980s and '90s they set GPCD targets and, in fact, Tucson was unfortunate enough to have done a lot of stuff before those targets were set, and so we were kind of ratched down farther, and we'd already taken care of some of the long - low-hanging fruit.

Then the ADWR established a non-GPCD program where you weren't mandated to reach a specific target, but you had to do best practices. The latest iteration of the ADWR deliberations, as I understand them, is closer to that best practice. They're not actually mandating GPCD targets at this point; it's closer to a best practice. So - and Tucson is very far below what GPCD targets might be set for us at that stage. So, we're not anticipating that they're going to impact us. Now, how ADWR impacts some of the other water users in the State or in the other Active Management Areas, that's a different story..

TINA LEE: Okay.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: Yeah, very quickly. You mentioned 100-and-some-odd strategies that you dug up from around the world and the universe, and you ended up with 23 or 32 adopted by the City?

MR. BASEFSKY: Twenty-two that were recommended and adopted by the Mayor and Council.

MEMBER JOHN CARLSON: I just wonder, Mr. Leader, whether we'd be interested in a short list of those; I mean, just as cogitative background as we think and make decisions.

MR. BASEFSKY: We can certainly provide you with the entire 123 strategies and the list of 22 strategies. They're on our Website, but we'll be happy to provide them to you in hard copy.

CHAIRMAN JIM BARRY: Yes. Sean?

MEMBER SEAN SULLIVAN: Got three quick questions. First, could you provide us with a diagram of your current Rate Structures?

MR. BASEFSKY: Yes, we can do that.

MEMBER SEAN SULLIVAN: And then on Stage 1 of the Drought Planning, you've got mandatory water audits of City Facilities and then, in Stage 2, you've got implementation of those measures found; that leads me to believe that implementation of those measures wouldn't take place until -

MR. BASEFSKY: Not -

MEMBER SEAN SULLIVAN: - Stage 2 occurred - is that the case?

MR. BASEFSKY: No. I'm sorry if I left that impression.

MEMBER SEAN SULLIVAN: Okay.

MR. BASEFSKY: The intent is that they do the water audits and they start programming them into their budgets immediately. What Stage 2 would say is, "You're required to do them very quickly"

MEMBER SEAN SULLIVAN: Okay.

MR. BASEFSKY: - as opposed to programming them in over time.

MEMBER SEAN SULLIVAN: Understood. Stage 3, in community actions, you have Plumbing Retrofit on Resale of All Customer Classes when a house is sold, commercial sold, and you said that would be an ordinance that the Town Council - that the City Council would have to pass; it's not currently on the books; is that correct?

MR. BASEFSKY: That's correct. We don't have a Retrofit on Resale Ordinance. Now - the Council, as part of the package that they they passed earlier this year, there are Retrofit on Resale Ordinances that they've already approved in principle, but the actual Ordinances would have to be developed,

MEMBER SEAN SULLIVAN: So, they do not have an Ordinance that gives them authority once Stage 3 is reached to move forward with that, so there would be a lag time, 'cause I'm sure you would get push back on an Ordinance such as that.

MR. BASEFSKY: Because of the difference between Stage 2 and Stage 3, none of this is going to happen overnight. Stage 2, when a shortage is declared, Stage 3, when we actually have our allocation cut, because Lake Mead continues to fall, we're going to have time between these stages. We're not anticipating - and I'm not aware of anybody anticipates - that there would be less than a year or two, or three, between these stages, because everybody's watching the Colorado, and so if it looks like it's going to continue to fall, we would have the time, the lead time available, to get those kind of things developed and passed.

MEMBER SEAN SULLIVAN: Thanks.

CHAIRMAN JIM BARRY: Dan?

MEMBER DAN SULLIVAN: I'm going to ask a non-excellent question. If - particularly the new programs that are projected, 2010, or whatever, obviously have economic impact, what has been the basic response of the developer and building community?

MR. BASEFSKY: Well, on the Conservation Task Force, we had a broad swath of the community, including building owners and managers, including development community, including landscapers, including realtors, so they were part of this process, to develop this set of recommendations; and, in fact,

the recommendations were brought forward. There were 13 people who actually ended up at the end of this 18-month process still on the Task Force and, of those, it was passed 12-to-one, and the one that voted against it was primarily concerned about the mix of programs, not about the programs themselves. They felt that there was too heavy an emphasis on one segment of the community, as opposed to other segments of the community.

MEMBER DAN SULLIVAN: And those 12 still have jobs?

MR. BASEFSKY: Yes, they do. And we're talking about people who represent the homebuilders' community, who represent multifamily. We had somebody from the multifamily organization, we had people, realtors - the people who - when we went into this process - let me just digress for a second - when we went into the Conservation Task Force process, we made it very clear to the Task Force members that when we come through this process, we allowed them to decide how they were going to choose these. Was it going to be by acclamation? Was it going to be unanimous only? Was it going to be with a majority, and then a minority opinion? They set the rules. They determined what strategies they wanted to go forward with. And so we're very confident that those organizations that were represented, again, including development community, as well as current residents and everybody was going to kind of have the opportunity to have their ox gore and/or to have benefits, and so we're pretty confident that they'll be supported. And that was one of the purposes of doing the Conservation Task Force so that as we brought forth strategic opportunities for Mayor and Council's consideration, that it would have community behind it, so . . .

MEMBER DAN SULLIVAN: Thank you.

CHAIRMAN JIM BARRY: Let's go to the audience. Tracy had her hand up first.

TRACY WILLIAMS: Thank you, Mr. Chair. My name is Tracy Williams, lifetime resident. Couple of things here tonight. When we look at the Conservation Programs, especially in terms of the Ordinances, I'm wondering where the WASH Ordinance went and the Storm Water Management, i.e., the Detection/Retention Basin Manual, because rainwater runoff is going to be part of - I would hope - the water portfolio of using reuse and recharge. So, why aren't those Ordinances up on your list?

MR. BASEFSKY: Well, primarily because those are not Water Department driven Ordinances; those Ordinances - the Water Department participates in the discussion of development standards of these kind of things, but we don't maintain, we don't manage storm water, we're not the Flood Water Department, and so we're aware of those kind of things, but they're not part

of the Tucson Water Programs. So, I really can't answer your question as to where they are in the process

TRACY WILLIAMS: Well, I think - as an inclusive and comprehensive issue, they ought to be up there.

CHAIRMAN JIM BARRY: They will be, Tracy.

TRACY WILLIAMS: Thank you. Next, looking at unintended consequences in connecting the dots. When we see new subdivisions going up and the low-flow toilets, that means there's less water going down the Pima County sewer system. So, with that less water, what we're witnessing as neighbors are fire trucks injecting huge amounts of water through the system and that doesn't seem to be like conservation.

And what my question is - and Melaney, we'd like this one up on the board, please - does the 4.9 million gallons of potable water that we have to put through the sewer system each year - and that's a fact, that's a fact, that's been proven here - 4.9 million gallons, does that include the amount of water that the fire trucks also put into the system to keep it clear?

MR. BASEFSKY: Well, what I can address is the fact that we're using reclaimed water for that. The County has trucks that hook up to our Reclaimed System and they're using reclaimed water to flush those sewers. So, in the past, they would've been using potable water but, currently, they're using reclaimed water to flush the sewers; correct?

MR. RULE: Yeah, where they can access it.

MR. BASEFSKY: Yeah, where they can access reclaimed water.

TRACY WILLIAMS: That's good. Thank you. And one last point to make. The Feldman's Neighborhood, which is very midtown, north of Speedway, Stone and Euclid, so they're right there by the University. Now, there's a neighbor that's very concerned right now and frustrated because they don't know who to call regarding a sink hole that's developing on their private property, and they're calling DSD, they're calling the Water Department, they're calling me, and they're saying, you know, nobody is interested, and I'm sitting here thinking about the sink hole that happened on Speedway by ASDB, and all the neighbors that were up in arms when that sink hole was developing in their backyard, but nobody paid attention until Speedway actually sank.

And so I'd like to know from you all who can I refer this neighbor to because - and I'm glad to have a Ward 3 representative here - nobody in the City is coming to the attention of this neighbor's problem.

MR. BASEFSKY: Chris wants to answer.

TRACY WILLIAMS: Hi, Chris.

MR. AVERY: Tracy, I think I got an email on this yesterday afternoon, and it looks like Tucson Water has taken care of it, and I will forward you what I've got to make sure that it's the right person.

TRACY WILLIAMS: Thank you. Hey, we're all on the same page here, aren't we?

MR. RULE: Actually, Tracy, I have to apologize. I gave Mitch incorrect information. The County has been using potable water off of our system in the past. What we're doing now is we're making access points for the Reclaim System available to the County so that they can use reclaimed water instead of potable water when they have to flush.

And, you know, again, we've been aware that this is an issue in the older part of town. As Mitch indicated, in the new subdivisions the County is aware and they have changed the gradients on the interceptors and so that shouldn't be an issue, but we're working with the County to make the reclaimed water available to the County for flushing those interceptors so that they're not using potable water anymore.

TRACY WILLIAMS: Well, just from a neighbor's point of view, it does seem a bit deceptive to say, "We're saving all this water with low-flow toilets," when actually you're not. And when you're using water to flush the sewer system, you're actually not saving potable water, and that you need to be clear about because we want messages that are truthful, not skewed to what you guys want us to believe.

CHAIRMAN JIM BARRY: Bob?

MR. RULE: That's a very good point.

CHAIRMAN JIM BARRY: Bob, do you have a question?

ALTERNATE MEMBER BOB COOK: Hello. Thank you. My first question really was related to the mismatch between conservation goals and the problem of fixed costs versus variable costs in the Tucson Water budget. And I hope as we move forward that we can come up with a better alignment so that the Tucson Water can actually profit by conservation, because it seems to me that as we move into this - continue to move into this slower growth period we may be looking at conservation, rainwater harvesting as probably the lowest-hanging fruit in terms of additional water supply, and also shifting back to our deferred maintenance, sort of catching up with that after decades of letting that go. So, there may be some opportunities to actually ramp-up conservation as we move into this slower-growth period.

I know that the City Manager several years ago instituted a Sustainability Budget Plan, which really depended upon a minimum of 2% growth in the City's revenues and tax base and, as we know now, that assumption may no longer hold as we

move forward, and I think we're going to have to recalibrate, and I'm very encouraged by really all of the thinking that 's gone into this conservation component. And I know that a lot of it only deals with new development but, in fact, in the future, we actually may be looking at redevelopment as the biggest opportunity here. Thanks.

CHAIRMAN JIM BARRY: Any other questions? Anybody want to do Call to the Audience?

UNIDENTIFIED SPEAKER: I think you just did.

CHAIRMAN JIM BARRY: Yes, that's true.

UNIDENTIFIED SPEAKER: (Inaudible) tell the difference.

CHAIRMAN JIM BARRY: All right. Anybody want -

TRACY WILLIAMS: I'd like to give a round of applause to our speakers.

CHAIRMAN JIM BARRY: Well, I would suggest - very good.

(Applause.)

CHAIRMAN JIM BARRY: Thank you. Once again, I forgot. All right. Anybody want to adjourn? So done. All right. Thank you.

MEMBER JOHN CARLSON: Oh, if we have to.
(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Presentations, and Questions and Answers with Presenters) of the City/County Water & Wastewater Study Oversight Committee Meeting held on October 8, 2008.

Transcription completed: October 18, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF OCTOBER 15, 2008

List of Presenters:

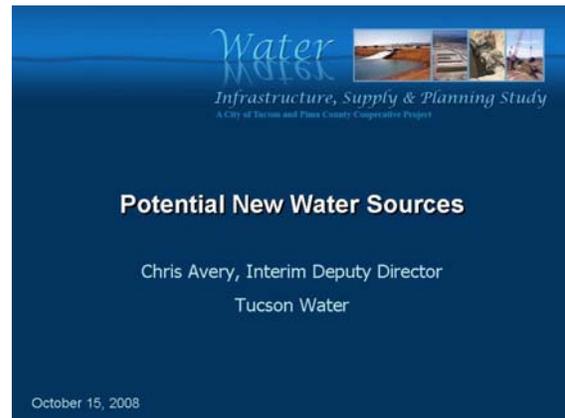
1. *Chris Avery, Interim Deputy Director of Tucson Water*
2. *Ken Seasholes, Senior Policy Analyst, Central Arizona Project*
3. *Nancy Freeman,*

CHAIRMAN JIM BARRY: We have a technical problem for Nancy, so we're going to jump to Potential New Water Sources, and we're going to start with Chris Avery and Tucson Water.

**Presenter #1:
CHRIS AVERY,
INTERIM DEPUTY DIRECTOR OF
TUCSON WATER: POTENTIAL NEW
WATER SOURCES**

MR. AVERY: Good evening, I'm Chris Avery and I'm the Interim Deputy Director at Tucson Water. And this evening we have the opportunity to talk with you about a subject that causes me trepidation. I'd like to start with a little bit of a preface, and that is that anytime you start talking about new water resources and the possibilities for new water resources, I think there are two kinds of competing dichotomies that you have to be careful that you don't go too far one, one way or the other. And one is the idea that all the water we have is all the water we have, and that there's very little likelihood that we'll be able to do anything about acquiring new water resources in Tucson, or that the municipal and industrial interests in Arizona will be able to change things much. There has been, in the past, some long-term efforts about acquiring new supplies in Arizona and across the west that have been successful.

The other side of the coin is the assumption on the part of some people that everything will just be fine; that all that needs to happen is the development of new technology and new resources, and all the issues will be resolved without a

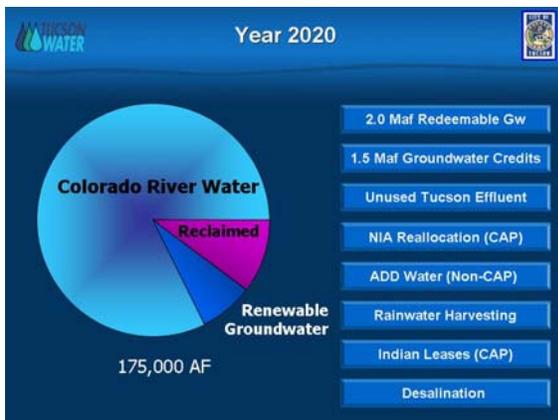


great deal of time and effort. And that's probably a wildly variant possibility as well.

These are the kinds of disputes that have been going on in the west for at least 140 or 150 years now, and they're not likely to change anytime soon. The players may change and the resources may change, but these are the kind of disputes that cause people like John Wesley Powell and John Fremont to head east and go back to Washington and paint a glowing picture about what would happen in the west if we could only reclaim it to this degree or explore it to that degree. So, it's nothing new.

But, what we're going to present tonight is a discussion about what Tucson Water staff thinks about the availability of new resources for the area, and we'll follow that up with a presentation from Ken Seasholes from CAWCD about one of those processes, the ADD Water Process that's ongoing today. So, we ended the Water Resources presentation on June 25th with this slide. And, at the time, I told you that there's a couple of assumptions in this slide, and by the time we

finished this process we would be able to show you where those assumptions are, and the time has come to do that today.



So, this pie chart is, essentially, a representation of the Plan B or C scenario that we talked about in the Long-Range Plan a few weeks ago, and the assumption is either that some conservation has occurred in a larger Obligated Area, or that a smaller area's being serviced by

Tucson Water without much conservation increases. And, on the right, you see a list of water resources that are ranked in some kind of order about possibilities that we have immediately available to us, like the redeemable groundwater credits, and some local supplies like unused Tucson effluent, and then some other supplies coming down the CAP. So, the time has come to talk about those resources and try to present them in some kind of coherent fashion. And the way we'd like to do that today is to talk about resources that are related to the CAP canal, and resources that are not.

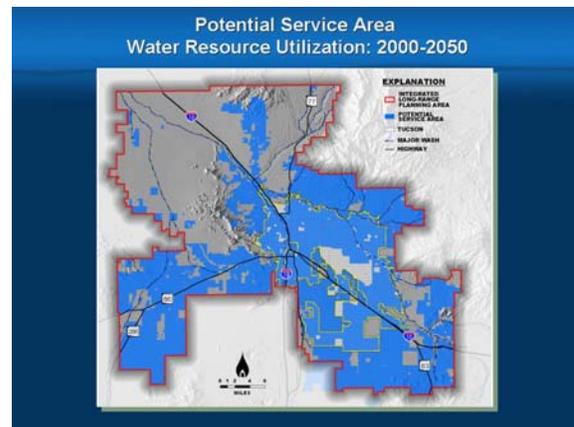
Again, here we go, this is the graphic that we've shown numerable times now; it talks about the potential Service Area. And this is a graphic that shows the larger area, the Obligated Area, plus a larger area that, although it's quite a bit larger in terms of overall extent. Under the Pima County TAZ

projections it will contain about 10% more population than the Obligated Area in 2030.

And, when you look at, under the Long-Range Plan, the resource demands that are posed by either serving water in that larger area with some conservation reductions that have seemed to have taken place just in the last few years, or if you talk about serving the Obligated Area, but without any conservation reductions, you get this portfolio and you get some kind of future demand that starts to take place in 2022 that needs to be filled with those water resources that we talked about on the left.

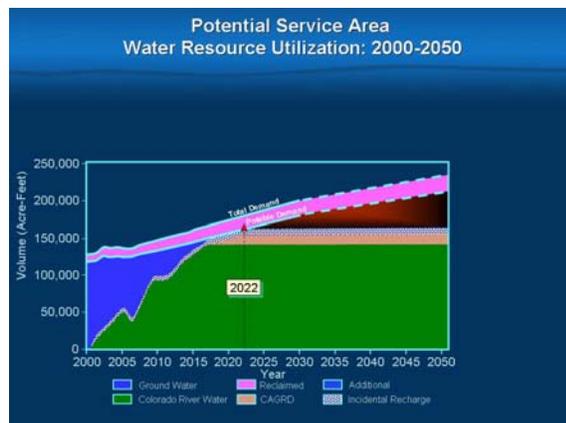
This is the Obligated Area and, again, when you take the Obligated Area and you take the conservation improvements that we've seen just in the last few years at Tucson Water, and expect that those conservation improvements will continue through time, you get this graph.

And this graph shows that, by about 2032, the utility is going to need to bring some additional combination of either reduction in demand or resources to the table. And so the discussion tonight is really about how we fill this future need.



So, one of the first possibilities is to increase conservation. And last week we talked extensively about those efforts that Tucson Water is undertaking, going forward over the next couple of years to increase its Conservation Program. And, in this particular instance, we've chosen to talk about rainwater harvesting and gray water use as a conservation method from a Tucson Water perspective.

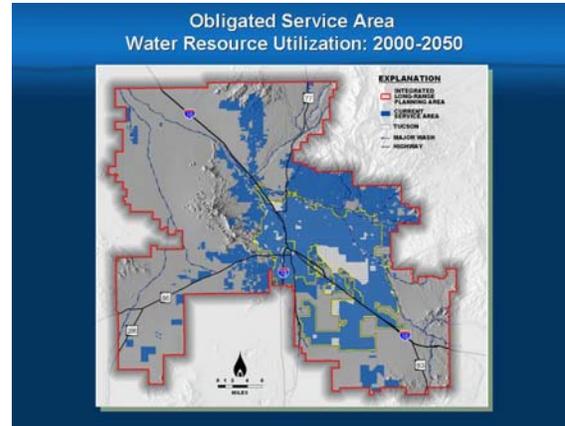
From the utility's perspective, rainwater harvesting



and gray water reuse essentially reduce our demand. From, I think, a customer's point of view, or from a community point of view, it's probably equally valid to think of these as additional resources, or additional supplies of water, that are available to the region. By putting them in a conservation bucket, I don't mean to demean the idea that rainwater and gray water are important sources of supply for the region,

and we're going to talk about those in additional detail in a minute.

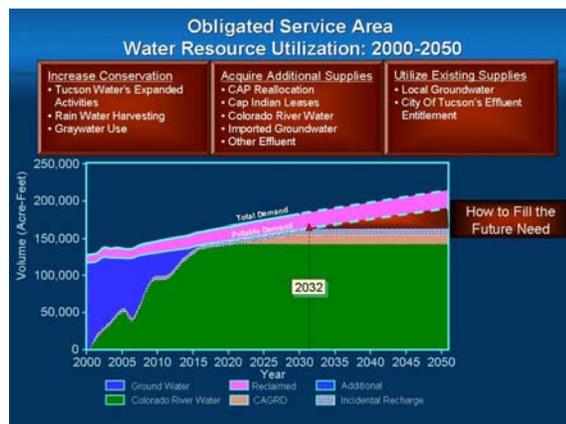
The other option is to try to increase supplies from the CAP canal. And some of those opportunities are some potential reallocations of existing CAP supplies that have already been allocated and for which there's already capacity available in the CAP canal. Some of those include reallocations of non-Indian Water. Some include CAP Indian leases. Some include bringing new sources of water through the CAP canal, such as Colorado River Water, imported groundwater, or other effluent, and we're going to talk about those in a minute. But, the one common thing that these



additional supplies have in common is they need to be brought into Tucson through some physical infrastructure, and the infrastructure that we're choosing to focus on here is the CAP canal. It may be possible that, at some future point, Tucson or Southern Arizona, indeed, the mega-city of, you know, the Prescott/Phoenix/Tucson mega-city that the demographers talk about, may need some additional source of supply, but we think that for our presentation tonight, that that's just too far off to the future to talk about in any kind of coherent fashion.

And, finally, there's always the option for Tucson to use existing available supplies that don't require additional acquisition but may, in some cases, especially in the case of Tucson's effluent entitlement, require additional infrastructure to be constructed locally.

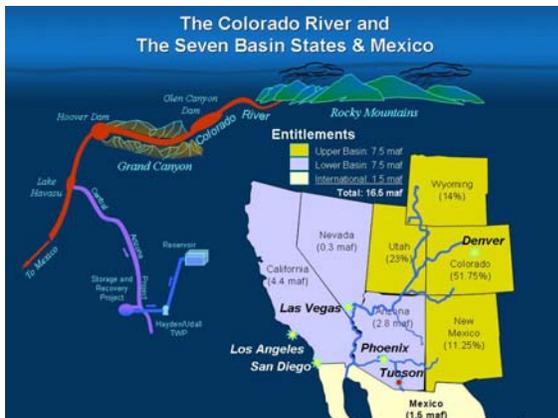
In the case of groundwater, you're talking about using a limited pool of resource and, basically, a limited bank account of groundwater and drawing it out as long as possible



and, essentially, accepting the negative consequences that follow from using that resource, perhaps, too early or making another decision about, you know, holding that resource in abeyance and using it later. That involves, obviously, a different set of tradeoffs than bringing and importing new water in from the CAP canal.

But, let's talk about

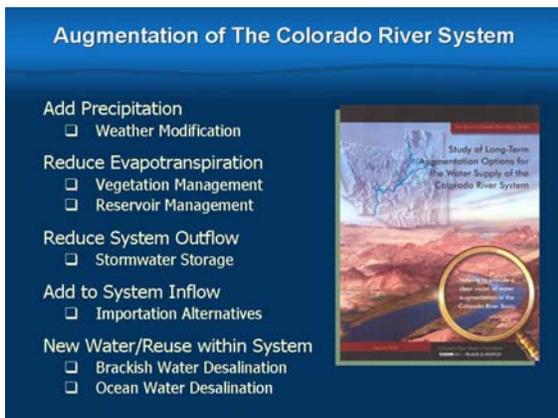
the CAP issues for a minute, and this is a graphic that we've showed on June 25th as well. But, to go back, essentially, the entire Colorado River is divided up and apportioned between the Upper Basin, Utah, Colorado, Wyoming, essentially, a little bit into New Mexico, a little bit of Arizona, and the Lower Basin. In the Lower Basin, Arizona has an equal priority with the other states, but the CAP entitlement that Arizona has doesn't have equal priority, and is subject to shortage, and we talked about that extensively.



One of the things that we wanted to bring up in this presentation and get out of the way, because we have seemed to have had some confusion about it is that this spring, the Seven Basin States, as a whole, have commissioned a report called "The Study of Long-Term Augmentation Options for the Water Supply of the Colorado River System" that looked at ways to augment the Colorado River supply as a whole.

And what these various options that are discussed do is increase the amount of water coming down the Colorado River. They increase the supply available to all Seven Basin States, and the water that would be available would be divided up and apportioned out according to the Colorado River Compact, the Treaty with Mexico, and the Law of the Colorado River. And so we don't think it's really appropriate to talk about these as Tucson resources are available, Tucson supplies.

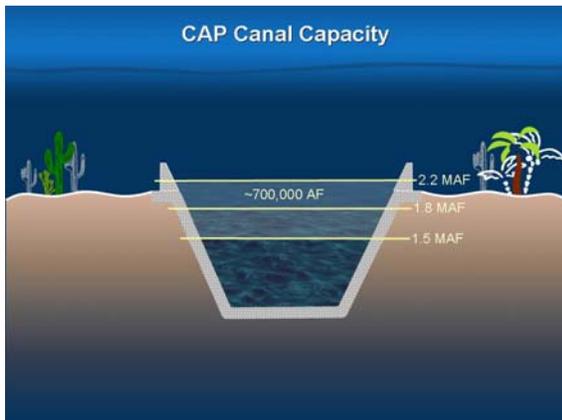
If anything is going to happen in terms of augmentation of supplies on the Colorado River in response to



climate change, it's going to involve, essentially, the entire western United States acting in some kind of a concerted effort to either, you know, change the weather, change evapo-transpiration, maximize the way that the various reservoirs on the Colorado River are operated, be able to maybe build additional storage capacity to capture extreme flood events that might

otherwise flow down - all the way down the Colorado River or the Gulf of Mexico and, perhaps, work some kind of deal that involve trading water that either is already exported out of the

Colorado River Watershed into other watersheds, or trading for water that would appear in other watersheds that would allow water to be brought to the Colorado River drainage.



And, finally, you get to what I think in some cases has been discussed as a solution for Tucson, but really doesn't fit within what we think as the Tucson solution, and that's the desalinization options. One of those options is to look at

desalinization of ocean water either in California or in the Gulf of Mexico, and another option is to look at desalinization of brackish water supplies. There are some relatively abundant brackish water supplies in the Buckeye area, for example, in Phoenix, that would need to be, you know, treated. You could deliver, theoretically, those supplies to the Phoenix area, and that might free up additional supplies for Tucson. But, generally, these kinds of supplies are available for the entire western United States as a whole, and the amount of funding that I think it would cost to develop them would have to be borne by the region.

So, what does that leave us with? Well, we've got the existing CAP entitlements, and the existing CAP entitlements are about 1.4 million acre-feet.

Those divide up, roughly, into municipal and industrial supplies, Indian contracts. One fairly exotic deal between the Arizona State Land Department and the Maricopa Stanfield Irrigation District. This does not include the State Land allocations that are otherwise subsumed within this municipal and industrial supply portfolio.

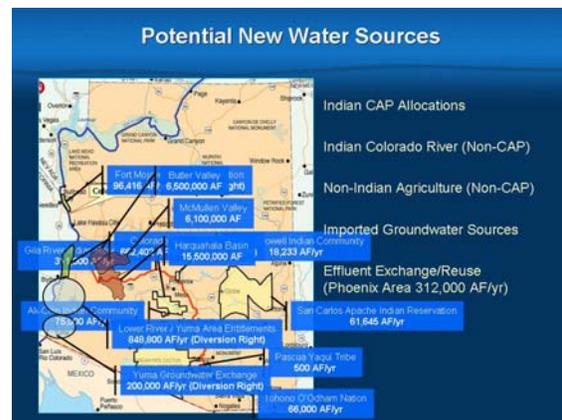
CAP Entitlements	
Municipal & Industrial	620,678 AF/yr
Indian Contracts	555,806 AF/yr
Az. State Land Dept.	9,026 AF/yr
Future Indian Settlements	68,578 AF/yr
Future Municipal & Industrial	87,269 AF/yr
Other Entitlements	73,703 AF/yr
Total	1,415,000 AF/yr

There's also some water that's been reserved for future settlements of some Indian Water Rights litigation in Central Arizona, and what we've called in here "Future Municipal and Industrial." This is, essentially, the non-Indian agricultural reallocations that are likely to take place in the CAP some point in the relatively near future. And then kind of a grab-bag of really complicated other entitlements that are essentially used to settle complicated

litigation, mostly between various parties that are served by the CAP system and Indian tribes.

Here's a basic graph of canal capacity. And, as part of the ADD Water Process that Ken's going to talk about, one of the places to look is how much capacity is in the CAP canal. According to most of the engineering estimates and depending on how much down time you factor in for maintenance and reliability and the rest of it, there seems to be a general consensus that there 's about 1.5 million acre-feet that's readily available in the CAP canal today. With some moderate level of improvements, perhaps, some more efficient pumps, more efficient plumbing, more efficient system operation it's possible to put another 300,000 acre-feet into the CAP canal and deliver it through, essentially cranking up the existing canal to its optimum utilization. And that with some very expensive, but nevertheless a lot less expensive than building an entire new canal, it might be possible to find another 400,000 acre-feet or so of capacity in the CAP canal by building sideboards along some of the most restrictive reaches of the canal. All tolled, you know, there's some reasonable possibility that with a pretty expensive outlay of funds, that you can find another 700,000 acre-feet of capacity in the CAP canal.

So, if you're looking for new water sources for the CAP, then where are you going to look? One of the first places that one would look if one didn't know how difficult it is to reach agreement with Indian tribes on water issues is Indian tribes. And this is just a quick graph of some of the in-State allocations that are allotted to various tribes in Southern or Central Arizona. San Carlos, Apache, it's 64,000 acre-feet a year; the Ak Chin Indian Community, the Tohono O'odham Nation, and the Gila River Indian Reservation. Again, these are recent supplies that, in many cases, were just acquired a few years ago as a result of some comprehensive settlement of Indian Water Rights litigation. And the tribes are playing quite coy - I think is a nice way to characterize it - with their intentions with the water, and it's obviously in their interest to do so. The more interest that they can create, the more demand that they can create for their supplies, the more they decide exactly how they want to use their allocations; it's quite possible that the more costly those supplies will become.



Another place to look is Indian tribes who have on-river entitlements, and one of the attractive reason for looking on the river for Indian entitlements is that these supplies would not be subject to the same kind of shortage criteria that the CAP entitlements would be subject to.

Where's another place to look? Well, existing agriculture in Yuma. According to the best guess system, folks who are putting portfolio supplies together, both looking for the CAGR's Plan of Operation, as well as for the ADD Water Process, some reasonable estimate that there may be a million acre-feet or so of water available in Yuma. The chances that you can get all of that are extremely slim, but if there are some options for doing the kind of creative deals with farmers that are starting to be done in the Imperial Valley, then there's at least some source of supply that's potentially available from Yuma.

Finally, having mined the Tucson area, then there's always other places to look for groundwater mining, and there are three basins that are located in relatively close proximity to the CAP canal that do have substantial supplies of groundwater in the basins, but these are use-it-once-and-that's-it kind of options.

The Butler Valley has about six and a half million acre-feet of groundwater. The McMullen Valley has about 6 million acre-feet of groundwater, and the Harquahala Valley has about 15 million acre-feet of groundwater and, obviously, this is a one-time shot; this is not an annual supply; this is not something that you can ever expect to get back. Once you pump it and - and there's probably a lot more geophysical investigations and other things that need to be done to exactly be able to tabulate what kind of opportunities you have here. But, as you look at ways to put additional water supplies in the CAP canal by trying to mix and match amongst all these various options you may get some way to fill the canal to whatever its capacity may be.

And, finally, one of the last places to look is effluent exchange and reuse in the Phoenix area. In the Phoenix area, there is some excess supply of effluent and, as water supplies become more constrained in Central Arizona, it's quite likely that those effluent supplies can be used in some kind of creative exchanges or trades, much like the brackish desal- - desalinization proposals that would not necessarily result in effluent being placed into the CAP canal and delivered around Central Arizona, but ways where water - effluent can be used to replace existing agricultural demands, or other uses of CAP water that would free up water for use in the CAP canal.

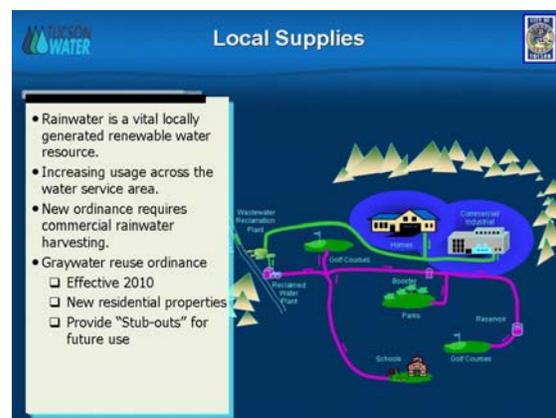
And, as Ken comes up here to talk about the ADD Water Process, the ADD Water Process is an attempt to take some systematic look at that portfolio of supplies and figure out how to bring it into Central Arizona using the CAP.

So, that leaves us with local supplies and we've talked a little bit about local supplies in the past, but mostly in the existing context. Essentially, this is what we talked about in June. Effluent is a vital locally-generated renewable water supply resource. Tucson's existing Reclaim System recycles effluent and preserves groundwater and, over time, the need to reuse effluent will increase. And, also, at the same time, as the community grows, the supply of effluent will also increase at some rate, and that in the future we see as a source of supply for the Reclaim System as well is the potentially available local supply effluent will continue to play an increasing role in Tucson.

And that role has only become more apparent with the recent auction of effluent credits in Prescott where, as a consequence of a water supply situation that's much more dire than in Tucson, a recent auction of effluent credits in Prescott found a market value for effluent in the Prescott AMA of somewhere around \$15,000 or \$16,000 per acre-foot. So, effluent is only going to become more important as a local resource.

What are the other local sources of supply? Well, here's where I put on my other hat and talk about rainwater harvesting and gray water as - as some kind of local source of supply. And, like effluent, rainwater is also a vital locally-generated renewable water resource. It's become apparent to me, as I drive around town, that more and more folks are using rainwater harvesting, at least to supplement their irrigation. Ten years ago, I was astonished at the idea that people would be doing it, and now it's pretty commonplace. So, I think it's fair to predict that, as we move forward, rainwater is going to become an increasingly important source of supply for Tucson Water's customers as they try to meet their water needs.

That importance was only reinforced by the action of the Mayor and Council just last night when they unanimously adopted a new Ordinance that requires commercial rainwater harvesting. And, essentially, the new Rainwater Harvesting Ordinance that applies within the City of Tucson requires

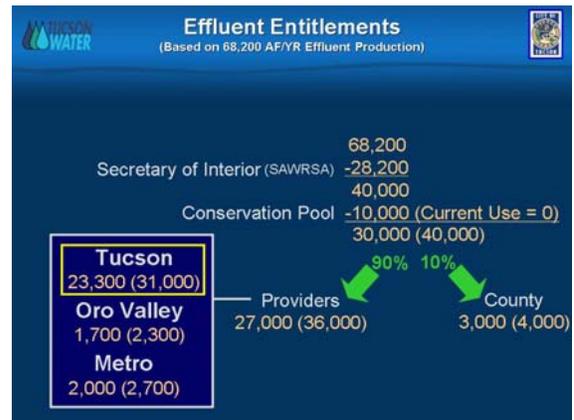


commercial - new commercial buildings to - after a grow-in period to meet 50% of their outdoor watering needs through rainwater harvesting, either through (inaudible) or cisterns.

In addition, a few weeks ago, the Tucson City Council also passed a Gray Water Reuse Ordinance that doesn't mandate the use of - of gray water, but it does mandate that new homes be plumbed to provide readily - readily available attachments, or stub-outs that homeowners or landowners who are so inclined can use to augment their use of gray water.

When you talk about the effluent entitlement that's available in the Tucson region - this is the replay of a slide that's been slightly amended since June - but, essentially,

today there's about 70-000 acre-feet of effluent that is treated by the Pima County's Regional Wastewater Treatment Plants. Of that, the Secretary of Interior owns title to 28,200 acre-feet as a consequence of settlement of water rights litigation in the Tucson area; that leaves about 40,000 acre-feet that's available to the



local water providers; 10,000 of that is legally obligated to the Conservation Pool, although none of its used there today; and that leaves some abundant supplies that can be used by the local water providers. And as demand increases in the Tucson area and, as the water providers try to figure out how to fill those wedges, some of the water that Tucson currently uses in managed recharged projects, or is planning to use in constructed recharge projects, may become available for reuse in other ways.

And one of the supplies that is available locally that requires a great deal of probably patience and effort, but can be - I think it's - it's reasonably certain that in the future someone will figure out how to put it to better use in the

Conclusions

1. Additional CAP delivery capacity is available.
2. Potential sources of additional supplies are available.
3. Statewide discussions are occurring about how to share these potential supplies and allocate costs.
4. Individual water users can reduce their potable water use by utilizing household graywater and rainwater harvesting.

Tucson region, and that's the Secretary of Interior's 28,200 acre-feet of - of effluent supplies that are not currently available to the City of Tucson, or the other local water providers.

So, with that, essentially, without getting - trying to fall off either side of the tightrope, there is some

additional CAP delivery capacity in the canal, and there are potential sources of supply to fill that capacity gap. There - there's no doubt in - in the mind of - of almost anyone who's worked on this issue, even for a short time, that those supplies will be expensive, compared to the existing CAP allocation. It's my personal opinion - and I think it's shared by the folks I work with at Tucson Water - that those supplies will be, in order of magnitude, more expensive than CAP.

So, right now, we've based a water resource fee on CAP past payment obligations, that value that - the cost of essentially acquiring that resource and paying for it over the years at about \$700 or \$800 an acre-foot. And it's probably reasonable to assume that new supplies coming down the canal will be seven to \$8,000 an acre-foot, maybe a little more, maybe a little less, but the idea that there's an abundant supply of \$700 an acre-foot water available in Arizona is - is a myth, in my opinion.

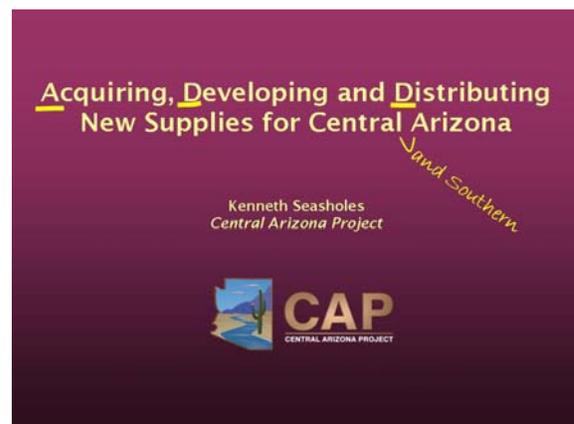
Ken's going to talk to you about Point Number 3, and that is that statewide discussions are occurring about how to share potential supplies and allocate the costs.

And, finally, as always, individual water users and customers of Tucson Water and other utilities in the region can, on their own, and - and in partnership with the utilities, do a great deal to reduce their potable water use by using household gray water, rainwater harvesting, and other appropriate conservation measures.

And, with that, I'd like to turn the podium over to Ken. We'll get questions after we're both done.

**Presenter #2:
KEN SEASHOLES
SENIOR POLICY ANALYST, CENTRAL
ARIZONA PROJECT: POTENTIAL NEW
WATER SOURCES**

MR. SEASHOLES: Thank you. I'm Ken Seasholes with the Central Arizona Project. And, after that presentation, I have the unenviable position of talking about process things, which is really quite comparatively dull. But, actually, Chris and Tucson Water



Staff have done a great job of kind of setting the stage about the available supplies. I'm going to hit on some of that, and I will try to just kind of go through this quickly.

We have mentioned ADD Water multiple times and I want to at least kind of give you some context for what the ADD Water Process is and, perhaps, also what it - what it isn't. Because we're in the water business, of course, ADD Water is an acronym for something, so it's "Acquiring, Developing and Distributing" supplies. And, of course, when we say "Central Arizona," we're including Southern Arizona because it's the CAP Service Area of the - the Tri-County Service Area.

And there's probably no better way to kind of summarize it than this is our problem statement, which is:

Problem Statement

Long-term water demands in CAP's three-county service area are projected to exceed currently available supplies. A comprehensive strategy may be desirable for the acquisition and delivery of water to meet these future demands.

"When you get right down to it, the projected demands for the three-county area exceed in the future, exceed the known supplies that we have readily available at some point." And that doesn't mean that we're about to run out of water; it means that we're - like Chris was mentioning the Tucson Water perspective - there needs to be additional acquisition if we're going to meet those

demands as they come along.

And the second part here about this sort of comprehensive strategy is really about the recognition that the CAP infrastructure is kind of the backbone for the Central part of Southern - Central and Southern part of the State, and it allows us to have access to a wide array of supplies.

And so if you start with that problem statement, you very quickly get to some fairly self-evident kinds of questions, you know. How much do you need? When do you need it? Where is it going to come from? Who's going to do it? And how are they going to share and pay? And so these are sort of framing questions that we're wrestling with, and I'll get to how those are put together here in a minute.

Questions Raised

- How much water is needed?
- When is the water needed?
- Where will the water come from?
- Who will acquire new water supplies?
- How will the water be shared?
- How will the water be paid for?

The demands, Chris mentioned from the Tucson Water perspective and it's similar across the Central part of the State that, of course, a lot of the demand is being driven by

growth; it's being driven by the legal requirements of the Assured Water Supply to rely, either directly or indirectly, on renewable supply.

Water Demands

- Cities, private utilities and other water providers/users need water to:
 - Replace existing non-renewable supplies
 - Meet future demands
 - Provide back-up supplies
 - Meet Assured Water Supply requirements
- Uses include direct delivery, recharge/recovery and replenishment

So, that's really a major emphasis on this in terms of where the new demands are coming in. There are also other kinds of demands that we're seeing, some industrial ones that are demanding renewable supplies.

And then this last piece is just to make it clear that when we talk about demands, we're also talking about not just direct use to a treatment plant,

but also for recharge and recovery. Obviously, the City of Tucson's annual storage and recovery, CAVSARP, SAVSARP, Clearwater Facility is a great example of that. So, just to be clear that we are including that in the scope of what we talk about on demands.

This relates just to take out of the same kind of portfolio supplies that Chris had mentioned that the Central Arizona Groundwater Replenishment District, one of our functions at CAP, the Plan of Operation identified a potentially-available portfolio of supplies; it was significantly larger than the kinds of supplies that we were needing to acquire for the Plan. So, the number - the 900,000 or the million - you can go through and look at some of those supplies; that's what on Chris' map shows where some of those supplies are potentially available. And I would concur with Chris' point that just because they're available doesn't mean they're easy to acquire, or that there's a lot of both money and time and acquisition issues, but there are definitely ones that could be available.

The part that was included in the GRD Plan of Operation - and I know on the website there's a link to the the table that kind of breaks those out more directly - it didn't include these two desal pieces. Those are both being looked at in terms of the overall system of augmentation, but they do present the possibility for actual new supplies or exchanged supplies.

Water Availability

- CAGR plan of operation identified more than 900,000 AF of potentially available supplies
- Other sources could also be developed
 - Ocean water desalination
 - Brackish groundwater desalination

And then Chris mentioned this same point about the fact that the infrastructure was built oversized, and there are some relatively creative ways that you can utilize the CAP infrastructure to deliver more than the long-term entitlements; in fact, we have delivered close to 1.7, using Lake Pleasant storage, which is our regulatory storage.

CAP System Capacity

- Long-term contract entitlements total 1.415 MAF
- CAP system, as it exists today, can deliver 1.8 MAF annually
- With reasonable improvements, CAP could deliver 2.2 MAF

So, we have a system that - depending on how you shuffle the demands - really can meet a substantial amount above and beyond our long-term obligations, and that both of these numbers - this is the one with the current system - the 2.2 is the kind of system enhancement that Chris mentioned. Those do include maintenance down time, 15%, so that it's not running at full bore with no margin of

safety; that is included in that.

This latter number comes from a sort of conceptual study that's being finalized, so we'll be able to share that I think this upcoming year. In just kind of round numbers that have been tossed around going from the 1.8 to 2.2 is about \$250 million. So, real money, but not like rebuilding the entire system.

So, if you come back to these questions, you kind of address these first three. And, for the purposes of this process, those are I don't want to say they're given, because there's a lot of issues behind them, of course, but those aren't the central issues that are driving the process that's going on currently. It's really more

Questions Raised

- How much water is needed?
- When is the water needed?
- Where will the water come from?
- Who will acquire new water supplies?
- How will the water be shared?
- How will the water be paid for?

ADD Water Process

about these last three. Who's going to do the acquisition? And then how do they get shared and paid for?

So, this ADD Water Process is focused on those things. And it actually has a couple of origins that are important because

it sets the stage for how we got to this point, and how CAP kind of ended up in this lead role.

Going back a really long time, there were some original statements about how you could use the infrastructure. It is, of course, a federal project, but there's some positions about being able to use the excess capacity; there's historic document. But, really, I think for a lot of us the piece that really kicked this off was a

process - another acronym - Project WHEEL. I don't remember what that stood for, but it was about arrangements of dealing with moving other supplies, non-project water supplies through the CAP system, and it got to a certain point, it helped frame some of the issues in terms of the legal issues and the sort of kinds of issues that we might have to deal with if individual entities were going to acquire their own supplies and try to wheel them through the CAP system. It didn't reach a final conclusion, but it set the stage really for a series of informal discussions among water providers, including Tucson Water subcontractors, and others about, "Well, maybe rather than having everybody go off and doing their own thing and trying to strike deals with Indians, or trying to wheel - mainstream Colorado River supplies, that there might be something that's more coordinated." And that came together in CAP's Strategic Plan, and one of the identified pieces was this idea that CAP would take a lead role.

I got a little bit out of sequence here - this is the piece of what was discussed in the ADD Water - excuse me - in the Project Wheel issue, and there were these sort of

Informal Discussions

- Water providers have historically worked independently to acquire their own water supplies
- AMWUA cities, Tucson and others met with CAP Board members to discuss a broad framework and public process for developing a wholesale water supply program

Origins

Potential use of CAP to transport non-Project water

- CAP position statement (1983)
- CAP discussion document (1988)
- Project Wheel (2002)
- Informal discussions (2005)
- CAP Strategic Plan (2006)

Project Wheel

- Continuum: CAP as "delivery agent" vs. "water provider"
- Adoption of hybrid approach and "interim set asides"
- Explore concept of developing new water supply for CAP service area, with public process addressing how to allocate new supply

competing ideas: Should there be one entity? Should there be multiple entities? Is CAP both the acquirer and the distributor? So, again, sort of setting the stage for what happened.

This piece about the informal discussions, it is important, not just because it really came about from the subcontractors' and water users' perspectives, but there was a recognition, kind of an epiphany when everybody realized, you know, if we're all going out and doing this all - everybody for their own, not only might that mean that there might be folks that were left out of that, folks maybe who didn't have the kind of financing to be able to do things, but also we'd drive up the price for ourselves. So, CAP is a piece of infrastructure that bridges us together and the kind of natural conclusion from that was that there'd be a coordinated effort.

So, this is really just about the Strategic Plan process, and I won't go into that. But, the outcome really is that, basically, they - our Board, the CAP Board - directed Staff to engage the stakeholders on a process to see whether we could come up with a way to get agreement on how we could do this that everybody came to realize was perceived to be fair.

Strategic Issue

"Developing New Water Supplies for the CAP Three County Area"

[CAP Strategic Plan, 2006]

So, we had a big kick-off meeting early on in the summer and it really starts with this idea that we're assuming that CAP is going to be the one that's going to be the primary entity that does this work of Acquiring, Developing and Delivering these supplies, so it takes that as a given. And then the question is: Okay. Let's

CAP Strategic Plan

- Developed by CAP Board in 2006
- Input and support from a broad spectrum of stakeholders
- Elements of Plan:
 - Strategic Issue
 - Strategic Objective
 - Action Plan
 - Desired State

So, again, when you look at these questions, these sort of over-arching questions, we break them into these two pieces: There's implementation, which is really about the sort of operations or actually acquiring these supplies, the legal issues, the system issues, and these program development ideas.

Strategic Objective

"Establish a collaborative process to determine when new supplies need to be acquired and what entities get those supplies. Encourage fair competition and eliminate perceptions of unfair advantage."

[CAP Strategic Plan, 2006]

say we do that. How do we go in and share and pay?

Program v. Implementation

Program Development

- Who will acquire new water supplies?
- How will the water be shared?
- How will the water be paid for?

Implementation

- How much water is needed?
- When is the water needed?
- Where will the water come from?

there's a lot of stakeholders, and there's a Project Team, Southern Arizona, Tucson Water, other folks down here are very well represented. And it's all out in the open.

And, like anything else, it's sort of a step-wise

5-Step Process

- Identify information needs
- Define and prioritize criteria
- Develop alternatives
- Evaluate alternatives against criteria
- Develop recommendations

the core values and you're not just jumping to conclusions, but it's a significant commitment. As you all know, serving on this Committee, a significant commitment of time and effort to get to that point.

The - where we are right now with that process is we have gotten through the first major piece, which is to develop sort of these broad parameters, criteria, against which

So - and I should give - for sure, some credit for some folks. I'm peripherally involved in the ADD Water Process, although its gravitational pull ends up having an effect on all of us at CAP - but, Terry Sue Rosse (ph.), a colleague of mine, is the Lead Staff Person. Our Senior Management is heavily involved, our CAP Board Members, and then

Focus Question

Assuming CAP is to be the primary entity that acquires, develops and delivers new water supplies for its three county service area, how should the water be shared and paid for?

process to it, and this is just a list from our email distribution list, to give you a little bit of an indication of the kind of breadth and list of folks that are routinely involved. The stamina of this group so far has been to me quite staggering. These facilitated processes are designed to make sure that you really get



alternatives are going to be evaluated. And, actually, Friday there's going to be a meeting, a big stakeholder meeting, we're going to start weighing some of those. Which of these factors are most important in terms of when we do get to the point of evaluating alternatives for sharing and paying for the supplies.

That's kind of a long mealymouthed way of saying that we're going through this involved process to get to a point where we can have a stakeholder consensus on how new supplies that are delivered through the CAP system, or exchanged through the CAP system, can be brought to fruition in a way that the broad representation of stakeholders feels is equitable and meets their needs, and those needs are substantial and we are working our way through it.

The timeline, we're looking at about probably I'd say late spring before we really have things really solidified and we know whether we have a program that we can actually start getting into the implementation phase on. Pretty involved process, obviously, but so far so good.

And, with that, Chris and I, I guess, we'll take questions.

CHAIRMAN JIM BARRY: Where's Chris? Okay. Questions from the Committee? Sean first.

MEMBER SEAN SULLIVAN: The question is for Chris. The slide when - that runs down potential new water sources, imported groundwater sources, the three basins west of Phoenix. How does that fit with Groundwater Management Act Compliance?

MR. AVERY: Those three basins are located outside of an AMA. So the - the Groundwater Management Act Compliance means that if you can bring those supplies into areas that are governed by an AMA you, perhaps, can show an Assured Water Supply. But, again, it's - you're - there's - I want to make sure there's no misunderstanding about this. You're talking about groundwater mining in basins that are currently uninhabited or - or largely uninhabited compared to Central Arizona and Southern Arizona.

MEMBER SEAN SULLIVAN: And a few follow-ups, if I could.

MR. AVERY: Yeah.

MEMBER SEAN SULLIVAN: Do you know if the land ownership in that area is primarily BLM or State land, or is it mixed?

MR. AVERY: I don't know the answer to that question. I know that there is some private in-holdings in the Harquahala Valley, you know, ranching and farming interests. I don't know the answer about Butler or McMullen, and I know that also - I think it's McMullen - well, I'm not going to answer it -

MEMBER SEAN SULLIVAN: Okay.

MR. AVERY: - until I know.

MEMBER SEAN SULLIVAN: Thanks.

CHAIRMAN JIM BARRY: Let me follow-up, John, if I could.

MEMBER JOHN CARLSON: Sure.

CHAIRMAN JIM BARRY: How does those - those three basins comport with the map that Rob Marshall showed about groundwater-dependent ecosystems?

MR. AVERY: That's a good question. I don't know the answer to that one, either.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: Well, isn't there a Safe-Yield out of those three, Harquahala, and those other two, that could - you - you said that's a one-time shot like -

MR. AVERY: Yeah.

MEMBER JOHN CARLSON: - you're going to drain 'em and God's not going to put any water back. But, isn't there a Safe-Yield that one could work towards?

MR. AVERY: God's not putting a whole lot of water into the Harquahala Basin; it's pretty dry out there. So, there may be some extremely minor amount of - of what we might consider to be Safe-Yield, but it's - it's groundwater that's built up over thousands of years, and that's why I'm - when - when you talk about those valleys, I - I think that - to talk about 'em honestly, you have to think of 'em as, essentially, groundwater mines.

MEMBER JOHN CARLSON: Okay. Now, it seems to me years ago there was an Indian allotment up on the Little Colorado, and I didn't see that on your map; am I wrong or what?

MR. AVERY: No, there - I haven't focused this presentation on water supplies that are outside of the three-county area because it - it's just - it's outside the area that really affects us.

MEMBER JOHN CARLSON: Okay. And I've - I've built a lot of these conveyances, but this increase in the CAP, you have to start taking water out. When you say you're going to go to 2.4, or whatever, for - where does that start dropping off? You're not going to build it clear down to Tucson with 2.4 capacity, but is that all taken into account, your - on your figuring or what?

MR. AVERY: What - what - yeah, what you're talking about is, you know, obviously, bringing more water into Phoenix and then progressively smaller. The - the canal itself today is sized to become progressively smaller as it comes through in - into Phoenix -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - and then out of Phoenix and past Casa Grande, so -

MEMBER JOHN CARLSON: Yeah, 'cause you mentioned the Lake Pleasant drop-off where you could interrimly store a bunch. Fine.

CHAIRMAN JIM BARRY: Bruce?

MEMBER BRUCE GUNGLE: To be honest, this is probably a stupid question, but I'm going to ask it anyway.

CHAIRMAN JIM BARRY: I've - I've been doing it (inaudible) so go ahead.

MEMBER BRUCE GUNGLE: You - you referred to the Indian Colorado River Water, the non-CAP water. If that is to be transported by the CAP, does it then come under those rules in terms of priority, or we - we're not going to have to build a separate system to move that water; correct?

MR. AVERY: That's a - that's a good question, actually, and it's - it's a little bit - I may - may not have explained it carefully enough. But, the - the priority for that water is, essentially, equal to all of the other basin states; it's not subject to CAP's junior priority, the 1968 CAP allocation. Basically, CAP funding placed the CAP allocations and the canal itself is a lower priority.

But, essentially, what it would mean, if you were trying to be really creative, is that if there were a shortage on the river, if you could get non- - that Indian Water into the canal, you might be able to - you'd still have the canal capacity available and you've got higher-priority water. So, it's a little bit of a mixture. You've got - you've got all - the canal capacity exists, whether there's water available to fill it or not, and the - some of the allure of looking at the on - in the on - on-river water is that it's got higher priority.

CHAIRMAN JIM BARRY: Follow-up?

MEMBER BRUCE GUNGLE: No.

CHAIRMAN JIM BARRY: No? Anybody else?

MEMBER JOHN CARLSON: She's - down there.

CHAIRMAN JIM BARRY: Oh, Tina. I'm sorry.

TINA LEE: Ken, what's your time frame for the ADD Water Process?

MR. SEASHOLES: The timeline for the ADD Water Process is really to have it wrapped up for this first three phases by mid-spring, and it may get pushed back a bit depending on how - how things go. We're - we're moving actually relatively rapidly through this last - last phase; it's going to, of course, depend on how much consensus we can get. The - the real rubber hits the road in a way when people start to - when we all start working on alternatives, and alternatives is actually the

mechanisms we've got issues about. How to fund things. How to finance things and, ultimately, you know, what - what - how do things cost out.

I want to just maybe clarify one - one piece that may not have been clear about the - the - the three basins that - the three groundwater basins that Chris mentioned. They are exempted from the overall prohibition on groundwater importation that was enacted in - in '92. So, there are only those basins, and Little Chino and - and - or, excuse me - Big Chino, and Little Colorado, there's a piece. But, those are the only ones for which you can do this kind of groundwater importation. So, there is a connection in with the regulatory structure in that - in that case.

And just one other piece on this. Both the issue of the priority and how you might think about groundwater supply, groundwater importation supply, like those in - in - in western Arizona is that they have particular characteristics that might be beneficial in times, for instance, of shortage on the Colorado, or fill- - filling in supplies if you were working on short-term leases or fallowing arrangements. When you start cobbling together some of these supplies, we tend to think about just the really durable, long-term ones, but there are also acquisition strategies that emphasize some of the shorter-term opportunities that may exist.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: On Indian Water, I've been around water all my life, even though I'm from out west, I've been either handling it or chasing it or - but, I just loved the idea the Indians had so much water that we could've gotten ten years ago, or 15 years ago, and then there was the adjudication where they got allotted more permanently. But, to me, that is extremely time-sensitive that we - who's going to be the driver to go out and try to secure supplies from the Indians? And that seems to me that we ought to be working on that immediately and not putting that off. You want to argue with me or ignore me?

MR. AVERY: I agree that - I - I agree that's an issue and - but, if you're - if you're thinking about it from - from the tribes' point of view -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - and, you know, if you're going to try to negotiate with them, I think that's probably why. From the tribes' point of view, first of all, these are relatively new supplies for them, so they've been embroiled in bitter litigation over their water rights for the last 30 years -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - and finally were able to settle those - those lawsuits and determined what their available supplies are.

I think that they - they - they are going to want to have - take the time to figure out what to do with them, and I think that, you know, if - if it were me, I - I think I would deserve it.

The other thing is that it's in their interest to play coy, you know, it's sort of the same thing that happens when somebody wants to trade a baseball player, you know. Well, he's a great team guy and he's a hustler, you know, and then as soon as he's traded, he's a clubhouse cancer and the guy, you know - I mean, it's in their interest - it's in their interest to say, "I'm interested in using all of this water for my own needs and, by golly, if you want to come get it, you're really depriving me of - of something that's going to affect my lifestyle for generations to come, 'cause the price goes up." If you say, "Ah, I'm not sure I really need it. I'm not sure I really want it, and I'm putting it on sale just to try to raise money short-term, the price goes down." So, it's a complicated dance and it's going to take some time.

MEMBER JOHN CARLSON: Well, I recognize it's extremely complicated and everything you say is true, and I grant that, but there still ought to be somebody working on something in that arena is what I'm saying.

MR. SEASHOLES: Let me just make it clear, too - well, first of all, there are people working on it - but, there is also a history of Indian leases, particularly in the Phoenix area. Phoenix area cities have entered into long-term arrangements with the - the tribes. So, you really have to look sort of deal by deal, area by area.

I think the point about the fact that the - the Arizona Water Settlement Act created large new supplies does put a number of the tribes, including the Tohono O'odham in a different situation -

MEMBER JOHN CARLSON: Yeah.

MR. SEASHOLES: - than they were. So, a long-term time frame, but we don't want to paint an entirely bleak picture. There is a history of actually entering into long-term leases that have been put to use in the - in the Phoenix area as well.

MEMBER JOHN CARLSON: Thank you.

CHAIRMAN JIM BARRY: Anything else?

Well, Ken, let me ask a question. I'm not sure I understand. When you say you're going to have something done by the spring in phase three, what -

MR. SEASHOLES: Well, not me personally, you understand.

CHAIRMAN JIM BARRY: Well, I'm sorry. ADD Water, what - where, in your presentation, do I get these phases and - and

what questions have been answered, or how do I know what you're talking about by - by spring?

MR. SEASHOLES: www.cap-az.com, and go the ADD Water link. And - and I should say I probably haven't given it due justice because I haven't - haven't been as -

CHAIRMAN JIM BARRY: Okay.

MR. SEASHOLES: - enmeshed in the process as some other Staff members. There - there's - we're following, basically, a facilitation framework that really has these sort of phases where you really identify the - the information needs. There - there's actually a slide in there and it kind of walks you through these pieces.

The - the objective is to, at the end of it, get to the point where you're actually evaluating specific proposals against the values that you've identified through the process. So, the - the facilitation process is designed to kind of get at: Well what is it that you care most about? And what is more important to you than less important? And then try to identify areas where there's overlap among the stakeholders.

CHAIRMAN JIM BARRY: Oh, okay. Vince?

MEMBER VINCE VASQUEZ: I've had the opportunity to participate a little bit in the ADD Water, and I think it would be helpful to - for this Committee, as we look to the Phase II, or beyond, to maybe look at the model that the ADD Water uses in terms of the stakeholders, the - can you - can you maybe explain the process? Just a little snapshot in terms of the different layers of the elected -

MR. SEASHOLES: (Inaudible).

MEMBER VINCE VASQUEZ: - well, the -

MR. SEASHOLES: Yeah, the -

MEMBER VINCE VASQUEZ: - there's the elected, there's the - the Policy Team, or the -

MR. SEASHOLES: Yeah, the Project Team. In order to manage a project like this - and when you have a, you know - folks who self-identify as stakeholders - and it goes on for a really long, long time, it's a - it becomes a management issue. So, it is kind of broken up into - to pieces. We do have what I call a "Project Team," and that's got representatives of the various entities, including Tucson, at the table, principally sort of acting, essentially, as a Steering Committee for the project - for the process, as a whole. Stakeholders, that's everybody, all together.

And, in fact, one of the things that happened at this last round of stakeholders is we had so many people wanting to come that we didn't have facilities at CAP to - to accommodate it, so we found a facility in Phoenix that was large enough.

Well over 100 folks participating for two full long days of facilitation that's real - very impressive amount of work.

But then also an important component has been to have individual Board members of our Board acting as - and I'm not going to use the right term - but I think it's "champions" - basically, they're engaged in the process, too. Having folks who are involved in the process who can then bring it back to a larger group. So, they - they can be representing what - the process, but bring it back to folks who can't have that level of engagement. It's worked pretty well; it's - it's a big commitment; that's the one kind of real down-side I think of those kinds of facilitated processes; it's a significant time issue. But, when you think about what we're talking about, these are the new supplies that are going to be used for meeting the demands many decades out into the future, so it's worth trying to get it - get it right.

CHAIRMAN JIM BARRY: Do we have any questions, as opposed to statements? Do we have questions from the audience? Tracy? Tracy, I see - and this is - this is in addition to your speaker's card? Okay.

TRACY WILLIAMS: Yes, this - hi. I'm Tracy Williams. This question is for Chris. Since Tucson just adopted the Rainwater and the Gray Water Ordinance, I'd like you to project when they're actually implemented, like in year 2010. Now, we're building houses with gray water stub-outs, we've got commercial with rainwater harvesting. Is Tucson Water planning on using those conservation efforts, those savings as credits, sort of like our paper water idea?

MR. AVERY: We're not planning on using them as credits. What we are trying to do with rainwater harvesting and gray water harvesting is provide a great deal of education to the public during this interim period about how to install systems that work. How to make sure that the - that the - the public has an easy repository of information. And then we will be watching as those processes move forward to implementation to see what they do in terms of water demand. How we can build projections of future rainwater and gray water use into our - our models and see what the effects are. But, we don't, at this point, intend to obtain credits or - or - or some other water supply for - for the City's use based on that.

TRACY WILLIAMS: So, would Ken pipe in on this idea? I'm talking about with the CAGRD, you know, if we're saving water, would that give us credits, because we've done this good thing in our community, or am I really projecting way ahead of you guys?

MR. SEASHOLES: I think when Chris sort of framed water harvesting and gray water as both, you can look at it as a

supply, but also as reducing demand. I think the way that it would work its way through on the regulatory side is that it reduces the need for potable deliveries. And, to the extent that those potable deliveries require an offsetting recharge, if you're a member of the CAGRD, it just - it reduces the amount of - of new supplies that have to be acquired to do that. So, it has that effect, but it wouldn't be a paper water accounting -

TRACY WILLIAMS: Okay.

MR. SEASHOLES: - piece.

CHAIRMAN JIM BARRY: Bob? Bob, this is a question; right?

ALTERNATE MEMBER BOB COOK: It's a question -

CHAIRMAN JIM BARRY: Okay. Thank you.

ALTERNATE MEMBER BOB COOK: - prefaced with a sentence.

CHAIRMAN JIM BARRY: Okay.

UNIDENTIFIED SPEAKER: With lots of semicolons.

ALTERNATE MEMBER BOB COOK: We're concerned about an apples-to-apples comparison between expanding the CAP infrastructure and other alternatives to increasing supply and other delivery infrastructures, including conservation, rainwater harvesting and gray water. And it's really clear that in the time frame that this additional water would be added we would be seeing increasing costs for energy, i.e., pumping water, construction costs adding to the infrastructure, the CAP, and also carbon penalties that would be accrued to the burning of coal for the Navajo Power Station which runs the system.

Will we see a good analysis of the actual per-acre-foot cost of an ADD Water Process that looks at what are the - what are the infrastructure costs for creating water catchment in processing rainwater, for - for - for encouraging conservation in various forms and the costs associated with that? You know, we can really make a comparison here if we have some good analysis of what those - those other systems would actually cost on an - on an apples-to-apples basis.

MR. AVERY: Well, I think that you've got a point in that - in trying to decide whether it's more cost-efficient and beneficial to continue to try to acquire new supplies versus develop Conservation Programs that save a commensurate amount of water for the utility.

ALTERNATE MEMBER BOB COOK: Rainwater is a supply.

MR. AVERY: Right, right. That - that you have to have accurate data in order to make a good comparison, and whether you can do that today, given that the costs for existing CAP's supplies is subsidized by the postage stamp rate and by, you know, federal infrastructure is one thing. I think, as the ADD Water Process moves forward, there will be, at some point,

coming out of the ADD Water Process, a pretty clear indication of what those costs will be. And, once you get those costs, then you can evaluate them against your conservation portfolio.

But, I think that the - the answer moving forward is to try to acquire the right mixture of supplies in order to meet the demand, and it may be both; it may be that you use a little bit of ADD Water and a lot of conservation, or a lot of ADD Water and a little bit of conservation, but I think that we're going to need both at some point in the future.

ALTERNATE MEMBER BOB COOK: Yeah, I'm asking this question because I'm anticipating that, in the next federal administration, we're going to see an increased interest in the federal investment in regional infrastructure for all kinds of needs, including water -

MR. AVERY: Right.

ALTERNATE MEMBER BOB COOK: - and I'm sure they're going to be very interested in that apples-to-apples comparison.

MR. AVERY: Yeah, and - and I think that you've got a question that not only applies just to water, but also, perhaps, a lot more importantly, in terms of energy. And one of the first slides that we presented during the very first meeting was a discussion of how the - the energy costs of Tucson's current supplies, as well as future supplies, is sort of hidden in the price of water, but it is true that virtually every gallon of water that Tucson Water delivers has been pumped uphill, either out of the ground or through the CAP canal, some considerable height, before it's delivered back down to our customers. And so energy and water are always going to be an important component of our costs. And, to the extent that - that the true cost of energy, in terms of whether it's a carbon tax, or emissions credits or offsets starts to be captured, then you'll be able to more accurately identify what the true costs of water are, too, and that can inform decisions going forward.

CHAIRMAN JIM BARRY: Nancy, did I see your hand? Please.

NANCY FREEMAN: Since the State is issuing 100-year water supply certificates based on Groundwater Replenishment District only have 20 years of water supply, I would like to know on this ADD Water how much of the water has been allocated to the Groundwater Replenishment District, and is there a cap on the amount the Groundwater Replenishment District customers will have to pay for water?

MR. AVERY: I can answer part of that question and that is that the Groundwater Replenishment District is part of the ADD Process, and so they - they will be participating in that process going forward. And the - the question about -

NANCY FREEMAN: But, there's no - there's no certain amount that's been designated that's going to go to a Groundwater Replenishment District?

MR. AVERY: I'm going to let Ken answer that, 'cause

. . .

MR. SEASHOLES: Clarification on the first part of your question. The 100-year supply that's associated with certificates is groundwater. The consistency with goal, the requirement to offset that groundwater pumping with Safe-Yield is met through the CAGRD. So, the Replenishment District serves one piece of the Assured Supply Program; it doesn't guarantee 100-year supply to 100-year supply; it has to be proven on groundwater. I keep saying that until - until I - until I keel over.

The - the CAGRD Plan of Operation sets the parameters for how much obligation there is during the planned period for the CAGRD, and it's - 237,000 acre-feet was the - the amount that was identified through that planned period. There's a tracking process to see where we are relative to that that's regulated by the Arizona Department of Water Resources.

The recognition, in - in large part, about this process about cobbling together supplies and meeting our shared needs in a Service Area is partially recognition that the CAGRD, the replenishment responsibilities of CAP, are part of the supplies that need to be acquired. So, the data that both Chris pointed to and I pointed to out of the Plan of Operation was this idea, well, the CAGRD - which is to say CAP - needs to go acquire supplies to meet its replenishment obligation at the same time that individual cities need to do it; that individual other entities are trying to figure out how to meet their demands. So, we are all in the same boat. The - the Replenishment District members and the individual entities that are needing to meet those - those wedges that grow out into the future need to - need to be working on conservation; need to be working on local supplies; and they need to acquire new supplies; and that's where the - the GRD and the individual members come together in the ADD Water Process.

NANCY FREEMAN: And is there any cap on the amount that the Groundwater Replenishment customers will have to pay for water in the future?

MR. SEASHOLES: No.

CHAIRMAN JIM BARRY: Anybody else in the audience?

MADELINE KISER: I have two questions for - related questions for Chris, and one for Ken or for both. I wasn't clear, what will the breakdown be in terms of future supplies, local versus outside of the area? What were you projecting?

MR. AVERY: What I try to do is talk about those supplies in terms of what they are, not so much about how much they are, and that's because it's really hard to figure out. You - it's - it's relatively easy to know how much additional capacity there is in the CAP canal, and look at some portfolio supplies that's out there. How much of that gets to Tucson, hard to figure out.

In the case of - of local supplies, we have a fairly good idea about how much the effluent entitlement is going to grow, and it's roughly proportional to new demands, at least that's our expectation. It - what we don't know yet - 'cause the data's still pretty raw and new - is: How much of a source of either supply or conservation - depending on how you look at it - will rainwater and gray water harvesting prove to become? It's hard to tell at this point exactly what that's going to be.

MADELINE KISER: I'm just curious, like, the percentage of, you know, effluent, rainwater versus CAP -

MR. AVERY: We -

MADELINE KISER: - extra -

MR. AVERY: Yeah.

MADELINE KISER: - what -

MR. AVERY: We didn't - we deliberately didn't try to put numbers on that because it's - it's - they're - they're just wild guesses at this point.

MADELINE KISER: Okay. Relatedly then, you're talking about shifting from seven to \$800 to \$7,000 per - to \$8,000 per - when is that - how - when do you see that happening?

MR. AVERY: Well, I think that the first real indication of that's going to come out of the ADD Water Process. What we've dealt with in the - in the recent past in Tucson, as well as the three-AMA area, has been a renewable water supply portfolio that's all based on - roughly, on CAP costs, either the costs of - of direct allocations of CAP, or the cost of putting excess CAP or unused CAP allocations to use through Water Bank, Groundwater Replenishment District, Recharge Facilities, and - and otherwise.

There have been a few, from my perspective, at least, and I'm probably not aware of everything that's going on, but from my perspective, at least, there's been a few moderate deals here and there for small amounts of water rights on the Colorado River and - and things. But, the ADD Water Process has really - not only is it important in terms of developing a process and looking at putting CAP water to use, but the ADD Water Process is also critical, because what is going to come out of the ADD Water Process is for the first time some reasonable estimate of about what CAGR D supplies are going to cost in the future, and some reasonable numbers for what this next bucket of water is

going to cost in the future. And, at this point, we don't know, but I - I just, you know, I'm throwing -

MADELINE KISER: Is there -

MR. AVERY: - a number out there.

MADELINE KISER: - any estimates? Five years? Ten years? Two years as we start to shift? And that shifts into the next question too. I'll go ahead and just ask that one. It just seemed like - both of these just seemed like a tremendous shift and - locally and our state level, and I've been following the ADD Process. I've been online. I've been watching it with great interest. It hasn't been reported that thoroughly. And I know that the stakeholder process is really involved, but this is a major story for our State, and I'm wondering about what kind of out- - public outreach, you know, reportage on it you're planning, along with that question about when do we shift from \$700 to \$7,000.

MR. SEASHOLES: Well, I - I don't - I don't endorse that - that view. But - and one thing I think is important when people talk about costs associated with water is to differentiate between acquisition costs for rights versus an annualized delivery of an acre-foot of water.

MR. AVERY: And I agree. And I think they're both going to be in order of magnitude higher, but . . .

MR. SEASHOLES: Right. But - but - so, when you're looking around and you see kind of shocking numbers of, you know, one transaction, one place, one another, it does help to kind of look at, well, what - what was the transaction for? Was it for a perpetual right, high-priority right, and there's an up-front cost, or is that the delivery? There's a lot of kind of nuance to that.

In terms of sort of generating additional stakeholders and additional engagement, as important as the issue is, it's really kind of still quite blanche-ish (ph.); it's - we've had lots of conferences and discussions over - about the, quote, "next bucket supply" in the water community for a long time and it's hard to really get engagement interaction. I think that's - that's going to change in the next five years; that I'll - that I'll agree with for sure. And we've - we've seen some real markers on that.

Our Board, the CAP Board, was - was, I think, really kind of jarred into really look - taking a hard look at this in the CAGR Plan of Operation. When you roll out the numbers and it's a, you know, a quarter million acre-feet that needs to be acquire for the plan - for the membership that's going to enroll through 2015, those numbers start to really grab folks' attention.

And when we do start making these transactions, when we do have to acquire some of these rights, that's when the numbers become realer, and I think that's why you maybe don't have, you know, stories in the paper about it is that it hasn't really gotten to the point where it gets to people's pocketbooks or where the actual paradigm has shifted. We're - we're talking about it, but it hasn't gotten there yet.

MADELINE KISER: Thank you.

CHAIRMAN JIM BARRY: Anybody else? Colette?

COLETTE ALTAFFER: We've been talking about desalinization as another source of water, and we're looking at desalinization of brackish water up in the Phoenix area. You probably know there's huge energy costs associated with desalinization, as well as a waste stream that must be disposed of. Who's going to pay those costs if we're doing this up in the Phoenix area? And where are we going to store this waste stream?

MR. AVERY: I - I - I think that - you know, everyone - let me back up. I think, in some cases, the ADD Water Process is (inaudible) blot test and everybody can look at it and see what they want to see coming out of it. But, I think that one of the benefits of at least attempting the ADD Water Process is that I think you will - rather than having individual parties come in and try to cherry pick little pieces of supply, that you will start to see - at least I hope - a process where certain blocks of water, or - or aggregate clumps of water will be allocated at some relatively equitable price.

So, the folks who benefit from the additional water supplies that - that comes out of desalinization will be the ones paying those costs and - at least the way I see it. And those costs are - and, again, just my opinion, are going to be, in order of magnitude, higher because of the brine disposal costs, because of the increased energy costs, because of the incredible infrastructure investment you've got to make just to build the plant, and - and it's a significant difference between the water supplies that we have available today in going to that regime.

On the other hand, as I've tried to - we - we tried to show on the June 25th presentation, agricultural water, no matter how - how you slice the numbers, some - develops somewhere between \$1,000 to \$500 to \$1,500 of economic return to the State and to the country for every acre-foot of water that gets used. And, in Tucson, an acre-foot of water generates about \$150,000 worth of economic return. And so, while those supplies are likely to be, in order of magnitude, more expensive than existing supplies, it's also likely that municipal and industrial users will be able to pay those costs because of the

- what - what are, in my mind, enormous economic returns that come out of municipal and industrial use of water.

CHAIRMAN JIM BARRY: We have - over here, Mike.

MARK MARIKOS: Mark Marikos. One global question and one local one. On those three basins, has any thought gone into actually storing unused CAP allocations in those basins?

MR. SEASHOLES: There is a Recharge Facility in Harquahala. There's also an Irrigation District that receives CAP water and earns paper water credits. So, there is some activity there. Butler and McMullen are less developed and less ac- - directly accessible to the - to the CAP infrastructure. There's a private entity, Good- - Goodyear Water Company, has made investments in Harquahala to - to store excess CAP. So, the answer is yes, it's - it's happening.

MARK MARIKOS: Okay. Is there a fairly large capacity for storage there or is it - are the ba- - aquifers pretty close to full?

MR. SEASHOLES: The - the aquifers aren't necessarily full in terms of there being - there's - there's aquifer space. The actual Recharge Facility, the Goodyear Facility hasn't been one of the more productive ones; its infiltration rates aren't - aren't as high as, for instance, the City of Tucson's. So, there - there definitely are opportunities, but the - the supply there, the supply development, both in terms of the water that's been stored from excess CAP, as well as this groundwater that can be mined, is being investigated kind of a couple of different ways, whether it may be used as a - as a interim supply, a drought supply, those kinds of things. But, there's - there's been a noticeable up-tick in interest in - particularly in Harquahala, a lot of proposals, a lot of proposals for solar, large-scale development, all kinds of things out there, but we're - we're a ways away from anything concrete.

MARK MARIKOS: Okay. Then the local question. I know we've got a number of large holes along the Santa Cruz, gravel quarries and stuff. Has any thought been given to using some of those as storage of excess storm water?

MR. AVERY: I - I - I think the answer is there's been some thought, but not a lot on the gravel - the gravel pits. We are working with Pima County, basically, right now looking to try to identify some constructed recharge opportunities in the Santa Cruz River to try to increase infiltration rates and the - one of the real questions is: How you design facilities that are - not necessary flood-proof, but so inexpensive that when there - when there is one of those monster Santa Cruz River floods that everything washes away and you start over again.

And, as we move forward in that process, I think that we'll have in - in five years, or maybe even three years, we'll

have more answers about what works in the Santa Cruz River and what doesn't than we do today.

CHAIRMAN JIM BARRY: Anybody else?

MEMBER JOHN CARLSON: Jim, I have a question of - confusion on my part. Gray water. I'm - I'm in Colonial Verde and I was on their Homeowners' Association Board when a gentleman wanted to use gray water, and we turned him over to Tucson Water and they sent him to the - Pima County. So, have you got a jurisdiction thing there? And who's in charge? And what are the thoughts there?

MR. AVERY: I don't know the time frame that you're talking about, but - and I can't -

MEMBER JOHN CARLSON: A year and a half ago.

MR. AVERY: Yeah, I don't - I can't remember the date. As soon as I walk away from the podium, I'll know it. But, it seems to me that it's 2002 or '03 that the Arizona State Department of Environmental Quality adopted the gray water rules.

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: And, before that, there was always some question about whether gray water reuse was legal or not, and whether it could be done in Arizona or not; that all changed with the adoption of those rules. So, that - those rules and, essentially, the adoption - it's called a "Gray Water General Permit" - basically mean that if you follow the rules in - in the permit and the conditions of the permit, that you can use gray water in Arizona. And so I don't know exactly what kind of run-around you were getting.

MEMBER JOHN CARLSON: Well, who - who - who's enforcing it? You just mentioned the environmental aspect.

MR. AVERY: In - in terms of the - the enforcement - that's a good question - ADEQ has the jurisdiction to enforce a violation of its rules, or a violation of what would be the general permit conditions. How it gets reported and whatever is a different question. But, it's clear that in - in Arizona - and you might have homeowners' association codes that I - that I don't know about - but, in Arizona, generally, if you want to use gray water to irrigate a non-food-bearing tree or a - or - or a food crop that's not likely to be - you know, you can irrigate a citrus tree, but you probably don't want to irrigate carrots with it - it's - it's legal. There's some standing-water restrictions, and some other - some restrictions about the source of the water that's used, and I can't answer the particular question. But, generally, gray water now is - is a legitimate use of water as long as those rules are followed, and that's what's the City of Tucson Ordinances are trying to build on is a way for homeowners who want to follow those rules

to have a source of supply that's available without grabbing a reciprocating saw and cutting holes in one's walls.

MEMBER JOHN CARLSON: Well, that's my confusion. They - they said once it got out there and started to flow it became a County jurisdiction because of the - the drainage system and so forth, and I'm just confused. Are you guys -

MR. AVERY: The Arizona rules -

MEMBER JOHN CARLSON: - stalking each other?

MR. AVERY: The Arizona rules basically say that if you want to use the water on your own property - and I don't - you say homeowners' association, I - anyway - if you want to use the water on your home - on your own property to irrigate certain kinds of trees, and - and you don't allow the water to pool so that it becomes a hazard, it's entirely legal to use gray water, and if you - if you violate some of those permit conditions, if you let the water pool, if you use the -

MEMBER JOHN CARLSON: Yeah.

MR. AVERY: - wrong source of water, if you - you irrigate the wrong plants, then you violate the conditions.

MEMBER JOHN CARLSON: Well, I'm - I'm with all that, but who's going to come and shut us down? You or the - or the County?

CHAIRMAN JIM BARRY: I - I think we don't know the answer.

MR. AVERY: Not me.

CHAIRMAN JIM BARRY: John, I'm going to go out to the audience.

MEMBER JOHN CARLSON: Please -

CHAIRMAN JIM BARRY: We got -

MEMBER JOHN CARLSON: - do that.

CHAIRMAN JIM BARRY: - we got another question out there.

WILLIAM CROSBY: William Crosby, Tanque Verde. I'd like to know if there is an annual acre-foot use figure for the Tucson Basin, both incorporated and non-incorporated areas.

MR. AVERY: Yeah, there is and we can - we can figure that out for you. In terms of how much water - Tucson Water delivers within the incorporated areas and how much water we deliver outside?

WILLIAM CROSBY: Right.

MR. AVERY: Yeah, we can provide that number for you. It's about -

WILLIAM CROSBY: Okay.

MR. AVERY: - 6,535. And I don't know exactly, but in terms of Tucson Water's provision of service, about 65% of the water that we deliver every year is delivered within the City limits, and about 35% to 40% is delivered outside the City

limits. Oro Valley doesn't deliver much water outside of its incorporated boundaries; not - not any that I know of. And I think Metro is entirely - well, I don't know the answer - Metro may deliver some small residual deliveries inside Oro Valley.

WILLIAM CROSBY: Okay. And is - question for Tucson Water - how active are the Central Wellfields?

MR. AVERY: Today, they're - they're pretty inactive. This morning, we delivered - well, last - last week, we delivered somewhere between 106 and 110 million gallons a day; and, of that supply, about 55% came from Avra Valley, about 45% came from our Wellfields, but only about 20 to 30 million gallons of that demand is coming from the Central Wellfields, a lot of it's coming from the Santa Cruz and the South Side Wellfields. So, at this point, probably a third of what was being pumped seven years ago from - from the Central Wellfield. We know that in the last seven years, in the area right around Rincon University High School that the water tables rebounded about 30 feet.

CHAIRMAN JIM BARRY: All right. Anybody else? Are we set up for Nancy now? Okay. Chris, Ken, thank you very much.

(Applause.)

<p style="text-align: center;">Presenter #3: NANCY FREEMAN, EXECUTIVE DIRECTOR, GROUNDWATER AWARENESS LEAGUE: STORM WATER RECHARGE</p>
--

MS. FREEMAN: Well, I know why I'm going last, because I think this is very inspiring; to me it is. I - when I lived in Green Valley, I - I searched around and pestered Ken Seasholes and found out we had a 40,000 water - acre-foot deficit per year, and so I was - I joined a community garden over in Sahuarita, and they told me, "Don't - don't plant anything in the summer." And I go, "Yeah, it's too hot." "No, it all gets washed away because of the floods."

Last year, our toolshed, which is a huge toolshed with two or three rototillers, and all sorts of other tools in it, got washed across the - got washed across the garden and only got stopped by the fence. And I go, "There's that much water, you know. Why isn't somebody doing something?" So, I started talking to the different people in the neighborhood and they have photographs and it's true, we've got water.

This is El Toro Road. This is Delgado Road. And this - oh, pardon me - that first one was Davis Road. This is El Toro Road. And so we wanted to think about, "What are others

doing with their storm water?" This is a reservoir in Colorado where you can go fishing; there's a lot of these in California, too, recreational reservoirs to catch the storm water. And this is Bosque de la Apache in New Mexico, which is a managed wildlife refuge which is absolutely incredible. If you haven't been there, it's - it's something not to miss.

And this - of course, Australia, they got there before we did when it came to low water supplies. So, this is an example of a golf course that catches its storm water and stores it and uses it. Now, this is more sophisticated. This is also in Australia and on the website is posted their - their plan for water management in this whole district, and it's a really incredible, logical plan.

What are we doing with our storm water? Somebody's backyard. Cleaning water out of their home. This is a rescue team from Green Valley. They didn't have vehicles to get in there, so they had to borrow a backhoe thing. And these are kids going home from school. Their home's not quite the same as it used to be.

Now, this is a map of the floodplains in Tucson. Now, the pink areas are what the Flood Department has called the new sheet floodplains, so this is the region, one of the regions that I'm speaking of, which is south - south of Sahuarita Road, but these areas exist all over Tucson, and if you notice even part of it is a FEMA floodplain areas. So, there's - this is not rainwater harvesting. This is serious storm water and flooding.

And, of course, many people in Tucson don't - are stopped by not being able to get home from their jobs when there is a big rain storm event. And I will mention that this particular area - I'm sure they all have their own stories - it was settled in the '70s. A lot of the people there worked for Hughes, and they wanted to get away from it all. And - and, during the 1983 and the 1993 storm events, they had no problems at all with flooding. So, there's new water being created, and how is this - why is this flood water increasing? Some of it is definitely maintenance issues. In this region, the - the ditches are filled up along Sahuarita Road, washes are silted up. Washes that used to be six feet are now two feet, culverts are clog- - are clogged up. Some people swear that the ditches haven't been cleaned out in 20 years.

Now, there are some key issues. Swiftly-moving water creates hardpan, so it's going to move swifter. And also new roads and housing developments. Now, this is a piece of State Trust Land just to see the hardpan that's been created by swiftly-moving water moving over it in that same region. New developments.

Now, this is actually along Wilmot and Sahuarita Road. There's been a lot of development on Wilmot, and this is what the result has been. And, as you can see, a lot of this water is - it's a good view, so you can see a lot of this water is delivering down Sahuarita Road downhill.

So, how much water do we have in these floodplains? I mean, really no one knows. But, the region that I'm working with - there's about 1,000 acres involved. In rain events, there's six inches to three feet of overflow, and I'm talking about overflow. The washes in the - what's left of the washes and the ditches are totally full. So, we can say we have an excess of one foot over 1,000 acres, which gives us 1,000 acre-feet of water and that is in the - one region, and then there's another region from Wilmot to Country Club, the very same scenario. And this is 1,000 acre-feet of water every time it rains a good monsoon rain, four times this year.

Now, they have recharge basins in Chandler. And I used to live in Chandler, and I - I think - I - I just think they were doing a super job there. They - you don't have to use turf with recharge basins; some of those use the rocks.

Now, this is actually a soccer field, and this soccer field is a recharge basin. And what happens when it rains? Well, nobody plays soccer for two days, you know; it's just - it's just the reality. And how - and then how - oh, you make sure the water infiltrates. You notice the dry wells on the far end because it delivers down to this end and there's mandated to have the water cleared in 48 hours because mosquitoes will form in 36 hours. What do you do if - if, historically, traditionally doesn't clear? Simple. You put in another dry well. This is another - this is a recharge basin; it's got parts and metal equipment.

Now, as it turns out, Chandler has 3,763 dry wells in it, which is, you know, it happened over a long period of time; it didn't happen overnight. What's the cost of a dry well? Ten to \$15,000 each. Now - and this shows how the dry wells are mainly just in the open green space. And the - the historical recharge estimate for this area when it was under agriculture and not used for housing, the re- - estimate, recharge was 191 acre-feet annual. Now they're getting 3,600 to 4,600 acre - acre-feet, and this is what they call "incidental." These are places that had flooding, they put in a dry well to get the - to take care of the flooding problem. They really weren't attempting to augment the groundwater recharge.

Other projects in Arizona, it's Tucson, kind of fuzzy photo, but there it is, Kino recharge - not recharge - Kino storm water project; that's in 2001; and there it is in 2005; that catches storm water to use for the ballpark.

And this is El Coronado Ranch in Cochise County, before picture, and notice those stubs, those stubs are actually branches of a willow tree that - not rooted or anything; after picture.

And now I've been - we've been talking about rural area. I want to just quickly give this information on Santa Monica, which did a storm water recycling facility. Santa Monica, as it turns out, has 12 inches of rain per - per year, the same as Tucson. And I'm just going to go through it quickly, just to show you what you have to go through when you're filtering and catching urban storm water. But, there is an interesting story here, and that is look at, they got their - their money from so many different sources, that ISTEA is a federal pool of money in - considered with transportation, but also EPA has funds, but basically we're thinking about projects upstream. We're in a basin, all the water is flowing downstream to us. If we get the flooding taken care of in the perimeters, then there's going to be less flooding in Tucson itself.

And I ran across in the - from Douglas County, the Colorado Storm Water Management Website, a little paragraph that is just so appropriate. "Nature has claimed a prescriptive easement for floods via its floodplains that cannot be denied without public and private cost. Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property, damage to public infrastructure and utilities, and economic impacts to the residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural and attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat, and movement corridors for wildlife, and opportunities for recreation."

So, I want to think of this storm water as an asset and that we can use as recharge in some areas, and recharge the water where it is instead of moving - moving it around and paying for a lot of infrastructure. Thank you.

CHAIRMAN JIM BARRY: Thank you, Nancy. Very good.
(Applause.)

CHAIRMAN JIM BARRY: Very informative.
Okay. We're going to do Call to the Audience.

* * * * *

CALL TO THE AUDIENCE

CHAIRMAN JIM BARRY: Okay. We're going to do Call to the Audience. Charles, do you want to . . . ?

CHARLES COLE: Mr. Chairman, I - I was out of town and missed two meetings, and they were recent meetings and I reviewed them on the website and saw that some misleading information on cost of rainwater harvesting was presented. I'd like to take about three minutes to correct the record.

In answering a question from the audience on October 2nd, Mr. Avery compared the cost of our residential rainwater harvesting system to the \$20 or \$25 average household's monthly water bill. He was essentially comparing the cost of apples and oranges because of the following: One, our system was built in a remote, semi-remote location, with no other development occurring at the time. So, we had no options for cost sharing; whereas, most people in Tucson are spreading infrastructure costs across thousands of households.

Two, mortgage estimates for our costs were based on year 2003 costs, but the Tucson Water infrastructure was priced decades ago. The monthly water bill stated for Tucsonans does not - and this is number three - does not accurately reflect what citizens are paying for their water.

For our system, the reasonable comparison would be with the estimated costs the Pima County Board of Supervisors obtained a year or so ago for possibly extending water service up Camino Del Cerro, the next canyon to the north of us. If the Board had not voted that down, they would have assessed each household at least \$50,000 to \$60,000, plus a connection fee, plus a monthly water fee. This cost would have been far more expensive than our system, and ours provides outstanding water quality.

In addition, Mr. Avery's use of the \$20 to \$25 average water bill per month in Tucson does not reflect properly what people are actually paying for water. After the last meeting, last week's meeting, I asked Mr. Mitch Basefsky if they had any idea how much people are paying for bottled water. He said that a survey was conducted about two years ago and, if he recalled correctly, people were paying \$28 to \$30 a month for bottled water. This would bring the average monthly water cost to \$50 per household, if accurate, not \$20 or \$25.

In considering such things as untapped water sources, innovative planning, and extending new water surface - new water service - excuse me - to areas that will include shared costs among many water users, futuristic planning should include thinking out of the box, being entirely objective without bias, and costs analyses for possible alternative systems must include appropriate comparisons, not the apples versus oranges phenomenon.

You are discussing extremely serious issues here, and anybody who would use misleading comparisons or funny numbers

would be providing a great disservice to the Committee and to the citizens of Southern Arizona. Thank you.

CHAIRMAN JIM BARRY: Tracy, you want to . . .?

TRACY WILLIAMS: Thank you, Mr. Chair and Committee members. Clearly, one of our community's greatest concerns is the aging infrastructure of Tucson Water and Pima County Wastewater Departments. Many of the pipes, pumps, wells, and treatment plants are outdated, and due to be replaced. This places a huge burden on the employees who are responsible for the operation and maintenance of these vital systems. To improve our understanding of the big picture, we asked the Water Committee to acquire some basic Human Resources information.

Number one - and, Melaney, I'll get this to you in writing, so you don't have to put it on the chart - overall, how many people are currently employed at Tucson Water and Pima County Wastewater? How do these numbers compare with people employed there five years ago, back in 2003?

Number three. How many people work in Operations and Maintenance for both of these systems? And what are their responsibilities, like, what are their job descriptions?

And four. Are any of these Operation and Maintenance jobs being outsourced to private contractors, consultants, companies, or individuals? If so, what are the timelines related to those contracts? How much is being paid? What are the costs related to those contracts? If there are, do they produce reports, and are those reports available as public records? Please provide these reports for our review. Thank you.

CHAIRMAN JIM BARRY: We'll - we'll do that. Asking about how many people work there reminds me of back in 1963 somebody asked John Paul the 22nd, who was the Pope at the time, how many people worked in the Vatican and he said, "Oh, about a third." So, maybe we'll get you that information.

Anybody else? Call to the Audience. Colette?

COLETTE ALTAFFER: I feel like I've gone down the rabbit hole when it comes to talking about effluent and gray water. We talk about the amount of gray water increasing as the population increases, but the water to fill the toilets has to come from somewhere first; doesn't come out of thin air. So, it sounds like we're not factoring that in.

And then we talk about how we're going to conserve water by putting in gray water systems but, because of the way our sewer system is designed, it is designed at a particular pitch, which means you have to have a certain amount of water in the system in order for the sewer system to function, and if we start taking water out, that may amount to a savings for me if I put a gray water system in, but somewhere down the line we've

got to put - whether it's potable or pipe effluent back uphill to put it back into the system. So, it looks like all we're doing is redistributing my costs to the rest of the community that doesn't put a gray water system in, and I 'm just hoping we don't lose sight of that and that we keep that in mind is that, at this point, it doesn't really sound like a real conservation measure.

MEMBER JOHN CARLSON: Yeah, we addressed that last time; that there's -

CHAIRMAN JIM BARRY: Yeah. Anybody else? Anybody want to adjourn? Done. Thank you all very much.

(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Call to the Audience) of the City/County Water & Wastewater Study Oversight Committee Meeting held on October 15, 2008.

Transcription completed: October 19, 2008.

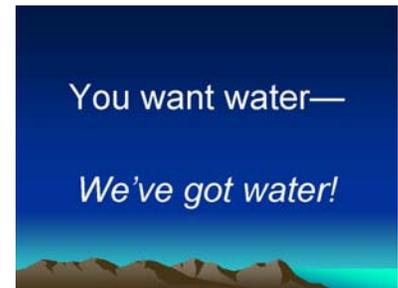
DANIELLE L. KRASSOW-TISDALE

**Presenter #3:
NANCY FREEMAN, EXECUTIVE DIRECTOR,
GROUNDWATER AWARENESS LEAGUE: STORM
WATER RECHARGE**



MS. FREEMAN: Well, I know why I'm going last, because I think this is very inspiring; to me it is. When I lived in Green Valley, I searched around and pestered Ken Seasholes and found out we had a 40,000 acre-foot deficit per year, and so I joined a community garden over in Sahuarita, and they told me, "Don't plant anything in the summer." And I go, "Yeah, it's too hot." "No, it all gets washed away because of the floods."

Last year, our tool shed, which is a huge tool shed with two or three rot tillers, and all sorts of other tools in it, got washed across the garden and only got stopped by the fence. And I go, "There's that much water, you know. Why isn't somebody doing something?" So, I started talking to the different people in the neighborhood and they have photographs and it's true, we've got water.



Davis Rd., Sahuarita



Delgado Rd., Sahuarita



El Toro Rd., Sahuarita



This is El Toro Road. This is Delgado Road. And this - oh, pardon me - that first one was Davis Road. This is El Toro Road.



And so we wanted to think about, "What are others doing with their storm water?" This is a reservoir in Colorado where you can go fishing; California, too, catch the storm water. Apache in New Mexico, is a managed wildlife refuge which is absolutely incredible. If you been there, it's something not to miss.

Wolford Reservoir, Colorado



Bosque de la Apache, New Mexico



which refuge haven't

Barnwell Park Golf Course - stormwater channel, retention basins and storage tanks - Australia

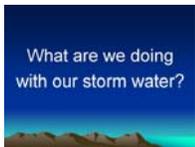


And this - of course, Australia, they got there before we did when it came to low water supplies. So, this is an example of a golf course that catches its storm water and stores it and uses it. Now, this is more sophisticated.

This is also in Australia and on the website is posted their plan for water management in this whole district, and it's a really incredible, logical plan.



Kaurna Park Wetlands - Site for the Hidden - Edinborough Park Water Supply Project



What are we doing with our storm water? Somebody's backyard. Cleaning water out of their home. This is a rescue team from Green Valley. They didn't have vehicles to get in there, so they had to borrow a backhoe thing. And these are kids going home from school. Their home's not quite the same as it used to be.

Filling up back yards



Green Valley rescue had to borrow a back-hoe/tractor



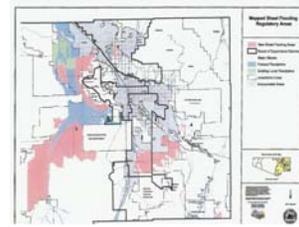
A tough trip home from school



Home is not quite the same!



Now, this is a map of the floodplains in Tucson. Now, the pink areas are what the Flood Department has called the new sheet floodplains, so this is the region, one of the regions that I'm speaking of, which is south of Sahuarita Road, but these areas exist all over Tucson, and if you notice even part of it is a FEMA floodplain areas. So, this is not rainwater harvesting. This is serious storm water and flooding.



Why is amount of flood water increasing?

Maintenance issues:

- Ditches filled in along roads
- Washes silted up
- Culverts clogged up

Key issues:

- Swiftly moving water creates hard-pan
- New roads and housing developments

And, of course, many people in Tucson are stopped by not being able to get home from their jobs when there is a big rain storm event. And I will mention that this particular area - I'm sure they all have their own stories - it was settled in the '70s. A lot of the people there worked for

Hughes, and they wanted to get away

from it all. And during the 1983 and the 1993 storm events, they had no problems at all with flooding.

So, there's new water being created, and why is this flood water increasing?

Another moonscape due to flood water flows



Land turned into hard pan from fast flowing water



Some of it is definitely maintenance issues. In this region, the ditches are filled up along Sahuarita Road, washes are silted up. Washes that used to be six feet are now two feet, culverts are clogged up. Some people swear that the ditches haven't been cleaned out in 20 years.

A new development in a sheet flood plain without a single flood management facility



Damage at Wilmont and Sahuarita Rd. due to flood waters



Now, there are some key issues. Swiftly-moving water creates hardpan, so it's going to move swifter. And also new roads and housing developments. Now, this is a piece of State Trust Land just to see the hardpan that's been created by swiftly-moving water moving over it in that same region. New developments.

Now, this is actually along Wilmot and Sahuarita Road. There's been a lot of development on Wilmot, and this is what the result has been. And, as you can see, a lot of this water is delivering down Sahuarita Road downhill.

How much water do we have?
No one knows — here's a couple of possibilities:
Santa Rita Rd-DeIgado Region = 1,000 acres
• Rain events = 6 inches to 3 feet of overflow
• Excess = 1 ft over 1,000 acres = 1,000 af
Same scenario: Wilmot to Country Club

So, how much water do we have in these floodplains? I mean, really no one knows. But, the region that I'm working with - there's about 1,000 acres involved. In rain events, there's six inches to three feet of overflow, and I'm talking about overflow. What's left of the washes and the ditches are totally full. So, we ves us 1,000 acre-feet of water and that is in the one region, and then there's another region from Wilmot to Country Club, the very same scenario. And this is 1,000 acre-feet of water every time it rains a good monsoon rain, four times this year.



Turf isn't necessary, river rocks work



Now, they have recharge basins in Chandler. And I used to live in Chandler, and I just think they were doing a super job there. You don't have to use turf with recharge basins; some of those use the rocks.

Sand and plants work too!



Recharge basin #1 in Chandler —
A soccer field



Now, this is actually a soccer field, and this soccer field is a recharge basin. And what happens when it rains? Well, nobody plays soccer for two days, you know; it's just the reality. And then how - oh, you make sure the water infiltrates. You notice the dry wells on the far end because it delivers down to this end and there's mandated to have the water cleared in 48 hours because

mosquitoes will form in 36 hours. What do you do if, historically, traditionally doesn't clear? Simple. You put in another dry well. This is another recharge basin; it's got parts and metal equipment.

Dry wells on low end of field —
Enough to clear water in 48 hours



Now, as it turns out, Chandler has 3,763 dry wells in it, which is, you know, it happened over a long period of time; it didn't happen overnight. What's the cost of a dry well? Ten to \$15,000 each. Now - and this shows how the dry wells are mainly just in the open green space. And the historical recharge estimate for this area when it was under agriculture and not

used for housing, the recharge was 191 acre-feet annual. Now they're getting 3,600 to 4,600 acre-feet, and this is what they call "incidental." These are places that had flooding; they put in a dry well to take care of the flooding problem. They really weren't attempting to augment the groundwater recharge.

Recharge basin #2—
A neighborhood park with picnic facilities



Other projects in Arizona, it's Tucson, kind of fuzzy photo, but there it is, Kino storm water project; that's in 2001; and there it is in 2005; that catches storm water to use for the ballpark.

And this is El Coronado Ranch in Cochise County, before picture, and notice those stubs, those stubs are actually branches of a willow tree that - not rooted or anything; after picture.

The park has metal play equipment



Drywells by land use classification

Land Use	Total Drywells (estimate)
Single Family Residential	1548
Multi Family Residential	470
Commercial	545
Industrial and Airports	101
Schools, Churches, Hospitals	512
Infrastructure	105
Parks, Golf Courses	107
Agriculture	16
Water	113
Desert, Vacant Land	245
Total	3763

And now we've been talking

about rural area. I want to just quickly give this information on Santa Monica, which did a storm water recycling facility. Santa Monica, as it turns out, has 12 inches of rain per year, the same as Tucson. And I'm just going to go through it quickly, just to show you what you have to go through when

Santa Monica Urban Runoff Recycling Facility

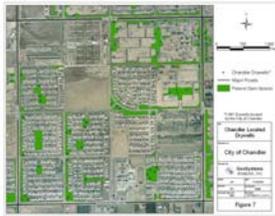
(Note: Santa Monica has 12" of annual rainfall, same as Tucson)

- Reuse a local water resource.
- Keep a pollution source out of Santa Monica Bay.
- Reduce imported water supplies & impacts on other watersheds.
- Open, walk-through facility to educate the public.
- Up to 500,000 gallons/day, avg. is 325,000
- 3% of City's daily water use.
- \$12 Million
- \$175,000 O&M



you're filtering and catching urban storm water. But, there is an interesting story here, and that is look at, they got their money from so many different sources, that ISTEA is a federal pool of money - considered with transportation, but also EPA has funds, but basically we're thinking about projects upstream.

We're in a basin, all the water is flowing downstream to us. If we get the flooding taken care of in the perimeters, then there's going to be less flooding in Tucson itself.



"after" — a wonderful riparian habitat



And I ran across in the - from Douglas County, the Colorado Storm Water Management Website, a little paragraph that is just so appropriate.

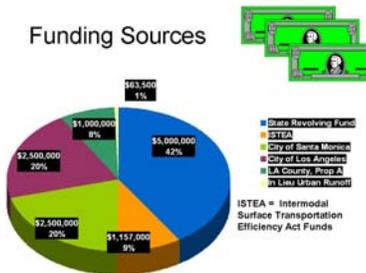
"Nature has claimed a prescriptive easement for floods via its floodplains that cannot be denied without public and private cost. Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property,

Estimated groundwater recharge summary

Historical recharge estimate	= 191 acre feet annual
Stormwater runoff from Dry wells	= 2610-3320 (afa)
Turfgrass and Agriculture Infiltration (from precipitation)	= 1290 (afa)
Potential Enhanced Groundwater Recharge	= 3900-4600 afa

damage to public infrastructure and utilities, and economic impacts to residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural and attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat, and movement corridors for wildlife, and opportunities for recreation."

So, I want to think of this storm water as an asset and that we can use as recharge in some areas, and recharge the water where it is instead of moving it around and paying for a lot of infrastructure. Thank you.



The price is high for collecting urban stormwater

Tobacco is a toxin, so if we collect water in the peripheral regions, we will help the flooding in Tobacco Road.

Advantages:

- Lower cost of recharge facilities
- No water going to the Santa Cruz River, creating both pollution and flooding concerns

However, Santa Monica was able to tap into a variety of funding sources:

Floodplain Philosophy

Nature has claimed a prescriptive assessment for floods, via its floodplains, that cannot be denied without public and private cost. Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property, damage to public infrastructure and utilities, and economic impacts to the residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat and movement corridors, and opportunities for recreation.

—From Douglas County, Colorado Stormwater Management website

Nancy Freeman
Groundwater Awareness League
www.g-a-l.info

CHAIRMAN JIM BARRY: Thank you, Nancy. Very good. (Applause.)

CHAIRMAN JIM BARRY: Very informative. Okay. We're going to do Call to the Audience.

* * * * *

TRANSCRIPT OF OCTOBER 22, 2008

List of Presenters:

1. *Ron Proctor representing Sustainable Tucson*
2. *Madeline Kiser representing Sustainable Tucson*
3. *Colette Altaffer representing the Neighborhood Infill Coalition*
4. *Kendall Kroesen representing Tucson Audubon Society*
5. *Tres English representing Sustainable Tucson*
6. *Linda Ellinor representing Sustainable Tucson*

CHAIRMAN JIM BARRY: All right. I'm going to call the October 22nd, 2008, meeting of the Oversight Committee to order. We have a Meeting Summary from the October 15th meeting. Do I hear a motion to approve it?

UNIDENTIFIED MEMBER: Yes.

UNIDENTIFIED MEMBER: Second.

CHAIRMAN JIM BARRY: Any objection?

(No response.)

CHAIRMAN JIM BARRY: Done. Announcements. Does anybody on the Committee have an announcement they want to make?

By the way, Bob? Bruce is not - Bob? You're at the table - Bruce is not coming tonight I heard. Nobody from the - from the Committee has a - any announcements? All right.

Brenda Garcia sent you all a copy of the Questionnaire that - that Marcelino has sent out as a way of organizing our thoughts for the - for the writing process, and I would just ask you to, again, look at it and start thinking about that; it's going to - to - hi, Rob - it's going to greatly facilitate our writing process if we have been thinking about those things and - and, even submitting 'em and giving us a chance to look at 'em in advance.

Nicole Fyffe gave me this. Nancy Freeman gave her presentation on storm water last time, and Nicole wanted to - to call the Committee's attention and the public's attention to a dedication ceremony November 1st - 1st, 2008, to the Arroyo Chico Cherry Field Retention Basin. You may have seen that under construction; it's a huge hole in the ground that was built - as I remember it - to - to make TUSD a hole after they had to give up properties to allow for that detention process to be done. So, it's - it's - it's a - it's a major storm water detention basin, and -

MEMBER JOHN CARLSON: It's off Tucson Boulevard?

CHAIRMAN JIM BARRY: It's off of -

UNIDENTIFIED MEMBER: Campbell, isn't it?

CHAIRMAN JIM BARRY: - it's off Kino.

UNIDENTIFIED MEMBER: You know, Campbell . . .

UNIDENTIFIED MEMBER: Where the baseball -

CHAIRMAN JIM BARRY: Yeah -

UNIDENTIFIED MEMBER: - it's just south -

CHAIRMAN JIM BARRY: - it's right at - it's where Father Kino Statue is, isn't it? Yeah. Okay.

We - just to remind the Committee, November 15th, we have a meeting; it's - it's currently scheduled for the Doubletree from 9:00 until 3:00; that's going to be our first writing session. So, I just wanted to remind you of that; that's the 15th.

MEMBER JOHN CARLSON: Which Doubletree?

CHAIRMAN JIM BARRY: Right over here.

UNIDENTIFIED MEMBER: Across the street there.

CHAIRMAN JIM BARRY: Yeah, I like to keep things in my neighborhood. I can walk - I can walk here. I don't, but I could, if I wanted to.

Okay. We are now at a new phase in this process. From - and I'm - I made some notes - and if you'll excuse me, I'm just going to kind of read from them. From June 11th until last week, the Committee received presentations from Staff, and from various outside experts, on a variety of topics that were - were germane to the scope that the Board and the Mayor and Council gave us. And tonight and next Wednesday, we want to get presentations from the public and - on an issue that is really central to what the Committee believes is the concept that the Mayor and Council and the Board had in undertaking this five-phase process, and that is: What is a sustainable water future for us? Meaning, Tucson, for Pima County, for the Tucson Active Management Area, and - and, eventually, it's going - it's going to be larger than that.

Now, we're going to talk about sustainability tonight and next week; those are the last two planned presentation sessions. So, sustainability temporally is coming last; but, conceptually, it is really of the first order; it is - it is central to how we will understand what are the common facts that we're unearthing? What is the common understanding to the context that - that we wish to - to be able to capture in - in our reports? Sustainability is - is going to be the - the first principle, really.

So, we want to hear from the community on how you define sustainability and what your concerns would be for sustainability. And we've issued an open-ended invitation for you to present your views on sustainability in whatever structure and words are most appropriate to you. These presentations will help us as we transition - the Committee transitions into Phase II.

In - Marcelino, hi - in - in opening up the - the microphone to the Committee (sic), we expect to hear a diversity of viewpoints, and that's good. But, to help us, the Committee, to process what we're hearing, what - what you're saying to us, to help us listen and hear, we've asked two people to help us, and we have Margot Garcia and - and Dale Keyes, who are, luckily for us, in Tucson and free at this - over the next couple of months to help us out.

Dale recently retired as a Senior Program Manager at the U.S. Institute for Environmental Conflict Resolution. His professional interests span urban planning and environmental assessment, in addition to conflict resolution, and he's been in the community a long time.

Margot is a retired professor of Environmental Planning. She taught classes in public participation, mediation and environmental assessment, involved in - in voter issues since the 1970s, and served on several panels for the National Research Council. Both of - both Margot and Dale bring a lot of process experience that will help us listen.

So, what you're going to be seeing tonight, while you're presenting, is Margot or Dale recording your ideas, your notes, on - on flip charts. We are filming, yes? We are taping, so there will be a transcript. And we are expecting - we are hoping that everybody who presents, or even doesn't present, there will be written comments so that Margot and Dale will take their notes, the transcripts, whatever written things we have, and make a report to the Committee, synthesizing what we hear, try to identify the major points, where are the areas of agreement, where are the areas of different emphasis, so that we have a basis for taking what we hear from you and integrating it into our report.

MEMBER JOHN CARLSON: Mr. Chair?

CHAIRMAN JIM BARRY: Yes, sir.

MEMBER JOHN CARLSON: You know, they had us send in, if we've had time a couple paragraphs -

CHAIRMAN JIM BARRY: Right.

MEMBER JOHN CARLSON: - that's floating around wherever.

CHAIRMAN JIM BARRY: Right.

MEMBER JOHN CARLSON: What we get tonight, what's - what's the intent? To make one nice big book with everybody's comments, or selectively reproduce some of this stuff, or how are you going to handle -

CHAIRMAN JIM BARRY: We -

MEMBER JOHN CARLSON: - it, getting it over to us?

CHAIRMAN JIM BARRY: John has - has made a point; that - that we issued an invitation for all of the Committee members

to submit one-paragraph statements on what you think sustainability is, or what you hope to get out of it. We're not going to present that to ourselves. We're going to have that - we're not asking Margot and Dale to summarize that for us, we will do that for ourselves. But, I envision, again, that we will have every Committee's - member's statement, every statement - that we hear this on the transcript, and every written statement we have, and that we will figure out how to summarize that for the report that we make, and we will keep documentation of all of that.

MEMBER JOHN CARLSON: Good.

CHAIRMAN JIM BARRY: Okay.

MEMBER JOHN CARLSON: Thank you.

CHAIRMAN JIM BARRY: So, ground rules: We - we sent out invitations, more than once in more than one format, asking people to - to tell us if they wanted to come. We've had - we've had a number of people who have signed up already. Those people have priority. We will call them - on them, acknowledge them in the order that we have them signed up. We've asked people to limit their comments to five minutes. If you do it in less than five minutes, nobody's going to be mad at you, but we've asked you to limit it to five minutes and, with the Committee's approval, I will do my best to enforce that, okay?

We plan to finish by 8:00. So, if we have more than that, 8:00, sometime around there, Committee, maybe we need to make an assessment. Do we go a couple minutes extra? But, we'll have to - we'll have to play that by ear.

So, that being said, let me ask a question: How many people out here in the audience are prepared to pre- - make presentations tonight? All right. We're not going to run across a problem.

Does the Committee have anything that they want to say?

MEMBER JOHN CARLSON: What's happening next meeting?

CHAIRMAN JIM BARRY: Same thing, more people coming in. Bonnie?

MEMBER BONNIE POULOS: I just wondered if we can make sure that each speaker gives us their name, address -

CHAIRMAN JIM BARRY: Yeah, right.

MEMBER BONNIE POULOS: - and, if they have an affiliation that they're -

CHAIRMAN JIM BARRY: Yes.

MEMBER BONNIE POULOS: - for, if they'll let us know that.

CHAIRMAN JIM BARRY: Okay. Good. Margot, Dale, do you want to add anything by way of introduction? No? Okay. We all set? This is it.

UNIDENTIFIED FEMALE: Sure.

CHAIRMAN JIM BARRY: Okay. I'm going to read 'em as I see here. Ron Proctor. Is he here?

RON PROCTOR: Yes.

CHAIRMAN JIM BARRY: Okay, Ron, come on. Oh, let me - let me - I'm sorry - let me interrupt. What - my plan is that we're going to treat this kind of like Call to the Audience. We'll - we'll take the com- - the statements, we won't interact with people, 'cause we - we got to make sure that we - we give time for everybody who wants to speak, okay?

Ron, please go ahead. Thank you.

RON PROCTOR: Okay. Thank you.

CHAIRMAN JIM BARRY: And give us your name and affiliation, please.

<p style="text-align: center;">Presenter # 1 Ron Proctor representing Sustainable Tucson</p>

RON PROCTOR: My name is Ron Proctor. I live at 1031 East Copper Street. I'm affiliated with Sustainable Tucson. There - well, I'll just mention that there are several people - I don't know how many, four or five or six from Sustainable Tucson with - with messages this evening. Thank you all for doing the work that you're doing and - and bringing this very important issue forward.

I don't know how many of you saw *Frontline* last night on PBS. There's a - a - a - it was an episode called "Heat" about global warming, excellent-base information about where we stand with that, and I'd recommend people seeing that; it's, essentially, what I'm talking about this evening regarding sustainability.

Sustainability is the ongoing process of securing a quality of life for ourselves and future generations. Over the course of human history, we have been able to sustain ourselves by using abundant and readily available resources, and the natural world has had the capacity to process the resulting waste. Now, however, sustainability is becoming part of our greater understanding because we are realizing we live in a world with limits, and those limitations are causing a decrease in our quality of life and, perhaps, a challenge to our existence. The state of our natural ecosystem that yields a continuous flow of valuable goods or services is in a deteriorating state, and population pressures are accelerating the problem.

Tucson is a desert community living beyond the care and capacity of its local resource base. The vast majority of

resources are imported, including food, fuel, material goods and, more recently, water delivered through the Central Arizona Canal. We are sustained by a resource transport system that relies almost entirely on fossil fuel. Unfortunately, consumption of fossil fuel supports us on the one hand, and strikes with the other. While this transport system supplies us with consumable goods, it also produces carbon dioxide, undercutting the stability of our shared climate and destroying the natural capital that needs to remain the basis of our physical support. Carbon dioxide emission reduction should, therefore, be a major part of the sustainability equation.

Science suggests worldwide levels of co2 emissions need to be reduced by between 50% and 85% by 2050. Other argues that zero or negative carbon goals are urgently needed. Regardless of the actual percentage, science is indicating major reductions will be necessary to mitigate climate change. Fortunately, Emission Reduction Agreements have already become stated policy. The Western Climate Initiative, signed by Arizona Governor Napolitano, and the U.S. Mayor's Climate Protection Agreement, signed by Mayor Walkup, both call for large-scale co2 emission reductions. A draft Greenhouse Gas Inventory for Pima County and the City of Tucson just released will help determine the baseline for greenhouse gas reductions and what part the City and County Water and Wastewater Systems should play in meeting those goals. An 85% reduction in co2 emissions worldwide by 2050 is a daunting task, to say the least. It seems likely a rethinking of infrastructure and levels of services will be necessary in order to meet those goals.

One way or another a sustainable water system will require making sure the whole system satisfies carbon emission goals. In rethinking the water system in this time of environmental fragility, and considering the problems associated with carbon emissions, one obvious approach suggests creating a system that inherently requires less energy. Developing water supply that falls naturally at, or near point of use, can use gravity to advantage, eliminating major environmental and energy costs. The case may be made that the water we have been importing over long distances and raised to great heights may be better used in other ways. Colorado River allotments currently delivered to Tucson may be more efficiently used supporting agriculture in the Colorado River lowlands and restoring the fisheries beyond its delta.

CHAIRMAN JIM BARRY: Ron, one minute, please.

RON PROCTOR: Okay. So, what might - so, what might a sustainable water system look like in Tucson? It could be based on non-imported water catching all necessary rainwater for

residential use at or near where it would be used. Charles Cole, who has presented for this Committee, has demonstrated that water harvesting - harvesting can be done, satisfying typical residential water needs in Tucson.

A public wastewater system could collect excess or sewer wastewater, purify it to necessary standards, and recirculate it for toilet flushing and distribution to recreational areas and for fire suppression. Aquifer pumping could be discontinued until natural recharge restored surface flows in riparian areas. Once the aquifer was restored, excess water could be banked appropriately.

Commercial and industrial users would be responsible for their own water supplies, either by leased catchment or private pipeline, and be responsible for any costs incurred or waste products produced. Water rates would be based on the cost of treatment and pumping using carbon neutral - renewable energy, as well as the amor- - amortized cost for the catchment and necessary piping infrastructure. In this whole system approach, each - each citizen would be responsible for their actual water use, and assessed a share of cost of public amenities such as green space and fire protection.

Any sustainable water supply system for Tucson will need to meet the carbon emissions requirements necessary for climate change mitigation. If we continue to import long-distance water, a thorough analysis is needed to prove its merit. Alternatively, one could design a system based on the only truly renewable water resource we have: rainfall. We have technology that allows us to recycle that water to maximize its use for our community purposes. What environmental and financial costs, either of these options incur, should be compared and brought before an informed public before requesting funding for major public investment. Thank you.

CHAIRMAN JIM BARRY: Thank you, Ron.
Okay. Madeline Kiser.

Presenter #2
Madeline Kiser representing
Sustainable Tucson

MADELINE KISER: I'm Madeline Kiser, and I'm also from Sustainable Tucson and I, too, thank you. My colleague, Carol, is actually handing out a poem which I will send to the Committee. I've come to feel that we're fellow travelers on a good road. I use this metaphor to recall Chaucer, who's endearing message about the importance of fellow travelers sharing stories came to mind as I was preparing for tonight. As much as present views about sustainable water management, I want

to share a few lessons learned from another region, another story.

Two years ago, as a laywoman concerned about rivers and aquifers here, and also in Costa Rica, where my husband is from, I assisted over two dozen environmental groups, government agencies, and university departments in Central America and here in Arizona in shaping conferences about sustainable water management practices. They included leading water experts from three continents who came together to expediently translate water science, or to respectfully borrow a term Mr. Ken Seasholes used last week, "wonkiness," into terms policymakers and the public can understand. In this era, perhaps above all, sustainable water management is coming to mean scientists from different disciplines communicating clearly among themselves and then, with a sense of urgency in these urgent times, with the public. The time for having time for wonkiness has ended.

The main point I'd like to make is that sustainable water management involves two categories. I'll focus on the second. First, personal behavioral. As we all know, everywhere a profound cultural shift is taking place; it's centering assumption, north on a road, is that we need to consume less water, less everything. Water harvesting, gray water, Xeriscaping, all are part of this shift.

Second, sustainable water management involves setting into place at the basin, regional and national levels to-scale, as well as locally, comprehensive water laws and policies that reflect the understanding that nature is alive and has limits, north on a road. This is a profound paradigm shift, one that implicitly questions our current leading paradigm in Arizona that high-tech options, like effluent and desalinization, will allow more and more people to live here, as long as we have money and technology, we can defy nature's limits. In her presentation to this Committee, Kathy Jacobs called part of this - part of this shift, "adaptive water management;" growing numbers of countries are turning to it.

This new paradigm, in turn, includes two important components: Designating nature itself and people as the only two entities that have a right to water is the first. Sustainable water management begins with stating these principles at the outset of any decision-making process and translating them into law.

The second is assembling teams of local and international experts to evaluate the triple bottom line, or potential economic, social and environmental costs and benefits of altering any river or aquifer and presenting - presenting potential scenarios of change to the public. These scenarios must include the harshest, as well as mildest possibilities.

What, for example, will the true costs and benefits of relying on effluent be in Arizona? What will the cost to our children's health be in the long run? How will we pay for high-tech options in a time of financial crises? Changing costs and supplies of energy needed to produce water? And, as the current issue of southwest hydrology suggests, declining interest in financing big-water projects?

Ultimately, sustainable water management means turning to these teams of local and international experts to address the hardest questions about proposed alterations to the - to nature at the outset of decision-making so that policymakers and the public can fully understand what we're choosing.

This mix of local and international experts is important for the exchange of best practice is afforded, as well as the opportunity for transparent peer review. When faced with a serious illness, what we seek are not only best practices in our hometown, but global standards. We need to adapt the same habit of vigilance, of seeking out the best, of placing where we are in our State in the broadest context when evaluating sustainable practices in Arizona and the west.

And our state at this moment - I think that, perhaps, first and foremost, sustainable water management would mean holding a visible statewide public forum about what the one conversation which will define the rest: Our search for new sources, the ADD Water Process. We need to bring together our own respected water experts from diverse disciplines, along with outside experts to evaluate the triple bottom line of what are being called our major options: effluent, desal, importing water from elsewhere, among others. Much more rigorous peer-review, and local and also national media attention need to be given to this critical debate; it will define us and define this land we love.

I began with Chaucer and I want to end with Autumn Poet, Ofelia Zepeda: "Tucson is a story. Tucson is a linguistic alternative. Citizens gravitate to Sabino Canyon, the humming, buzzing, clicking water of life. It should be unnecessary for sticky notes to remind us of what a desert place is." Thank you.

CHAIRMAN JIM BARRY: Thank you, Madeline. Colette?

COLETTE ALTAFFER: Thank you, Madeline. Colette?
C: you want
this passed

Presenter #3
Colette Altaffer representing the
Neighborhood Infill Coalition

COLETTE ALTAFFER: I'm Colette Altaffer, and I'm here to speak on behalf of the Neighborhood In-fill Coalition. We're a group

of community advocates who focus on quality of life issues in neighborhoods.

As we were thinking about water and sustainability and our neighbors, the recent financial meltdown was never far from our minds. We've been reading about a report which the General Accounting Office delivered to Congress in 1994 in which it warned that the unregulated derivatives market could produce the type of economic meltdown that we have just experienced. Congress, of course, ignored those warnings and allowed the markets to continue as if the party would never end, until it did. And we were struck by the parallels between the financial meltdown and Tucson's own political climate from the undue influence exerted on our politicians by special interests to government's failure to act in a way that protects the interests of all its citizens.

From this financial fiasco, we chose three lessons that Tucson could learn from and applied them to water and sustainability. The first lesson is: Practice the precautionary principle. We've probably all heard the term, "precautionary principle," but it - and it is defined in many ways, but one of the most succinct definitions describes it as, "caution practiced in the context of uncertainty." When it comes to water, uncertainty is one thing. Tucson has an abundance.

During these past few months, you've helped our community learn a great deal about water and wastewater treatment, and the infrastructure that makes our lives here possible, but you've also shown us that Tucson's water future is fraught with uncertainty, and uncertainty leads to troubling questions. For example, we're told that Tucson sits on top of 60 million acre-feet of water, but how accurate is that number? How much of this water is off limits due to pollution? And how much do we have to keep in the ground to avoid the severe infrastructure damage that comes with subsidence? How much further can we extend our sewer system without dramatically increasing the water deficit that it already operates at? How can we create greater density within the City's core without expensive upgrades to the aging and undersized infrastructure that this increased population will need to rely on? How do we pay for the exorbitant costs of desalinization, when a disproportionate number of our citizens are living at or near the poverty level?

It is crucial that we answer these questions before we continue with growth as usual, which leads us to our second question: Don't paint yourself into a corner. Our democracy thrives on having choices, but having choices requires flexibility. Flexibility only occurs when there is enough room

to maneuver. So, we need to ensure that the recommendations we make, and the actions we take, provide us with enough wiggle-room so that our choices aren't limited to crisis-based decisions. If we continue down the path of growth as usual, and blindly pursue a megalopolis that stretches from Mexico to Prescott, we may find that the ability to choose is no longer ours and a Federal Judge, or even nature, will make the choice for us.

Democracy also thrives on all voices being heard, and this leads us to our third lesson: We like to call this the all-hands-on-deck approach. For too long we have tolerated our political system where we elect our representatives, and then they largely ignore us while the special interests get their way. This has recently culminated in Town Halls and growth forums that are controlled by these special interests who mute the voice of our citizens, and then represent the outcome as community consensus. This needs to change. We can no longer accept that a handful of people know what is best for Tucson, while ignoring the vast untapped resource that is our citizens. It is in our citizens we have available to us a wealth of knowledge, expertise, life experience, and creative energy, and we need to utilize that resource.

Sustainability isn't just about conserving resources, it's also about utilizing those resources more efficiently, just as we can no longer afford to have water flowing off of our yards and onto our driveways, we can no longer afford to marginalize the talents and energy of one of our greatest untapped resources, our citizens. If we're going to turn this ship around, we need all hands on decks. This process has provided us with the opportunity to step back from the growth as usual abyss and assess the uncertainties of our community's water future.

As you draft your report, we hope that you will draw from the lessons of our current financial crisis and ensure that you practice caution in the context of uncertainty, avoid painting yourselves into a corner, and involve the entire community in achieving Tucson's sustainability.

CHAIRMAN JIM BARRY: Thank you -

COLETTE ALTAFER: Thank you.

CHAIRMAN JIM BARRY: - Colette. Tracy?

TRACY WILLIAMS: Next week, please.

CHAIRMAN JIM BARRY: Next week? Okay. Kendall . . . and you - I'm going to ask you to pronounce your last name for me, Kendall.

<p style="text-align: center;">Presenter # 4 Kendall Kroesen representing Tucson Audubon SOciety</p>

KENDALL KROESEN: Kendall Kroesen from the Tucson Audubon Society.

CHAIRMAN JIM BARRY: Okay. Thank you.

KENDALL KROESEN: There are two big problems with our current water delivery system. First, it assumes that humans are the only users of water. In the United - western United States, less than 1% of the total land area is covered by the lush riparian vegetation found along rivers, streams and washes. Yet, in Arizona and New Mexico, about 80% of all vertebrates depend on riparian areas for at least part of their life cycles. More than half of all bird species that reproduce in the region are heavily dependent on riparian areas. Riparian areas are among the most endangered ecosystems, along with wildlife that depends on them. Seventy percent of threatened and endangered vertebrates in Arizona depend on riparian habitat. Riparian vegetation often depends on the presence of surface water or high groundwater tables that come close to the surface. Groundwater pumping has severely compromised local riparian areas. The central historic natural resource for Tucson, the perennial flows, and rich wildlife habitat of the Santa Cruz River and Rillito have been eliminated.

We have a responsibility to conserve water for species that need water; to conserve riparian areas for their aesthetic value and other inherent qualities; and to protect the wildlife watching industry that represents a significant revenue stream for our region, and which is also heavily dependent on riparian areas.

Any Comprehensive Water Plan first must protect remaining high water tables that support riparian areas and strive to restore those that have been lost. Groundwater pumping has been reduced, at least temporarily, by importation of Colorado River Water, but there is a high monetary and environmental cost of this as well. We use - now use over 144,000 acre-feet, or nearly 47 billion gallons, annually from the Colorado River; it comes with a high energy cost and carbon footprint and contributes to the desiccation of the Colorado River Delta. The Delta was formerly one of the greatest freshwater estuaries in the world and now receives only one-tenth of 1% of river flow - the river's flow and, by one estimate, only 5% of its historic biological productivity. So, taking more water from the river, perhaps even maintaining our current level of use, should not be an option.

The second flaw in our current outlook is to confuse the true human need for potable water with the current

per-capita demand. Easily more than half of the water that we use in homes does not have to be potable. About 35% of the water used by Tucson commercial and industrial sites is used outdoors, and 45% of water used by single-family residences is used outdoors; much of that on landscaping. This does not represent a need for potable water; it represents a desire for water for landscaping and other potable uses. Tucson has started down the path toward using potable water only where potability is really called for, and substituting rainwater, gray water, and reclaimed water for other uses. Recently, approved City Ordinances are a welcome start, as are Tucson Water conservation efforts that were funded recently, but we can do much more. Conservation is always the least expensive step and, in the long run, the least painful step.

At the same time that we expend non-potable water delivery systems, we should not, in our haste, dedicate all reclaimed water for these purposes. It is important to maintain effluent flow in the Santa Cruz River, which is the only thing currently providing any semblance of the vegetative and wildlife richness of our unrestored rivers.

It is time to expand the Conservation Effluent Pool and determine a system for actually implementing its use. In addition to conservation, the Comprehensive Water Plan must link development policy within an assessment of how much water is - extraction is really sustainable, while protecting and restoring wildlife and riparian functions and protecting us from subsidence. It should identify areas off limits to groundwater pumping to should protect and restore groundwater supported streams, and it should include incentives for conservation and assurances to users that they are not conserving only to provide future growth capacity.

CHAIRMAN JIM BARRY: Kendall, one minute, please.

MR. KROESEN: Okay.

CHAIRMAN JIM BARRY: Thank you.

MR. KROESEN: A new Plan should (inaudible) various - very expensive and unproven technologies, and ones that would harm ecosystems in other regions, such as nuclear-powered desalinization or cloud-seeding; it should apply water rates that reflect not only the cost of acquiring and delivering water now, but the replacement cost of water being unsustainably removed from the system today. I believe we can meet these challenges. Thank you.

CHAIRMAN JIM BARRY: Thank you, Kendall.

Tres English. Oh, there you are. Okay.

Presenter # 5
Tres English representing
Sustainable Tucson

TRES ENGLISH: Thank you, Mr. Chairman. My name is Tres English. I'm also a member of Sustainable Tucson.

There's a lot of discussion about - a lot of confusion about what sustainability is. I think it actually has a very simple definition. Sustainability means nothing more, nothing less than the ability to sustain; it's that simple and that profound. The issue before us with respect to water is with all sorts of things; it's not an issue of: Do we have enough water? The issue before us is: Who are we and what do we need our water for?

Within the boundaries of the Tucson SMSA, the Standard Metro- - Metropolitan Statistical Area, which I believe is around 450 square miles, a large area, much larger than the City of Tucson, there's approximately a quarter of a million acre-feet of rainfall every year; that's more than we use for everything in this metropolitan area; that comes out to over 80,000 gallons per person per year of rainfall; it's a huge amount of water, and we waste almost all of it. Only about 4% of the water we use we receive ends up as recharge in the ground, and most of what gets used is spent on decorative purposes; it's not spent for anything that would really constitute a high priority in a desert. The issue is not: Do we have enough water? It's who are we and enough water for what?

Sustainability is really an issue of rights and priorities. Do we - do we have a right, as citizens, to water? That's an issue that I bet you've never even thought of, let alone seen any serious discussion of. Do we have a right to water here in this desert community? And what do we need to use our water for? We don't talk about needs. We don't talk about priorities. We talk about demand. Well, there's a lot of things that we might want, and if you've got enough money you can get it under our system because, with the current rights - or with the current issue of - of rights, we do have rights. As citizens, we have the lowest right of any water user in the metropolitan area. Current residents have the lowest right for water. Higher users are turf users. They are new development, all sorts of different things where we have a systematic policy of forcing current users to decrease their water use, to pay for the infrastructure to expand the water capacity so we can give water away to more people; that, to me, says that the current users have the lowest possible priority for - for water.

And then the issue of priorities is very simply: How much money you got? If you're poor and you want to use your water for a high-efficiency garden that would feed your family, you're going to be paying the same rate as a rich family that has a large grass - grass lawn. So, we have priorities and they're totally screwed up.

Sustainability is really - if we want to become a sustainability community, we have to do two things: We have to set priorities and we have to establish rights. To date, we have not done any - either of those. To do that, we really need to have a basic community dialogue. What are the - who have - who has rights? And what do we need our water for? Does La Oeste Gardens - which is a commercial garden here in town, over an acre that sells to several of the Farmer's Markets - should they pay the same rate as a decorative lawn? Right now, the answer is "Yes, they pay the highest rate for water in Tucson." Is that the priorities we want to set for this community? Should the environment have a lower priority than new development for water? Do current users have to give up their water in order to provide for additional users? That is a priority - a dialogue that has not occurred in this community. And if we want to become a sustainable community, we must have that - that discussion. The issue is not: Do we have water? The issue is: For whom and for what? Thank you.

CHAIRMAN JIM BARRY: Thank you, Tres.
Linda Ellinor.

<p style="text-align: center;">Presenter #5 Linda Ellinor representing Sustainable Tucson</p>
--

LINDA ELLINOR: Thank you. My name is Linda Ellinor. I'm also with Sustainable Tucson. I'm actually a recent member. I've been involved in social change for about 15 years, and I'm very pleased that this kind of participation is happening between citizen groups and, you know, such as this. I think really this kind of problem in terms of water and anything that's challenging us environmentally right now in terms of peak oil and global climate change really has to come from local regional work.

My talk, actually, is going to build a bit on what Tres talked about in terms of human right to water. I'm coming at this more with respect to privatization and the dangers of what I see happening in our world today in terms of increased drive for for-profit distribution and management and ownership of water. A lot of my comments are taken from this book. I really recommend it. The title is, "Blue Covenant, the Global

Water Crisis and the Coming Battle for the Right to Water," by Maude Barlow; it was published in 19- - or 2007.

The main point I want to make is that there is an essential conflict of interest in following the path of privatization and what is referred to as "co-modification of water resources." This comes in the face of a continued push by recent legislation that opens up opportunities for private investments in the water industry. The conflict of interest is that for-profit concerns are not motivated to conserve water resources, nor are they motivated to provide what we might call "universal distribution," some of what Tres was suggesting. People at the margins, for instance, of a community might be not able to afford water delivery if the prices were too high.

These private interests are whetted to very expensive technological solutions, as you might imagine, that may even lead to more serious challenges regarding peak oil and climate change. I'm talking about large desalinization plants, for instance, and - as some other people have mentioned - the transportation of water to this area from outside the area.

Some 30 years ago, privatization hardly existed in water management. The U.S., Canada, and most of Europe all used a public model for water distribution and management. France and England were the exceptions; they used a private model, which created three very large transnational corporations. They're known as Suez, Deolia, and the Water Thames Company. These three private corporations were perfectly poised to provide for-profit service to third world countries.

We're probably all familiar with World Bank and IMF policies over the last ten to 15 years that have caused quite a lot of disastrous things to happen in that area. These Washington consensus policies put out by the World Bank and IMS - or IMF - are now being seen as having had many disastrous effects. With respect to water, the point I want to make is every time a country's water system has been privatized, it has resulted in waste, corruption, the cutoff of service to the country's poorest peoples, and problems of pollution and wastewater.

Luckily, in North America, we have had a history of the public model. However, today the big three European water companies have bought out the three biggest American private water companies; those are U.S. Filter, United Water, and American Water. These companies and others are now running water systems in such cities as Atlanta, New Orleans, Tampa, Indianapolis, Oklahoma City, Stockton, Milwaukee, Springfield, Pittsburgh, Honolulu, to name just a few. The goal of these private concerns is to control 70% of the U.S. market within two decades. To me, as a citizen, that's frightening.

Just to give you a sense of how the U.S. water industry has shifted in nature over the last few years, the following: Between 1995 and 1998, only half a million dollars was spent on campaign contributions by water companies. In the elections of 2000 and 2002, campaign spending more than tripled. Because of lobbying, federal laws now have been changed that require utilities to consider private partnerships with water companies before they receive federal assistance. So, you see what's happening, there's a lot of pressure on communities, such as ours, to privatize. Because of these new laws, privatization of water services doubled throughout the '90s. Quote, "New liberalized federal tax laws are allowing municipalities to enter into long-term private water utility contracts of up to 20 years. In 1997, only 400 of these long-term contracts were in existence. In 2006, the number grew to 1,600, with over 15% of Americans being serviced by these public/private partnerships." Keep in mind that in long-term contracts, the difficulty is that even if the city decides to go with it, it's very hard to pull out.

Let's back up for a moment and consider some of the underlying dynamics that's leading to this.

CHAIRMAN JIM BARRY: Linda, one minute, please.

LINDA ELLINOR: Oh, boy. Okay. For-profit businesses target dwindling national - natural resources, such as water, because of the large profit potential to be made. I'm not going to cover a lot of these statistics; they're here in my - my notes. It is one of the most profitable investment opportunities right - right now out there, which is why privatization is happening so fast.

So, we have surface water pollution. So - so, the point is: It's not that we are running out of water, exactly, water is becoming scarce; it's not that we're actually running out of it; it's that we're running out of fresh water resources. And, when you have a scarce resource and you have growing population as we do then, all of a sudden, the profit potential just skyrockets, so that 's one reason why privatization is happening.

So, what does all this mean to Tucson? One, there will be government incentives and financial pressures to enter into long-term public/private water contracts, and wherever these have happened, as I have said, they have been a disaster. One example was in East London where the Mayor was actually fighting the proposal to put in a desalinization plant because he said, "Hey, you guys are wasting so much water because the infrastructure of the plant that you're already running is so bad."

There's a new practice now of buying, trading and selling bulk water and water rights; it's called "water mining." Well, I'm not clear exactly how that might affect Tucson, there are developers coming into Nevada and Arizona buying up large tracts of water rights. One such company owns more than 135,000 acre-feet of water rights, currently worth more than \$500 million, and is planning to hold on to the water and to buy up more because the price of water is steadily going up in this region. Clearly, we need to be vigilant about who owns water rights in our area and not allow them to be transferred into private hands.

There another phenomena of bottled water - I won't go into - it's very wasteful. It'd be wonderful we could - if we could take a leading position and, perhaps, create incentives for this very wasteful practice to not continue to increase in our area.

There's also some very high-priced technological solutions that I've also already mentioned - desalinization - and others have mentioned as well. We should stay away from those and not allow private enterprise to twist our arm to bring them in.

By keeping water in the public sector, or what we might call "the commons," Tucson can avoid the many pitfalls that other cities have faced in privatization efforts. Public ownership will allow us to take the active role in water conservation that does not occur in for-profit ventures. We need to be focusing our efforts on keeping our precious rainwater in Tucson's local watershed. The practices that have already been mentioned can help us do that, such as roof gardens in family homes and office buildings, urban planning that allows rainwater to be captured and returned to the earth, and water harvesting in food production.

Continued public ownership, we - we - will allow us to monitor - monitor our use of groundwater supply so that we do not extract them at a greater rate than natural recharge; that's the real meaning of sustainability; it's like a bank account. We can't take out more than we can put back in. Thank you very much.

CHAIRMAN JIM BARRY: Thank you, Linda.

That is - is everybody we have on the list. Do we have anybody else that's not on the list that wants to speak?

UNIDENTIFIED SPEAKER: Can I (inaudible)?

CHAIRMAN JIM BARRY: No, I've already said I'm not calling on you. You're sitting here. Well, no. We don't have any other speakers.

Does the Committee want to indulge in any conversation, or do you want to do Call to the Audience and go

home early? Call to the Audience. Anybody want to comment?

(No response.)

CHAIRMAN JIM BARRY: Okay. I'll entertain a motion for adjournment.

UNIDENTIFIED MEMBER: Chairman, I motion that we adjourn.

CHAIRMAN JIM BARRY: Second? I want to thank everybody who came and spoke. We will - we'll do again next week. We'll - probably going to have more people. Very, very helpful comments and - and I appreciate it. Thank you very much.

(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Sustainability Discussion) of the City/County Water & Wastewater Study Oversight Committee Meeting held on October 22, 2008.

Transcription completed: October 30, 2008.

DANIELLE L. KRASSOW-TISDALE

TRANSCRIPT OF OCTOBER 29, 2008

List of Presenters:

1. Carol West
2. Dorothy O'Brien representing the Town of Marana
3. Randy Serallio representing the Center for Biological Diversity
4. Trevor Hare representing Sky Island Alliance
5. Jennifer Neely representing the Sierra Club Rincon Group
6. Christine Cotton representing Malcom- Pirnie
7. Alice Roe
8. Amy McCoy representing the Sonoran Institute
9. William Crosby
10. Donna Branch- Gilby representing Milgro Co- Housing
11. Nancy Freeman representing Stormwater Awareness League
12. Michael McNulty representing Arizona Builders' Alliance, the Alliance of Construction Trades, the Marana Chamber of Commerce, the Metropolitan Pima Alliance, the Northern Pima County Chamber of Commerce, Safe and Sensible Water Committee, the Southern Arizona Homebuilders, the Southern Arizona Leadership Council, the Tucson Association of Realtors, the Tucson Metropolitan Chamber of Commerce, and the Tucson Utility Contractors' Association.
13. Beryl Baker
14. Charles Cole
15. Tracy Williams representing Neighborhood Infill Coalition
16. Leslie Leberti representing the City of Tucson
17. Tedra Fox representing Pima County

CHAIRMAN JIM BARRY: All right. We have a quorum, and I will call the meeting of October 29th to order. Everybody, can we get started, please?

Do we have Minutes from the last meeting?

UNIDENTIFIED FEMALE: We do. They're just not physically here, but they (inaudible).

CHAIRMAN JIM BARRY: Well, did - we - we emailed the Minutes out. Did anybody look at the Minutes? Did people -

MEMBER JOHN CARLSON: I'll move they're accepted.

UNIDENTIFIED MEMBER: Second.

CHAIRMAN JIM BARRY: Second. Any comments on it?

(No response.)

CHAIRMAN JIM BARRY: Anybody opposed?

(No response.)

CHAIRMAN JIM BARRY: Done. Does anybody have any - on the Committee have any announcements?

MEMBER MARCELINO FLORES: Here.

CHAIRMAN JIM BARRY: Marcelino?

MEMBER MARCELINO FLORES: Mr. Chair, I just wanted to make mention of a meeting that's occurring on Monday, the Groundwater Users' Advisory Council's going to meeting at the - the Active Management Area. Oh, I don't have the address here. 400 West Congress, 9:30 a.m. Among the Agenda is information about the Operating Plan for the Water Banking Authority, and

International Policy Advisory Group that's going to be updating on issues on M&I for the Tucson AMA. So, I'll - I'll send - forward more information by email so that can be distributed if - if it has not already been replicated.

Another discussion, symposium that's occurring in November, November 18th to the 20th, is titled, "Coming Together, Coordination of Science and Restoration Activities for the Colorado River Ecosystem," and that's - that's a symposium that's occurring in Scottsdale the 18th through the 20th. And, again, I'll - I'll forward the information if it's - again, probably - probably reproducing information that's - Staff may have, but I just wanted to - to make mention of that.

CHAIRMAN JIM BARRY: Okay. Thank you, Marcelino. Anybody else?

(No response.)

CHAIRMAN JIM BARRY: Let me do a couple things. Remind you this is the - you all are going to feel badly about this, but this is the last of our weekly meetings. Our next meeting is Saturday, November 15th, over at the Doubletree starting at 9:00. As of tonight, including tonight, we will have met 20 times since April 9th, so that's quite impressive, and I want to congratulate the audience first for listening to us, the Committee and the Staff and everybody that presented.

This is a transcript of the meetings, 564 pages, not including last week and tonight. We've produced an awful lot of information, And, when we get into the report writing, we've got some responsibilities to try to make sense of that for everybody. But, we've done a lot of work, Staff has done a lot of work, the Committee has - has been very helpful to us, and - and we appreciate that.

So, we are moving on then to - is there anything else I'm supposed to announce? You have anything? No. Oh -

MEMBER JOHN CARLSON: What are the Doubletree hours again?

CHAIRMAN JIM BARRY: 4:15 in the morning until midnight. Okay. I lied.

MEMBER JOHN CARLSON: Filipino time?

CHAIRMAN JIM BARRY: 9:00 until 3:00.

MEMBER JOHN CARLSON: Okay.

CHAIRMAN JIM BARRY: All right. Let me say something - and Melaney's right - people who don't speak, or don't get a chance to speak, can still submit written comments on sustainability. We will keep - we haven't cleared this with Dale and Margot, but we - we will keep the deadline for written statements open until November 7th. And the Committee - we've asked the Committee, all to submit statements, but one - one way

that we might want to do this is - is - is, rather than submitting now, listen to what people are saying and read the written stuff and we could give ourselves until that November 15th meeting, and we'll set aside time November 15th to discuss sustainability, and maybe the Committee can - can have until then to submit their comments, or to revise comments that they've already submitted. So, for - for everybody until November 7th, we'll keep that period open for getting written comments, and we - we may want to give ourselves until that meeting on the 15th to be able to make Committee comments. John?

MEMBER JOHN CARLSON: You - are we trying to draft a definition of sustainability, or is it to be so broad - coming from the Committee, or are we to have two or three of 'em, or - or what are we trying to do with this? You ask us for our thoughts and we put 'em out, so what happens to 'em?

CHAIRMAN JIM BARRY: Well, I - I would think that we will have a report from Dale and Margot on what we heard from the - from the community -

MEMBER JOHN CARLSON: Okay. And that -

CHAIRMAN JIM BARRY: - and we will -

MEMBER JOHN CARLSON: - that's in a summary type of thing?

CHAIRMAN JIM BARRY: Right. And we will have from us our - our comments, and we will have from the City and the County some presentations of what they're doing, and I think the best we can do in Phase I is try to synthesize all of that and notice the commonalities and notice any differences that there might be, and look into Phase II for the Committee to start trying to set its own parameters on what sustainability might mean.

MEMBER JOHN CARLSON: What - and what's the definition of sustainability? We're not going to try to hone in on that too much right now?

CHAIRMAN JIM BARRY: I don't think that we, as a Committee, in the time and the resources we have available can do it.

MEMBER JOHN CARLSON: I'm not to argue, I'm with you. I just want to know -

CHAIRMAN JIM BARRY: Yeah.

MEMBER JOHN CARLSON: - what we're - we're not headed. Okay. Good.

CHAIRMAN JIM BARRY: Okay.

MEMBER JOHN CARLSON: I'll sleep late that morning.

CHAIRMAN JIM BARRY: I'll remember to call you. All right. Given that little soliloquy and conversations, anybody want to ask anything about sustainability?

(No response.)

CHAIRMAN JIM BARRY: All right. I - I made these comments the last time, but we have new people in the audience, and let me remind people, by the way, I've looked through some of these transcripts and there are places in there where it says "inaudible," and that's because people didn't speak into a microphone. So, if the Committee is talking, make sure you got a mic in front of you and all of the comments that - that are made, make sure you're saying 'em into the microphone so that we can record 'em.

From June 11th until the 15th, the Committee received presentations from Staff and outside experts on a variety of topics and, last Wednesday and tonight, what the Committee is doing is inviting presentations from the public on an issue that's really central to the - what the Board and the Mayor and Council wanted this Committee to do and the study to do, and that is: What is the sustainable water future for us? For Tucson, for all of Pima County, for the Tucson Active Management Area.

Sustainability, in terms of sequence, is the last topic that we're looking at, but it is first - it's certainly not the least important. And probably, as we get into Phase II, we will start looking at sustainability as a first principle by which we look at - at the - the information and the topics to come to us; it will be a - central to the common facts and the context that we want to - that we want to be able to present.

We want to hear from the community on how you define and conceive of sustainability. We have issued an open-ended invitation to present your views of sustainability in whatever structure and words are most appropriate to you. These presentations will help the Committee as we transition into Phase II. We expect to hear a diversity of viewpoints and to help with the process.

To enhance the community's ability - the Committee's ability - the Committee's abil- - I'm sorry - the Committee's ability to hear what you're saying, we've asked to people to help us, and we have Margot Garcia and Dale Keyes, who you will see writing down in the flip charts comments as you - as you present 'em to - keeping a record. And we have asked them to - to then take all of the verbal comments we get - last Wednesday and tonight, and all of the written comments that we get, and - and synthesize it into some sort of - of meaningful report that they will make to the Committee on what the community thinks about sustainability and, hopefully, identifying where there are common elements, as well as where there are differences. And those will be important then to how we proceed with - with our understanding. Now, both Dale and Margot have extensive experience with this kind of work and - and we're lucky that

they're both retired and living in Tucson at the moment and have the freedom to help us out at this time.

Just a couple of ground rules. We sent out the present- - several invitations, and a number of people have signed up. We have asked that you keep your comments to a maximum of five minutes; and, with the Committee's approval, I will try to enforce that. Now, we have one exception that I've agreed to tonight, Southern Arizona Leadership Conference and ten other organizations said they wanted to individually make presentations, but they made a proposal that I couldn't turn down. They said, "Let us combine the 11 into one presentation, which will be presented by Michael McNulty, but give us 15 minutes." So, rather than having 11 presentations of 55 minutes, I agreed to let them have maybe 15 minutes to summarize the - the comments on the 11 people; that's the only offer I ever got that way. If any other groups had - had done it, that would've been great and we've would've - we would've done that also. But, short of that, we ask you to keep to five minutes.

And we have a list of people, but let me ask: Is there anybody in the audience who wants to speak who has not given us your name already? Okay. One, two. We - we are going to go with the people who have signed up already, because they responded to the invitation, and if we can get to you in - in - in two hours, great; if not, when we're getting to - towards the end, if the Committee wants to go longer than 8:00 o'clock, then maybe we can extend it.

If we have time, we've set aside time for the City and the County to talk, give us a short presentation on what they're doing about sustainability. If we don't have time, they won't make those presentations. Tracy Williams has asked to speak last and - and we will - we will do that.

So, with no further ado, let me start by calling Rob.

MEMBER ROB KULAKOFSKY: In case someone doesn't have a chance to finish what they have to say, or don't have a chance to get up and speak to us, I want you to know that we will accept written comments -

CHAIRMAN JIM BARRY: Oh, absolutely.

MEMBER ROB KULAKOFSKY: - and even if you are coming up to speak before us, we really appreciate written comments, because then we can sit down and look through them thoroughly instead of trying to get notes down, so I just want to mention that.

CHAIRMAN JIM BARRY: Thank you. Good point. Okay.

I want to start to Carol West, former Council member.

Presenter # 1
Carol West

CAROL WEST: I'll save Dale some time, I - I will give you a copy of my testimony. I want to thank you for allowing us to speak this evening and also thank you to this Task Force because you've been working hard over the last many months. I'm here representing myself this evening as a consumer of water in the Tucson Water and Pima County Wastewater Service Area.

When I was preparing for this, I remember two quotes from people in our past: Senator Ben Wade, Chair of the U.S. Senate Committee on Territories in 1866 said, "Arizona is like hell; it lacks water and good society." The other better known expression came reportedly from Ben Franklin, "When the well runs dry, we know the worth of water," and that is probably where we are today.

The other better - excuse me - sustainability is an important issue. I question whether we can really scientifically tell how much groundwater we have; that is one of the reasons I think we need to have stronger conservation and water harvesting programs. At the same time, I think we need to be made aware that with less water usage, utilities sell less water and that does affect their bottom lines. I know that that isn't something this Committee is dealing with but, nonetheless, it is a reality.

We must import or purchase the right to use our CAP water and other supplies that are not being used, and it's equally important that we ensure that no CAP allocations in our AMA are sold to others outside this AMA. The State has required water utilities to develop Drought Plans. When do those go into effect? It depends upon the water supplies that a utility has and the sources of those supplies.

In the late 1990s, the Bureau of Reclamation received funding for the Regional Effluent Planning Study. How much effluent could be taken from the Santa Cruz for irrigation and other uses while still maintaining the riparian area along the river? I think that that 's still a valid question today, although I'm not sure that the study was ever completed due to funding. Effluent is a growing supply of water in our region. Important decisions must be made about its use in the next decade.

Some would like to control our water use by limiting growth. State laws will work against that, and the present Legislature is not going to change that anytime soon; witness their refusal to deal with wildcat subdivisions as an example. A major issue for us is the massive sprawl in this region; that

is happening because of lack of planning and foresight; it would be much better to grow up rather than out. This would help not only with more frugal water use, but on transportation issues as well. The Tucson Mayor and Council voted unanimously to take all of the City 's annual CAP allocation of 144,000 acre-feet by 2011; it is vitally important that all of that water be recharged and stored for the future. Tucson Water is presently using 62% of its annual allocation.

We often fail to recognize that this region has CAP allocations totaling about 260,000 acre-feet of water; some of this is not in use because of the lack of infrastructure; progress on this is urgent. It is expected that the Secretary of Interior could declare a shortage on the river in the next couple of years. Why is this important? What impact will it have on our region? First of all, we are paying for water we are not using and allowing others in the State - and, yes, throughout the west - to use it. Arizona has junior rights on the Colorado River. The region - and, most particularly, Tucson's cut - if there is a declared shortage on the river, will be based on what we are now taking and not the full allocation in the region. Instead of bickering over regional issues, we must begin to consider all water resources in the region.

Where is water located in our region? Who uses it? How can it become more accessible for needed uses? What about water quality? Water is a regional issue and not just one for Pima County and Tucson. I think that supply issues will continue to dominate the region. Planning for the future is essential; that involves working with the entire region. Thank you very much.

CHAIRMAN JIM BARRY: Thank you, Carol. Appreciate that. Now . . .

(Applause.)

CHAIRMAN JIM BARRY: You're the first speaker that's gotten applause I must say. We'll see what happens with the rest.

CAROL WEST: That's a little scary.

CHAIRMAN JIM BARRY: Yeah. Okay. Now, I - I could very well butcher the name, but Dr. Graciella Snyder-Madonies (ph.). Was I even close? Is she here? Huh? Well, I butchered the name and she's so mad at me she's not going to speak. We'll - we'll see if she comes in.

Dorothy O'Brien?

DOROTHY O'BRIEN: Yes.

CHAIRMAN JIM BARRY Dorothy is representing the Town of Marana.

Presenter #2
Dorothy O'Brien
representing the Town of
Marana

DOROTHY O'BRIEN: Good evening. I'm Dorothy O'Brien. I'm the Assistant Utilities Director for the Town of Marana, and thank you for allowing the public to speak and to hear regional ideas that may not have been brought to the forefront.

As the lady before me so eloquently put, "effluent is the water of our future," and that is no more true for any region than it is for the Town of Marana. Within the next several weeks and months, the community will be hearing about the Town of Marana moving forward with the Pima area governments to look at our sustainability plan, which is using all of the wastewater which is in - within the Town of Marana by becoming a Designated Management Agency, which means that we will have the opportunity to design wastewater treatment plants, build them, and treat wastewater, as well as putting the effluent to the most beneficial use that we can think of, which is recharging it in most cases. What we're looking for is to be able to provide 360 (inaudible) services to our residents, and that includes potable water services, wastewater treatment, and effluent.

Sustainable resources really are key to the entire region; it means cooperative planning of councils, governments, the neighboring communities, to make sure that all of our water resources are put to the best effective use possible. And we really do look forward to working with this group as they move forward to the following phases, and we hope that the group has opened up a little bit more to other individuals, like this woman mentioned, not just Pima County and Tucson, but all of the other areas. I would highly recommend looking at the members of the Southern Arizona Water Users' Association; it's an organization that has been in place a long time. Those members get together on a monthly basis, the members from the Water Departments do, to talk about regional water issues, other directors and others of those Water departments, and I would highly recommend selecting some individuals from that group to move forward to assist in future planning processes. Thank you.

CHAIRMAN JIM BARRY: Thank you, Dorothy.

Randy Serallio (ph.)? Did I pronounce that right, Randy?

RANDY SERALLIO: That was perfect.

CHAIRMAN JIM BARRY: Perfect, yeah? All right.

Presenter # 3
Randy Serallio representing
the Center for Biological
Diversity

RANDY SERALLIO: Which is rare with my name. Thanks for the opportunity to come. Again, I can provide a written copy as well.

The Center for Biological Diversity is a nationwide nonprofit with nearly 200,000 members and online activists scattered throughout the United States and the world, but our headquarters is right here in Tucson. We work through science, law, and creative media to secure future for all species, great or small, hovering on the brink of extinction.

We share a great concern with some of the other groups that have presented to you from a conservation perspective ensuring that the solutions are community pursues in securing our water future are truly sustainable. Too often, lip service is paid to the concept of sustainability, even while we make choices in policies that belie a reasonable definition of that term; or, worse, hide unsustainable consequences in faraway places, or defer them to future generations. In that respect, we commend this effort to define true sustainability for Tucson and Pima County's water future.

Unfortunately, to some members of our community, sustainability equates to guaranteed supplies sufficient to maintain unlimited growth. This leads to a myopic focus on large-scale augmentation of supply and neglect of local and regional responsibility for consumption, rather than a hard look at the excessiveness or inefficiency of our current water use, or reasonable limit to the population our water supplies can realistically support in the desert southwest. We are instead perpetually focused on grand and hugely-expensive schemes that would allow us to avoid responsibility, such as diversion, canals, water mining, cloud-seeding, desalination, and so on.

I want to take a couple minutes to address desalination, in particular, in this context. While on the surface it might seem like a nifty way to tap into a vast new water supply, it comes at great cost, both economic and environmental. Depending on location and construction, a desalination plant can do serious and permanent damage to marine life and surrounding habitat in the source waters. The process generates huge waste disposal problems in the form of massive amounts of brine and concentrated chemical additives, and it requires a tremendous amount of energy, which carries an entirely different set of environmental consequences.

Even a project as seemingly innocuous as the Yuma Desalination Plant has been fraught with problems, offering relatively small amounts of water at exorbitant cost, and with

unacceptable environmental consequences. Originally proposed to desalinate agricultural runoff to help satisfy Colorado River allocations to Mexico, this extremely controversial and expensive product was shut down after only nine months of operation and has been dormant for 15 years.

In those intervening years, water that was allowed to return to the Colorado River Delta has nourished and restored a small portion of the ecological health and bio-diversity that once existed there in the form of the Cienega de Santa Clara. But, water managers and state officials eager to apply every available drop of the Colorado to the profit of humanity, consider that water to be lost and want to reclaim it. The truth is, that the 40,000 acres of habitat created by that lost water are virtually all that remains of 2 million acres of lush wetlands that existed before water was diverted from the river in the first place. To organizations such as the center that opposed this project, and certainly to the myriad species of the Cienega that rely on that water for survival - several of which are endangered - it is, in fact, water that was lost, but has been found. However, now that drought and continued unsustainable consumption have changed the context, pressure is building to restart that plant, despite its miserable track record and numerous legal hurdles; it seems that water managers are willing to throw good money after bad in the narrow quest to augment supply.

With the threat that shortages are possible, unless the plant resumes production, we're being told that we must sacrifice what little is left of one of the great jewels of the natural heritage of the southwest in exchange for a relatively small amount of water; that may buy a little time, but certainly will not solve the problem. At the same time we continue to ignore cheaper, more sensible and less damaging -

CHAIRMAN JIM BARRY: Randy, one more minute, please.

RANDY SERALLIO: Yeah, one minute?

CHAIRMAN JIM BARRY: Please.

RANDY SERALLIO: That's right about where I'm at.

CHAIRMAN JIM BARRY: All right. Good.

RANDY SERALLIO: Thanks. Not the least of which is admitting and addressing the folly of large-scale agriculture in the desert.

In essence, schemes such as desalination allows us to export environmental consequences to precious places far away, out of sight and out of mind. We believe that sustainable solutions to our water problems lie not in technological boondoggles, but common sense and responsibility. We think it is imperative that a Committee, such as this, focus on local and regional approaches to achieving a truly sustainable balance

between necessary consumption, realistic supply, and the needs of a healthy environment, in the hopes that we can avoid water wars and crisis in the future, and that our children will inherit a world in which the wild is still alive. Thanks.

CHAIRMAN JIM BARRY: Randy, thank you very much.

(Applause.)

CHAIRMAN JIM BARRY: Trevor Hare (ph.)?

<p style="text-align: center;">Presenter # 4 Trevor Hare representing Sky Island Alliance</p>
--

TREVOR HARE: Thank you, Committee. I am a - I'm here tonight representing Sky Island Alliance. I'm a conservation biologist who runs the Landscape Restoration Program. Sky Island Alliance is a grassroots organization dedicated to protection and restoration of our rich natural heritage in the Sky Island region of the southwestern United States and northwestern New Mexico. We work with volunteers, scientists, landowners, public officials, and government agencies to establish protected areas and restore healthy landscape, and promote the public appreciation of this region's unique biological diversity.

I want to talk about the sustainability for the nonhuman inhabitants of Pima County and the importance of instream flows, subsurface waters, riparian areas and then, at the end, the impact of water delivery and infrastructure. (Coughing.) Excuse me.

Approximately 90% of the wildlife in the arid southwestern United States is dependent on aquatic and riparian resources to fulfill some part of their life history. And, while a majority of aquatic systems in Pima County have been lost, a few remain, such as the San Pedro River and Cienega Creek and are, therefore, extremely important to protect.

Riparian ecosystems supported by shallow groundwater have also been largely lost or degraded due to water diversions, aquifer draw-down, and urbanization, but can still be found across the County in places such as Sabino Canyon, Davidson Canyon, Rincon Creek, and Soppery Wash.

Our riparian areas also play host to an amazing abundance of rare and endangered species, such as the Chiricahua Leopard Frog, the Mexican Garter Snake, Black Hawks and Gray Hawks, the Huachuca Water Umbel and the Canella Hills Lady Tresses and, of course, our high-adapted desert fish.

Besides the obvious benefits of providing water, shade, cover and breeding habitat for animals, another important aspect of these aquatic and riparian ecosystems are the connectivity they provide across our landscape and across many

barriers, such as I-10, I-19, and smaller barriers in town. This is for the daily and seasonable movements and dispersal of animals and plants across the landscape. For example, a mountain lion needs more than 200 square miles in its home range and our - many of our Sky Island mountain ranges and protected areas are less than 50 square miles, and so lions must travel between these ranges across lowlands to find mates and prey and to disperse into unoccupied habitat, and washes and riparian areas we were talking about provide the shelter and safe transit needed to achieve this.

So, our recommendations to this Committee include that we must protect our remaining aquatic and riparian ecosystems through the establish (sic) of no-pumping zones and buffers around existing aquatic and riparian habitats. We - we must also have a dedicated effluent pool to jump-start restoration efforts and to maintain the existing diversity of these systems in the Tucson Basin. Finally, we must implement land use provisions and reform state law to ensure that future population growth, and the associated water needs, do not exceed available supplies, nor impact existing and restorable water-dependent ecosystems.

We must also - as Randy just talked about - we must also resist the urge to import unsustainable environmentally detrimental supplies of water from outside the Tucson Basin. The infrastructure and methods proposed so far to make more water outside - outside water available to us will have large, unreversible (sic) impacts to landscapes and wildlife.

And, in closing, I'd like to quote an old friend of all of us: "Growth for the sake of growth is the ideology of a cancer cell. We can grow, but we can only grow under the environmental constraints this desert gives us." Thank you.

CHAIRMAN JIM BARRY: All right, Trevor. Thank you.
(Applause.)

CHAIRMAN JIM BARRY: Jennifer Neely.

**Presenter # 5
Jennifer Neely
representing Sierra
Club Rincon Group**

JENNIFER NEELY: Thank you. My name is Jenny Neely, and I'm here representing the Sierra Club Rincon Group. We have about 4,000 members here in the Tucson region. I want to thank you for the opportunity to comment on water sustainability. Water use is one of the most pressing issues facing our community.

Tucson's water supply may be more stable than most other western communities; however, our main water supply has come at an enormous price. To continue down a similar path moves this community away from achieving any semblance of sustainability. We are limited in the amount of water that can be served to the Tucson region. Our water resources are finite and unreliable. In light of this harsh reality, it's just not prudent to actively facilitate new growth. Instead, land use determinations should be based on the amount of water currently available without causing further damage to the natural environment, and also allowing for the restoration of riparian systems that have already been affected by currently unsustainable practices.

Many proponents of growth, including the Central Arizona Water Conservation District, have a number of plans that they say will provide our desert region with as much water as we need, but only at the expense of the natural environment. These plans include: desalination, groundwater mining and canal systems, linking us to other far distant rivers. These plans are simply unsustainable and utilizing water from far-away sources like this would directly contribute to the environmental devastation in other areas. How in the world is shifting environmental damage to somewhere else qualify as a sustainable way to guarantee water supplies for new growth?

It is important to understand, finally, the difference between Safe-Yield and sustainability when talking about sustainable groundwater supplies. Throughout this process, Tucson Water and others have referred to sustainable groundwater pumping as "pumping out the same amount of water that can naturally be recharged," but this is wrong; that definition more accurately represents Safe Yield pumping, because it does not take into account the water needs of groundwater-dependent riparian systems, or other negative effects caused by excessive groundwater pumping.

Under Safe-Yield rules, without allocating water for riparian systems, the remaining groundwater-dependent systems would eventually dry up and die, like 95% of them have in the southwestern United States. And previously lost riparian areas would never likely - are never likely to be restored.

If Tucson Water and Pima County wish to truly achieve sustainable ground use - groundwater use in the Tucson AMA, some amount of water beyond simple Safe-Yield quantities must be included in the Water Budget for the maintenance of existing, and the restoration of lost, groundwater-dependent riparian systems. We cannot rely on the Colorado River to supply a constantly increasing demand for water. The river was over-allocated to begin with. We are in the midst of a serious

drought, and the unknown effects of climate change are just starting to unfold. We cannot justify continuing our recent level of growth based on this unreliable source, nor can we claim sustainability if we continue to - to drastically impact environmental resources to facilitate growth above the carrying capacity of our region.

We are capable of constructing projects of an enormous scale, but just because we can do it, doesn't mean we should. We continue to damage the environment to facilitate growth in the middle of the desert, growth that is ultimately unsustainable. It is time to go down another path.

The Sierra Club will be submitting written comments to the Committee prior to your next meeting. Thank you.

CHAIRMAN JIM BARRY: Thank you, Jennifer.
(Applause.)

<p style="text-align: center;">Presenter # 6 Christine Cotton representing Malcolm- Pirnie</p>

CHAIRMAN JIM BARRY: Christine Cotton (ph.)?

CHRISTINE COTTON: Thank you for allowing me to speak tonight. My name is Christine Cotton. I work at Malcolm Purney, it's an environmental engineering consulting firm. And, over the last 12 years of my career, I've worked with water utilities around the country.

And sustainability is sort of a hot topic, not just in the community, but also in the environmental industry, which is where I'm - I - I do my profession. And some of our - triple-bottom-line is a method that you could use for sustainability evaluations. There's lots of methods that are out there. And triple-bottom-line is a method that you could consider as you evaluate your path forward. Triple-bottom-line is looking at other consequences than - than just money. As we look at sustainability, we must think about things beyond the capital perspective. We look at the society. The impacts of decisions on society, and also the impacts of decision on the environment. And it's a way to look at these items in one - with equal footing. And it's a method that's being used a lot in private industry - I believe Wal-Mart uses this, surprising enough - and also it's been used around the country by a lot of other water utilities. For example, Seattle Public Utilities uses the triple-bottom-line method to evaluate any capital project over \$250,000.

So, what they do is they have a project manager do the triple-bottom-line evaluation of environmental, the economics,

and also the societal - potential societal impacts. They bring it to a committee, and then they discuss it and then, potentially, either go forward if it - if the triple-bottom-line makes sense, or they go back and decide they do not want to fund this project and move forward. That's one gamut of the triple-bottom-line use. There are other utilities that use it to just evaluate a water quality decision, one specific thing looking at different technologies over another.

So - and I bring this to the Committee today for you to consider as you look at sustainability in your reports and - and your evaluation that triple-bottom-line may be a way for you to evaluate sustainability in a way that is transparent to the community. Thank you.

CHAIRMAN JIM BARRY: Thank you, Christine.
(Applause.)

<p>Presenter # 7 Alice Roe</p>
--

CHAIRMAN JIM BARRY: Alice - Alice Rowe (ph.)?

ALICE ROWE: Thank you. I am representing, apparently, my phone number when you look at the list over there, but I am a citizen of Tucson, so I - to me, sustainability means that I'm living within my means. In investment terms, this means that I am spending the income rather than spending down the principal. For our community, sustainability should be much the same. We are not robbing from the future of the community to maintain and expand the present. At a most basic level, our principal, as a community, is our water supplies that we are drawing down below replenishment.

What is the community? Tucson is as diverse as the people who have come to call this Sunbelt city their home. Old timer, pioneer family, newcomer - relative newcomer. Why are we all here? A place that is so unlike much of the rest of the U.S., with its own border heritage, sunshine outdoor lifestyle.

I came in 1975 to put down roots, raise my family to be a part of this community, to make this community my own. I live in a neighborhood that was built out pretty much by 1960. My neighborhood is anchored by the Arizona Inn. Mrs. Greenway built the Inn where it is because she wanted to be on City Water, so she built inside the then City limits. As a neighborhood, we have enjoyed the support of City infrastructure, water, sewer, and streets. What we see of our streets is they're crumbling under budget problems. We cannot see the water and sewer systems except when they do not work.

Without a well-maintained system of water delivery, and the reverse wastewater delivery to the treatment plant, wherever that may be, we, as a community, will falter.

My neighborhood is characterized by mature vegetation. Our 70-year-old pine trees and other large trees provide a special sense of place, besides allowing us a number of urban-adapted hawks and owls. Part of the sense of place for older Tucson neighborhoods is the trees, the bushes and, yes, even our little postage-stamp lawns hidden in the privacy of our backyards. Trees and vegetation offset some of our urban heat island and may even help us, as a community, to peck away at the causes of climate change. This vegetation, though, some of it may have survived through dry times, usually does need some irrigation. We pay for the water to maintain our yards and trees, or - now we're trying to arrange for water harvesting to support the greenery we want to enjoy around that outdoor room in our yards.

Sustainability, in a greater sense, means that we must look at where we live, how we live, and the choices and tradeoffs we can or wish to live with. In the quest to provide for the people who will come, we should not forget that many who came earlier came to a city that was not built out as a subdivision of matching dwellings. We need to take some care that the older inner city will not be destroyed.

We've heard about how our sewer infrastructure will need more maintenance if we do not flush enough, wash enough, or divert too much of our individual home's gray water to our plants. I do not want to see us abandon the Tucson of our grandparents' generation characterized by the sunshine club of the 1920s' promoters. Yes, they made sure all the promotion showed palm trees to symbolize warmth. Those business leaders of yore subscribed, I'm sure, to the philosophy that what was good for General Motors was good for the nation, but on a local level.

I'm not sure that this should be our current way of operating, even though land speculation and development have been our Tucson heritage for over 100 years.

In the past week or so, I've been asking others what they think about sustainability. Here's where we, as a community, suffer from the churn of transiency and snowbird -

CHAIRMAN JIM BARRY: Alice, one minute, please. Thank you.

ALICE ROWE: I'll wrap it up.

CHAIRMAN JIM BARRY: Okay.

ALICE ROWE: I've heard from several that they do not expect to worry about the future beyond a few years or so. They will either have or either leave or no longer be; that this city

should be a good place for their children and grandchildren. No, their children don't live here, and they don't expect to - and they expect to move to wherever those families are. These are the folks whose actions say: We should mine the water until it's all gone, just like the extraction industries in the past.

So, I urge that we include a sense of place in our sustainability discussions. The sense of place of the old center of the City and the sense of place of all our natural areas, and this sense of place depends upon the maintenance of our water and sewer infrastructure. Thank you.

CHAIRMAN JIM BARRY: Thank you, Alice.
(Applause.)

<p style="text-align: center;">Presenter # 8 Amy McCoy representing the Sonoran Institute</p>
--

CHAIRMAN JIM BARRY: Amy McCoy? Hi, Amy. Amy is the newest member of the Citizens' Water Advisory Committee, as well as representing the Sonoran Institute. Go ahead.

AMY MCCOY: Thank you. Again, my name is Amy McCoy, and I am an ecologist at the Sonoran Institute, and I want to thank you as well for the opportunity and invitation to speak tonight about Sonoran Institute's perspective on sustainability.

Sonoran Institute is a conservation organization based in Tucson, Arizona. We have offices throughout the western United States, and we strive for healthy landscapes, vibrant economies, and sustainable communities. We believe that - that sustainable conservation decisions are made collectively and collaboratively within communities and, in support of such collaborative and collective decisions, I highlight four goals to consider when addressing water sustainability.

First, to integrate water and land use planning at a regional scale. For sustainability to become operational, there must be policy shifts toward innovation and towards integration of our land use ordinances, tax codes to support incentives, and water management structures.

Number two, to balance the needs of human and wildlife. To build on Trevor and Jenny's comments about riparian areas, I'd just like to emphasize that riparian areas provide numerous services to local populations and act as foundational infrastructure, really natural infrastructure, if you will, for our communities. Riparian trees and roots slow flood flows; they increase infiltration into groundwater tables; and they also act and assist in filtering pollutants from water as it

infiltrates into groundwater tables. These services would be costly and difficult to mimic with technology, but are provided free to us with only the power of the sun. I believe that these riparian ecosystems and natural infrastructures should be factored into our sustainable water management equation.

Number three, to define and clarify purposes of different water. For example, CAP, groundwater, effluent, and rainwater. I'd just like to, again, commend the City of Tucson recently for the Water Harvesting Ordinance and the water harvesting - harvesting process that occurred. Forty percent of our municipal and commercial water uses go to landscaping. By utilizing rain water, a, thus, untapped resource, we reduce our reliance on groundwater and provide more nimble and flexible options for citizens. We believe that both the final ordinances of that, and the process itself, are tools for sustainable.

And the fourth comment is to ensure that conserved water is - conserved groundwater, in particular, remains in the ground, and is set aside for recharge and for, possibly, unanticipated future need, but also to restore our ecosystems.

So, with this in mind, I thank you again for this opportunity and look forward to working with you in the future.

CHAIRMAN JIM BARRY: Thank you, Amy.

(Applause.)

<p>Presenter # 10 William Crosby</p>
--

CHAIRMAN JIM BARRY: William Crosby.

WILLIAM CROSBY: My name is William Crosby. I live in Tanque Verde. My work is environmental and cultural conservation.

MEMBER JOHN CARLSON: Couldn't hear that, please.

WILLIAM CROSBY: Hello?

MEMBER JOHN CARLSON: That last comment, couldn't hear it. (Inaudible).

WILLIAM CROSBY: My name is William Crosby. I live in Tanque Verde. My work is environmental and cultural conservation.

Sustainable - sustainability means living within our means, by not overusing our natural resources, which we preserve for future generations. For me, at this time, sustainability means being able to at least maintain life as we know it in the Tucson Basin; it means being able to maintain the purpose and requirements of the Sonoran Desert Conservation Plan, designed in a large collective group, agreed upon by consensus, and

implemented to project - to protect the designated areas and resources as we know them now into the future.

Sustainability is particularly critical at this time. Tucson is at the end of the line of our most capable supply of water: The CAP. We no longer think of the Central Wellfield capacity as a primary resource, because unmanaged growth overused this resource at least 20 years ago. The business of growth has plundered the landscape.

The challenging and uncertain resources of the CAP are now more than a backup. For years we have become accustomed to thinking of our water supply coming from distance sources, breeding a complacency of endless growth that hungers for more, yet unrealistic and questionable resources. It is critical to know the water use requirements of all the water providers and private wells in the Tucson Basin, so that this can be guaranteed for the maintenance of our needs in a transparent and responsible manner. All the stakeholders must be represented.

For 20 years we have experienced extremes in drought and precipitation. For example, in the normal year, the Tanque Verde Creek at Wentworth Road has two winter and three summer floods. In 2007, there was not a single flood. In 2008, the monsoon rains were abnormally high at 12.7 inches; granted, this is from personal measurement and observation. However, the severe fluctuation of rainfall cannot be ignored. Recharge to the aquifers has diminished exponentially so that we now look at rainfall as a supplement to the CAP supplement.

Reclaimed water serves large turf projects. Water harvesting is needed - a needed and obvious tool now heralded as a requirement in new housing and business development. Perhaps, in the face of the great enigma facing humanity, climate change, we can consider reform of Arizona water law linking growth to sustainable water supplies.

Historically, organized societies and civilizations survived due - due to the wisdom and the realization of their vital resources and, when their planning failed, their civil foundations died.

This Committee and this effort have the potential of ensuring the future of Tucson, to nurture and preserve the extraordinary beauty of this place. Thank you.

CHAIRMAN JIM BARRY: Thank you, William.

(Applause.)

**Presenter # 10
Donna Branch -Gilby
representing Milagro
Co-Housing**

CHAIRMAN JIM BARRY: Donna Branch-Gilby, please.

DONNA BRANCH-GILBY: Good evening, and thank you for this opportunity. My name is Donna Branch-Gilby. I'm a co-developer of Milagro Co-Housing and I'm representing the 28 families that live in that development in the Tucson Mountains.

What does a sustainable water future mean for me and for us at Milagro? It means that our water use is balanced with our water supply, and that our water supply is replaceable and sustainable; that's a water supply that doesn't borrow from the future by dropping the water table below the riverbed; it doesn't borrow from our other ecosystems by transporting water from other aquifers; it does capture all the water that we can capture, rainwater; it reuses water and it puts all qualities of water to their appropriate use. Capture, conserve, and use wisely.

I know we can do this, because we're doing it at Milagro. We have increased our water supply through rainwater harvesting, reuse of gray water, and reuse of effluent for certain purposes, not by moving the water from other aquifers or that require high-energy costs. What we have done is we have captured every drop of rain water in a cistern or through basins, swales and berms. At Milagro, our goal is to slow down the water and help it soak into the ground. We mulch our basins and form wells around the many trees which help cool us. We reuse the gray water by dumping our dish pans on the plants at the kitchen door. We have reused all of our plumbed water, gray and black water, by sending it to our own subsurface wetlands or microbes on the hedges, clean it enough to use in a subsurface irrigation system.

This irrigation system yields for us 1,700 gallons a day, which waters the trees and shade trees along our community pathway. Roof water is captured in cisterns installed by half the households. We have approximately 15,000 gallons of storage. I, myself, am still using cistern water that was collected in our - in our last two rains.

We need to reduce our water use to a sustainable or replaceable level, and there are many ways that government, governmental entities, community organizations, and individuals can do that. At Milagro, we set a target for ourselves of using no more than 50 gallons per person per day. In 1905, we were a long way away. We were at 130 gallons per person per day. Earlier this year, we had learned how to use our resources and we were at 75 gallons per person per day. This includes City water and some water from our own well.

As I discussed this issue with my neighbors, we came up with a few ideas that we would highly recommend to this

Committee. One is the County has a Drought Plan that they would implement; it's very reasonable; it's put - puts restrictions on watering on use of misters and allows for use -

CHAIRMAN JIM BARRY: One minute, please, okay? One minute.

DONNA BRANCH GILBY: Okay. Thank you. That is, I think, appropriate given the environment that we're in. The impact of climate change is unknown, but we know it's - it's not going to make it easier for us here. So, please, let's implement that Drought Plan from the County right now, fully implement it.

Also, let's have an extensive public education system about the need to capture, reuse, and use wisely all of our water resources, and then to see some research being done. What would be public acceptance and technical feasibility of other water conservation measures, like composting toilets? There may be a segment of population that would be very happy to have composting toilets. Let's - let's see what we can do.

We - in Brisbane, Australia, that city functions on 53 gallons per person per day. We have a long - we have some room to learn how to do that. Let's - let's learn how to do it before Mother Nature gives us our final exam. Thank you.

CHAIRMAN JIM BARRY: Thank you.

(Applause.)

<p style="text-align: center;">Presenter # 11 Nancy Freeman representing the Groundwater Awareness League</p>
--

CHAIRMAN JIM BARRY: Nancy Freeman?

NANCY FREEMAN: I'm representing Groundwater Awareness League, Nancy Freeman, Executive Director; it's an educational, nonprofit, bringing grandmothering to Arizona.

Sustainability is living with our local resources; it means thinking of others; it means thinking of the future; it means thinking of the environment; in fact, it means thinking. I will speak of sustainability only as it regards water, because our Arizona legislators set up a system that makes sustainability impossible in municipalities.

When they passed the 1980 Groundwater Act, they grandfathered a 2.5 million acre-foot deficit per year in groundwater pumping in Central Arizona. They told the cotton growers, the alfalfa growers, the mining companies, "You just keep on doing what you're doing. We can get federal funds to import Colorado River Water to the cities." No problem that it has to be paid for by America taxpayers and repaid by Arizona taxpayers, many who will never receive any benefit. As a matter

of fact, it will be detrimental to those living on the river to see it disappear. Just think, Yuma used to be a seaport.

An Arizona Supreme Court Judge, Noel Fidel, has commented on the situation in the context of a water litigation in 1999, "The Arizona legislator has erected statutory frameworks for regulating surface water and groundwater based on southwest cotton. Arizona's agricultural, industrial, mining, and urban interests have accommodated themselves to those frameworks. Southwest cotton has been part of the constant backdrop for vast investments, the founding and growth of towns and cities in the lives of our people." So, the billion-dollar CAP system was meant for municipal use under the guise of agricultural use, but it was widely known that the agricultural sector would not use it.

In the 28 years since 1980, that 2.5 million acre-foot deficit means 70 million acre-feet of water, enough to water the present population and even agriculture use of the Tucson AMA, using 300 acre-feet annually for 233 years. Currently, nonagricultural use in all AMAs in just over some 785,000 acre-feet annually. So that 70 million acre-feet would have provided water for all Arizona in industry for 89 years.

Then, after giving away the groundwater - the Groundwater Code does mention that State water supply is a public resource - the legislators told the cities that you have to have an Assured Water Supply. So, the model was set and mandated, "import water," a renewable supply from somewhere else to replenish your water use. So -

CHAIRMAN JIM BARRY: Nancy, one minute, please. I'm sorry.

NANCY FREEMAN: So, to build the sustainable model on such criteria is simply impossible. Then our enlightened legislators, under the pressure from developers, created the Groundwater Replenishment District and put it under CAP authority to make it look legit, because the truth is there were no CAP allocations left for Groundwater Replenishment District to use, so now builders could build in south Pima County and replenish in north Pima County with an unknown supply of water. However, there would be excess CAP water for 20 years, never mind that the 100-year water supply certificates that the State water agency issues, they do not include the Replenishment District.

Now, who will pay the price? The new water users who come under Groundwater Replenishment rules? No, all the water users in the water provider district will pay. In other words, all Tucson Water Company customers will pay for the highest-priced water and - and will effectively be subsidizing new growth, currently 20,000 units.

Taxpayers and water users have to be aware of how government agencies love big projects. The federal project in Yuma costs over a billion dollars, when the task could've been done - accomplished by buying up the agricultural operations for a few million, that were dumping salty water into the Colorado, causing the need for the desalinization plant.

So, the first step of living within our means, within the limitations imposed on us by importing CAP would be to eliminate the Groundwater Replenishment District, which was created by and for the sake of new development. The second step would be to capture our storm water. Thank you.

CHAIRMAN JIM BARRY: Thank you, Nancy.
(Applause.)

Presenter # 12
Michael McNulty representing
Arizona Builders' Alliance, the Alliance of
Construction Trades, the Marana Chamber of Commerce,
the Metropolitan Pima Alliance, the Northern Pima
County Chamber of Commerce, Safe and Sensible Water
Committee, the Southern Arizona Homebuilders, the
Southern Arizona Leadership Council, the Tucson
Association of Realtors, the Tucson Metropolitan
Chamber of Commerce, and the Tucson Utility
Contractors' Association.

CHAIRMAN JIM BARRY: Michael McNulty? Michael, I have a list of people you're representing. Do you have that list and you're going to read it so we know who it is?

MICHAEL McNULTY: Yes, sir, I do.

CHAIRMAN JIM BARRY: Okay. Thank you.

MICHAEL McNULTY: As a water bureaucratic from way back, it really warms my heart to see the number of people involved in water policy. I admire you for what you've done. It looks like you'll be at this for a while.

I'm going to be talking a lot about transparency, and so I'll start with transparency about myself. I am a lawyer with the law firm called Lewis & Roca, and it is one of many members of a business group called the "Southern Arizona Leadership Council." When - when the City and the County started to put this together, a lot of business groups sort of got together and said, "We think we should probably make sure that our thoughts are added to the discussion." And they formed a group called the "Tucson Regional Water Coalition," and that

coalition is here tonight. I am speaking on their behalf, although I'm not paid by anybody. I'm a volunteer like the rest of you.

So, the - the groups that have bought into this policy statement include - and if you want to stand up when you hear your group called, please do - the Arizona Builders' Alliance, the Alliance of Construction Trades, the Marana Chamber of Commerce, the Metropolitan Pima Alliance, the Northern Pima County Chamber of Commerce, Safe and Sensible Water Committee, the Southern Arizona Homebuilders, the Southern Arizona Leadership Council, the Tucson Association of Realtors, the Tucson Metropolitan Chamber of Commerce, and the Tucson Utility Contractors' Association.

The group has been meeting and working through water planning policies that were sort of going under the rubric Integrated Water Resources Management, which is fairly accepted, sort of scientific rational way of doing this, that's been adopted by the World Bank and the United Nations and the AWWA, American Waterworks Associations. I'll leave a couple of their papers with you in case you decide to put them on the web.

I have a paper I will distribute, but I think I'll wait till I'm done. I'm - I've - I've distilled it quite a little bit. The - the Mission Statement of this coalition goes as follows: "Seek to promote policies and actions to create long-range planning for sustainable water supply that will support the economic vitality, the current and future population, and maintain the quality of life of the Tucson region. To identify and maximize the supply of water resources available within the Tucson region, and to implement best practices for the efficient use, conservation, and management of water resources in the Tucson region."

I want to make the point that about 80% of what you've heard tonight are principles that are shared by this group and by everybody here. People who are in Tucson are here because they love the environment, they want to encourage responsible growth, and they don't want to run out of water.

Now, in our view, sustainability is inescapably a resource management and resource economics discussion where tradeoffs and alternatives must be first be understood and debated in quantifiable terms. And that's another theme I'll be pushing is this quantification of what the costs and benefits of various courses of action are.

We don't think that sustainability can be the exclusive domain of environmental protection. And I say that simply because there are a million people in this valley and they're not going anywhere. And, to the extent that they -

CHAIRMAN JIM BARRY: That's water right, Michael.

MICHAEL McNULTY: Water from France. I'm trying to help out. The success of local sustainability forums we think rests on the - moving the debate towards a common language and a set of assumptions. We - we need to recognize water as economic good with economic value to all competing users, and we think that this cost analysis should play a central role in our attempt to define sustainability.

One of the principles of this integrated water resource management is that it must be based on a participatory approach involving a balance of technical expertise, an expression of community values. I think that - that if you are able to avoid polarizing the community, avoid turning it into a growth/no growth debate, you are likely to make a huge amount of progress, but if it slips into that trap, I would worry.

We think that sound water resource management knows no jurisdictional boundaries. We think that water planning should be conducted at the basin scale, defined as the Tucson AMA, and involve all the users in the Tucson AMA; that's something I think the Groundwater Code really got right. You have to look at the watershed before you decide how you can solve problems.

Further, we support the shared use of community infrastructure through cost-effective wheeling agreements for delivery of effluent or surface water, or groundwater or imported groundwater, or stored renewable supplies to achieve greater integration, reliability, flexibility, and reliance upon renewable supplies throughout the region. We think that the - the vulcanization of utility infrastructure does not work for the common good.

We should collectively maximize the purchase and storage of additional surface water and our under-imported groundwater supplies, augmenting local groundwater supplies. The pointing being that: We all should bear the costs and enjoy the benefits of what we're suggesting is really a community endeavor. And all of this always within the context of state law, because there have been a number of speakers tonight that suggested things that cannot be done, though they're welcome to go to the Legislature and try to change them and we'd probably help.

Next, we think we should - excuse me - we think that we need a consistent signal to the public. We're - we - we've been trying to tell people that there is a scarcity of water, but then we look at what the average water bill, let's say, in the City of Tucson is, and if you go to the movies and you pay for your date, you've paid more money than the average water bill. The public is not getting the signal. Water is very cheap and it is - I don't think you're going to get the message through if water remains that cheap.

We think we need to find a way to facilitate the reallocation of water resources to the highest and best use that will yield - yield the greatest economic social and environmental benefit for the region, based on quantifiable terms. There is an unescapable relationship between water resources and regional economic development, and that cannot be ignored.

We - we - and I'm speaking this entire business community that sort of represents a quarter million workers - we should promote community-wide conservation goals and standards that maximize acre-feet saved per community dollar spent. Public officials look - try to come to grips with spending \$1,000 to import a supply or \$1,000 in reducing a supply. Should you retrofit all the old plumbing in Central Tucson? Well, that's expensive. Well, is it more expensive or less expensive than paying to import more water? We think probably conservation wins, but we don't think the hard math is being done.

We should evaluate proven conservation measures as an alternative to supply acquisition. For example, gray water reuse is really not being encouraged, we think at the governmental level, but we don't know if it's advisable because the economics have not been flushed out. We have concerns about evolving climatic conditions, just like everybody else, and we think that they should be addressed through risk assessments, just like all of the other unknowns that we have, and that can - in a form that can be updated as things change and have response triggers that can be implemented as conditions change.

And then, finally, we think that a sustainable water resource management plan for the region is incomplete without a budget and implementation strategy, both fiscal and physical. The region must move away from the plan-as-you-go and pay-as-you-go approach and develop flexible long-range plans in funding mechanisms to avoid future crises; that is a - pretty much a sharp distillation of the whole talk, the whole talk I will circulate, and I certainly appreciate your attention.

CHAIRMAN JIM BARRY: Thank you, Michael.

(Applause.)

CHAIRMAN JIM BARRY: We know who your coalition is, I guess.

All right. Beryl (ph.), did I see your hand up? You want to come up, Beryl? Is she here? I'll ask her to come - yeah.

<p>Presenter # 13 Beryl Backer</p>
--

BERYL BAKER: My name is Beryl Baker, and I'm a concerned citizen. For 20 years, I've worked on water issues as a volunteer. We pushed and pushed to get water issues taken seriously. Finally, you've put together a group to take a comprehensive look at needs of the community as it relates to water. You've been indoctrinated and presented with a rich array of the many sides to be considered in this matter of water. Due to the worldwide urgency in the matter of water, and mankind's increasing pressure to desertify (ph.) his habitat, the world. Please don't study this to death for another 20 years. Make learned haste to make strong recommendations that think in terms of 700s of years, not decades of man's stay here. Plan for the future as well for the silent voiceless animals and plants that man's soul would be the lesser for without their presence.

Thank you for the many hours and hard work, both behind and ahead of you, and you may rest the future of our home. May you consider well and wisely the ramifications of your decisions, but hurry. Time is running out for being able to make decisions which can be - can - can make a difference between life and death of us all. Thank you for your undertaking to address this important, imperative issue of water.

CHAIRMAN JIM BARRY: Thank you, Beryl.
Charles Cole?

<p>Presenter # 14 Charles Cole</p>
--

CHARLES COLE: Thank you for allowing all this public input.

UNIDENTIFIED MALE: I'm sorry. I didn't quite . . .

CHARLES COLE: Charles Cole, West Sweet Water Drive. I'd like to define sustainability, or give it a try anyway. In the context - I'd like to try to define sustainability in the context of the three-and-a-half-billion-year history of life on earth. Now, don't let me frighten you. I'll give you the short story -

CHAIRMAN JIM BARRY: Colette, write -

CHARLES COLE: - of that history, and I think I can do this in - in no more than two minutes of your -

CHAIRMAN JIM BARRY: Okay.

CHARLES COLE: - time. To me, any system, whether it is a water delivery system, or something else, is sustainable if the following six criteria apply:

One, it functions essentially without significant consumption of nonrenewable resources; two, it is essentially pollution-free in all aspects of its operations and has no significant negative impacts on the environment; three, it is affordable by those who must pay for it without risk of bankrupting anybody or forcing anyone out of their home, including our less-fortunate citizens; four, it fulfills all of its intended purposes, including all quality control parameters; five, it works efficiently and cost-effectively for its intended lifetime, without significant unanticipated maintenance problems or cost overruns; and, six, it does not allow for temporary over-expansion of human population beyond the carrying capacity of the environment, only to be followed by a "Catastrophic Collapse" as has occurred with past civilizations as discussed by Jerrod Diamond in his book of that title.

In case this definition seems restrictive for our society, let me set the perspective with a few simple facts. Planet Earth has existed for more than 4.6 billion years. Life, in one form or another, has been evolving for more than 3-1/2 billion years. To set this timescale - to set this - excuse me - to a timescale to which we can relate, consider the 3-1/2 billion year history of life, as occurring within one 24-hour day, the first living cells appeared at a fraction of a second after midnight. The first terrestrial animals with a backbone appeared about 360 million years ago, or about 9:32 p.m. The clock has ticked away past noon and dinnertime, and people aren't here yet. These are simple biological and geological facts. The clock now - excuse me - on this timescale, a dinosaur, of one kind or another, existed for over an hour of life's history, between 10:28 and 11:31 p.m. Our species, human beings, have been here for only the last 12.4 seconds before midnight. And the industrial revolution, with all its consequences for the global environmental has raced through the last 1/200th of a second. If high-quality human life is going to be sustainable for the first hour after this noon midnight, we must get our act together, and this is your opportunity to influence the process. Thank you.

CHAIRMAN JIM BARRY: Thank you, Charles.

(Applause.)

CHAIRMAN JIM BARRY: Good. Thanks. Okay. Let me - is there anybody else in the audience that wants to talk? Did I hear a yes? No. All right. Now, let me ask a question: Tracy, do you want to speak now or do you want to wait until after the City and the County speak? You want to speak now. Okay. Tracy.

Presenter # 15
Tracy Williams representing
Neighborhood Infill Coalition

TRACY WILLIAMS: Oh, thanks. There's Melaney.

CHAIRMAN JIM BARRY: Uh-huh.

TRACY WILLIAMS: My name is Tracy Williams. I am a lifetime resident of Tucson, Arizona. I would like to thank all of you for how you have conducted yourselves during these past months. Your degree of professionalism and your commitment to ensuring a balanced, honest, and open discussion of this vital issue has gone a long way toward creating a level of trust among those of us whose jaded views have been fostered by years of exclusionary politics.

I would also like to thank the Staff and presenters who assembled a great deal of information and effective presentations while dealing with constrained schedules. It is my hope that all of you will continue this same open, balanced process, not only as you draft your report, but into Phase II as well.

Early in the start of this study, we saw a special interest group line up to demand a seat at the table. I know firsthand where that can lead. Time and again we have seen the development community obtain numerous seats at the table by dividing their industry into its multiple parts of builders, small builders, architects, planners, real estate investors, lawyers, et cetera. If we are lucky, neighbors and environmentalists receive one seat each. This unbalanced approach to critical problem-solving leads to the kind of distorted outcomes that help to create our current financial crisis. We cannot afford such a cavalier approach where water is concerned.

Water is a life-and-death issue. It cannot have the economic bottom line as its sole driving force, nor can it follow the dishonest path of Tucson's recent gray water ordinance which based its outcome on an incomplete picture of our wastewater's delivery system. Sustainability needs to include the quality of life elements of clean, healthy, unpolluted potable water.

The environment needs to be viewed as an equal partner, not only to facilitate this goal, but to become a beneficiary of it. I do not want to sacrifice the Tucson I love on the altar of the economic bottom line or trade the Sonoran Desert for one that more closely resembles the sub-Saharan Africa or compete with the Baghdad - compete with the - complete with the Baghdad model of water delivery. There are numerous less-destructive ways to approach growth that do not rely on the wholesale destruction of our desert and that are far better suited to help us achieve a more sustainable, equitable society. We need your help and commitment to ensure that the remainder of

this process does not follow the destructive, political paths of the past, but charts a new course towards a sustainable inclusive model for problem-solving. Thank you. Thank you.

(Applause.)

CHAIRMAN JIM BARRY: Thank you, Tracy. All right.

We have time now to let the City and the County talk and - and we're going to give them some time and, presumably, they will tell us not only what they're doing, but how and what they might've heard over the past two nights. So, we're start with Leslie Leberti (ph.) from the City.

<p style="text-align: center;">Presenter #16 Leslie Leberti representing the City of Tucson</p>

LESLIE LEBERTI: Good evening. Thank you. I very much appreciate the invitation from the Committee to come talk about sustainability. I've been the Director of the Office of Sustainability - well Conservation Sustainable Development at the City for about two and a half years. And, when I was first asked to give a brief talk on the meaning of sustainability, the one thing that kept running through my mind was a statement made by a guy by the name of Peter O'Riordan back in the mid-'80s. And he said that, "Defining sustainability was an exploration into a tangled conceptual jungle where watchful eyes lurk at every bend." Standing here right now, I know exactly what he meant.

In order to not duplicate what we are presenting to you, Tedra and I kind of worked out - I'm going to address more of the conceptual level of the issue of sustainability, and then she's going to follow up with things that are a little bit more specific, based on her work at the County. I'm not going to try to give you a definition of sustainability. What I wanted to do was kind of explore some of the conceptual foundations, some of the assumptions and some of my own personal observations about how those things have influenced the way in which the term "sustainability" is used, all in the hopes that it'll - this'll assist you as you consider this topic in the context of - of water planning in this region.

The - the textbook definition of - of sustainability, the one that's most commonly used, the one we hear about is, of course, from the Brundtland Commission which, in 1987, said that sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

What's not well-known is that report was actually quite an extensive report and went through a huge array of issues, and there were five key concepts that kind of underlied that definition, and they're as follows:

One, the needs of the future must not be sacrificed to the demands of the present; that humanity's economic future is linked to the integrity of natural systems, but protecting the environment is impossible unless we improve the economic prosperity of the earth's poorest people. The present world system is not sustainable because - because it is not meeting the needs of many, especially the poor. And, finally, we must act to preserve as many options as possible for future generations since they have the right to determine their own needs for themselves.

The problem with that definition is that it was really general, and what happened is there were a ton of attempts to try to narrow it to a more specific focus, so there's a whole range of interpretations of sustainability from, you know, a pure ecological to a pure economic, the triple-bottom-line, which we heard about earlier. In fact, in the first two years after the Brundtland report, there were about 140 different definitions that came out. And, currently, we have about 300 definitions of sustainability and sustainable development.

What's happened more recently is an attempt to get away from just a pat definition to the development of frameworks that more are focused on describing the conditions, the characteristics, guiding principles, and indicators of sustainability.

The most common of those frameworks is that triangular concept we heard about, sometimes it's called the "triple-bottom-line," but it's the three pillars of economy, environment and society; that one, because it's the most common, I wanted to talk about a little bit more, because often we don't really give any discussion to what those three elements mean.

Ecological sustainability really focuses on natural biological processes and the continued functioning and productivity of ecosystems; it acknowledges that humans are part of nature; that nature has limits; and that communities are responsible for protecting and building natural assets. Some of the concepts that are - are fundamental to this are biodiversity and carrying capacity.

Social sustainability is defined as the survival and happiness of the maximum number of people, or the provision of the minimum needs to even the poorest groups; it emphasizes justice, living conditions, health and the opportunity for full participation in all activities, benefits and decision-making of society.

Economic sustainability includes issues such as the creation of jobs and wealth, but it's tempered by the efficient use of environmental and social resources. Economic activity should serve the common good, be self-renewing, and build local assets and self-reliance. There's a lot of other frameworks, There's a four-legged stool. I think there's even a six-legged and eight-legged stool. There's the natural step. Herman Daley has a pyramid of sustainability concepts, ecological footprint on the sustainability hierarchy. These frameworks and the definitions have come about as different groups emphasize various aspects of sustainability over others. So, social justice would emphasize the maintenance of a high-quality of life for people, with an emphasis on equality.

An environmental perspective may say that all species should be protected for their own sake. A business perspective would look at it through a lens of the maximum - maximization of capital, leading to greater opportunities and higher quality of life. This isn't bad. But, what it highlights is how we view sustainability as - as influenced by our individual perceptions and values. That's why, in just a minute, I want to touch on why having a public dialogue in which the full spectrum of community values is considered as such an important aspect of - of this process.

The frameworks are - are important because they give us a basis for prioritizing our values. Sustainability is about tradeoffs. But, more importantly, we live in an evolving and a very dynamic system, things are constantly changing, and we can't try to sustain everything in every condition; otherwise, we're just freezing the moment, freezing the world at a particular moment in time, and that's not what we want to do. So, it does make sense, however, to try and sustain some things for practical or for moral reasons. Things like the life-support services of the ecosystem, economic productive power, and social capacity for the nurturing of humans and for problem-solving.

So, refining the notion of sustainability really involves identifying those things that are higher priorities, those things that need to be sustained; and, in the cases where they haven't been, how - identifying how to repair or restore those things.

I've given some thought, personally, to what I think could be a framework for sustainability, and I wanted to just briefly share that with you. Please keep in mind this is just my own personal opinion and, again, there is no way to really - no one way to frame sustainability.

I see sustainability as a three-tiered concept. The first and most basic tier can be referred to as "survival

sustainability." It captures the notion of ecosystem and human health, and includes the maintenance of ecological support systems, the social capacity to solve major problems, and the economic capacity to meet the subsistence needs of the population. My one caution here is that we rarely know what is too much to sustain until we've crossed that threshold. As much as we would like, there's not complete agreement on what is necessary for the survival of people or the ecosystem. As a result, the concept of the precautionary principle is a very strongly-held concept in ecological fields. This principle requires that we respect the inherent uncertainty of systems, understand the limitations of our knowledge, avoid taking poorly-understood risks, or making decisions that could lead to serious or irreversible damage, and developing systems that allow for adaptation to surprises.

With respect to water, while we, at this point in time, don't have any significant issues with access to safe drinking water, the past use of local water resources has resulted in the loss of a significant amount of riparian habitat. The full impact of that loss is not known, nor do we really have a concept of what constitutes a necessary level of riparian habitat to preserve ecosystem function. In my mind, this first tier asks the question of "How much is essential?" and leaves the question of "How much is appropriate in excess of that level?" to be balanced against the issues raised in the other two tiers.

The second of which is a tier that reflects the very important aspect of sustainability that has to do with the needs of future generations, and this tier involves the preservation of options and flexibility, with an emphasis on the most efficient use of resources. Because we don't know - and as the Brundtland report stated - we don't know what future generations are going to want, and we should give them the right to decide as they see fit, what it really comes down to is preserving options for them to make those decisions, and the best way to do that is through the most efficient use of resources.

With respect to water, efficiency would include both the use of all existing resources, whether it's CAP, groundwater, reclaimed, rainwater, storm water runoff, and also matching the source of the water to the particular use in a manner that reduces the resources demand - resource demands for things such as treatment and disposal.

In order to evaluate the relative efficiency of different options, however, it is necessary that a full life cycle cost and benefit is considered. This further underscores the importance of taking a long-term view.

The third tier has to do with an equally ambiguous term, "quality of life," and this deals with value-based allocation of resources through our existing governance and economic systems. This is where sustainability truly becomes a gray area. So, just briefly, the tiers are, you know, health, survival, not just of our - ourselves, but of the system that supports us, making efficient use of resources, and then everything else really ultimately falls into an issue of quality of life, and how we choose, through our government and through our economic systems, to allocate resources to meet those.

So, it is especially in this area we're having a common vision of where we want to be as a community is essential. Sustainability really becomes a local concept; it fits - has to fit in with our environmental context, with the values and the needs of the community. And, in order to really effectively address sustainability through policies, we have to know where we're - we're going, where we want to end up in the long run.

So, with respect to water, this vision might include concepts of increased local food production, the use of water to supply large-scale solar/thermal energy generation locally, or water for other industrial uses that promote a green economy and enhance local job opportunities. These are just, you know, a few concepts to think about. But, what's most important is the pursuit of this broader vision should be constrained by the first two tiers: Survival of - of us and our system, and the preservation of options for the future.

So, as I was pulling my thoughts together for this, there were a couple of things that - that really were driven home about what sustainability means, or the consideration of sustainability. The first of those is that we recognize that our ability to see the needs of the future 's limited, and any attempt to define sustainability should remain as open and flexible as possible.

We should ask ourselves whether the policy decisions we're promoting are, in essence, making decisions for that future generation, and making decisions they'll have to live by, as opposed to preserving options so they can determine their own needs and values for themselves. This precaution also allows current generations to adapt to uncertainty and rapid and unexpected change, such as the financial crisis that we're all living through right now. I think that we often are inclined to tie our hands in order to preserve the things that we value but, in doing so, are we limiting the essential flexibility and capability for adaptation in the future?

My second observation is that - and this one's, I think, pretty obvious to everyone - sustainability involves

tradeoffs in all areas: economic, social, and environmental. It is impossible to have it all. And an extreme interpretation in any one of the areas, whether it's social, economic, or environmental, likely means that one or both of the other two areas are being under-served. So, we should look broadly to consider the multiple consequences of policy actions.

Three, sustainability is not about preserving the status quo. Without change, we stagnate and become unable to adapt to the changing natural economic and social environment.

Four, sustainability cannot be accomplished overnight. The need for change cannot overwhelm the ability of our natural, social, and economic systems to adapt to imposed change. In addition, the pursuit of sustainability is not just about achieving a desired outcome, but it's also a process. So, it's not just about having a vision for where we want to be in the future, but a set of principles that guide us in how we get there.

Accepting progress as a transition from where we are now to where we want to be in the future means that we have to have a vision of where we want to be; that the development of those collective goals and the process of moving forward towards them must be inclusive. We need to set short, medium, and long-term goals, take small steps, and review our success and use that information to adapt either the vision, the process, or both.

Five, no single approach to sustainable development or framework is consistently useful, given the variety of the environmental conditions, societies and economic and institutional structures. What is important is that there is a vision; it is developed through an inclusive process, all viewpoints are respected, and we don't forget our obligation of both preserving the natural life-support system, but also preserving options for future generations.

And my final observation is, at the same time, remember the local - the global context. It's easy to forget that the consequences of local decisions reach far beyond just our region to state and national and international levels. It's also easy in dealing with the day-to-day to forget the concept of sustainable development and sustainability came out of a struggle for peace, freedom, better living conditions, and a healthy environment. Similarly, we can't forget that defining sustainability is essential, a social and political decision.

So, I will end with what I think is one of the best definitions of sustainability that I've run across. It says that, "Sustainable development is positive change which does not undermine the environmental or social systems upon which we depend; it requires a coordinated approach to planning and

policymaking that involves public participation; its success depends on widespread understanding of the critical relationship between people and their environment and the will to make necessary change." Thank you.

CHAIRMAN JIM BARRY: Thank you, Leslie.
(Applause.)

<p style="text-align: center;">Presenter # 17 Tedra Fox representing Pima County</p>

CHAIRMAN JIM BARRY: Now from the County, Tedra Fox.

TEDRA FOX: Thank you very much for the opportunity to be here before the Committee. And I was going to present slides but, in lieu of that, I've brought some handouts and, hopefully, I have enough now for all the Committee members, and I apologize to the participants and the audience, but maybe we can make them available, or I'd be happy to send anybody a copy.

It's been a real pleasure to be able to participate and sit in on the last two meetings because we've heard so many thoughtful and constructive approaches to us a sustainable water future for Pima County, and so I've just really appreciated all of the wonderful public dialogue there's been, and the fact that there's been so much interest in this issue.

And what I'd like to do is share with you tonight, share with the Committee members, a little bit about the County's approach to sustainability and, specifically, talk about two - two tools that we've used to help establish a framework for our sustainability efforts, our County operational sustainability efforts. And the first of those tools is the concept of spheres of sustainability; and the second one is the use of guiding principles, which you've heard other speakers talk about as well. And so, in that regard, my talk will be a little bit more process-oriented in approach and, perhaps, some of the ideas may have applicability for the Committee or, at least, they could be jumping-off points for consideration, even when you talk about the next phases of your - of your work in your Mission Statement.

The - the first slide - I apologize for having to do this, and I apologize, too, because then some of the things, just because I don't want to lose anything for the audience - I'm going to end up reading a little bit more than I would. But, just to begin with, in May of 2007, the Board of Supervisors adopted a Resolution that included a far-reaching set of sustainability initiatives, and those initiatives addressed a variety of topics. Everything, as you can see on

the slide, from green building and renewable energy, to waste reduction, to very importantly - and why we're here today tonight - water conservation and management. And what the Resolution recognizes is the environment, the economy, and the social dimensions of our community are inextricably linked, the triple-bottom-line, like we've heard a lot of people mention.

And sustainability, to me - this is now my personal opinion - is really about making decisions that are going to elevate all three of those. And I'm going to sound a little heretical probably compared to Leslie, but I think it - I think sustainability is about trying to elevate and enhance all three, and not necessarily about balances, because purported balancing acts are, to some extent, how we got to where we're at because, in balancing, typically, something is being given and something is being taken away. So, I think the concept is that we do try and elevate all three of those things at once; it may not be every aspect of it, but we try our best to. And, of course, the most fundamental building block of sustainability is people, and the ability of people to meet their basic needs and, also, to aspire to their full potential; that has to be the very essence of sustainability and everything builds upon that.

As I mentioned, the Board provided us with a very far-reaching Resolution, and so one of our first challenges was to determine the best way to effectively implement that so that we could meet its ambitious goals, and so we started thinking about different frameworks. And the Steering Committee that was assembled to take this task on saw that the Resolution intrinsically gave rise to three distinct spheres of sustainability, and that's what's on the next slide. And the first of those spheres is the County operational sphere, and that's the sphere where the County looks inward at itself and says, "What can we do? How can we improve our practices to make them more sustainable throughout our County operations?" And we thought it was very important that the County do that first, identify our own best practices, before moving on to the second phase of our planning, which is the community-wide sustainability planning that we want to initiate in the beginning of next year, hopefully, with a lot of public and private partners.

Then the second sphere of our sustainability planning is really the community scale where we ask the question, "What programs and services can we provide at the community scale to enhance sustainable living community-wide?" And then, finally, we've got the regional scale, the largest scale, where we look at, "How can we coordinate and collaborate with public and private entities to work on issues of regional importance, like water, like land use, like transportation, and like renewable

energy?" And so we found that a very helpful way for organizing what is a very large all-encompassing topic, as we've all learned sustainability is.

So, the next slide shows spheres of water sustainability, because I think it might be helpful, possibly, to think about sustainable water planning also in terms of different scales in terms of policy development and actually coming up with very specific recommendations. And so - and anytime I think you take - you have a very multi-dimensional topic like sustainable water futures - I think it helps to break it down into its component pieces. So, this slide shows three spheres. The first is the home business sphere, and topics that could be addressed under that are things like green building, landscaping, efficient use of appliances, small behavior modification items, like taking shorter showers, obviously, you know, turning off the faucet when you're brushing your teeth, rainwater harvesting, gray water reuse, and there are a lot of overlap between these - the different spheres.

The next one is the neighborhood community design level where we would look at some bigger issues, like permeable paving materials, green infrastructure for flood control in order to facilitate more groundwater recharge, how we're going to landscape common areas in roadways and median areas, community pools, perhaps, promoting those over individual pools, but still giving people the option, looking at community gardening opportunities, because we know the importation of food requires a tremendous amount of energy and, whenever you have a tremendous amount of energy being used, you have a lot of water being used, mixed-use development to create more walkable communities. There are examples of neighborhood community design, policy initiatives that could be created to achieve a sustainable water future. And then, of course, the regional issues which we've heard a lot of people here tonight very articulately explain, you know, population growth, smart growth, sustainable development, how we're going to address groundwater pumping and recharge. I'm just mentioning these as topics, and I'm not proscribing a direction for any of these. Certainly looking at the cost of infrastructure and energy for wastewater and water operations, groundwater-dependent ecosystems, the health of the Colorado River ecosystem as well, public transit and, finally, water rights and collaboration. So, those would all be important topics to try and address, to come up with some policy directive under regional issues. And, again, I recognize there's a lot of overlap.

So, at the County, as I mentioned, we began our planning efforts with - at the County operational level, and that's the next slide, and we created a Sustainable Action Plan

for County operations, which underwent public review and now is in final form, it was adopted by the Board in August, and it's available online.

And what we did is we assembled multi-disciplinary teams representing 22 different County departments, because we believe - like this process believes - the more perspectives, the more people you have involved, the more ideas and creativity, the better product that's going to come out of the process. So, we brought these multi-disciplinary teams together to work on different topics in that Board Resolution. And, of course, one of the very important topics was water conservation and management. And so we first began with an understanding of the Board of Supervisors' directives regarding that.

One of their first goals was that the County cut water use in all of its facilities by 15% by 2015; that we double the number of parks using reclaimed water by 2018, which would bring it up to a total of 18 parks; and that we maximize our County water rights assets to sustain and protect our natural environment. So, those were the three goals - again, this is at the County operational level, not addressing community-wide planning yet.

We then began conducting inventories of our existing success stories. What are we already doing right? What are our practices that are already contributing to sustainability? And - and where could we go further and where are the gaps in those practices?

The next task that we did is we developed - for each of those topic areas, including water conservation - and that's the next slide - are guiding principles, and we found the guiding principles very helpful in taking us from our point of origin, which were the - the large-board goals and measurable targets, to our destination, which was coming up with very specific action items that specific departments would be responsible for implementing and held accountable to, and it - the principles, essentially, became our roadmap; they guided us there. And anytime we brain stormed and we thought of an idea or an activity, we could measure it against the principles. Does it achieve all of these? Is it helping us further? And, in the future, if there's a new program or an idea that comes up, it gives us a way to evaluate it.

And so we found the concept of the guiding principles very helpful for kick-starting our effort and we developed 32 specific recommendations for enhancing water conservation and management at the County, and it's actually a quarter of our Action Plan. We have 119 action items, eight topic areas, and a quarter of them are devoted to water conservation; that's what

an important issue it is, and we realize it touches so many different areas.

And we also came up with - as Leslie mentioned - all sustainability plans now have success indicators, so we came up with six measurable successor indicators so we could determine the progress that we're making on an annual basis and report that to the public, as well as to the Board of Supervisors.

The next slide for the (inaudible) is - is to suggest that, perhaps, you could also have a principle-driven water future, or a sustainable water planning process as well. And I included a quote from Ralph Waldo Emerson regarding the use of principles, which I thought was very interesting. I'll go ahead and read it, since we can't project it. He said, "As methods, there may be a million and then some, but principles are few. The man who grasps principles can successfully select his own methods. The man who tries methods, ignoring principles, is sure to have trouble."

So, what I was really struck with when I - especially at the last meeting, because I was able to hear the - all of the public comment, were the number of very strong principle statements that could form the foundation of an implementation strategy for water sustainability. And so what I tried to do on the next slide is capture those, and these are just a handful of the things that I heard from the community as they spoke, and there - you know, my paraphrasing, of course, to some extent - but, I'll go ahead and read those because I think that they are an example of what could be a very strong foundation, whether the Committee accepts these, it's just - it's the concept of driving us towards a preferred future and giving us direction for future action.

So, the first of those things that I heard was that: Conservation should always be treated as a first priority in water management, because it is often the easiest and least expensive step.

Second was: Recognize, protect, and manage water resource assets as a public good. We heard a speaker explain in detail about water managed by private entities versus public entities, and there's just some competing interests, obviously, involved there.

Third, link development policies with appropriate levels of groundwater extraction.

Four, maintain the health and biodiversity of riparian ecosystems, including the Colorado River.

Five, the development and operation of regional water systems should satisfy carbon reduction goals; and

Six, engage the resources and talents of all the region's residents in the development of a sustainable water plan.

That's just a sampling, of course, there were so many excellent ideas, but just as - how - how you can, essentially, take those principles and think of them as the hub of a wheel - and maybe a better analogy in this case, I guess, would be like the headwaters - the headwaters of a watershed and then from those headwaters could flow out of those principles very specific actions and initiatives and recommendations. So, that is just one idea for, you know, possibly framing a sustainability plan that I would just offer to the Committee for consideration.

And I think it's wonderful that so many people have such full and inclusive definitions of sustainability. And I was going to read one that - that was actually authored by school-age children when they were preparing a green map of lower Manhattan and it's: "Sustainability is living, working, eating and playing in ways that will not jeopardize the health of the planet or the quality of life for all cultures, species, and generations to come."

And, just like this definition, and Leslie mentioned, quality of life as well in her definitions, our Pima County Board of Supervisors have a definition of sustainability that appeared in the Resolution that was adopted in 2007, and it also emphasizes quality of life and that definition is: "Improving the quality of life of current generations without compromising the resources needed for future generations." So, that is how it's being defined at - at Pima County, and I thank you very much for this opportunity to provide a presentation.

CHAIRMAN JIM BARRY: Thank you, Tedra.

(Applause.)

CHAIRMAN JIM BARRY: Call to the Audience?

(No response.)

CHAIRMAN JIM BARRY: I'll entertain a motion for adjournment.

UNIDENTIFIED MEMBER: (Inaudible).

CHAIRMAN JIM BARRY: No objection?

(No response.)

CHAIRMAN JIM BARRY: We made our 8:00 o'clock.

(Conclusion of meeting.)

* * * * *

CERTIFICATE

I hereby certify that, to the best of my ability, the foregoing is a true and accurate transcription of the audio recording of (Sustainability Discussion) of the City/County Water & Wastewater Study Oversight Committee Meeting held on October 29, 2008.

Transcription completed: November 6, 2008.

DANIELLE L. KRASSOW-TISDALE