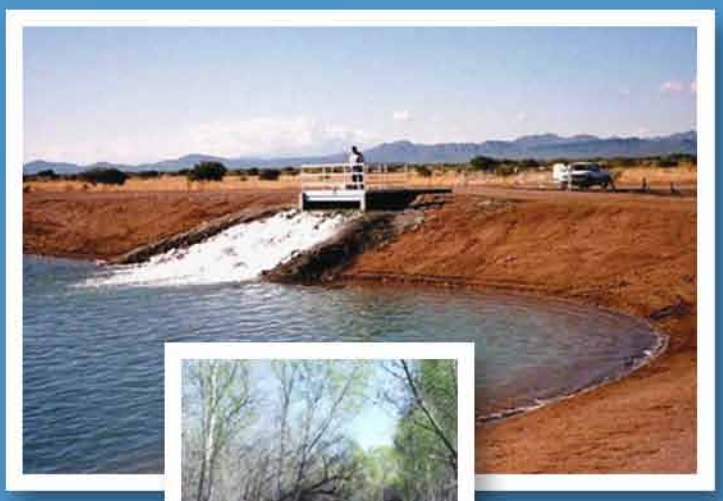
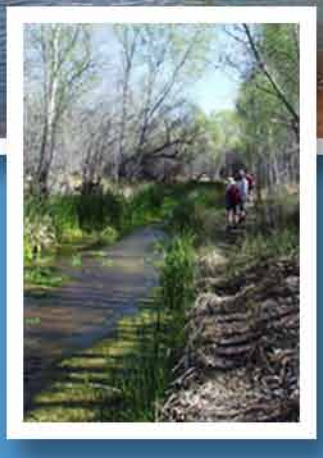
A City of Tucson and Pima County Cooperative Project

Water & Wastewater

Infrastructure, Supply & Planning Study





Executive Summary

April 2009

Executive Summary Table of Contents

Acknowledgements

The contributions of the following people to the successful completion of Phase I of the City/County Water and Wastewater Infrastructure, Supply and Planning Study are greatly appreciated.

City of Tucson Mayor and Council

Robert E. Walkup, Mayor
Regina Romero, Ward 1
Rodney Glassman, Ward 2
Karin Uhlich, Ward 3
Shirley Scott, Ward 4
Steve Leal, Ward 5
Nina Trasoff, Ward 6

Pima County Board of Supervisors

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Ramon Valadez, District 2
Sharon Bronson, District 3
Raymond J. Carroll, District 4
Richard Elias, Chairman, District 5

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Marcelino C. Flores, Vice Chair, Regional Wastewater Reclamation Advisory Committee
John Carlson, Regional Wastewater Reclamation Advisory Committee
Bruce Gungle, Pima County Planning and Zoning Commission
Rob Kulakofsky, Regional Wastewater Reclamation Advisory Committee
Tina Lee, Citizens Water Advisory Committee
Bonnie Poulos, Pima County Planning and Zoning Commission
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Daniel J. Sullivan, Citizens Water Advisory Committee
Sean Sullivan, City of Tucson Planning Commission
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Jeff Nichols, Deputy Director of Administration and Finance, Pima County Regional Wastewater Reclamation Department

We would also like to acknowledge the dedicated public who spent many hours attending meetings, listening to presentations, asking questions, providing suggestions, and helping to shape the final content of the report.

Background

In April 2008, the Tucson Mayor and Council and Pima County Board of Supervisors approved a joint "Water Infrastructure, Supply and Planning Study" (Joint Study). The Mayor and Council and the Board of Supervisors anticipate using this Joint Study to improve City-County collaboration on water and wastewater issues and to develop a regional dialogue on a sustainable water future for the region. The regional dialogue will address developing a complete inventory of water and wastewater systems, respect for the environment, agreement on population and urban form for the future, and development of new, renewable water supplies. The ultimate goal of the study is to define and develop a sustainable water future for the region.

The Mayor and Council and the Board set forth a five-phase scope of work, with a City and County dialogue initiating the process, relying on a cooperative effort of their respective staffs to gather existing information. To provide independent review and oversight of staff work, Mayor and Council and the Board appointed a Joint City/County Oversight Committee (Committee), consisting of four members each from the Citizens Water Advisory Committee, the Regional Wastewater Reclamation Oversight Committee, and two members each from the jurisdictions' Planning and Zoning Commissions, for a total of twelve members.

The Joint Study began the five phase process, with Phases I and II focused on Tucson Water and Pima County Regional Wastewater Reclamation Department and their service areas (Figure 1). This Executive Summary and the related documents represent the Committee's report on Phase I of the Joint Study.

The Committee and city and county staff have initiated Phase II of the Joint Study, which is planned for completion by the Fall of 2009.

At the explicit direction of Mayor and Council and the Board, the Committee implemented a broad-based and transparent public process for engaging the community in Phase I and will do so again for Phase II. (Volume 3: Public Participation Report contains a complete description of the Committee's public outreach process.)

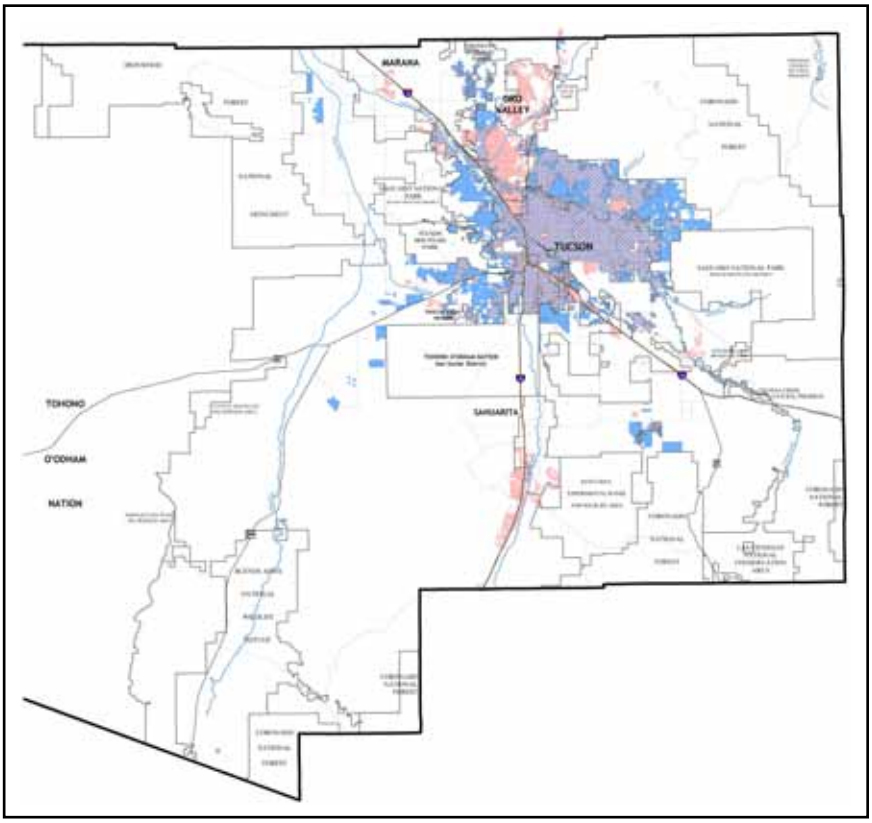

Figure 1-Tucson Water & Pima County Wastewater Services Areas

Phase I Scope of Work

Phase I was identified as an "Inventory and Assessment of Water and Wastewater," involving four tasks:

- An inventory of existing infrastructure conditions and assessment of this infrastructure and its capacity;
- A water resource assessment of resource supplies for the city/county service area;
- Assessment of what is a sustainable water population for the city/county service area, based on present, known water supplies; and,
- Cooperation between city and county staff to improve communication and cooperation between the two departments; development of a joint constructed recharge project for city and county effluent; finalizing the Conservation Effluent Pool agreement and amendments to the water/sewer intergovernmental agreement; and locating wastewater reclamation facilities in the southeast area.

Oversight Committee: Members and Record of Meetings

The twelve Oversight Committee members are listed below. (Carol Zimmerman was an original member representing Citizens Water Advisory Committee, but when she resigned from the Oversight Committee and CWAC, Vince Vasquez was appointed to replace her.)

James T. Barry, Chairman, Citizens Water Advisory Committee
Marcelino C. Flores, Vice Chair, Regional Wastewater Reclamation Advisory Committee
John Carlson, Regional Wastewater Reclamation Advisory Committee
Bruce Gungle, Pima County Planning and Zoning Commission
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Vince Vasquez, Citizens Water Advisory Committee
James Watson, City of Tucson Planning Commission
Alternate: Bob Cook, Pima County Planning and Zoning Commission

The Oversight Committee thanks city and county staff for their extraordinary efforts to prepare and present to us the information needed to produce this report. The Oversight Committee worked hard as well. An indication of our joint work effort can be seen in the record of committee meetings. The Oversight Committee met twenty-three times, for a combined total of just over 60 hours of meeting time and a combined total of 600 man-hours. These total hours reflect only the committee's time in actual meetings; it does not gauge time the committee invested in preparing for meetings; time staff put in preparing for and attending the meetings; nor the time put in by the public attending the meetings.

Date	Time	Date	Time
April 9, 2008	7:30a.m. to 9:30 a.m.	October 2, 2008	6:00p.m. to 7:43p.m.
April 18, 2008	8:00a.m. to 10:15a.m.	October 8, 2008	6:00p.m. to 7:43p.m.
April 23, 2008	6:00p.m. to 8:00p.m.	October 15, 2008	6:00p.m. to 8:00p.m.
May 12, 2008	6:00p.m. to 8:00p.m.	October 22, 2008	6:00p.m. to 8:00p.m.
May 21, 2008	6:00p.m. to 8:00p.m.	October 29, 2008	6:00p.m. to 8:00p.m.
June 11, 2008	6:00p.m. to 8:00p.m.	November 15, 2008	9:00a.m. to 3:00p.m.
June 25, 2008	6:00p.m. to 8:00p.m.	December 13, 2008	9:00a.m. to 2:05p.m.
July 9, 2008	7:00a.m. to 9:50a.m.	January 10, 2009	9:00a.m. to 3:00p.m.
July 23, 2008	6:00p.m. to 8:00p.m.		
August 13, 2008	7:00a.m. to 9:00a.m.		
August 27, 2008	6:00p.m. to 9:25p.m.		
September 3, 2008	6:00p.m. to 7:50p.m.		
September 10, 2008	7:00a.m. to 8:55a.m.		
September 17, 2008	7:00a.m. to 8:55a.m.		
September 24, 2008	6:00p.m. to 8:00p.m		

Overview of Phase 1 Report

The Committee learned early that the issues in Phase I were complex, technical, interrelated, and multifaceted. Along the way, the came to the realization that "everything is related to everything else."

At the Committee's August 27, 2008 meeting, Dr. Sharon Megdal, Director of the Water Resource Research Center at the University of Arizona, summarized a study she and a colleague conducted of forty-seven people actively involved in regional water issues and how they viewed the prospects for a regional water planning process. Dr. Megdal's sample recognized that having "a common set of facts" and an "understanding of the context" within which decisions are made and policies are formulated make up the critical starting points for a regional dialogue on water. The Committee informally adopted Dr. Megdal's formulation as its mission statement.

But the formulation is not "cut and dry," since there are different meanings of "facts." On one level, an "inventory and assessment" implies "facts" as cold, hard, irrefutable statistics (such as miles of pipe). Such "hard facts" about Tucson Water and Regional Wastewater Reclamation exist and, with the help of city and county staff and outside experts, the Committee presents this information in the Phase I Report.

On another, equally important level, "facts" are based on, and exist in reference to, assumptions, value judgments, and personal or institutional visions for the future. For example, quantifying currently available water resources, such as Colorado River water, is inseparable from assumptions about the reliability of the source, given concerns about population growth, continuing drought, and climate change in the Colorado River Basin. Equally, assessment of a "sustainable water population" elicits divergent definitions of "sustainability."

The Committee did reach substantial agreement on a common set of facts and understanding of context, in the first definition of the term, about Tucson Water and Regional Wastewater Reclamation. These "hard facts" are presented in the first section of this Executive Summary and in Section Two of the Phase I Report.

The Committee, however, also reports that we reached far less agreement on the "softer facts" that are dependent upon assumptions, value judgments and visions for the future. Many of these issues will be explored further in Phase II.

Inventory of Tucson Water and Regional Wastewater Reclamation Systems

> ***More than 11,300 readers of the BMJ chose the introduction of clean water and sewage disposal – "the sanitary revolution" –as the most important medical milestone since 1840, when the BMJ was first published…sanitation topped the list, followed closely by the discovery of antibiotics and the development of anesthesia. (emphasis added) --British Medical Journal of January 20, 2007:***
>
> ***Children suffer most. Diarrhea — nearly 90 percent of which is caused by fecal- contaminated food or water — kills a child every 15 seconds.... Cholera and typhoid kill so many kids a year that it amounts to two jumbo jets full of children crashing every four hours. -- New York Times book review of The Big Necessity (December 12, 2008) explains why the "sanitary revolution" matters.***

Water and wastewater systems, buried underground and largely invisible to us in our daily lives, except when they break, are indispensable to a sustainable Pima County, for the people living here now and for the people to come in the future. There are other questions regarding water, wastewater, and a sustainable community, but the indispensability of the sanitary revolution is beyond question.

Figure 2-Tucson Active Management Area

Tucson Water Department in the Regional Context

Tucson Water is located within the Tucson Active Management Area (TAMA), which covers 3,800 square miles, including eastern Pima County and portions of Pinal County and Santa Cruz County. Arizona Department of Water Resources defines four water sectors within the TAMA: Municipal, Agriculture, Industry and Indian. **Table-1** reports total demand, in acre-feet, and the percent of total TAMA water demand accounted for by each sector, for 2006. The Municipal Sector was the largest source of water demand, at just over 193,000 acre-feet (55.9%), followed by Agriculture (25.3%), Industry (15.4%), and Indian (3.4%).

Figure –3 charts water demand by sector, from 1941 to 2000. This data shows that, first, between 1940 and 1985 Agriculture was the predominant water user in the Tucson

Sector	Demand (Acre Feet)	% of Total
Municipal	193,468	55.90%
Agriculture	87,755	25.30%
Industry	53,397	15.40%
Indian	11,678	3.40%
Total	346,298	100.00%

Table-1 Water Demand in Tucson AMA for 2006 (Acre Feet)

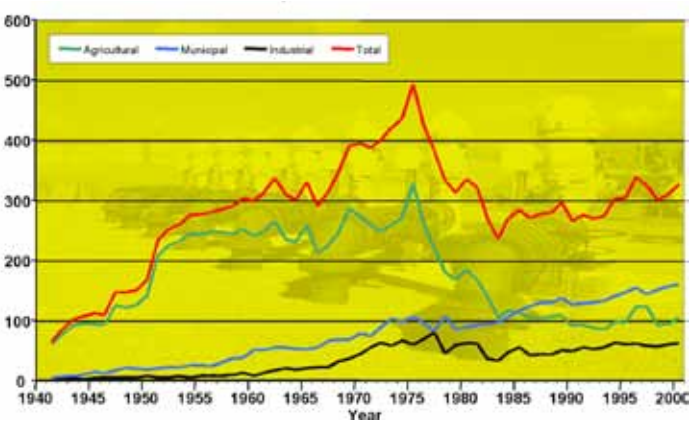

Figure-3 Historical Water Use in the Tucson AMA by Sector, 1941 to 2000

AMA. It began to be eclipsed by the Municipal Sector, and second, water demand peaked in 1975 at just under 500,000 acre feet and then fell steeply because of declining demand in the Agriculture sector.

Figure – 4 extends the chart on historical water use, from 1985 to 2006. This data shows the increased demand by Municipal sector in 1985, along with the continued, though uneven, decline in Agriculture sector demand.

The Municipal sector, of which Tucson Water is the largest utility, includes 26 Large Providers (delivering more than 250 acre feet of water); 119 Small Providers (delivering less than 250 acre feet); and approximately 7,400 private, exempt wells.

The Municipal sector provides water for both residential and non-residential customers. **Figure – 5** shows that residential customers serviced by the Large Providers accounted for almost 110,000 acre feet in 2006, followed by non-residential customers of Large Providers, with deliveries just under 60,000 acre feet in 2006.

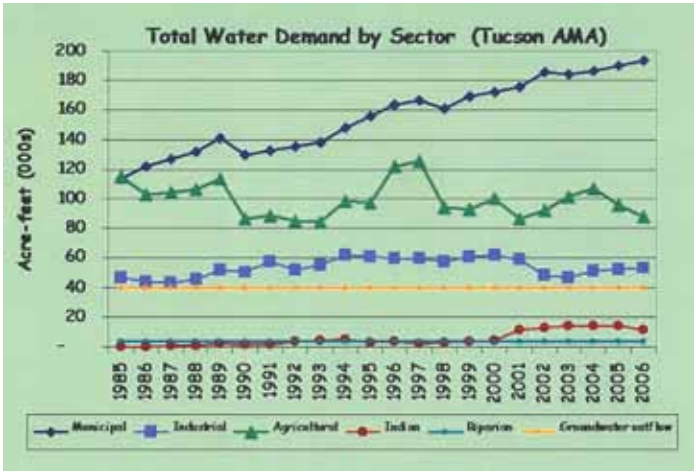

Figure-4 Historical Water Use in the Tucson AMA by Sector: 1985 to 2006

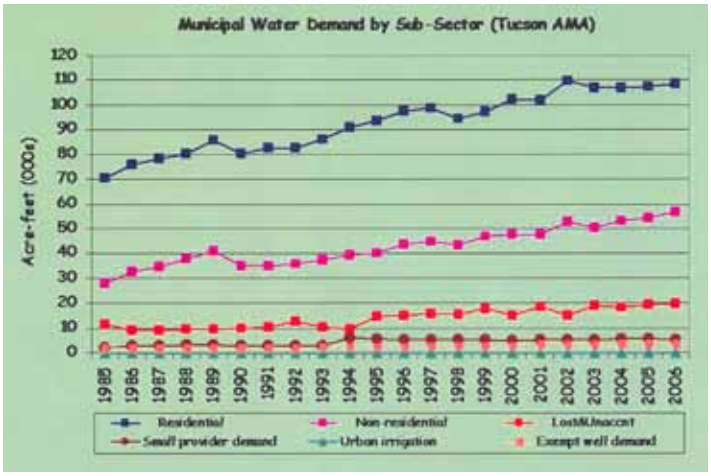

Figure-5 Municipal Water Demand by Sub-Sector

Tucson Water Department in Detail

Figure – 6 shows Tucson Water's Obligated Service Area, which encompasses 410 square miles. The area in dark blue is the current service area, which is approximately 290 square miles. The area in yellow shows the current Tucson city limits and the areas in light blue, approximately 120 square miles, are undeveloped areas within the city limits that will be served as they develop. [1]

According to Arizona Department of Water Resources (ADWR), Tucson Water accounts for 72% of the Municipal sector water demand. With the Municipal sector accounting for 55.9% of Tucson Active Management Area (TAMA) water demand and Tucson Water accounting for 72% of the Municipal sector, in 2006 Tucson Water accounted for 40.3% of total AMA water demand (55.9% x 72%), making Tucson Water the single largest provider in the region.

Tucson Water operates both a potable water system and a reclaimed water system. **Figure – 7** provides a snapshot of the two systems. The Tucson Water potable system has approximately 225,000 metered services, delivering water to approximately 800,000 customers. The reclaimed system delivered more than 15,000 acre-feet in 2007, including 18 golf courses, 704 single-family residences, 47 parks, 61 schools, 1,600 acre-feet to the Town of Oro Valley, and to a business in the Flowing Wells Irrigation District.

[1]-Additional information on the obligated service area, including the legal basis, is posted to the study website under "Tucson Water Reports" at http://www.tucsonpimawaterstudy.com/Documents/City_Co_Docs.html

Potable Water System

Tucson Water currently has approximately 4,800 miles of pipe delivering water over its service area. The utility has developed several "well fields" from which it pumps and delivers water. Three recharge projects are devoted to storing the City's Central Arizona Project (CAP) allocation: the Central Avra Valley Storage and Recovery Project (CAVSARP), the Southern Avra Valley Storage and Recovery Project (SAVSARP), and the Pima Mine Road Recharge Project. CAVSARP and SAVSARP are owned and operated by the City of Tucson while the facility at Pima Mine Road is jointly owned by the City and CAP. The well fields at CAVSARP and SAVSARP are dedicated to recovering the City's recharged CAP water while the Santa Cruz Well Field both recovers CAP water and pumps groundwater. All three of these City well fields are used to provide renewable potable supply to Tucson Water customers.

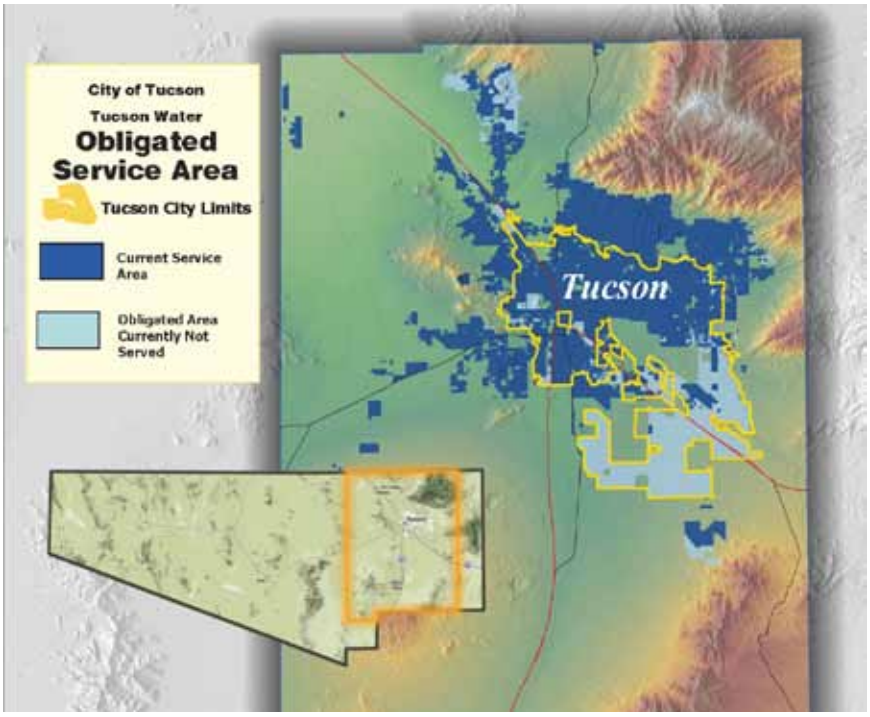

Figure-6 Tucson Water Obligated Services

Tucson Water also developed four well fields to pump native groundwater: Central, Southside, Santa Cruz, and Avra Valley. Tucson Water also operates the Tucson Airport Remediation Project (TARP), a system of wells, transmission mains, and a sophisticated small-scale treatment plant designed to remediate contaminated groundwater near the Tucson Airport.

Tucson Water counts 225,000 metered accounts, divided between three classes of customers: Single-Family Residential, Multi-Family Residential, and Commercial-Industrial (**Table – 2**). Single-Family Residential accounts represent 89% of all accounts and 56% of water demand. While the Multi-Family Residential and Commercial-Industrial are only 11% of all accounts, they constitute 44% of Tucson Water's total water demand.

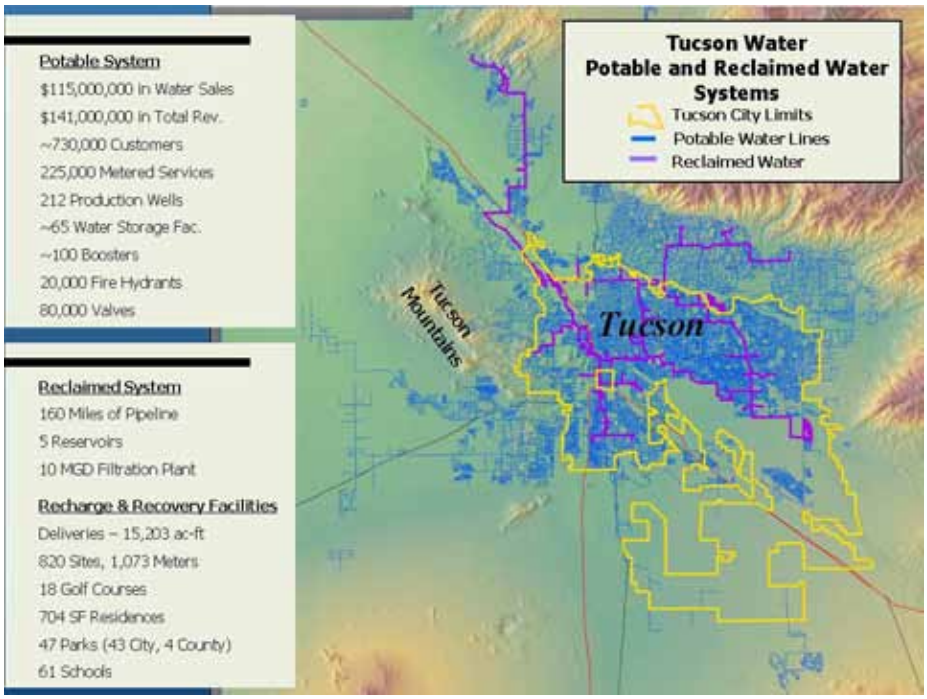

Figure-7 Tucson Water Potable and Reclaimed Water Systems

Class	% of Accounts	% of Water Delivered
Single-Family Residential	89%	56%
Multi-Family Residential	4%	19%
Commercial-Industrial	7%	25%

Table - 2 Tucson Water Metered Accounts, by Class

Figure – 8 shows how the various classes of customers use the water delivered to them. While the profiles of each class have their unique configurations, one characteristic is common to all three classes: Outdoor use of water is the largest single category of use.

Figure – 9 shows water use for all three classes combined. For all classes of customers, Outdoor use is the single largest category, at 39%. The second largest category is Toilet/Restroom/Shower at 22%. It is worth noting that Leaks/Other uses account for 11% of water use.

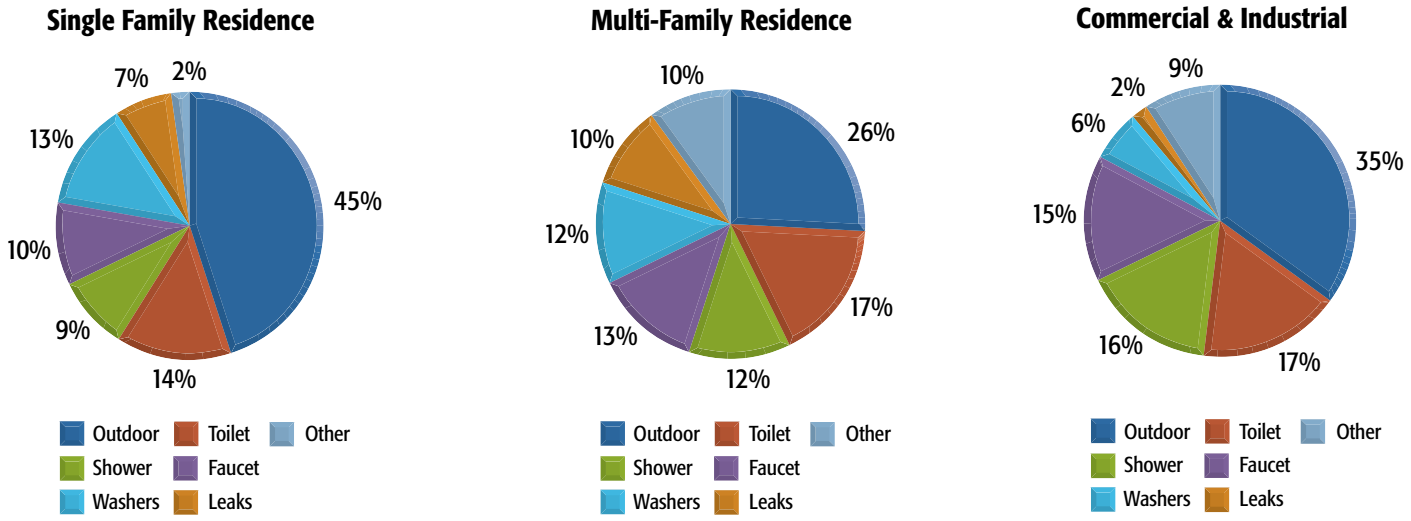

Figure - 8 Water Use by Class

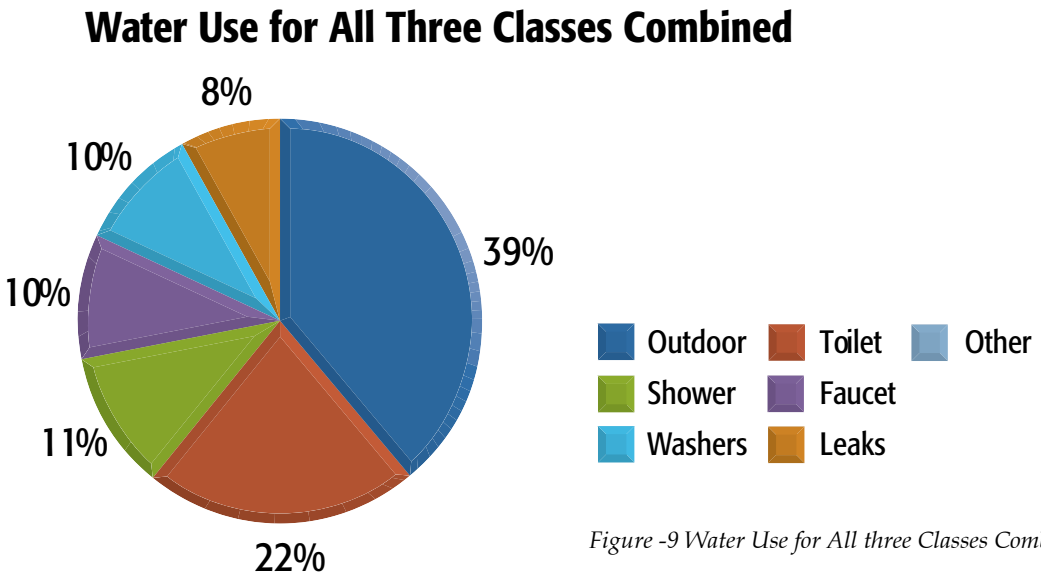

Figure -9 Water Use for All three Classes Combined

Regional Wastewater Reclamation Department in the Regional Context

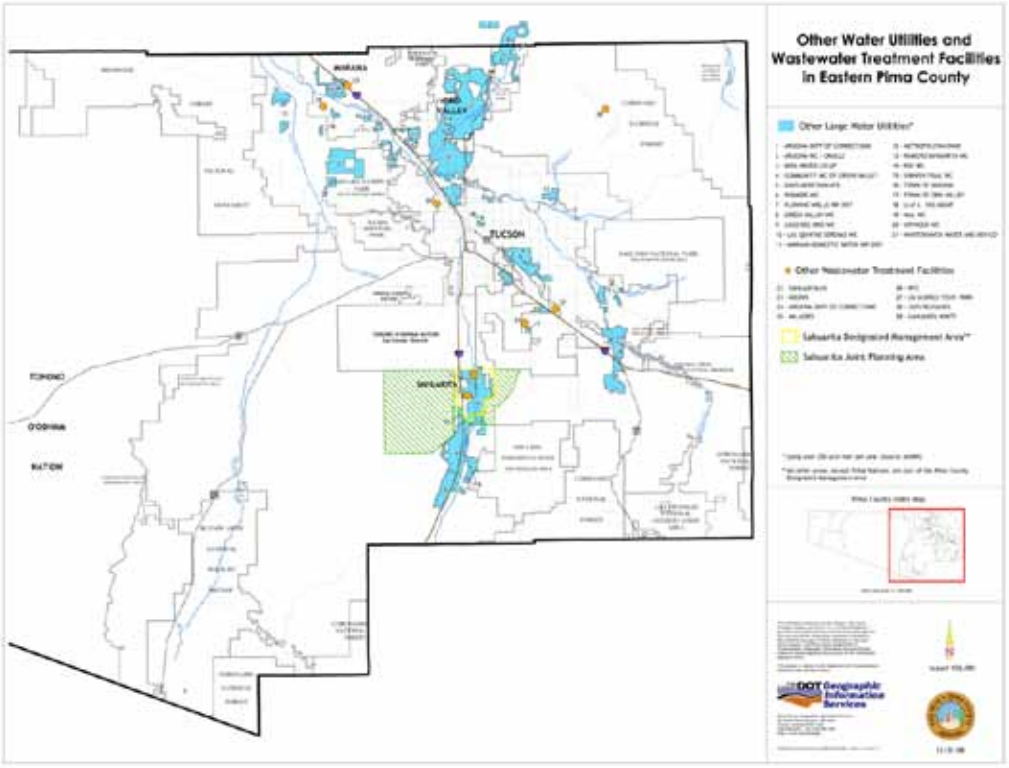

Figure - 10 Other Water Utilities & Wastewater Treatment Facilities in Eastern Pima County

The Pima County Regional Wastewater Reclamation Department (Department) operates and maintains the second largest wastewater reclamation system in Arizona. It has a 700-square mile service area; 259,883 customers; 500 employees; a conveyance system of 3,400 miles of pipes; 73,000 manholes and cleanouts; and 31 lift stations; and a treatment system of 11 wastewater reclamation facilities processing more than 70 million gallons of wastewater every day (MGD). Pima County is authorized to own and operate the regional sewer system by Arizona Revised Statutes 11-264. The federal Clean Water Act (CWA), focused on the protection of surface water, governs the operation of this system by employing a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways and to help finance municipal wastewater treatment facilities. The wastewater treatment aspect is primarily covered under Section 208 of CWA which requires that a framework be established to coordinate wastewater treatment on a regional basis.

As recognized in the Area-Wide Water Quality Management Plan (the 208 Plan) of the Pima Association of Governments (PAG), the Department is the Designated Management Agency (DMA) for all of Pima County, except for the Tohono O'odham Nation and the Town of Sahuarita. In addition, there are "non-designated" private sewage treatment facilities operating within Pima County's designated management area. **Figure – 10** shows the Pima County and Sahuarita designated management areas, as well as the non-DMA service areas, in Eastern Pima County. The Department provides 97% of the total sewage treatment capacity in the County. In addition, there are as many as 60,000 properties that are on septic systems.

An Intergovernmental Agreement (IGA) in 1979 between the City of Tucson and Pima County established the foundation for a regional approach to wastewater conveyance, treatment and reuse. The IGA gave Pima County the responsibility to construct capital projects and maintain and operate the conveyance and treatment facilities within both the City and unincorporated Pima County necessary to ensure compliance with existing Federal (EPA) and State (ADEQ) wastewater requirements.

Under the IGA, unincorporated Pima County retained 10 percent of the effluent from its treatment facilities and the City of Tucson owned the remainder. This IGA has been subsequently modified, and the effluent allocations are subject to the 1982 Southern Arizona Water Rights Settlement Act (SAWRSA) with the U.S. Department of Interior. The County has entered into additional IGAs with the other local jurisdictions in support of the 208 Plan mandate for the regionalization of wastewater services in Pima County. Pima County is governed in regard to effluent quality by the Arizona Pollutant Discharge Elimination System (AZPDES) for surface discharge standards and the Aquifer Protection Program (APP) for aquifer discharge standards.

The Department operates financially as an enterprise fund, and it secures funding for large projects both through selling

sewer revenue bonds and obtaining public infrastructure loans. As a result, the Department is required to maintain and finance its operations in compliance with covenants to the bond purchasers and the public financing authorities. In summary, the Department operates within the regional context established by Federal laws and regulations, State enabling legislation and regulations, the DMA designation and PAG 208 Plan, County ordinances, IGAs with local jurisdictions, and sewer revenue bond covenants.

Regional Wastewater Reclamation Department in Detail

The Joint Study focused on the Department's Regional Sewer Service Area, which includes Metropolitan and Sub-Regional Wastewater Reclamation Facilities (see **Figure – 11**). The regional sewer system consists of treatment facilities and conveyance systems.

Treatment Facilities

There are eleven treatment facilities in the regional system. Three of these facilities comprise the Metropolitan Wastewater Reclamation Facilities, with a total treatment capacity of 81.5 MGD and current usage of 64.7 MGD.

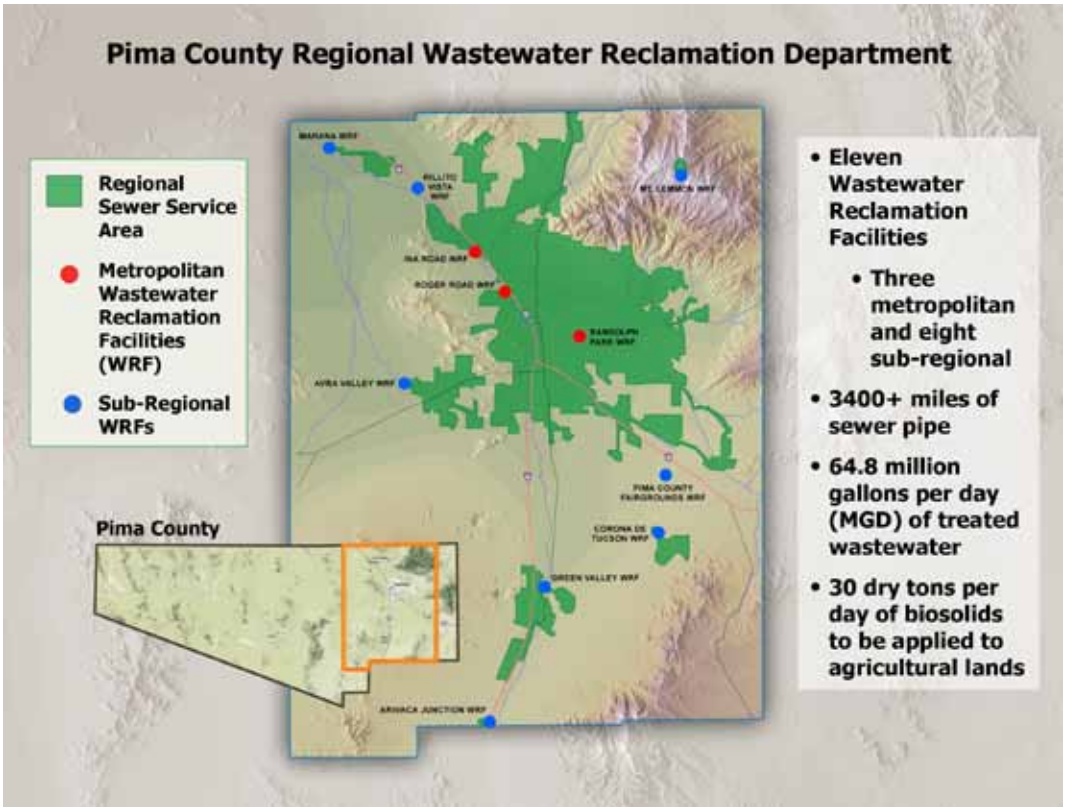

Figure -11 Metropolitan Reclamation Facilities, Current Capacity and Demand

The eight Sub-Regional facilities are much smaller, with a total current treatment capacity of 10.3 MGD and current demand of 3.3 MGD (**Table -3**). The Green Valley, Avra Valley, and Corona de Tucson facilities are the major Sub-Regional facilities. (The County Fairgrounds WRF demand fluctuates dependent upon scheduled functions each week).

Conveyance Facilities

The Department's conveyance facilities consist of 3,400 miles of sewer lines, 73,000 manholes and cleanouts, 15 siphons, 4 flow management structures, and 31 lift stations. The largest component is the Metropolitan Conveyance System, which serves the Ina Road, Roger Road, and Randolph Park WRFs.

Regional Wastewater Reclamation has almost 260,000 customer accounts (259,883), of which 92.6% are residential accounts. Commercial accounts constitute 6.8% of the department's customer base and Industrial accounts 0.6%.

Measured by volume discharge, residential customers are still the largest factor, at 64%. Commercial accounts constitute 32% of Volume Discharge, though only 6.8% of customer accounts.

Almost 90% of the Department's customers receive service from the Metropolitan System WRFs, with the remaining 10% served by the Sub-Regional WRFs.

Seventy five percent of the Department's customer accounts are also Tucson Water customers and 89% of department customers are served by four major water providers in the metropolitan area.

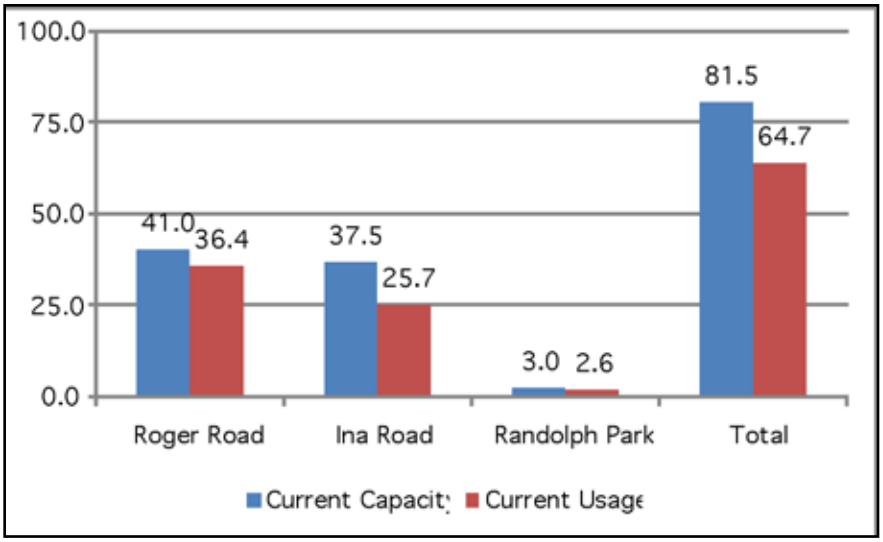

Figure -12 Metropolitan Wastewater Reclamation Facilities Treatment Capacity

Facility	Current Capacity (gal/day)	Current Demand (gal/day)
Green Valley WRF	4,100,000	1,760,000
Avra Valley WRF	4,000,000	1,080,000
Corona de Tucson WRF	1,300,000	135,000
Marana WRF	700,000	190,000
Arivaca Junction WRF	100,000	60,000
Mt. Lemmon WRF	15,000	5,000
Rillito Vista WRF	20,000	12,000
County Fairgrounds WRF	35,000	-
Total	10,270,000	3,242,000

Table - 3 Sub-Regional Reclamation Facilities, Current Capacity and Demand

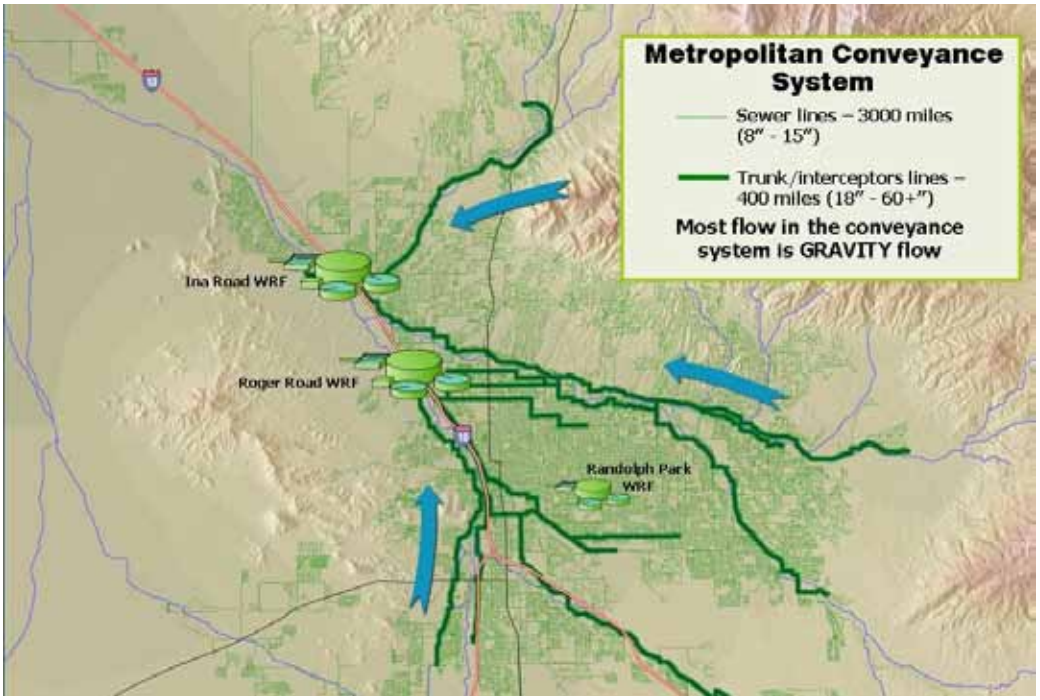

Figure -13 Metropolitan Conveyance System

Tucson Water and Regional Wastewater Reclamation: Infrastructure Condition Profiles

Both Tucson Water Department and Regional Wastewater Reclamation Department have similar infrastructure and the conditions of this joint infrastructure can be assessed for both at the same time.

In 2001, the American Water Works Association (AWWA) published "Dawn of the Replacement Era," which projects expenditures of $250 billion nationwide for the replacement of underground water infrastructure that is and will reach its expected lifespan. A documentary film produced by Penn State University titled "Liquid Assets" (recently shown on KUAT 6) "tells the story of essential infrastructure systems: water, wastewater and stormwater" … systems "largely out of sight and mind" that are "aging systems (that) have not been maintained, and some estimates suggest this is the largest public works endeavor in our nation's history."

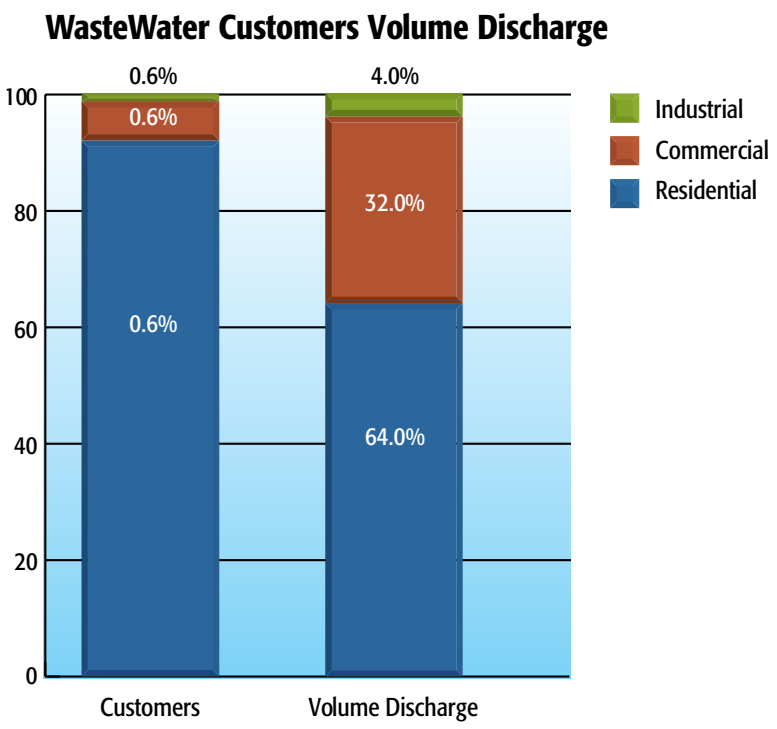

Figure -14 Wastewater Customers Volume Discharge

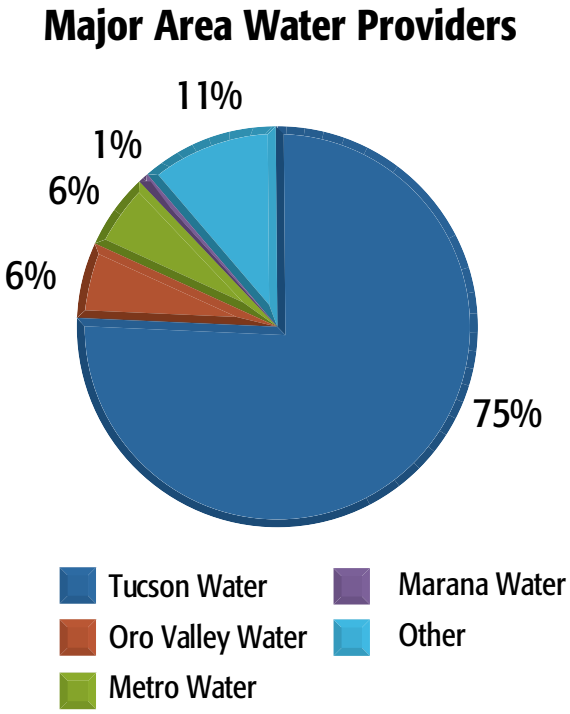

Figure -15 Major Water Providers

As a community of the post-WWII boom, our infrastructure is newer than systems in the east and midwest. For example, the majority of Tucson Water's mains were constructed between 1970 and 2000, which is also true of Regional Wastewater Reclamation sewer lines. Furthermore, both Departments' treatment facilities have been continuously upgraded and improved.

Nonetheless, our region will face and need to fund its own "replacement" era in the not-too-distant future. At the July 23, 2008 meeting, Tucson Water staff presented a graph charting projected repair and replacement costs based upon the expected life span of materials used in infrastructure construction and the time in which those materials were installed. The graph is called the "Nessie Curve" because of its resemblance to the so-called Loch Ness monster. The "Nessie Curve" for Tucson Water, which would not be dissimilar for Regional Wastewater Reclamation, shows an increasing cost curve that will peak between 2040 and 2050.

It is important to note that these costs are related to existing distribution systems serving existing customers and do not chart costs that will be encountered to provide services to new growth.

By virtue of its age, size and diversity, the potable system is in constant need of updating, repair, routine maintenance and sometimes emergency response for pipe breaks or water supply outages. More than 170 miles of aging potable system galvanized steel and cement/asbestos mains have been replaced with PVC pipe, and 48 miles of cast iron mains have been relined. A sampling of Tucson Water's current infrastructure maintenance issues include:

- Aging wells in the central well field need refitting or reconstruction;
- Aging reservoirs need complete refurbishment and storage capacity will need to be increased;
- Isolated systems require new wells, equipment or piping;
- The corrosion control program cannot meet all system needs;
- The Department needs more formal and fully-funded programs for evaluating transmission mains and critical system components 20 years of age or older.

Tucson Water routinely assesses the condition of its potable water system. The Department is using and improving an electronic asset management system for tracking the condition, age-specifications, maintenance requirements, installation date, and other critical data for system components and equipment.

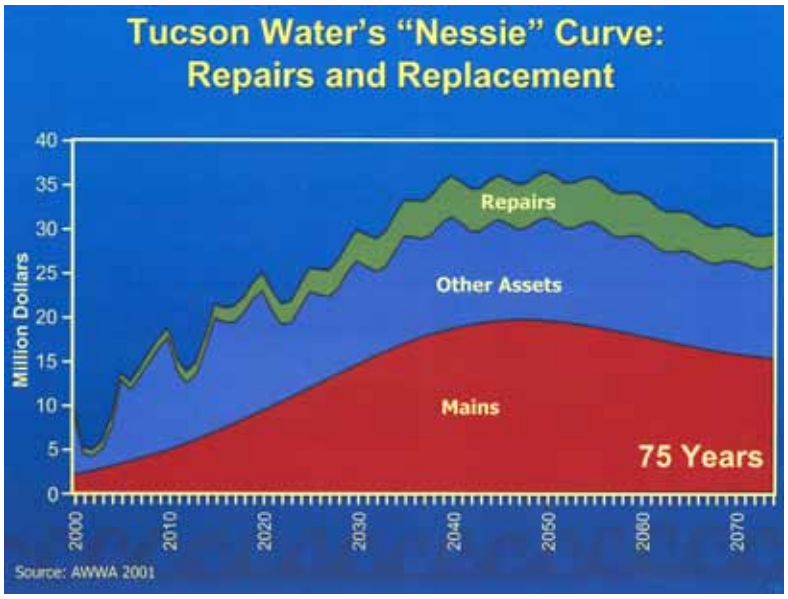

Figure -16 Tucson Water's Maintenance Curve

Regional Wastewater Reclamation operates a variety of programs to manage and maintain its conveyance systems.

- Preventive Maintenance Program includes a "rodding program" applied to all sewer lines 15 inches or less in diameter.
- Scheduled Maintenance Program uses vacuum/pressure trucks on scheduled responses to problem areas identified by work crews using remote-control inspection devices in sewer lines.
- Emergency Response Plan contains, remediates and mitigates conditions of any real or potential emergency.
- Computerized Maintenance Management System is the key component of the department's asset management program.
- Conveyance Condition Assessment includes the Sanitary Sewer System Inventory and Inspection Program, Closed-Circuit Television Inspection, and the Pipeline Assessment Condition Program.
- Capacity Management Operations and Maintenance (CMOM) Plan meets the requirements of the permit that governs the management of public sewage conveyance systems including the regulation of Sanitary Sewer Overflows (SSOs).

Tucson Water and Regional Wastewater Reclamation: Expenditure Profiles

Both departments have similar expenditure profiles, though each department has current capital improvement plan profiles that are unique to each.

Table -4 summarizes the current year approved budgets for both departments. The Operations and Maintenance (O&M) budgets for both departments were very similar: $131.4 million compared to $132.3 million. The Capital Improvement Program (CIP) budget for Regional Wastewater Reclamation, however, was almost twice as large as that for Tucson Water - $117.2 million compared to $60.7 million. For the current fiscal year, the combined budgets for both departments were $441.5 million; $263.7 million for O&M and $177.8 million for the CIP.

Budget Category	Tucson Water	Regional Wastewater Reclamation	Total Both Departments
Operations and Maintenance	$131,417,140	$132,293,349	$263,710,489
Capital Improvement Program	$60,650,000	$117,153,210	$177,803,210
Total	$192,067,140	$249,446,559	$441,513,699

Table - 4 FY 2008/09 Approved Budgets for Tucson Water and Regional Wastewater Reclamation

Table – 5 compares O & M budgets for both departments for FY 2008/09. As can be seen, both are similar for Personal Services and for Supplies and Services. Both budgets are also standard for O&M budgets in the industry as well.

Regional Wastewater Reclamation		Tucson Water	
Expenditure Category	**Approved Budget**	**Expenditure Category**	**Approved Budget**
Personal Services	$38,098,861	Personal Services	$34,852,820
Supplies & Services	$93,460,088	Supplies & Services	$96,564,320
Capital Outlay	$734,400		
Total	$132,293,349	**Total**	$131,417,140

Table - 5 FY 2008/09 Approved Operations and Maintenance Budgets

CIPs are 5-year plans for additions to, replacement of, or improvements to the existing Tucson Water and Regional Wastewater Reclamation infrastructure. CIPs will include projects that address infrastructure serving existing customers as well as infrastructure needed to serve new customers. The current CIPs for both departments reflect a mix of projects that are common to public infrastructure programs nationwide. Both CIPs, however, contain projects that are unique priorities for each Department at this time.

Figure – 17 summarizes the 5-Year CIP for Tucson Water, which totals $352.7 million. Tucson Water distinguishes between two broad categories of projects: Supply, which is 46% of the CIP, and Infrastructure at 44% of the CIP. Tucson Water also included a category of Development and Growth (10%), which the Department characterized as projects solely addressing new capacity needs generated by growth. It is acknowledged, however, that the categories of Supply and Infrastructure include improvements that will serve new development as well as existing customers.

Projects in this CIP would be typical of water infrastructure CIPs across the country. This CIP, however, includes a set of projects under Supply identified as the "Clearwater System," which are $124.3 million (35.2%) of the total CIP. These projects implement Mayor and Council policy directives specific to the utility and its customers at this time and place. The "Clearwater System" refers to projects being constructed to recharge, store, recover, and deliver the City's CAP allocation.

As the potential for shortages on the Colorado River has become a matter of concern in recent years, Mayor and Council determined it was in the best interests of the utility and its customers to accelerate delivery and acceptance of the City's full CAP allocation in FY 2009. To implement this policy, the City has had to expend significant funds to purchase additional CAP water for delivery as well as make major infrastructure investments, the costs of which are reflected in Tucson Water's current CIP.

The Regional Wastewater Reclamation 5-Year CIP includes investments in treatment and conveyance facilities typical of industry standards. The Department's

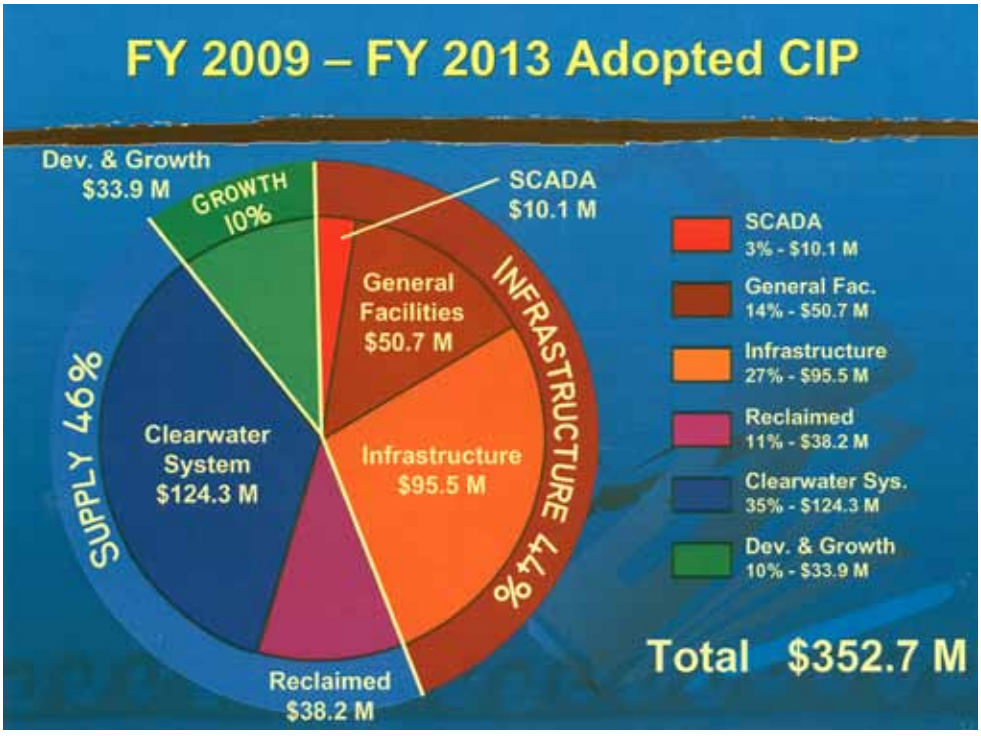

Figure -17 FY 2009-FY 2013 Adopted CIP: Tucson Water

CIP is "driven" by several factors, one of the most important of which is regulatory changes in federal, state and local environmental regulations and permits. The Arizona Department of Environmental Quality (ADEQ) is requiring the department by 2014/2015 to reduce nutrients in the form of nitrogen and ammonia currently discharged into the Santa Cruz River from the Ina Road and Roger Road WRFs. To achieve these regulatory goals and timelines, as well as other program goals such as rehabilitation, modernization and planning for growth, the Department developed, and the Board approved, the Regional Optimization Master Plan (ROMP).

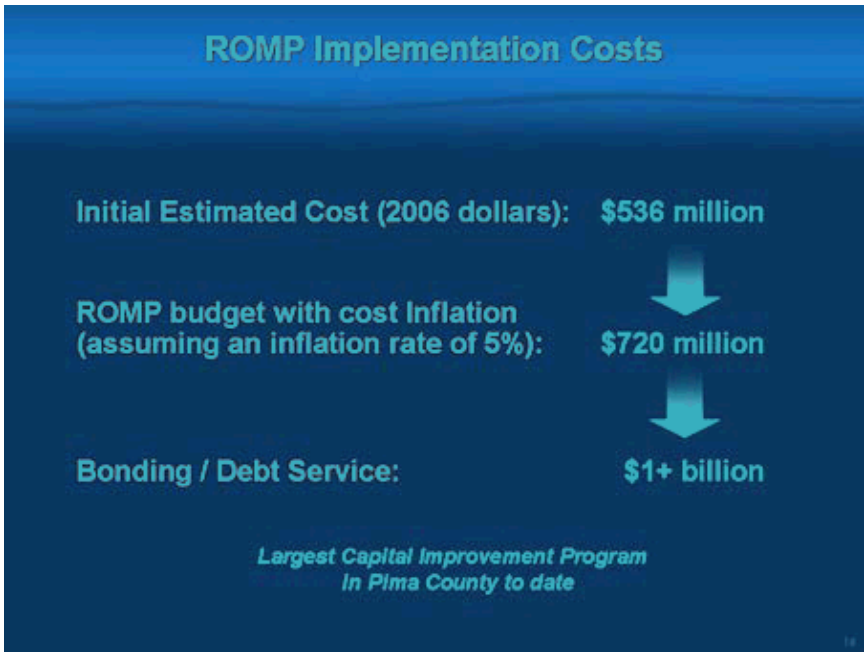

Figure -18 Romp Implementation Costs

The primary function of the ROMP is to upgrade the Ina Road Wastewater Reclamation Facility (WRF) and Roger Road WRF. This includes developing the optimal treatment process and plan to comply with regulatory requirements for effluent reduction of ammonia and nitrogen, master plan future regulatory requirements, determine the long-term treatment capacity needs of the county, develop a regional plan for the treatment, handling and reuse of system biosolids and bio-gas; develop a detailed implementation schedule to meet regulatory implementation deadlines; and develop a financial plan to support the systems' regulatory and other needs for the next fifteen years. Upgrades for regulatory requirements are to be operational and in compliance with ADEQ requirements at the Ina Road WRF by 2014 and at the Roger Road WRF by 2015.

The ROMP includes the Ina WRF upgrade and expansion project which will increase the capacity of this facility to 50 MGD and also convert the existing processes at Ina to the new Bardenpho process to bring nitrogen and ammonia levels down. The Department will centralize all biosolids processing and handling at the Ina Road WRF, as well as bio-gas utilization. The new Water Reclamation Campus in the vicinity of the existing Roger Road site includes a new 32 mgd Bardenpho treatment process and will house the central laboratory facility and may be a showcase for cultural and biological resources. Some environmental enhancements could include adjacent parks, natural areas and economic development, as well as the County's solar energy project. The Plant Interconnect will connect the Roger Road WRF to the Ina Road WRF. The intent of the Plant Interconnect is to convey wastewater from the Roger Road service area to the Ina Road WRF where there is more treatment capacity available.

Figure – 18 shows that the total estimated costs of ROMP, in 2006 dollars, are $536 million, which climbs to $720 million when 2006 costs are inflated by 5% per year through the project completion dates of 2014/2015. When bonding and debt service costs are included, ROMP total costs climb to over $1 billion.

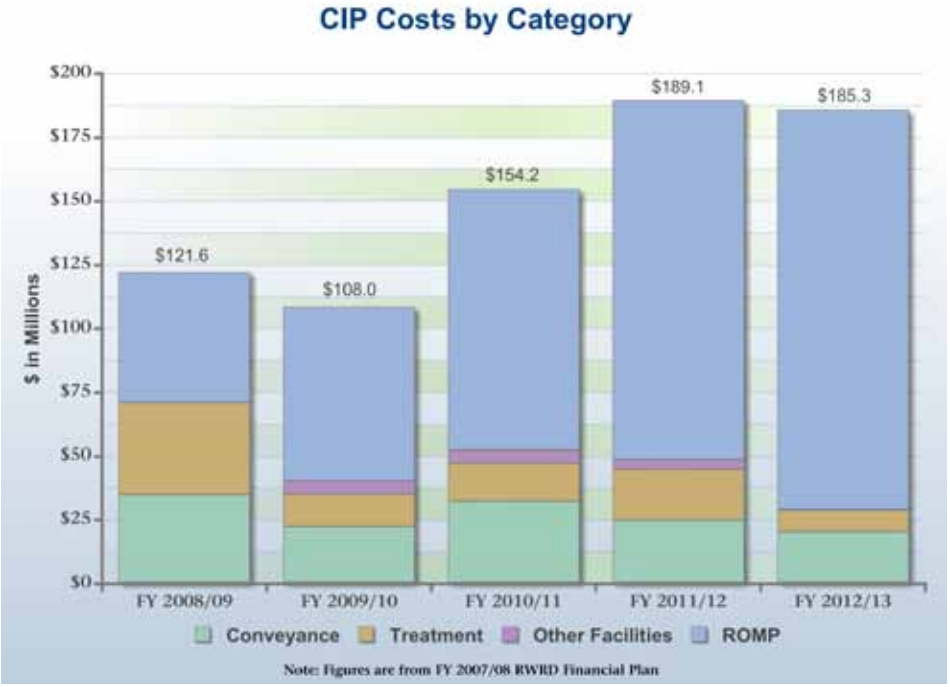

Figure -19 CIP Costs

Actual cost of wastewater ROMP systems:

- Ina Road treatment upgrade: $243,900,000
- Electrical upgrades: $35,000,000
- Plant interconnect: $22,300,000
- New wastewater campus at Roger Road: $211,000,000
- Demolition of the old Roger Road treatment plant: $23,000,000
- Total major costs: $536,000,000

Figure – 19 shows the Department's 5-Year CIP expenditures and the prominence of ROMP expenditures in this CIP. It is important to note that the 5-Year CIPs in the upcoming years are almost totally dependent on future voter bond authorizations, votes which could be placed before voters in 2009 or 2010.

Tucson Water and Regional Wastewater Reclamation: Finance Profiles

Both Departments are considered "enterprise funds" and often are referred to as "municipally owned utilities." These terms refer to the fundamental fact that the costs of their business must be covered by revenues generated in the course of doing business: revenues such as water and sewer fees, charges for new development, and various other fees that cover costs of business.

Both departments follow a similar financial plan and rate process, which is standard in the industry. The first step is to determine, "Is a revenue increase necessary?" the answer to which is based on projected revenues from current rates and fees compared to projected expenditures. If expenditures exceed revenues, then a revenue increase is necessary.

The second step is known as a "Cost of Service Analysis," which determines how much of the revenue increase must be recovered from different rate payer classes, based upon the costs of providing to each class.

The final step, "Rate Design," determines within customer classes how much rates must be increased to achieve the revenue increase targets for each class. This is a complicated process, undertaken each fiscal year that achieves basic fairness and equity in what customers pay each month for their level of service.

For each department, financial planning also includes two similar financial policies that govern business operations.

- Reserve Requirements are official policies of both governing bodies. Mayor and Council adopted a reserve requirement of 5% of annual water sales, which would be approximately $10 million. The department, however, strives to achieve a goal of a 10% reserve over the five years of each financial plan. The Board of Supervisors has adopted a reserve requirement of $10 million per year.
- Debt Service Requirements are covenants to bond holders. Because revenue bonds are pledged against the revenues of the department, debt service covenants are pledges to bond holders that the department will conduct business in such a fashion that, in any given year, after deduction for O&M expenses, the department will have revenues on hand that exceed the debt service payments for that year. Tucson Water uses a debt service ratio of 1.75, while Regional Wastewater Reclamation uses 1.2.

Figure – 21 compares revenue sources for each department for FY 2008/09. For both utilities, rate payers provide the majority of revenues: 84% of Tucson Water revenues come from water sales and monthly user fees provide 63% of Regional Wastewater Reclamation revenues.

Regional Wastewater Reclamation reports that approximately one-third of its revenues come from development-related sources: connection fees at 23% and capital contributions at 11%. Tucson Water reports 6% of its revenues come directly from Development/Impact Fee revenues and another 4.6% from Miscellaneous Fee revenue, which includes several charges related to inspections of development and new hook-up fees.

Rate payers shoulder the heaviest burden for paying the costs of both utilities. Rate structures are complicated, but both departments report on the average residential water and sewer bills, effective as of July, 2008 (**Table – 5**). For both utilities, the average residential monthly bill is just over $23.

Table 7 shows the range of water usage rates, breaking out water usage according to water billing rate blocks in hundreds of

cubic feet (Ccf) by counts of services and volume of usage.

Regular O&M expenditures are funded through these revenues. For their CIP budgets, both utilities rely heavily on revenue bonding. Revenue bonds are public debt issued only after voters have authorized issuance of the debt. At special elections, voters are asked to approve aggregate debt not to exceed a specified amount and to be sold at interest rates that also are capped.

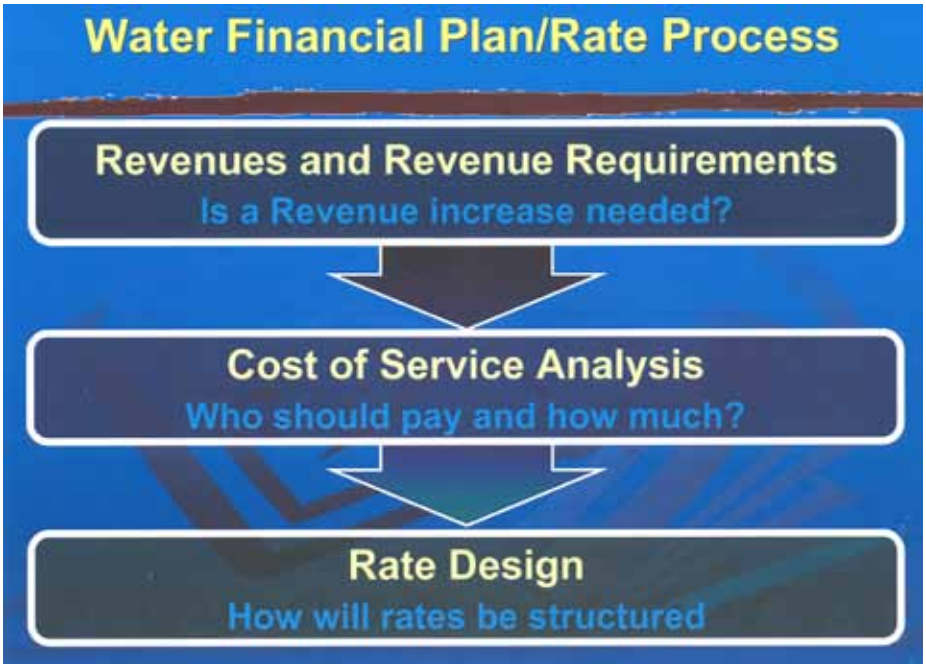

Figure -20 Plan/Rate Process

If voters approve the revenue bonds, governments will periodically sell bonds to pay for capital expenditures over the upcoming 1 to 3 years. These bonds are tax-exempt and repayment is pledged against revenues of the department. Because they are tax-exempt, interest rates in the municipal bond market are lower than those charged in the private corporate bond markets. Additionally, both departments have used the Water Infrastructure and Finance Authority of Arizona (WIFA), which makes loans against voter-authorized bonds at interest rates typically 75% of those in the municipal bond market.

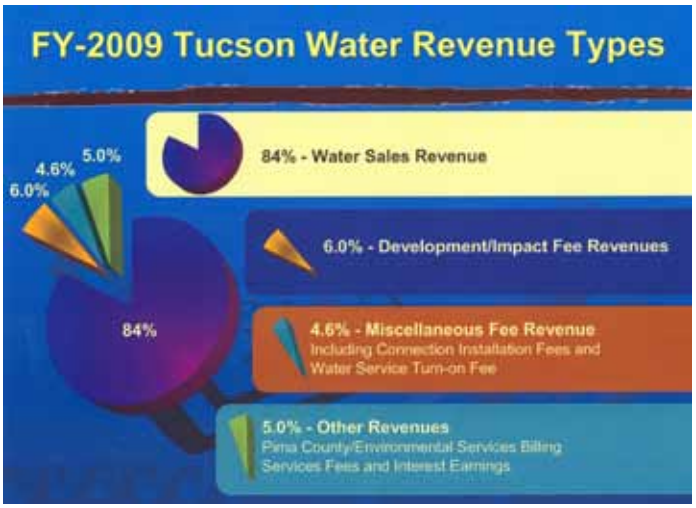

Figure - 21 Tucson Water and Regional Wastewater Reclamation Revenue Types/Sources

Tucson Water		Regional Wastewater Reclamation	
Use	Monthly Bill	Use	Monthly Bill
14ccf	$23.44	10ccf	$23.61

Table -6 Average Monthly Water and Sewer Bills, as of July 2008

Volume in Ccf	Services	Usage
0 to 15	71%	41%
16 to 30	22%	34%
31 to 45	5%	13%
Over 45	2%	12%

Table - 7 Single Family Residential Services and Usage by Rate Block June 2008

Tucson Water Resource Portfolio and Future Service Population

The following information summarizes Tucson Water's current water resource entitlements and translates those entitlements into estimates of the potential population that can be served with full availability and utilization of these presently known water supplies, based on water usage demand assumptions.

Uncertainties and variability associated with each resource and water demand estimation are important to keep in mind as these have a direct bearing on the number of people who can ultimately be served with currently available water resources.

The Committee believes there is no single, definitive answer to how much water Tucson Water can deliver and how large a population that water can serve. The Committee does believe there is a preferred, logical methodology available that should inform discussions of resources and population, which the Committee presents here.

There is an important distinction between "paper water" and "wet water" that often times confuses discussions of water.

"Paper water" refers to legal entitlements to water. Tucson Water has legal entitlements to CAP water through a complex set of laws and case law referred to as the "law of the river." Tucson Water has legal entitlements to groundwater through the Groundwater Management Act and its associated case law. These legal entitlements provide Tucson Water with the right to receive and consume this water and sets limits on how much water the utility can receive and how it can be used.

Based on these legal entitlements, the City of Tucson has a designation of an "assured water supply" from the Arizona Department of Water Resources, which means Tucson Water has demonstrated a portfolio of water resources that will be physically, legally and continuously available for 100 years. For an assured water supply designation, the City also demonstrated its water use was consistent with the goal of the AMA and its current management plan and that it has the financial capability to construct all necessary infrastructure.

"Wet water" simply refers to water that is physically available, that comes out of our faucet, the second test of 100 year availability.

The following information summarizes Tucson Water's current water resource entitlements (assured water supply portfolio)) and identifies uncertainties that could restrict the physical availability of that water. The section then translates those entitlements into estimates of the potential population that can be served with full availability and utilization of these

presently known water supplies, based on water usage demand assumptions. In other words, the Committee is presenting a "best case scenario" of water resources and future population size.

Water Resources

• Central Arizona Project—Annual Access to City's CAP Allocation (Volume: 144,191 AF/yr)

The City of Tucson has an entitlement to Colorado River Water of 144,191 AF (acre feet) per year. The City began accepting full delivery of this entitlement on July 1, 2008. Under terms in the Secretary of the Interior's Record of Decision for Central Arizona Project Allocations, 1983, if a shortage were declared on the Colorado River, Tucson's subsequent annual deliveries of its allocation could be limited to the amount of CAP water delivered to the City in the last normal year prior to the shortage declaration. Language under the Record of Decision was modified with the passage of 2006 Arizona Water Settlement Acts such that Municipal and Industrial allocations during a shortage would be distributed by a process to be determined by the Secretary and CAP to fulfill all delivery requests to the greatest extent possible. Given that this process is not yet in place, a policy ensuring that Tucson Water takes full delivery of its CAP allocation prior to a potential shortage declaration significantly reduces the risks of diminished supplies in the event of a shortage.

In late 2005, the Colorado River watershed was in a long-term drought and the Mayor and Council were encouraged to accelerate the construction of the remainder of the Clearwater System to create the capacity to purchase the City of Tucson's full annual allocation of CAP water. It was predicted at this time that the first shortage could occur as early as 2011. To implement this policy, Tucson Water finished constructing the SAVSARP recharge facilities and ordered its full allocation in October 2008, for delivery during 2009. Due to budgetary constraints however, the City of Tucson elected to remarket up to 50,000 acre-feet of its calendar year 2009 CAP water order. Under the terms of the CAP subcontract, remarketing a portion of the City of Tucson's annual CAP water order does not pose any threat to the City's CAP allocation or to the City's future ability to store CAP water in its recharge facilities.

During 2008, precipitation in the Colorado watershed increased and there were greater flows in the Colorado River causing water levels to rise in Lake Mead and Lake Powell. As a result, the first year in which a shortage declaration is possible has now been pushed out until the year 2014 or 2015. Also two parallel efforts clarified management of both the Colorado River and the Arizona allotments under conditions of shortage. First, an interim shortage sharing agreement was negotiated among the seven Colorado River Basin states that explicitly defined the operations on the Colorado reservoirs, Lake Mead and Lake Powell, to minimize disruptions to all Colorado River users. Second, stakeholders within Arizona forged an agreement to determine how shortages would be shared among the Arizona stakeholders. Both efforts established a higher level of certainty regarding the impact to municipal priority CAP allocations under shortage conditions on the Colorado River.

> **Uncertainties:** In the next ten to twenty years, it is unlikely that the City will see any reductions in the delivery of its CAP allocation as a result of Colorado River shortages. This is primarily due to 1) the staging of shortages provided under the interim Shortage Sharing Agreement entered into by the Seven Basin States; 2) the fact that not all CAP subcontracts are being fully utilized at this time, leaving a significant amount of excess CAP water that will be cut during the early shortage declarations; 3) the relative high priority of Municipal and Industrial (M&I) CAP subcontract water which means it will be among the last to be reduced during shortages; and 4) the firming of the M&I CAP allocations by the Arizona Water Banking Authority (AWBA).
>
> In the longer term, however, it is almost certain that Colorado River shortages will result in some reduction in the amount of CAP water delivered under the City's subcontract, possibly for years at a time. The City may prove able to buttress itself against such shortages through the acquisition of additional water supplies. Tucson Water is currently engaged in CAP's ADD Water process to determine how best to allocate and finance these new sources of supply.

• CAGRD—City's CAGRD Contract (Volume: 12,500 AF/yr)

The Central Arizona Groundwater Replenishment District (CAGRD) is under contract with the City to replenish 12,500 acre feet of groundwater pumped by the City to meet its service area needs. The City of Tucson does not plan to utilize this replenishment supply source for many years and when it does, it would be used as a renewable supply source to replenish groundwater pumped from CAVSARP, SAVSARP, and/or Pima Mine Road.

Uncertainties: For the purposes of this discussion, it is assumed that this annual volume will be provided as per statute even though there currently are questions about how the CAGRD will ultimately meet its total obligation.

• Incidental Recharge - 4% (Volume: ≈ 5,500 AF in 2007)

Incidental recharge refers to water that informally recharges the aquifer after it has been supplied by a water provider and used by people within its service area. The State provides Tucson Water with an incidental recharge credit each year which constitutes four percent of its annual total water deliveries. The incidental recharge credited to Tucson Water each year is considered an important part of its renewable water resources portfolio.

Uncertainties: Because this is a percentage, the total volume of incidental recharge each year is variable but it is expected to increase as total water demand increases over time.

• Local Groundwater– (Avg: 24,750 AF/yr - ≈ 16,500 AF/yr over 200 years or ≈ 33,000 AF/yr over 100 years)

The City currently has a groundwater account balance of about 1.9 million AF. This is a simple volumetric account, similar to a savings account in a bank, which will be debited whenever the City pumps unreplenished groundwater in the future. In addition, the City is able to add a legislatively-defined amount of groundwater credits to its Assured Water Supply between now and the year 2025; these groundwater credits are associated with the City's previous purchase and retirement of agricultural lands in Avra Valley and are reflective of the amount of groundwater that would have been pumped from these lands had they remained in agricultural production. The amount of groundwater credits available to the City increases over time from a current quantity of about 1.35 million AF to a maximum of 2.0 million AF in the year 2025. This represents a total of 3.25 million AF of groundwater credits currently available to the City, with the potential of an additional 0.65 million AF becoming available between now and the year 2025.

The two annual groundwater pumping end numbers cited above (33,000 AF/yr over 100 years or 16,500 AF/yr over 200 years) represent two potential scenarios under which the City could utilize this groundwater over a 100 year period or, alternatively, over 200 years. Either quantity is within the range of what is considered hydrologically sustainable pumping based on average annual estimates of local natural recharge in the area.

Uncertainties: Uncertainty for this resource relates to how available groundwater resources will be utilized by the City in the coming years. If the City continues to increasingly rely on renewable supplies and reduce groundwater pumping, then these resources will be highly reliable sources of supply for many years. Potential impacts are based on hypothetical modeling. Climate change factors are being closely monitored by many parties. Conditions will continue to evolve over time and jurisdictions should continue to develop and implement plans, proportionately responding with policies and investments to buffer local areas from potential impacts of climate change. In addition, groundwater uncertainties relative to global warming include:

- Higher temps lead to a higher evaporation rate, which might reduce the recharging of the aquifer.
- Higher temps can lead to stronger storms and higher rainfall amounts; however southwestern rain events are often short lived, with sudden downpours which do little to recharge the aquifer.

Precipitation events tend to come in more intense bursts in warmer climate, as illustrated by this bar graph from 100 weather stations around the world. Seasonal precipitation for all locations averages about 9 inches (230 millimeters). Yet precipitation in the warmer locales was more likely to arrive in heavy (greater than 40 millimeter) or extreme (greater than 100 millimeter) events compared to the cooler locales. Temperature ranges were converted from Celsius and are approximate values only. [2]

- As temperatures rise, the snowline moves higher up the mountaintops; snow cover is a major recharger of the groundwater is it melts in areas with high groundwater recharge rates (mountain faces, alluvial fans, wash basins, etc.)
- Higher temps cause winter storms to bring more rain and less snow which bring less consistent stream flows and lower recharge rates when compared to snow pack melt. [3]
- Snow packs cover less area due to more rain, which adds to intermittent melting rates, likely leading to lower recharge rates. [4]

2-Source: Karl, T., and K. Trenberth. 2003. Science, 302:1719–1723. Reprinted with authors' permission.
3-Global Warming in the Southwest; Projections, Observations and Impacts by Melanie Lenart; 2007; pg 13
4-(http://www.climas.arizona.edu/pubs/pdfs/GWSouthwest.pdf)

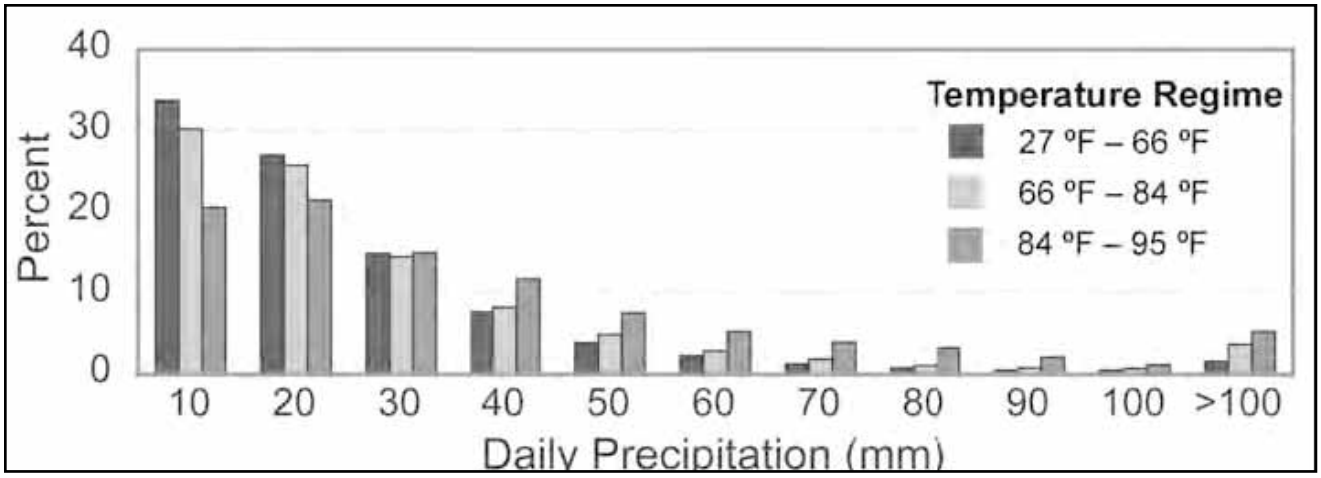

Figure - 22: Preipitation

• City's Effluent Entitlement (Volume: ≈ 30,500 AF in 2007)

In 2007, the City's Reclaimed System utilized about 12,500 AF of the City's effluent entitlement with the balance, about 18,000 AF, being discharged into the Santa Cruz River. The City's effluent entitlement was established in a 1979 Intergovernmental Agreement with Pima County, and was established on the principle that entitlements to effluent should be based on its potable water deliveries. In contrast, the Arizona Supreme Court's John F. Long decision generally allocates effluent based on ownership of wastewater treatment facilities, unless, as in the case in Pima County, there is a contract or agreement that specifically allocates effluent resources.

Uncertainties: The amount of effluent grows with increased potable water deliveries; therefore, the City of Tucson could have access to as much as 60,000 AF of effluent by 2030. On the other hand, the amount of effluent available could be affected by allocation of additional water to environmental purposes (no deductions have yet been made to account for the Conservation Effluent Pool) and impacts of household greywater recycling on effluent volumes.

Tucson Water Resource Portfolio

Table –8 summarizes Tucson Water's currently available annually water resource portfolio.

Water Resource Type	Annual Water Supply (AF)
CAP	144,191
CAGRD	12,500
Incidental Recharge	5,500
Local Groundwater	24,750
Effluent	30,500
Total	**217,441**

Table-8 Estimated Annually Available Tucson Water Supplies

Water Demand

Translating legally available water supplies into estimates of the population that can be served is dependent on how much water Tucson Water customers use, which is measured in "gallons per capita per day" or GPCD. Tucson Water's historical average rate over the past 25 years has been 177 GPCD. However, in more recent years, data suggest that this number is decreasing (166 GPCD in 2007). This recent reduction in GPCD could continue and may further decrease in the future. On the other hand, the recent reduction could be a temporary departure from the longer-term trend. To be conservative in the context of the uncertainties described above, the longer historical average (177 GPCD) is being used for purposes of this discussion. The components of the 177 GPCD include 14 GPCD for reclaimed water and 163 for all potable deliveries. Potable water usage can be further broken down into total residential use at 110 GPCD, commercial and industrial water use at 35 GPCD, and water loss at 18 GPCD. For reference purposes, Tucson Water's residential GPCD rate of 110 compares to rates in Phoenix of 169 GPCD and Las Vegas of 220 GPCD.

Uncertainties: Uncertainties associated with projecting water demand include people's willingness to adjust lifestyle to increase conservation, effects of an extended drought or permanent climate change on local rainfall and water demand, and future urban form of the service area.

Estimated Population that Can be Served with Current Water Supplies

Estimating the population that can be served with current water supplies is a function of water supply and user demand. ***Table -9*** shows step by step how this calculation is made.

Annual water supply in AF	**217,441**
Multiply by Gallons/AF	325,851
Equals annual supply in gallons	70,853,367,291
Divide by days/year	365
Equals annual supply per day	194,118,814
Divide by GPCD	**177**
Equals estimated population	**1,096,716**

Table – 9 Estimated Potential Tucson Water Service Population (This estimate does not take into consideration allocations to riparian restoration projects or reduced use of legally available sources to avoid negative environmental impacts.)

Under this scenario, approximately 1.1 million people can be served by Tucson Water with current water resource entitlements. In 2007 (the most recent full year for which data is available, as reported to ADWR), Tucson water delivered 136,561 acre-feet of water to 733,937 customers, which yields a water usage rate of 166 GPCD. Tucson Water currently serves approximately 75% of the total population within Pima County.

It is important to note that information and recommendations coming out of the Study (related to planning for growth, environmental needs for water, sustainability, climate-related uncertainties, etc.) will help shape Tucson Water planning efforts going forward and could potentially affect the variables used in this analysis.

Securing Additional Water Resources

The following sections discussing new water resources are taken directly from presentations made by Tucson Water and Central Arizona Water Conservation District staff at Committee meetings. The Committee has a variety of concerns about the implications associated with acquiring new water resources and will be looking at this issue further in Phase II. The Committee recognizes that new water resources will be much more expensive than current water resources. Equity and

affordability issues must be considered. A full cost-benefit analysis for new water resources is needed before new resources are pursued. Full costs should consider such things as non-local environmental effects, environmental justice issues, and comparing new water costs to those required for investing in the use and re-use of locally renewable water resources - effluent and rainwater. Acquiring new water should be evaluated in comparison to investments in local resources such as stormwater recharge, greywater systems, rainwater harvesting, expansions to the reclaimed system, and constructed recharge of our effluent. Water conservation and new water resources are seen as two sides of the same coin. More conservation means less need for new water and therefore conservation acts to provide a source of future supply.

ADD Water Process

While this analysis is only looking at current water supplies, some committee members felt it was important to mention the ADD (Acquiring, Developing and Distributing) water process that is underway by the Central Arizona Water Conservation District (CAWCD) to address the problem of projected demands exceeding the readily available supplies in the Central Arizona Project service area. Key questions being addressed through ADD Water include: 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? Tucson Water is well represented in this process.

New potential water sources/augmentation being identified in this process include:

- Desalination
- Cloud seeding
- Purchasing CAP entitlements from other allotment holders
- Increasing CAP capacity
- Mining and importing groundwater from the Butler, McMullen, and the Harquahala Valleys west of Phoenix.

Additional Critical Factors Associated with Water Sustainability

In addition to the issues of infrastructure, water resources, water demand, and related uncertainties discussed in the previous sections, how we manage the built and natural environment affects our ability to create a sustainable water future.

Water Management Models

The environment needs water as people do. Balancing environmental and human needs for water is critical to sustainability. There are two possible models in water management depicted in the pie charts below. In the traditional model, water necessary to meet environmental need is reduced and allocated for human use. This model has resulted in the destruction of river systems and riparian habitat throughout the southwest. In the sustainability model, environmental water needs are identified and the proper amount of water is allocated to ensure environmental systems remain healthy.

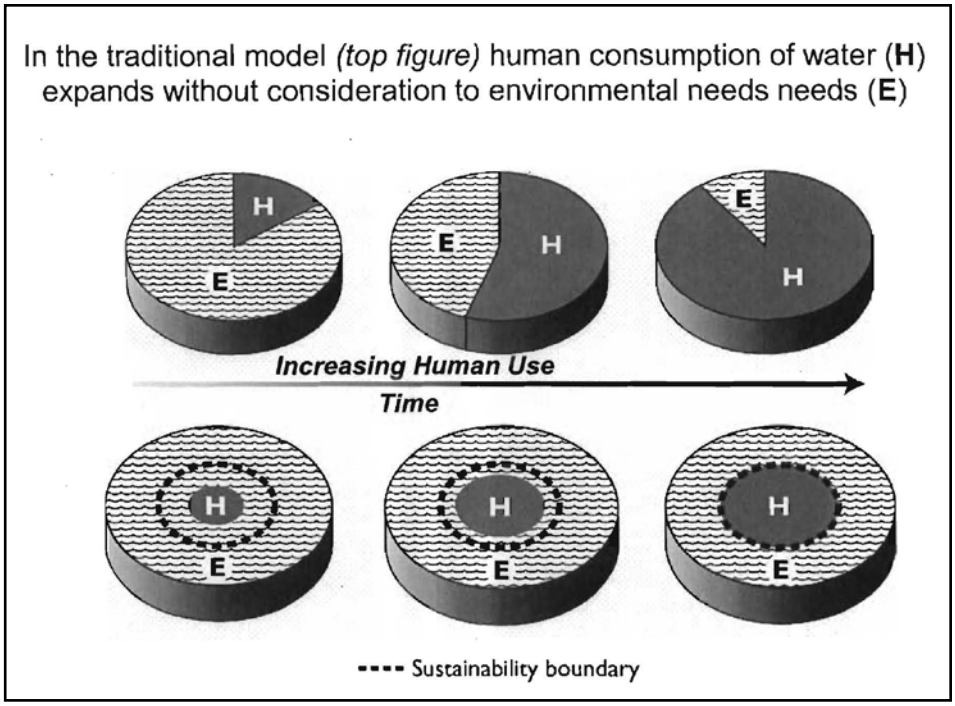

Figure- 23 Water management Models

Water Managers in Arizona, including Tucson Water, have followed the traditional model resulting in planning efforts that do not fully address environmental factors which in turn have resulted in the impacts listed above. Any semblance of a sustainable water future for the region will have to directly face the challenge of following the sustainability model. Environmental protection and restoration efforts are a regional benefit. Costs of environmental restoration projects should be shared equitably by all beneficiaries in the region.

Environmental Needs for Water

The health of our river and riparian systems is dependent on the availability of surface and groundwater supplies. These natural systems provide a number of benefits to people such as provision of drinking water, water to irrigate our agricultural crops, purification of wetlands and drinking water and groundwater recharge. Riparian systems also support wildlife, sequester carbon, provide oxygen, filter the air and provide recreational opportunities. Riparian vegetation conditions respond to changing surface and groundwater levels, over both short and longer time frames. It does not take much groundwater pumping before water tables are lowered and river flows decline. This is the challenge of moving forward with growth in areas that rely primarily on groundwater supplies.

The Sonoran Desert Conservation Plan (SDCP), adopted by Pima County in 2001, defined goals for protecting the cultural and natural heritage within unincorporated Pima County. The SDCP has implications for the City/County Water and Wastewater Study, including: (1) the importance of floodplain functions and the need to pursue a more integrated management approach among various floodplain management programs and agencies, land use planning agencies and across jurisdictions; and (2) a great deal of inventory work was completed helping expand understanding of where some of the remaining stream ecosystems are that can be affected by groundwater pumping, hydro-geology, and the distribution of species and water supplies in eastern Pima County.

Riparian Restoration

Riparian restoration is a key component of the SDCP. Mechanisms to relieve stress on aquifers and protect important, sensitive ecosystems include land and water rights acquisition, the establishment of no pumping zones (requires state legislation), and the allocation of effluent, groundwater and surface water to maintain ecosystem functions. Additionally, water conservation in targeted areas could positively impact groundwater-dependent ecosystems, as could the expansion of reclaimed water infrastructure and potable water interconnections.

A key issue with the Santa Cruz River restoration is that there is no effluent allocated to the river. It is being discharged now because it needs to be disposed of. The Science Team that helped develop the ecological component of The Sonoran Desert Conservation Plan recommends that effluent being discharged into the Santa Cruz be maintained at current levels

The "Conservation Effluent Pool" was formed in an agreement between the City and the County that is dedicated to environmental uses but currently, that water has not been allocated to any environmental projects. However, there are a number of projects/activities that Pima County has used to accomplish riparian restoration or enhancement with effluent. The Marana High Plains project encourages riparian development along its Santa Cruz River diversion channel and around the recharge basins. The Kino Environmental Restoration Project (KERP) integrates reclaimed water conveyance and storage for reuse at Kino Sports Park with stormwater harvesting and riparian ecosystem development in the Ajo Detention Basin. Effluent from Avra Valley WRF has been applied near the treatment facility site using a spray field along margins of the braided channel of Black Wash to encourage plant growth. The Marana WRF irrigates landscape in a riparian habitat and has a surface water discharge that flows to the Santa Cruz River. PCRFCD recently completed the Swan Wetlands project to use reclaimed water and stormwater to augment wetland and riparian habitat of approximately 60 acres along the south bank of the Rillito River from

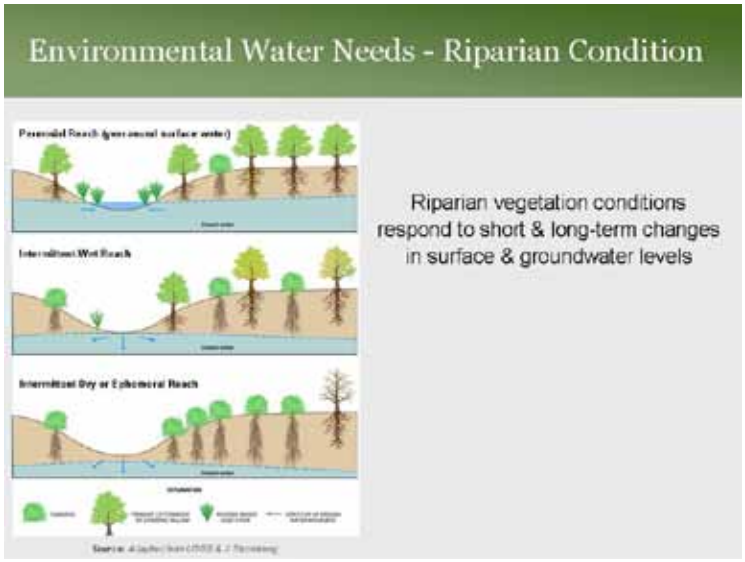

Figure-24 Riparian Condition

Craycroft Road to just west of the Columbus Boulevard alignment. Because these riparian enhancement/restoration projects are multibenefit in nature, it is difficult to provide exact volumes of the amount of effluent devoted solely to habitat value. It is estimated that in 2007, Pima County used approximately 286 acre-feet of effluent for this purpose. This figure does not include the riparian benefits derived from continued flow of effluent in the main channel of the Santa Cruz River.

A key issue with the Santa Cruz River restoration is that there is no effluent allocated to the river. It is being discharged now because demands for effluent and reclaimed water are currently less than supply. The Science Team that helped develop the ecological component of The Sonoran Desert Conservation Plan recommends that effluent being discharged into the Santa Cruz be maintained at current levels.

Phase II will include a detailed analysis of all restoration projects that are planned for the future or currently underway which will include the amount of effluent necessary to maintain them.

Population Growth and Urban Form

Understanding population trends and projections and planning for and directing growth are critical factors in creating a sustainable water future.

The Committee acknowledges that different levels of uncertainty are inherent in population estimating and projecting. Figure 26 presents three population projections for Pima County. All three projections track each other closely through approximately 2015. After that year, the Tucson Planning and University of Arizona projections follow a similar trajectory, while the Department of Economic Security projection line diverges after that year, producing consistently lower estimates. In 2030, Tucson Planning/University of Arizona project a population of approximately 1.7 million people compared to a Department of Economic Security projection of approximately 1.4 million. In 2040, the respective projections are approximately 1.8 million and 1.6 million and in 2050, the projections are almost 2 million and 1.7 million.

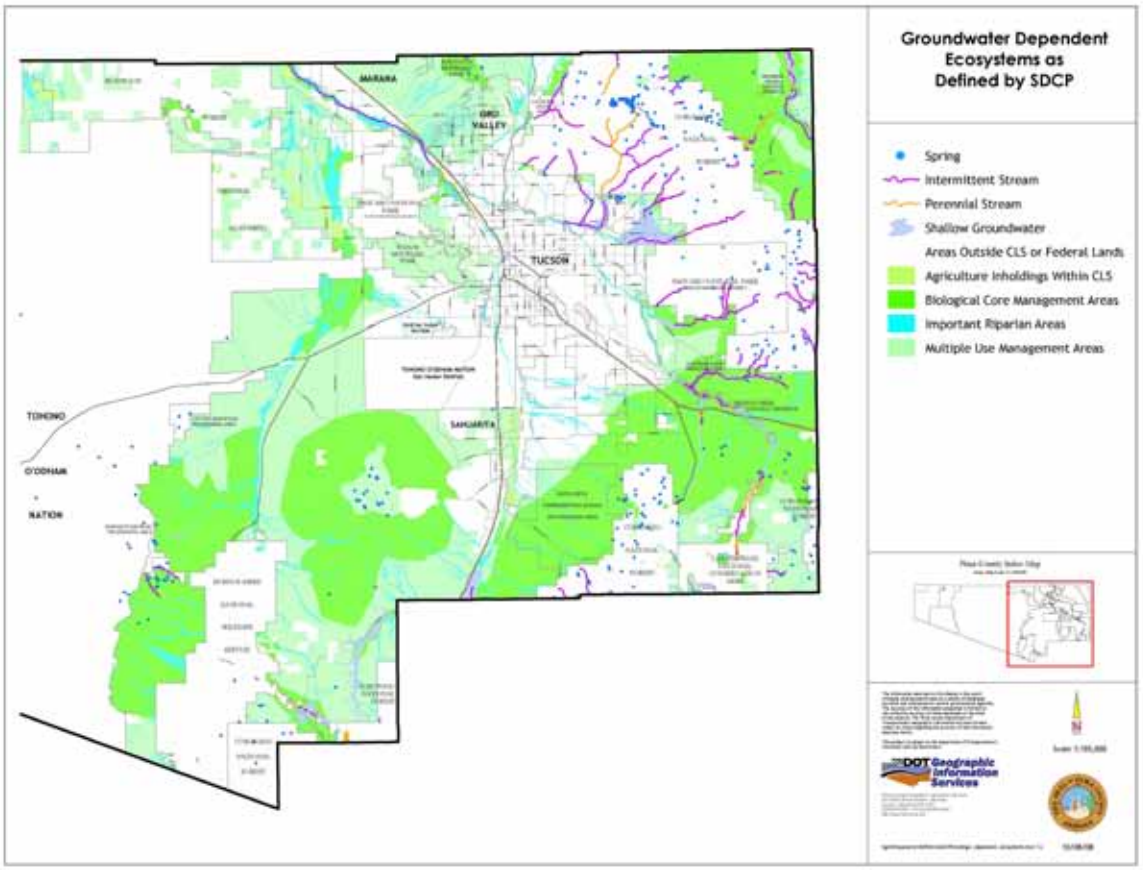

Figure-25 Groundwater Dependent Ecosystems

Regardless of the differences in "official" population projections, it is clear the "official" forecast is for continued and substantial population increases in Pima County. Not all Committee members believe these "official" projections as "facts." Most Committee members acknowledge that any population projection is inherently uncertain, especially the further out into the future they go. Some members assume that there will be continued substantial growth while others maintain either that the projected levels of population are not attainable and will not occur, or that they are unsustainable and should not be allowed to occur.

There is, however, substantial agreement that there are inherent limits to how large Pima County will grow. For example, as a potential upper limit on population size, Dave Taylor from PAG noted that we absorb approximately 5,300 acres of vacant land per year. Based on this trend, and assuming horizontal development at current densities, there is enough private and state land (subtracting out environmentally sensitive lands identified in the County's Sonoran Desert Protection Plan) to accommodate 2.2 million people. This calculation makes several assumptions: that we will continue to develop horizontally at current densities and that local jurisdictions will allow up-zonings on land outside of the environmentally sensitive lands. The Committee does not view this calculation as a projection of future population in Pima County, but simply as a result of just considering physically available land to build on. Of course, if development in Pima County were build to higher densities (vertical growth), then the available land could sustain a higher population, assuming there were no other constraints on population growth.

There is a theory in demography that human settlements tend to follow an S-curve in development: a period of rapid population growth followed by a period when the growth curve flattens out with the population achieving a relative stable or steady state. The Committee did not try to predict exactly when population growth might level out or what would be the drivers of that leveling out, but the Committee believes it will happen at some point in Pima County.

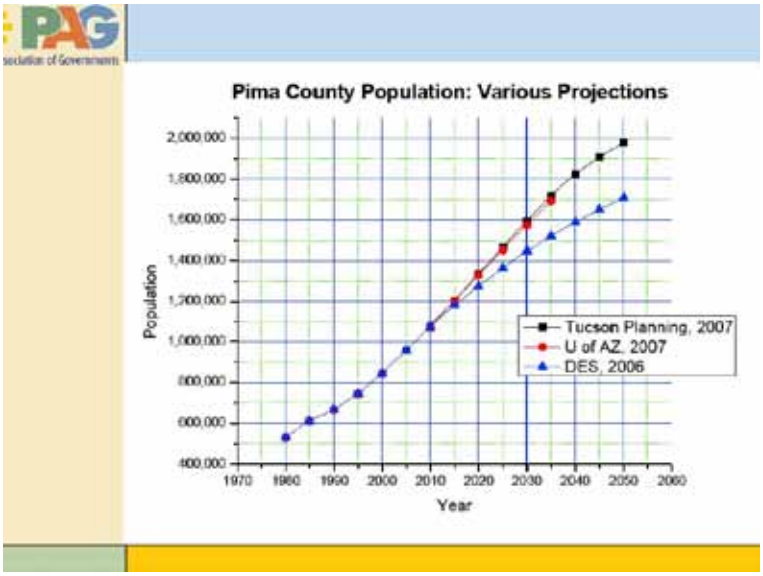

Figure-26 Population Projections

The Tucson region is not an isolated entity, but rather part of a larger economic reality commonly referred to as the Sun Corridor, a swath that extends from Nogales to Prescott. According to the Morrison Institute, Metro Phoenix generates 75 percent of the Arizona Gross Metropolitan Product, a share of state economic productivity that is 6 times larger than Metro Tucson's share of 13 percent. The Sun Corridor is projected to grow significantly and will continue to be increasingly economically interconnected. Tucson's share of this growth and of this economy going forward is uncertain, but it is important to keep in mind that we are affected by this larger context.

Not just how much we grow, but where we grow and what form it takes are key considerations as well. Tucson has seen rapid and consistent growth since World War II. The typical development pattern has been suburban in nature due to many factors including the preference of the population for single-family housing, few constraints on development, and the availability of cheap land. Despite all the plans, there has been a lack of regional coordination with respect to land use planning. Development at the urban edges has also occurred due to the complexity and time necessary to build near existing neighborhoods, the abundance of cheap land in unincorporated areas, and the location of state lands which, because they have not been released for development, have encouraged "leap frog" development. Over time, this has left vacant or underdeveloped land throughout the City's urban core and insufficient infrastructure to serve growing populations.

Tucson and Pima County are seen as being primarily reactive to growth and development and ineffective at steering development to desired locations. The local jurisdictions are criticized for making growth and development decisions that have regional impacts without coordinating with each other. There are positive and negative aspects of growth just as there are positive and negative aspects to a lack of growth. And there are limits on what can be done to stop growth, if that were desired, just as there are limits on how much growth an area can realistically sustain without negatively impacting the quality of life on current residents and the environment. However, it behooves the community and local governments to direct where the new growth will go, what it should look like, and how to pay for the necessary infrastructure.

Committee Themes, Values and Concerns

This section summarizes, in no particular order, the key themes, values and concerns from Phase I of the Study as identified by the Oversight Committee in discussions during their November, December, and January meetings.

The Committee worked diligently to make the previous section and Chapters 1 to 3 fact-based, not straying from information presented to us. The Committee also identified areas that we called "committee themes, values and concerns." We set a ground rule for ourselves that everyone's opinions would be included in this section. This section summarizes these themes, values, and concerns. At the outset, it is important to recognize two characteristics of the substance in this section.

First, opinions stated here were not voted on. The opinions should not be understood as reflecting the Committee as a whole, a majority or even a plurality of the Committee. Some opinions might reflect the views of only one member, some members or several members. The Committee has not made an attempt to quantify the level of support for any opinion stated within.

Second, the themes, values and concerns are organized according to the scope item to which they most apply. The opinions, however, are not presented in any particular order or prioritization.

The Committee believes this section is important because it surfaces a range of themes, values and concerns that the regional dialogue will contend with and because the range of opinions suggests the range of people who will have to be "at the table" in the regional dialogue.

Scope Item A: Current State of Water, Wastewater and Reclaimed Water Systems

• ***Overall, our water and wastewater systems are reliable and well maintained***
Tucson Water and Pima County Regional Wastewater Reclamation Department are well-run, highly professional utilities that manage and operate complex systems. Our water and wastewater systems are relatively newer and in better condition than many older cities.

• ***Both utilities face increasing need for investment in maintenance, rehabilitation, and replacement***
In the near future, investment in the maintenance and rehabilitation of our water and wastewater systems will need to increase to address aging infrastructure and to meet increasingly stringent water and wastewater quality standards. Both water and wastewater rates have traditionally been maintained at relatively low levels and rates must increase in the future to fund these needs. A sustainable finance structure needs to be established in order to prioritize ongoing maintenance and rehabilitation of our systems.

• ***Tucson Water has focused recent investments on utilization and delivery of CAP***
Tucson Water has invested heavily during the past decade in developing infrastructure to reduce dependence on groundwater pumping and increase use of renewable CAP water. To meet critical future demands, new funding will be needed to maintain and replace aging mains, pipes and other delivery infrastructure. Currently, lost water exceeds 10 percent of total water delivered by the utility – an indication of the growing need to address issues of rehabilitation and system maintenance.

• ***Pima County Wastewater will need to make significant investments in its treatment facilities to meet new wastewater quality standards***
Pima County Wastewater is facing a huge investment to upgrade and replace its Roger Rd. and Ina Rd. regional treatment

facilities through the ROMP (Regional Optimization Master Plan). This is primarily the result of the need to meet new, more stringent wastewater quality regulations, but is also a result of the age of the current facilities and the need to expand capacity. Significant increases in wastewater rates will be needed to pay for ROMP. The wastewater system in central Tucson is at or near capacity. New cross-town interceptors or upstream facilities are required to address this. During construction of Roger and Ina Road facilities, and the plant interconnects, the contractors will be required to establish and implement flow and capacity plans for maintenance of operations and permit compliance. This is a contractual obligation and is referred to as "MOPOs" – Maintenance of Plan Operations. Determining the right balance of investing in centralized versus de-centralized wastewater treatment facilities will be important as new areas develop. Another concern that needs to be addressed is that as conservation efforts increase, there could be less liquid in the wastewater system which could increase the need for system flushing. This would be at cross-purposes with the conservation goals we are trying to achieve.

• ***While further expansion of the reclaimed water system is desirable, it will require prioritization of uses and analysis of potential funding methods***

Tucson Water is a nationally renowned leader in reclaimed use and serves as a best practices model for other utilities developing and constructing reclaimed systems. All significant turf irrigation users that can be reached in a cost effective manner have been joined to the reclaimed system. To expand the system further, study will be needed to establish priorities for use of reclaimed water and most appropriate funding methods. Specific questions that need to be addressed include what are the most appropriate uses, who pays, how much resource is available and how should it be allocated, cost trends, and barriers to increased use. The cost-effectiveness of all options will need to be examined. This issue will be further addressed in Phase II of the Study.

• ***Growth should pay for itself***

Both water and wastewater have fees in place with the goal of growth paying for itself, but further study is needed to ensure that these mechanisms are effective. This issue will be explored further in Phase II of the study.

• ***Energy is a significant cost of operating the water and wastewater systems***

Energy costs for transporting and treating water and wastewater are significant and as energy costs increase, this will affect rates. Renewable energy sources should be pursued to help offset costs and make the systems more sustainable.

Scope Item B: Water Resource Assessment

• ***Tucson Water has a reliable and renewable water supply for the near term***

Tucson Water has a reliable and renewable water supply that will meet the needs of its current service population as well as for a certain amount of growth. Over the past decade, Tucson Water has made significant investments in infrastructure to recharge and deliver Colorado River water, moving from dependence on groundwater to this renewable supply.

• ***We face uncertainty on a variety of fronts and need to be prudent with our resources***

We are in a time of uncertainty with global warming, climate change, and drought potentially affecting local water demand, local rainfall, and future flows of the Colorado River. As flows become more limited, there could be legal pressure to change the Colorado River sharing agreements and our allocation could diminish. Based on past records, rising temperatures in the southwest over the next 50 years will lead to precipitation that is even more variable with wetter and drier years.

- The southwest may expect more frequent El Nino events if the earth's average temperature continues to rise. El Nino events bring above normal precipitation levels to the southwest during the winter season.
- Historic 20th century records show the southwest temperatures trends increased 2-3 degrees F while precipitation trends increased in some areas (southern NV, UT, NM, and central AZ) and decreased in other areas (northern and southern AZ, southeast CA, central Rockies).
- 21st century models predict higher precipitation amounts in CA, southern NV, and AZ. These models contradict current trends towards a drier southwest.

In this context, we need to act conservatively and responsibly when it comes to managing our water resources and build in a buffer. We should diversify our water resource portfolio so that we are not overly dependent on imported water. We should increase conservation and maximize our use and re-use of renewable locally-generated water sources such as rainwater harvesting, stormwater capture and recharge, greywater systems, and maximizing the use of effluent and reclaimed water.

Many Committee members referred to the concept of "adaptive management or integrated management" as an example of best practices and a more comprehensive approach to water resource planning and management. Committee members cited a variety of characteristics of this approach including diversity, importance of relationships, integration of parts, science and value-based assessments, and stakeholder processes. Such an approach would also include consideration of legal rights and protections for people and ecosystems and commitment to sustainability. Other analytic tools suggested included optimization, visioning, quantification of costs and benefits and scenario exercises. Other analytic tools suggested included optimization, visioning, quantification of costs and benefits, scenario exercises, and use of quantitative risk assessment techniques to understand probabilities of occurrence and financial impact.

Committee members cited several key elements that should be included in a sustainable water resource management plan:

- Evaluation criteria that include measuring the greatest economic, social, and environmental net benefit for the region expressed in monetized or quantifiable terms
- A budget and implementation strategy (fiscal and physical)
- Prioritized needs
- Allocation of the infrastructure costs of new growth to new populations
- Accounting for both water and energy costs in the production and delivery of water and conveyance of wastewater
- Ensuring a sustainable balance of all infrastructure needs by determining acceptable costs and choosing affordable solutions
- Monitoring, correcting and redirecting to ensure efficient, effective and equitable use of resources
- Responsiveness to all users of water in our region including ecosystem needs
- Involvement of peer-review processes to ensure that the plan benefits from proven best practices
- Use of a flexible, values-based process

• Expanding the Tucson Water service area must be done thoughtfully and deliberately

In the past, Tucson Water has operated in the context of a large planning area extending service throughout the region based on demand. This approach has led to the ongoing expansion of the service base and has increased the need to focus on the acquisition of new water resources. In an effort to move away from this demand-driven approach, the City of Tucson has implemented an interim policy to provide water service only to its obligated service area, which includes city limits plus the built-out areas of the water system. Before decisions to extend service beyond the obligated area are made, the City needs to understand the economic, social, and environmental implications of extending service. The definition of the Tucson Water service area has implications for many things. The Committee recognizes there are both positive and negative impacts of limiting service. Examples of specific questions that need to be addressed include how areas outside the obligated area will get water if not from Tucson Water, and what financial implications there are for Tucson Water's current ratepayers if service is extended, and as a result, new water resources need to be acquired. Phase II of the Study will examine this issue further.

• We should strengthen City-County and regional cooperation around water and planning issues

The separation of water and wastewater systems and operators has created challenges in the past since the two systems are interdependent and need to be managed in a coordinated way. The initiation of the City/County Water and Wastewater Study signals a new era of cooperation between Tucson Water and Pima County Regional Wastewater Reclamation. This effort needs to continue and expand to a regional level following the completion of Phase II of the Study. While City/County collaboration is an important step to addressing many issues, some of the critical issues associated with a sustainable water future are particularly germane to a regional dialogue. These include pursuing new water resources, addressing environmental issues created by groundwater pumping, wheeling water by sharing existing infrastructure to help all providers employ renewable supplies, and planning for and directing growth in a sustainable manner.

• Additional water will be needed in the future and the time to plan for it is now

While Tucson Water does not have an immediate supply issue, the Committee recognizes that the Tucson region will need to secure additional, renewable water resources at some time in the future. The Committee also recognizes that securing additional water resources is a complex undertaking involving many difficult decisions. There is also recognition that we are part of a larger context involving the seven Colorado River Basin states, the Sun Corridor, and the Tucson AMA, which limits our degree of freedom. While each water entity in the region has different needs for additional supplies, securing additional water resources is likely to be more successful when done using a collaborative, regional approach. The City should continue to be actively involved in the statewide ADD water process, while at the same time establishing local standards for additional water resources.

Additional water resources will be more expensive and possibly, much more expensive, than current water resources. Equity and affordability issues must be considered. A full cost-benefit analysis for additional water resources is needed before additional resources are pursued. Full costs should consider such things as non-local environmental effects, environmental justice issues, and comparing additional water costs to those required for investing in the use and re-use of locally renewable water resources – effluent and rainwater. Acquiring additional water should be evaluated in comparison to investments in local resources such as stormwater recharge, greywater systems, rainwater harvesting, expansions to the reclaimed system, and constructed recharge of our effluent. Water conservation and additional water resources are seen as two sides of the same coin. More conservation means less need for additional water. By encouraging greater water-use efficiency, water conservation programs can have a significant impact on the timing of critical decisions on water-resources and system-planning projects. Conservation has been a critical component of Tucson Water's planning process for several decades. Many programs have been implemented to encourage greater water-use efficiency. Phase II will include further analysis of the issues involved in securing additional water resources. The Committee will not be in a position to identify what those additional renewable water resources will be. The Committee, rather, will suggest approaches that can be used to engage in a regional and state-wide process as well as provide evaluation criteria that the Mayor and Council and the Board of Supervisors can use in considering which additional water resources to pursue.

Scope Item C: Sustainable Water Future

• ***A sustainable water future must be discussed within the overall context of sustainability***
The concept of sustainability is comprehensive and its definition encompasses the capacity to maintain and/or regenerate ecological, social and economic processes, resources and functions and it considers the needs of existing and future generations. A comprehensive definition of sustainability that integrates these concepts of maintaining desirable conditions and regenerating or renewing resources is an important framework for the discussion of how best to plan for adequate, high quality, secure water supplies under changing conditions and climate related resource uncertainties. Definitions of sustainability should be flexible. Sustainability is a principle that evolves over time and its definition will therefore change as well with future generations.

• ***Water sustainability involves equitable consideration of, and trade-offs, among a variety of inter-related issues***
Water sustainability in the Tucson region means balancing rights to safe, high quality, affordable, water with the needs of future residents and the environment. A definition of sustainable water management must consider the regional impacts of water use at the watershed scale and the localized impacts to aquifers and groundwater-dependent ecosystems. It must establish a link between sustainable groundwater use and the provision of renewable water resources to areas impacted by groundwater overdraft.

• ***Planning for and managing growth is critical to creating a sustainable water future***
In the past, our land use planning efforts have been incremental and site specific, rather than comprehensive and regional. We have not directed growth, but have responded to demand for it. Water and wastewater infrastructure have followed suit, extending service based on demand.

It is difficult to develop answers about how and where growth should occur based simply on water supply because, while we do have limited water supplies, more water can be acquired at a cost if growth is desired. Water is part of the equation, but not the only driver or limiting factor determining growth. We must plan for and direct growth considering a wide array of factors (environment, transportation, public services, infrastructure, etc.), of which water is one, albeit critical, factor. Such planning could then guide our water and wastewater service extension decisions.

One line of thought maintains that our local economy is overly dependent on growth and development and that this is not healthy or sustainable. While our population is likely still going to grow at some rate, past growth patterns are not necessarily a predictor of the future – Tucson, our state, and our nation are in a time of flux and uncertainty. There is no guarantee that in the future we will grow in the same manner as we have in the past. Declining growth rates are not necessarily a bad thing. Diversifying our economy can help to make our community more resilient to changing growth trends. Paris, France, for example has a shrinking population but is not considered a stagnant or undesirable place. We should plan ahead for growth, but this should not mean facilitating as much growth as possible without consideration of the impacts of growth on other elements of our quality of life. We need to plan ahead for and develop a future economy that is sustainable and based on a stabilized population size, not perpetual growth. Some members believe that perpetual growth is not in Pima County's future and that population size will stabilize at some time in the future, but there is uncertainty about when that time will arrive.

Growth projections and land use planning have important implications for utility planning. The methods used in the past to project growth have not been consistently accurate. We need to improve our population projection methods, be more deliberate in directing where growth should occur, and link utility extensions and investments with agreed-upon plans and projections. It is essential that we get more aggressive about calculating the cost of growth and ensure that growth is paying its share.

• ***We should increase water conservation measures and maximize our use and re-use of locally renewable water resources***
Aggressive water conservation and maximizing the use and re-use of locally renewable water sources should be seen as key elements of a sustainable water future. Water usage trends, measured in terms of GPCD (gallons per capita per day), have been decreasing, likely in part due to the education, assistance, and regulatory efforts of the City and County to encourage water conservation. The implementation of the City's Water Conservation Task Force recommendations, the recently adopted greywater ordinance for new residential development, and the water harvesting ordinance for new commercial development are examples.

The potential to increase water conservation exists, but in encouraging further conservation, we must ensure people have real incentives to conserve. Investment in any conservation measure should be based on rigorous Cost-Benefit analysis to ensure maximum water saved per community dollar spent. Some members object to singling out environmental uses of water for special cost/benefit analysis, as if the environment were a mere externality that detracts from unquestionable primacy of human consumption of all water resources. Concerns expressed during the study process by audience and committee members include: 1) using less water will require that rates be increased to compensate for lower revenue, 2) conservation will just provide the water for more growth, and 3) the more our population conserves, the more water will be needed to flush wastewater mains. It is important to note that flushing of sewer lines is a part of the wastewater preventative maintenance program and in 2007, Pima County used 3.5 million gallons of potable water (0.01% of the total water delivered to Tucson Water customers) to flush the lines in the regional wastewater system.

Another aspect of conservation is maximizing the use and re-use of locally-generated water sources such as rainwater harvesting, greywater use, stormwater capture and recharge, and increased utilization of effluent. It is important to note that conservation efforts decrease demands for water, but they are not counted as new resources as part of Assured Water Supply designation. These issues will be explored further in Phase II of the Study.

Some members of the committee have voiced concern over understanding the full costs and benefits associated with allocating water to different uses. It has been recommended that the finalization of the Conservation Effluent Pool agreement between the City of Tucson and Pima County be delayed until the Committee has been able to deliberate and analyze the costs and benefits associated with reallocating water to specific uses. Currently there is disagreement on the Committee regarding allocation of effluent for the environment without understanding replacement costs and/or opportunity costs associated with that decision.

• ***We need to balance human, environmental, and economic needs for water***
No one would dispute the fact that access to clean, safe water is a basic human need and right. The environment needs water as do people. In the past, we have not been the best stewards of water for the environment. Going forward, we need to 1) recognize the environment as a water user, 2) allocate water to environmental needs, and 3) decrease groundwater pumping in environmentally-sensitive areas. A pumping/re-charge disconnect is created by the State's Assured Water Supply (AWS) rules and the CAGRD (Central Arizona Groundwater Replenishment District) under which water can be pumped in one location while it is recharged in another location – negatively impacting environmentally-sensitive locations where the water is pumped. In the Arizona groundwater code, "safe-yield" is defined as a long-term balance between groundwater withdrawals and natural and artificial recharge in an Active Management Area (AMA). In other words, the water pumped out of the regional aquifer in an AMA must be balanced, at a minimum, by water that enters the regional aquifer. However, this does not take into account the water needs of groundwater-dependent riparian systems. Exempt wells that have grandfathered rights to pump water and are located in environmentally-sensitive areas are also an issue.

While this regulatory structure is the purview of the State, there are steps we can take locally to address the problems. This is an issue for the Tucson AMA, not the Tucson Water Service area per se and must be addressed regionally. Strategies to address pumping of water in environmentally-sensitive areas include retiring exempt private wells, buying water rights, and wheeling renewable water supplies using existing infrastructure. As noted, protecting environmentally–sensitive areas is a regional benefit. The costs associated with strategies to protect the environment should be equitably shared by all regional beneficiaries.

Water is critical to the health of our economy and a strong economy is a critical element of a sustainable future. All commercial and industrial businesses use water to one degree or another and rely on an adequate and affordable supply. Tucson Water estimates that in 2007, the 136,000 acre-feet of water that Tucson Water delivered to municipal uses supported a local economy with a $22 billion gross domestic product. That works out to $160,000 in economic value per acre foot of water delivered. The state average is about $110,000 in economic value per acre foot. Tucson is more efficient compared with the state when it comes to economic value gained from use of its water.

A healthy environment also has a positive economic benefit to our community. The Arizona Game and Fish Department documented that in 2001 in Pima County, "watchable wildlife recreational opportunities" produced retail sales of $173 million with a total multiplier effect of $326 million.

• ***We need to employ flexible, long-range, participatory, and rigorous planning processes***
The Committee supports having better, more rigorous analytic planning and decision making processes and use of best practices in managing our water resources. Some Committee members see the foundation for sustainable principles and practices as including triple bottom line accounting whereas others do not feel that triple bottom line accounting is adequate in terms of addressing negative consequences (i.e. unsustainable resource consumption) of population growth.

• ***Water pricing and financing approaches should further policy objectives***
Price signals are an important tool for achieving efficient allocation of water resources. Current retail water rates do not match claims of scarcity and conflict with messages urging conservation. Water subsidies should be granted for valued outcomes such as low-income user access, community food gardens, and restoring eco-systems, but water should be priced higher to encourage conservative use and to sustain ongoing needed investment in our systems. Social justice issues must be a consideration for plans to increase water and wastewater costs.

• ***We need to fully address environmental impacts of past and future water policies***
This report fails to fully address the environmental needs of water and the negative environmental impacts of past water policies as well as future plans to acquire new water supplies. This report fails in this regard because environmental considerations have been lacking from water management and planning practices. Future planning efforts should strive to weigh all considerations, including the environment, when developing long range plans. Most committee members agree with the goal stated here, but would note that the committee made an explicit decision to postpone fuller discussion of these issues to Phase 2.

• ***Legal mechanisms to protect our river and riparian systems are inadequate.***
The prior appropriation laws were set up for beneficial use. Beneficial use is agriculture and mining, domestic consumption, et cetera. Provisions, such as in-stream flow, are not enough in light of current and projected population growth patterns. Safe Yield and the Assured Water Supply provisions of the Groundwater Management Code are mechanisms for managing human water supplies, not for managing water for the environment. There is no requirement for an evaluation of impacts to rivers, streams, riparian systems, et cetera.

• ***A proactive scenario where growth is not accommodated should be established in future planning efforts***
To date, long range planning by Tucson Water has made the assumption that new growth will be accommodated. The cost of such accommodation, both monetary and environmentally, have the potential to be extremely high. The community may wish to take a more proactive approach to dealing with growth rather than simply plan to accommodate unhindered growth. A full and comprehensive planning process should directly address a scenario such as this in future planning efforts. Most committee members agree that the paradigm of water and wastewater utilities simply serving growth, whatever its size and location has to be changed. Many committee members would be opposed to "unhindered growth" and actually expect growth in the Tucson water service area and in Pima County to level off at some point in the future. Some members, however, are uncomfortable with the language in this statement and will defer further judgment to the Phase 2 discussions on comprehensive planning principles.