



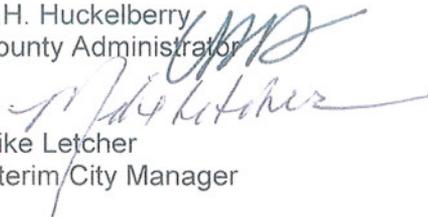
City/County Water and Wastewater Study



Date: April 13, 2009

To: City/County Water and Wastewater
Study Oversight Committee

From: C.H. Huckelberry
County Administrator


Mike Letcher
Interim City Manager

Re: **Reclaimed Water Technical Paper**

Background

One of the goals included in the scope for Phase II of the City/County Water and Wastewater Study was for the City and County to work together to increase the use of reclaimed or recycled water on turf irrigation to substitute for groundwater use. A City and County interdisciplinary staff team was assembled to look at this issue and has been meeting since December to develop this report.

The Tucson Water reclaimed system that has been constructed over the past 25 years is extensive in nature and most of the customers for whom there is an economic incentive to convert to reclaimed water have been connected to the system. The system currently utilizes 42 percent of Tucson Water's effluent allocation and 27 percent of Pima County's allocation.

The use of reclaimed water must be considered within the broader context of sustainability, with the goal of maximizing our water resource portfolio as a community. There are other valued uses for effluent besides use in the reclaimed system (environmental and aquifer augmentation purposes) and there are other water resources that should be considered for outdoor irrigation such as stormwater and rainwater harvesting. Resource efficiency should be a primary value driving reclaimed expansion considerations.

That being said, there is capacity for expanding the reclaimed system, and the report makes recommendations for establishing expansion targets, prioritizing customers and for overcoming financial and regulatory issues that have been barriers to maximizing our use of reclaimed water in the past.

The recommendations in the paper include:

1. Prioritizing Reclaimed Customers

The City and County should seek to increase the amount of their effluent allocations used in the reclaimed system by approximately 10 percent (or 1,300 acre-feet) and 25 percent (or 270 acre-feet) respectively over the next 10 years. These targets are based on work done for the Tucson Water 2050 Plan and the Pima County Sustainability Action Plan and provide a framework for customer prioritization in the near-term. With these targets in

mind, the City and County should work together to identify, prioritize, and pursue additional reclaimed customers based on the following criteria:

- Proximity to existing reclaimed infrastructure
- Cost to join to the system
- Energy, operating, and maintenance costs
- Potable and groundwater savings
- Opportunity to mitigate environmental impacts of existing groundwater pumping
- Turf areas that provide greatest public benefit
- Availability of other water resource options

2. Overcoming Financial Barriers

The City and County should pursue the following approaches aimed at overcoming existing financial barriers to expanding the reclaimed system:

- Expand financing options to include the use of General Obligation bonds and other funding mechanisms that expand Tucson Water's ability to pay for extensions to the reclaimed system without relying solely on paying customers and revenue bonds.
- Maintain the current policy that private customers with a revenue source (e.g. golf courses, industrial) who can pay the full costs of reclaimed should pay, however explore options to encourage potential customers who currently have no financial incentive to join the system to join, such as phased-in rates and expanded potable water ratepayer subsidies.
- Work to lower the costs of operating the reclaimed system through efficiency improvements to the system.
- Incorporate the consideration and evaluation of the use of reclaimed water into the City and County development review processes (for both new growth areas and infill projects).

3. Overcoming Regulatory Barriers

The City and County should jointly advocate for policy and rule changes (through ADEQ and ADWR) to overcome regulatory barriers to maximizing the use of reclaimed water:

- Alternative operational and permitting strategies to achieve a Class A+ or equivalent rated reclaimed system
- Use of groundwater savings facility credits to attract new reclaimed customers
- Alternative permitting requirements for riparian restoration projects

4. Multiple Benefit Public Projects

The City and County should pursue cost-effective, multiple-benefit public projects that utilize reclaimed water to accomplish goals such as aquifer augmentation, riparian restoration, wetlands, habitat protection, environmental enhancement, turf irrigation, and recreational opportunities.

5. Consider Use of Reclaimed Water within the Broader Context of Sustainability

- The City and County should maintain a balance of effluent use over time continuing to dedicate effluent to the reclaimed system, to environmental purposes, and to aquifer augmentation. Other technical papers in Phase 2 will address environmental needs for water and aquifer augmentation.
- The City and County should evaluate the use of reclaimed water for particular sites with the goal of maximizing the community's overall water resource portfolio.

Reclaimed water may not always be the best option. The key is matching up the most effective and resource-efficient water source with a particular site and its needs.

Recommendation

It is respectfully recommended that the Committee consider this report and provide input to the City and County on its recommendations.

- c: Nicole Ewing Gavin, Assistant to the City Manager
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City/County Water and Wastewater Study Phase II



City of Tucson and Pima County Reclaimed Water Technical Paper

April 2009

This paper was prepared by a joint team of City of Tucson and Pima County staff from the following departments: City of Tucson - Tucson Water, Office of Conservation and Sustainable Development, and City Manager's Office; Pima County - Regional Wastewater Reclamation Department, Regional Flood Control District, County Parks and Recreation, and County Administrator's Office. Lead authors on the paper were Nicole Ewing Gavin, Karen Dotson, and Kathy Chavez.

City of Tucson and Pima County Reclaimed Water Technical Paper

Water and Wastewater Infrastructure, Supply and Planning Study, Phase II

April 2009

As part of the scope for the Joint City of Tucson/Pima County Water and Wastewater Infrastructure Supply and Planning Study, the City and County were asked to explore how we can overcome the financial and institutional constraints to building reclaimed water infrastructure in order to maximize the use of this renewable source of water. This paper examines this request by providing:

1. An overview of effluent resources;
2. An overview of the existing reclaimed water system including facilities, resources, customers, uses, financing methods, and planned improvements to the system;
3. An analysis of opportunities and constraints to maximizing the use of reclaimed water, and
4. Recommendations to maximize the use of reclaimed water

1. Overview of Effluent Resources

It is important to begin a discussion of reclaimed water with an explanation of wastewater and effluent resources because the two systems are closely linked. Wastewater is an important water resource in eastern Pima County in that it is the only water supply that continues to increase as the population grows. Pima County owns and operates the wastewater system for most of Pima County. The community currently has three major methods of effluent utilization:

- Use in the City of Tucson reclaimed water system
- Discharge to the Santa Cruz River, and
- Recharge in constructed recharge facilities, the Santa Cruz River and at the various outlying wastewater facilities

A total of 72,588 acre-feet of effluent was produced in Eastern Pima County in 2007 of which 68,299 acre-feet (94%) was produced in the metropolitan area (from the Ina Road, Roger Road, and Randolph Park wastewater reclamation facilities). This white paper focuses on the utilization of the City and County shares of this effluent (45.5 and 5.9 percent respectively in 2007) through the City of Tucson's reclaimed water system and the opportunities for maximizing this utilization.

Effluent Agreements and Allocation

Effluent is allocated among various entities based on local intergovernmental agreements and the Southern Arizona Water Rights Settlement Act (SAWRSA). The 1979 Intergovernmental Agreement transferring the City of Tucson sewer system to Pima County allocates 90 percent of the effluent generated from Metropolitan Wastewater Treatment Facilities to the City of Tucson and 10 percent to Pima County. Tucson Water divides its share of this allocation (along with a proportional share of Conservation Effluent Pool and SAWRSA obligations) with Metro Water and Oro Valley according to a

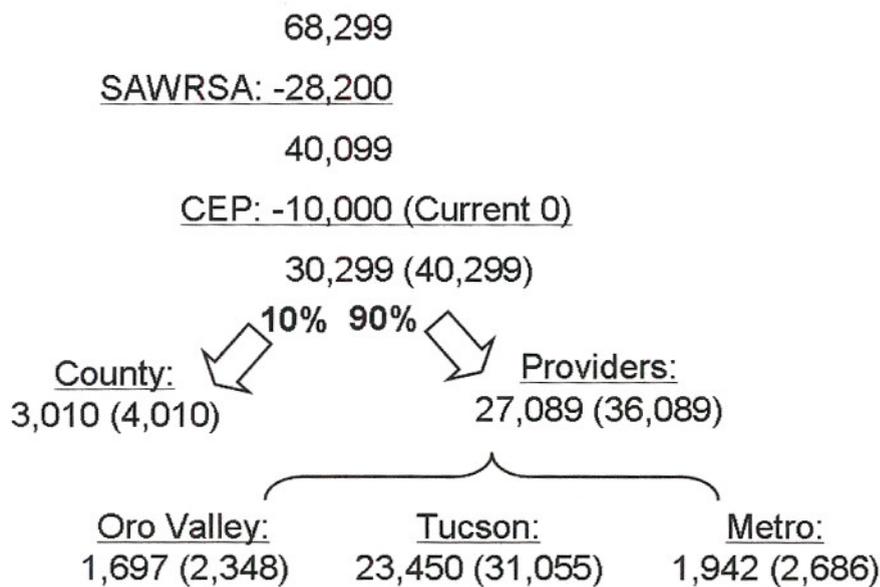
formula that reflects each water providers control of the effluent generated from within their water service areas.

The 1979 IGA also provided for the City to use all or part of the effluent from County sewer treatment plants to settle or satisfy litigation with the Tohono O'Odham Nation. In 1983, the Southern Arizona Water Rights Settlement Act (SAWRSA) resolved the litigation, in part, by delegating 28,200 acre-feet of the City's annual effluent entitlement to the Secretary of Interior to hold for the benefit of the Nation.

The 2000 City/County Supplemental Intergovernmental Agreement (IGA) stipulates that up to 10,000 acre-feet of effluent known as the Conservation Effluent Pool (CEP) - shall be made available for riparian projects that are a part of a habitat conservation plan or that are mutually agreed upon by the

Metropolitan Effluent Entitlement

(Based on 2007 Effluent Production - 68,299 ac-ft/yr)



City and County. Similar to the SAWRSA volume, the CEP is effluent, which is deducted from the total prior to calculating the share for the County and the municipal providers. Currently, none of the CEP has been used for designated environmental projects. Approval of an agreement to establish a

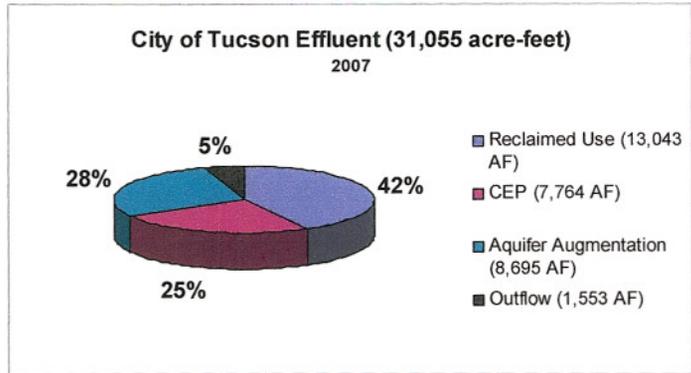
decision-making process for developing projects and committing this water for its intended purpose is pending and is being presented to the City and County governing boards for approval.

Effluent Usage

Currently, seventy-seven percent (52,352 acre-feet) of the effluent produced at the two large metropolitan treatment plants is discharged to the Santa Cruz River where it accrues credits in permitted recharge projects, supplies downstream users, replenishes the aquifer, and sustains the riparian habitat. The entire effluent allocation belonging to the Secretary of the Interior as well as the allocations belonging to Metropolitan Domestic Water Improvement District, and the Conservation Effluent Pool (CEP) are discharged to the Santa Cruz River, along with portions of the City share and County share.

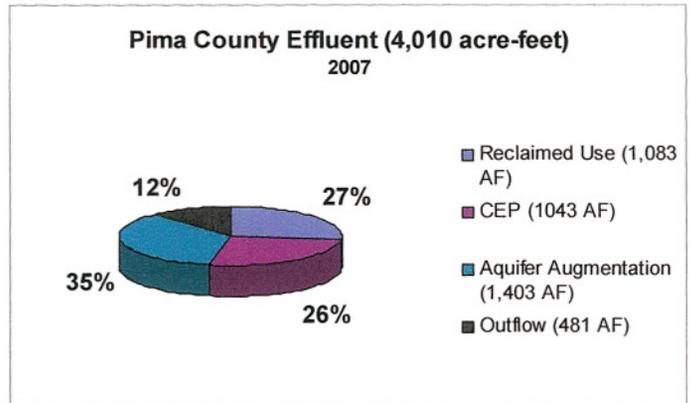
- *Reclaimed System*

Approximately 38 percent of the total metropolitan effluent resource owned by local entities (excluding the Secretary of the Interior) is presently distributed for direct use through the Tucson Water reclaimed water system. For 2007, the City of Tucson used 42 percent of its effluent allocation for reclaimed and Pima County used 27 percent.



- *Aquifer Augmentation*

Reclaimed water is a renewable resource available to the community to replenish the aquifer in appropriate locations. Appropriately treated reclaimed water can be stored underground in the aquifer today and remain available for recovery by the community in the future for a variety of purposes. Of the various ways of utilizing effluent, aquifer augmentation provides the most flexibility for future use because it can be withdrawn at any time and used for various purposes.



Tucson Water's 2050 Plan calls for a portion of treated effluent to be used for aquifer augmentation so that it will be available for future use. Stored water can help to diversify Tucson Water's current water resource portfolio and buffer against future drought or climate-related events. Because locally-generated effluent supplies are unlikely to be reduced by drought and access to them is not subject to curtailment or Central Arizona Project infrastructure outages, effluent will be an important locally controlled supply during future shortages.

The City of Tucson, Pima County, Bureau of Reclamation, Metro Water, and Oro Valley participate in the Lower Santa Cruz River Managed Recharge Project along the Santa Cruz River from the Ina Rd discharge point to Trico Rd. ADWR allows this project to receive credit for recharge of 50 percent of the effluent that reaches the aquifer. Evaporative losses and downstream flow out of the recharge project are subtracted before determining the volumes eligible for credit. For Tucson Water's remaining 17,919 acre-feet not used in the reclaimed system was discharged to the Santa Cruz River, earning the City 5,080 acre-feet of groundwater storage credits for future recovery. For Pima County, the 2,912 acre-feet not devoted to reuse was discharged to the Santa Cruz River, earning 604 acre-feet in groundwater storage credits for future recovery. The City of Tucson and Bureau of Reclamation operate the Upper Santa Cruz River Managed Recharge Project (Phase I) which is permitted to recharge 9,307 acre-feet of effluent annually and Tucson Water can accrue approximately 2,300 acre-feet of recharge credits per year. The two Santa Cruz River Managed Recharge Projects have a combined recharge capacity of 43,000 acre-feet.

Pima County operates two of its non-metropolitan wastewater reclamation facilities (WRFs) to actively recharge the aquifer. Although neither facility received storage credits in 2007, Corona de Tucson WRF was recently permitted as an underground storage facility by ADWR and Pima County intends to

secure permitting from ADWR for the newly expanded recharge basins at Avra Valley WRF this year. Another facility, the Green Valley WRF, provides effluent to Robson Communities for underground storage and recovery. The balance of the effluent at Green Valley, 507 acre-feet in 2007, is recharged without any accrual of credits. Finally, Pima County Flood Control District operates the Marana High Plains Effluent Recharge Project as a diversion of water from the Santa Cruz River into constructed recharge basins. In 2007, the project had a net recharge of 319 acre-feet for which Pima County received 184 acre-feet of storage credits.

The City of Tucson and Pima County are currently in discussions to develop a constructed effluent recharge project that will use effluent generated at the metropolitan area wastewater plants. The goals of the project are to accrue additional recharge credits, maintain existing riparian vegetation currently dependent on the effluent, and to site a recharge facility such that the effluent remains in the local area. For more information on effluent recharge projects, see Phase 1 Report, Chapter 4.

- *Effluent for the Environment*

Both effluent and reclaimed water can be used for riparian restoration projects and other environmental purposes. These projects not only benefit vegetation and wildlife, but benefit humans by increasing recreational opportunities, decreasing heat island effects, reducing green house gasses, and decreasing flood insurance costs. Furthermore, projects that enhance naturally vegetated watercourses provide green infrastructure that helps control non-point source pollutants, such as those found in urban stormwater. Environmental needs for water will be the subject of other Phase II technical papers.

The City and County have designated effluent supply for environmental projects through the Conservation Effluent Pool (CEP), established by an intergovernmental agreement in 2000 (see table). Up to 10,000 acre-feet/yr of local effluent is set aside for habitat conservation plans (HCPs) approved to meet Section 7 or 10 requirements of the Endangered Species Act or to projects designated as a riparian project for purposes of environmental restoration by mutual consent. Under the terms of the agreement, CEP effluent is available to project operators at no charge and reclaimed water is available at a rate that is about half the standard retail rate for reclaimed water.

Conservation Effluent Pool Contributions by Owner			
	2007 Effluent Entitlements	CEP Contribution (ac-ft)	% of Total CEP
Tucson Water	31,055.00	7,605	76
Pima County	4,010.00	1,000	10
Oro Valley	2,348.00	651	6.5
Secretary of Interior	28,200	0	0
Metro Water	2,686	744	7.4
TOTAL	68,299.00	10,000	100

¹ In 2007 none of the CEP was used. CEP volumes do not accrue annually.

Table 1: Effluent Entitlements in 2007.

Effluent generated by the outlying facilities which currently has no reclaimed distribution system provides opportunities to preserve and restore riparian habitat as well as irrigate recreation amenities. Outlying wastewater treatment facilities are anticipated to produce 11,076 acre-feet of effluent by the year 2025. These outlying treatment plants are located in areas that are generally rural and the

County owns adjacent lands that would be suitable for restoration. Projects currently being planned that would utilize effluent for restoration purposes include the Canoa Ranch, Canoa restoration project, Avra Valley Black Wash enhancement and restoration, and Anza Park ecosystem restoration.

Although CEP allocation has not been made or implemented, there are a number of projects/activities underway to accomplish riparian restoration or enhancement with effluent. The City of Tucson has used reclaimed water and reclaimed backwash to develop riparian habitat projects in the Sweetwater wetlands near the Roger Road treatment plant and at the Atterbury Wash on the southeast side. For Pima County, 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. PCRFC recently completed the Swan Wetlands project which uses reclaimed water and stormwater to augment wetland and riparian habitat of approximately 34 acres along the south bank of the Rillito River from Craycroft Road to just west of the Columbus Boulevard alignment. Because these riparian enhancement/ restoration projects are multi-benefit 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.

Effluent Volume Projections

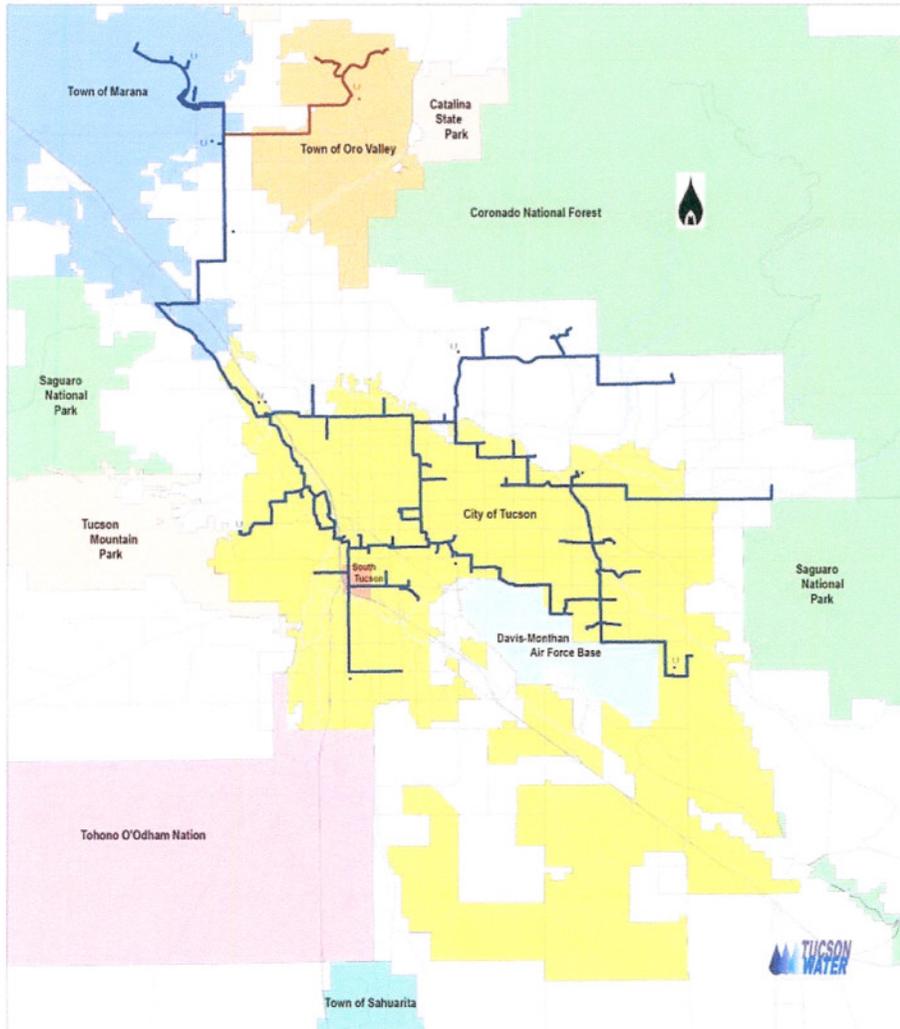
Updated projections of wastewater generation through 2030 were developed in consultation with the Pima County Regional Wastewater Reclamation Department. These projections indicate that effluent produced at the metropolitan wastewater treatment plants in 2030 could reach 95,286 acre-feet/year. Of this, Tucson Water projects it would have annual entitlement to approximately 43,000 acre-feet.

Effluent Entitlements 2007 & 2030 by Owner				
	2007	% Total Effluent	2030	% Total Effluent
Tucson Water	31,055.00	45.5	43,813	46.0
Pima County	4,010.00	5.9	5,709	6.0
Oro Valley	2,348.00	3.4	3,152	3.3
Secretary of Interior	28,200	41.3	28,200	29.6
Metro Water	2,686	3.9	4,413	4.6
Conservation Effluent Pool	0	0.0	10,000	10.5
TOTAL	68,299.00		95,286	

Pima County's non-metropolitan area wastewater reclamation facilities produced 4,362 acre-feet of effluent in 2007. By 2030 it is projected that this amount will increase to 29,377 acre-feet. Some of this effluent may be suitable for distribution through new reclaimed water systems of turf irrigation, environmental restoration or aquifer augmentation.

2. Overview of the Reclaimed Water System

The focus of this paper is the reclaimed system owned and operated by Tucson Water. Tucson Water has owned and operated a reclaimed water system since 1984. The system includes 160 miles of pipelines that deliver reclaimed water to 938 sites located throughout the region in the City of Tucson, unincorporated Pima County, Town of South Tucson, Flowing Wells Irrigation District and the



Town of Marana. A portion of Oro Valley's effluent entitlement is delivered to the town through the City of Tucson's reclaimed water system but Oro Valley operates its own reclaimed water system.

Tucson Water has invested approximately \$145 million (\$250 million in present dollars) to build the reclaimed water system that we have today. These costs do not include additional investments by customers to extend transmission or distribution mains to their property and installation of on-site facilities such as lining of lakes, private booster pumps, piping, and irrigation systems. The annual operations and maintenance cost of the reclaimed system is approximately \$2.8 million.

Of the 68,299 acre-feet of metropolitan area effluent produced by Pima County in 2007, the City of Tucson had entitlement to 45 percent (31,055 acre-feet) of this effluent and used 40 percent of its entitlement as reclaimed water for turf uses such as golf courses, municipal parks, other recreational facilities and schools, which accounted for 83 percent of the deliveries through the reclaimed system. Pima County's share accounts for about 7% of deliveries through the system and 27 percent of their total effluent entitlement.

Tucson Water Reclaimed Water System Deliveries by Effluent Entitlement Calendar Year 2007				
	Effluent Entitlement	Total Reclaimed Water Delivered (ac-ft)	% Total Deliveries	% Total Effluent Entitlement Used
Tucson Water	31,054.80	12,515,70	83	41
Pima County	4,009.80	1098.5	7.1	27.4
Oro Valley	2,347.90	1,612.50	10.5	68.68
Metro Water	2,685.00	0	0	0
Secretary of Interior	28,200	0	0	0

Permitting and Regulatory Requirements

- *Arizona Department of Environmental Quality (ADEQ)*

The Arizona Department of Environmental Quality (ADEQ) regulates the City’s reclaimed water system through permits which include a “Type III General Permit – Reclaimed Water Agent” and various aquifer protection permits. The Reclaimed Water System also operates under a Consent Order with the State of Arizona resulting from an unauthorized discharge of reclaimed water to the Pantano Wash in 2003. The Consent Order is in effect until all of its conditions are met, which include changing to A+ water and implementing a supplemental environmental project.

The aquifer protection permit for the Tucson Reclaimed Water Treatment Plant classifies the reclaimed water as “Class A,” meaning the water has undergone secondary treatment, filtration, and disinfection to eliminate fecal coliform. The water can be used for a number of listed purposes, including open-access turf and landscape irrigation, operation of cooling towers, construction, dust control, and vehicle or equipment washing. Class A water is safe for use at public facilities such as parks, schools, and recreational impoundments. It can be used to water edible vegetables, orchards, and vineyards. It can also be used for toilet flushing, fire protection systems, and livestock watering. Because Tucson Water holds an “Agent” permit, reclaimed customers do not need to obtain their own permits or submit routine regulatory reports to ADEQ.

ADEQ Reuse Regulations require lakes and other impoundments that are filled with Class A reclaimed water be lined or meet minimum leakage standards. Also, the agency’s irrigation requirements limit the reclaimed water application rate in order to prevent aquifer contamination with nitrate. ADEQ prohibits runoff of Class A water under any circumstances from sites where its use is allowed. Under the Consent Order, ADEQ requires Tucson Water’s prompt response to any instance of reclaimed water release. This restriction presents problems for Tucson Water since reclaimed mains do break, reservoirs need to be cleaned and pipes need to be flushed. Customers also experience problems, since a malfunctioning irrigation system or on-site main break may result in off-site discharge.

Class A water is distinguished from Class A+ water by the total nitrogen concentration. Class A water may be high in nitrogen, but Class A+ water must have a total nitrogen concentration at or below the

drinking water standard of 10 mg/l. Currently, Tucson Water's reclaimed water quality matches Class A+ standards during parts of the year but not all of the time. The Utility's long-term goal is to operate the reclaimed water system as a Class A+ facility, which expands the options for reuse and has the following regulatory compliance benefits:

- Allows unrestricted application rates for irrigation uses,
- Eliminates liner requirement for lakes, ponds, and storage impoundments, and
- Simplifies annual reporting so that volumes, uses, and acreage for each end user need not be tracked by the Utility.

Also, switching to A+ reclaimed water would lift the Consent Order requirements and allow Tucson Water to handle system releases and other compliance issues without a heightened alert status for each occurrence.

It is expected that the treatment processes to be constructed under the ROMP program will produce, without filtration, reclaimed water that meets Class A+ quality except during storm events. During those brief periods of increased inflow, the turbidity level in the effluent may rise above the Class A+ reclaimed water quality standard of 2.0 NTU as a 24-hour average. Permitting to A+ may be achievable without additional filtration using ADEQ's rule provision A.A.C. R18-11-103(C) allowing the use of alternative treatment methods. Joint discussions with ADEQ will be necessary to clarify these permitting requirements. Pima County will continue to be responsible for permitting its facilities to B+ and Tucson Water will be responsible for permitting to A+.

- *Arizona Department of Water Resources*

The Arizona Department of Water Resources (ADWR) regulates the City's reclaimed water system through the Tucson Active Management Area (TAMA) Management Plans which include regulation of underground storage facility permits, water storage permits, and recovery well permits. Underground storage facilities recharge water in an aquifer by using some type of constructed device, such as an injection well or percolation basin and accrue credits for 100% of the water that is recharged. Managed underground storage facilities allow water to be discharged to a naturally water-transmissive area such as a streambed that allows the water to percolate into the aquifer without the assistance of a constructed device, and accrue credits for 50 percent of the water that is recharged.

ADWR is also responsible for the groundwater savings programs in which approved facilities may replace groundwater use with reclaimed water or effluent use on a one-for-one basis. For each acre-foot of groundwater that is replaced, a stored water credit is earned by the provider of the reclaimed water or effluent. This credit can be used to pump groundwater in the future and has a value that can be used towards offsetting the increased price of building a reclaimed system compared to pumping groundwater. Groundwater savings programs could be a valuable tool in getting groundwater users to convert to reclaimed water; however, ADWR's position has been that groundwater users that have reclaimed water service readily available to them are not eligible.

Local Policies and Regulations

- *Mayor and Council Water Policies*

The Mayor and Council have adopted water policies that govern the reclaimed water system including:

- New turf facilities and golf course development shall use effluent or reclaimed water for irrigation purposes.

- The substitution of effluent and reclaimed water for potable source waters is an important element in achieving safe yield in the Tucson basin.
 - Unless otherwise determined by special agreement adopted by the Mayor and Council, it is the responsibility of the customer/developer to pay for the extension of reclaimed mains from Tucson Water's system to the property where service is desired. The customer is responsible for the purchase of the reclaimed water meter and all on-site work required for the delivery of reclaimed water.
 - Charges for effluent and reclaimed water shall be based on the cost of service whenever possible
 - To the extent that charges for effluent and reclaimed water that are based on cost of service do not provide an adequate price incentive, the price of reclaimed water shall be based on a market value which encourages its use.
- *Pima County Policies and Ordinances Requiring Use of Effluent or Reclaimed Water*

The Sustainability Action Plan-Resolution 2007-84 includes a goal to double the number of county parks served reclaimed water by 2018. Pima County's Golf Course Zone Ordinance prohibits the use of groundwater for newly zoned golf courses. Additionally, the Landscape Code provides general standards for buffer yards, landscape designs and landscape plans. Preservation of native, on-site vegetation is a primary objective of site planning. The code specifies the use of reclaimed water, effluent or CAP water on turf applications over ten acres and turf use shall be for functional uses only, such as play or picnic areas. Landscaped areas will use a separate reclaimed ready irrigation system to promote the use of effluent.

Reclaimed Water System Production Facilities

Currently, reclaimed water is produced from secondary effluent that is received from Pima County's metropolitan treatment facilities either through filtration at the Tucson Reclaimed Water Treatment Plant (adjacent to the Roger Road Wastewater Treatment Plant) or after recharge in a number of facilities including the Sweetwater Recharge Facilities, the Santa Cruz River Managed Underground Storage Facility (Santa Cruz Phase I) and the Lower Santa Cruz River Managed Recharge Project (Santa Cruz Phase II) as shown in Figure WP – 4. The Santa Cruz Phase I facility is co-owned with the U.S. Secretary of the Interior and the Santa Cruz Phase II facility is jointly owned by multiple parties. Reclaimed water is also produced at Pima County's Randolph Park Water Reclamation Facility (WRF) for delivery via the City's reclaimed system to nearby reclaimed customers. In addition, there are two sources of back-up supply to meet peak reclaimed demand: effluent storage credits accrued via managed in-channel recharge at the Lower Santa Cruz River Managed Recharge Project (LSCMRP) and Tucson Water's potable distribution system (which has only been used once as a back up source of supply).

The Upper Santa Cruz River Managed Recharge Project (Phase I) is permitted to recharge 9,307 acre-feet of effluent annually. The ADWR regulations that govern managed recharge facilities award credits for only 50 percent of the effluent that is recharged. The City of Tucson and the Secretary of the Interior evenly share the credits accrued at Santa Cruz Phase I; therefore, Tucson Water can accrue approximately 2,300 acre-feet of recharge credits per year. Effluent recharged under Santa Cruz Phase I is recovered through a well, disinfected, and conveyed through the reclaimed distribution system to customers. The City, Pima County, the Bureau of Reclamation, the Metropolitan Water District, and Oro Valley are participants in Santa Cruz Phase II. This facility does not currently have a recovery component. The two Santa Cruz River Managed Recharge Projects have a combined recharge capacity of 43,000 acre-feet.

Other facilities in the reclaimed water system include five reservoirs with a storage capacity of 15 million gallons, booster stations, disinfection facilities, and a central computerized operating system.

In calendar year 2007, Tucson Water spent approximately \$1.12 million on electricity to operate the reclaimed system. Energy is used to pump, treat, and deliver water through the system.

Reclaimed Water System Deliveries

In calendar year 2007, the reclaimed water system delivered approximately 15,000 acre-feet of reclaimed water to 938 sites (see Map #1 attached). These deliveries included reclaimed water from the effluent entitlements of Tucson Water, Pima County and Oro Valley. Tucson Water has IGAs with Oro Valley and Pima County to “wheel” reclaimed water through their system to their sites.

Golf courses account for the highest volume of reclaimed water delivered with parks and schools as the next largest volume user.

Reclaimed Water System Deliveries by Effluent Ownership (2007)

Tucson Water System Sites & Deliveries by Effluent Ownership				
	Tucson Water Sites	Pima County Sites	Total Delivery Volume (acre-feet)	% of Deliveries
Golf Courses	17	1	9,237.20	58.8
Parks	46	8	2,428.70	15.5
Schools	62	0	1,134.30	7.2
Residential	710	0	424.1	2.7
Other Providers	1	0	1,803.30	11.4
Other	102	2	673	4.2
TOTAL	938	11	15,700.60	

Since 2006, four golf courses have been added to the reclaimed water system. The City of Tucson is contractually obligated to serve an additional nine holes at the Dove Mountain golf course if construction is started by July 1, 2010. The City also has an agreement with the University of Arizona to work with them in planning reclaimed water service for a proposed executive golf course as part of their Science and technology Park.

Financing of the City of Tucson Reclaimed Water System

Since its inception, the reclaimed water system has been developed and expanded based on large volume water users’ willingness to use reclaimed water and to pay at least a portion of the cost of expanding the system. To date, these large volume water users have been golf courses, but in the future could be parks, cemeteries, schools, or industrial sites. Golf courses have provided a number of the “anchors” in today’s system:

- Northeast anchor - La Paloma (1984)
- Far northeast anchor - Arizona National (2000)

- Northwest anchors - Dove Mountain, Heritage Highlands, etc. (1999)
- East anchor - 49er's (2006)

As the routes for the pipes to large customers were being laid out, efforts were made to have them pass close to as many of the smaller potential customers, like parks and schools, as possible. Both the reclaimed system and the smaller customers benefited from this strategy because without it, the cost of extending a reclaimed main to a school would have been prohibitive.

In terms of pricing reclaimed water, the following guiding principals are used by Tucson Water:

- reclaimed water has more limited uses than potable water, so should be priced lower,
- pricing incentives are needed to encourage the replacement of potable use with reclaimed use, especially when considering that customers switching to reclaimed must pay on-site conversion costs as well as on-going maintenance costs,
- reclaimed use has benefits to the potable system and to Tucson Water ratepayers by displacing potable use, resulting in reduced potable system costs, and therefore some subsidy from potable ratepayers is warranted.

Both the operating and capital aspects of the reclaimed system are financed with a combination of recurring revenues from reclaimed customers, revenue bonds, and a potable water system subsidy. In the past three years, recurring revenues have covered 23 - 43 percent of the system's expenses, revenue bonds have financed 56 - 77 percent of expenses, and the potable system subsidy has ranged from 5 - 15 percent. To put the potable system subsidy in context, under the FY 2009 rate schedule with a 5 percent subsidy, the "average" Tucson Water single family customer using 12 ccf per month pays \$0.12 per month in support of the reclaimed system.

Reclaimed rates compared to other water rates are best illustrated using an example. A golf course that utilizes 640 acre-feet/year would pay \$619,000/year to purchase potable water from Tucson Water, \$445,000/year for reclaimed water and \$64,000-\$128,000/year to pump groundwater. As you can see, there is a price incentive for a golf course that receives potable water from Tucson Water to switch to reclaimed water, but not for golf courses that pump groundwater.

Planned Improvements to the Reclaimed Water System

Tucson Water's major projects in the short term capital improvement program (Fiscal Year 2008-2010) for the reclaimed water system are described below. Projects marked with an asterisk* will also provide additional system capacity to accommodate new customers. See Map #2 attached.

*Booster Pumping Capacity (\$3.5 million)

The existing booster pumping capacity of about 33 mgd is now maximized, and the addition of new customers to the reclaimed system has necessitated a booster pumping capacity increase and associated recovery increase. This project also includes maximizing disinfection facilities.

Booster Pumping Capacity: Construction is presently underway to increase booster pumping capacity up to about 38 mgd. The new booster pumps are being constructed to the south of the existing reservoir.

Recovery Capacity: In addition to increasing the booster pumping capacity, recovery capacity must also be increased to match the booster capacity. Well EW-008 was drilled in 2008, and is awaiting outfitting. The design is virtually completed for outfitting this well, and providing for a pipeline to bring that recovered water to the existing reservoir. Construction is expected to commence after completion of cultural resources work.

*Recharge Basin Capacity (\$1.2 million)

Significant testing of recharge capabilities indicated that the existing recharge capabilities could be significantly enhanced by some relatively minor modifications, including increasing berm height, enhancing flow control to the basins, and providing for the capability to operate some of the basins independently from others. These modifications are presently under construction.

Sweetwater Wetlands Improvements (\$360,000)

Prior to, and for a couple of years following 9/11, mosquito populations in the wetlands area were controlled by distributing larvicide's to central areas of the wetlands, via a remote controlled payload helicopter. After 9/11 those helicopters were identified as a possible terrorist tool, and were recalled by the Country that produced them. As a result of that recall it was no longer possible to distribute the larvicide's to remote areas of the wetlands, and another means of mosquito control was necessary.

The new means of control is to provide more open water areas in the center of the wetlands. This open water area will allow the existing fish population to control mosquito larva in the central areas of the wetlands, and larvicide's can still be distributed (via vehicle mount unit) along the edges of the wetlands, for overall wetlands mosquito control.

In the winter of 2008 the western portion of the wetlands was partially lined to provide for more open areas and mosquito control. This open area has provided for the added benefit of more viewing opportunities for wetlands visitors, as well as more habitat for wading birds.

Lining of the eastern portion of the wetlands is presently under construction.

In addition to wetlands lining, enhanced flow control will be provided for backwash flows into the settling basins. This will help equalize flows, and minimize the possibility of overflow of the settling basins.

Backwash Improvements (\$136,000)

A design project is presently underway to enhance flows to the wetlands, provide for better mixing in the backwash tank, and minimize the possibility of overflow of the backwash tank. This project will replace existing pumps with pumps suitable for solids handling and better flow control. It will also enhance mixing in the backwash tank to minimize solids settling in that tank. In addition, enhanced controls will replace old air operated controls to provide more reliable system operation, and prevent false readings.

Capital improvement projects planned beyond Fiscal Year 2011 are described below.

*Additional Recharge Basins and Recovery Wells (\$9.5 million)

Recharge Basins 9, 10 and 11 have been designed, and will be constructed in 2012/2013, along with recovery wells EW-009 and EW-010. These facilities must be in full operation by 2014 in order to meet the anticipated reclaimed system demand. Failure to meet this deadline will likely mean that the reclaimed system will not be able to meet its customers reclaimed needs.

Cooperative Reclaimed System Projects in Conjunction with the County's ROMP program (\$18.6 million)

The Pima County Regional Optimization Master Plan (ROMP) program is being driven by regulatory requirements, and must be in place by January 2014 for the Ina Road Water Reclamation Facility

(WRF), and January 2015 for the New Water Reclamation Campus (WRC). This program will result in significant wastewater treatment system modifications, including:

- A Plant Interconnect to move wastewater flows from the existing Roger Road WRF (and the new WRC) to the Ina Road WRF
- Treatment process upgrade and Increase of capacity at the Ina Road WRF to 50 MGD
- Consolidation of biosolids processing at the Ina Road WRF and
- A new 32 million gallons per day (MGD) Water Reclamation Campus north of the existing Roger Road WRF.

In conjunction with these improvements, Tucson Water will be redesigning the reclaimed facilities and internal distribution systems, including:

- Some moderate re-design of recharge basins 9, 10 and 11
- Design and installation of a Capture Point at the Ina Rd. WRF
- Design and installation of a new Capture Point at the County's new Water Reclamation Campus

Moderate Re-Design at Recharge Basins 9/10/11: An agreement with the County to allow the County's plant interconnect to cross the reclaimed plant area, will move recharge basins 9/10/11 about fifty feet to the west. As a result some design modifications of these basins will be required, along with additional cultural resources work. That additional work is expected to begin in 2010, to ensure their completion for construction of those basins in 2012/2013.

Capture Point at the Ina Road WRF: The County will move wastewater away from the Roger Road WWTP to the Ina Road WRF. This effectively moves part of the secondary effluent needed in the reclaimed system, away from the reclaimed plant. As a result, Tucson Water will need to capture that water at the Ina Road WRF, and move it back to the reclaimed plant, for treatment and distribution. The capture point for this work will be constructed along with County improvements, in 2012-2014. This capture point will be used for a pipeline construction expected in 2015/2016.

Capture Point at the New Water Reclamation Campus: The County will replace the existing Roger Road WRF with a new Water Campus. The new facility will be capable of a maximum of 32 MGD flow, while the old facility is capable of 41 MGD. This will result in a significant reduction in the quantity of flow available to Tucson Water at the existing reclaimed plant. A new Tucson Water capture point will need to be constructed along with the County improvements, in 2013-2015.

Additional Source Water from Ina Road. WRF: A reclaimed plant interconnect may be built from the Ina Road WRF to the City's reclaimed facilities near Roger Road. This water would be used to supplement flows at the reclaimed plant, as well as to provide for full use of the City's reclaimed source. To meet the community needs, the new pipeline and pumping facilities may be required to be in place by 2017.

3. Analysis of Reclaimed System Expansion Opportunities & Constraints

The Tucson Water reclaimed system that has been constructed over the past 25 years is extensive in nature and most of the customers for whom there is an economic incentive to convert to reclaimed water have been connected to the system. The system currently utilizes 42 percent of Tucson Water's effluent allocation and 27 percent of Pima County's allocation.

There is room for expansion of the reclaimed system, but it is limited. As noted earlier in this report, there are other valued uses for effluent besides use in the reclaimed system (environmental and

aquifer augmentation purposes) and these should be maintained. It is also costly to extend reclaimed infrastructure and it does not make financial sense to extend the reclaimed system to all potential sites.

Resource efficiency should be the primary value driving reclaimed expansion considerations. Alternatives to the use of reclaimed water that provide more resource-efficient and localized solutions to decreasing the use of potable water or groundwater should be considered first.

Another consideration is community benefit. Turf recreational areas and multiple benefit projects that are open to the public should be prioritized for use of reclaimed.

Opportunities to Expand the Use of Reclaimed Water

There are a variety of ways to identify and prioritize potential customers that could be added to the reclaimed water system. Tucson Water has conducted several studies over the years to identify potential customers. The information below describes the universe of potential customers that could be added to the reclaimed system and different ways of identifying and prioritizing potential customers.

Golf Courses

There are a total of 39 golf courses in Eastern Pima County, 23 of which are within the exiting service area of the Tucson Water potable system. Of those 23 within the Tucson Water service area, 18 of are on the reclaimed system, one is using potable water from Tucson Water (Tucson Estates) and four are pumping their own groundwater (Quail Canyon, The Pines, El Dorado, and Rolling Hills). See Map #3 attached. As large turf areas with high water usage, and an ability to pay, golf courses are good potential candidates for expansion of the reclaimed system, however cost to extend reclaimed mains and price incentives for those pumping groundwater are barriers.

High Water Use Infill Customers

In 1999, Tucson Water completed a Reclaimed Water Master Plan that looked at potential reclaimed customers with high water usage (see table below and Map # 4 attached). It grouped potential customers into clusters by geographic location and used a set of criteria to prioritize the clusters. A capital improvement program to construct transmission mains to the clusters was developed. This program did not include funding for extensions of the transmission mains to the individual sites within

the clusters or funding for the onsite work that would be required prior to conversions. When the Mayor and Council adopted the Master Plan in 1999, they directed staff to proceed with

Potential Reclaimed Water Customers by Irrigation Water Source				
Current or Planned Irrigation Water Source	Number of Existing Sites	Volume for Existing Sites (ac-ft/yr)	Number of Future Sites	Volume for Future Sites (ac-ft/yr)
Tucson Water Potable	1,271	7,446	9	1,028
Other Water Companies	123	2,969	17	6,458
Private Wells	53	13,941	0	0
Secondary Effluent	2*	1,112	0	0
Total	1,449	25,468	26	7,486

Source: Malcolm Pirnie Report 1999

* Arthur Pack Golf Course has been converted to reclaimed water

projects to construct transmission mains to the top five clusters. A new Mayor and Council were elected soon thereafter and before any of these transmission mains were constructed, they directed a

change in focus to convert groundwater users and new golf courses in the northwest. Therefore, most of the new customers identified in this study have not yet been joined to the system.

Groundwater Users

In 2000, an update to the 1999 study was done focusing on potential customers that currently use groundwater. This study looked at the types of uses shown on the table below that were using groundwater and developed cost estimates for making reclaimed water available to them. Discussions with each of these facilities indicated that unless the cost of reclaimed water were the same as or less than their cost to pump groundwater, they would not convert. Since the report was completed, the County's Arthur Pack (Crooked Tree) Golf Courses has been converted to reclaimed water. An updated map of potential groundwater customers is attached (Map # 5).

Potential Reclaimed Water Customers Currently Using Groundwater

	Number	Annual Irrigation Rate (ac-ft)
Cemeteries	3	550
Golf Courses	5	2,039.7
Hospitals	3	123
Industry	2	1,320.0
Sand & Gravel	9	3,497.0
Schools	7	713.0
TOTAL	29	8,242.7

Source: Malcolm Pirnie Report 2000

County Parks

Pima County has identified 21 County-owned parks (totally approximately 637 acre-feet of water use per year) shown in Map #6 attached that they felt would be good candidates for reclaimed water main extension. Park sites selected are in close proximity to the existing Tucson Water reclaimed lines or proposed future lines and either have turf areas or used a substantial amount of water. Consideration was also given to sites that were near schools or near other County parks that could also be connected to the reclaimed water system in the future.

New Development

New development presents an excellent opportunity to expand the reclaimed system because reclaimed infrastructure can be incorporated as part of new construction rather than being retrofitted into an existing built-out area. Pima County's Golf Course Ordinance requires new development to extend reclaim water lines and utilize reclaimed water, but otherwise the extension of reclaimed service is not regularly considered by the City or County in the development review process. New development that is located in close proximity to the existing reclaimed system or with wastewater treatment facilities nearby should be prioritized for use of reclaimed. Large planning areas, such as in the Southeast and Southwest portions of the metropolitan area present an opportunity for extension of reclaimed water service. In some cases, effluent from outlying WRFs may provide the most cost-effective way to deliver reclaimed water to new areas.

General Obligation Bond Funding

There are many potential customers for reclaimed that don't have the funding to extend the system to their site (e.g. environmental restoration areas, schools, parks). It can be argued that adding these types of customers to the system and thus increasing use of reclaimed water over potable or

groundwater is a public benefit to the entire community, not just those who use the reclaimed water. Therefore, funding these extensions through a County-wide tax measure such as General Obligation bonds may make sense.

As part of a comprehensive bond program, Pima County is proposing to fund various extensions of Tucson Water's reclaimed water system with general obligation bonds, which would require voter approval at a bond election, and would be paid back through a secondary property tax levied county-wide. These extensions would primarily serve public parks and restoration projects, but could also help join other customers along the new lines to the system.

The Pima County wheeling rate for reclaimed water from the Randolph facility is substantially less than the cost of full price reclaimed water. Under the 2003 Wheeling IGA, the County gets access to the Tucson Water Reclaimed Distribution System pipelines for Tucson Waters pipeline distribution O&M costs, but does not pay for Pipeline Capital Repayment, Treatment Capital Repayment or Treatment O&M. Thus, the current wheeling rate is \$96 per acre-foot, compared to the standard reclaimed rate of \$697 per acre-foot. If Pima County were to need more water than could be supplied by the Randolph facility, or if the County were to use Conservation Effluent Pool water for a particular facility, that water would be available at the rate of \$315 per acre foot.

If the County were to use General Obligation bonds to pay for reclaimed system extensions to public facilities or other facilities eligible for either rate, the water to serve those facilities would be available at a substantial price savings, and the costs of constructing those pipelines would not be added to the total reclaimed system costs. Therefore, the substantial benefit of using General Obligations to fund extensions to Pima County Parks and other public projects is the due to access to the "wheeling" and environmental rates. The benefits of General Obligation bond funding are less dramatic for private customers, because even if General Obligation bonds were to pay for new additions to the reclaimed system, there would remain an outstanding debt service obligation for existing reclaimed system treatment infrastructure. By comparison, both of the wheeling rates for Pima County customers are calculated with no debt service obligation.

Constraints to Expansion

Limited Supply of Effluent & Resource Efficiency Considerations

Effluent is a limited, albeit growing supply of water in the region and there are other uses for effluent besides its distribution through the reclaimed water system. As described in the first section of this report, effluent is needed for environmental restoration and enhancement purposes and for aquifer augmentation. These are both considered valuable uses that should continue. Other technical papers being developed as part of Phase 2 of the Study will look in more depth at these other uses for effluent and will help inform a broader perspective on total effluent utilization.

Use of reclaimed water should be considered within the context of the community's overall water resource portfolio with the goal being to match up the most effective water resource with a particular site and its needs. Reclaimed water may not always be the most appropriate or most resource-efficient option. Localized alternatives to reclaimed such as small and large scale rainwater and stormwater harvesting, condensate harvesting, and greywater plumbing systems can be less expensive alternatives to extending the reclaimed system when construction, maintenance, energy and delivery costs are considered. In some cases, ground water pumping or the use of potable water may be the most appropriate resource for a particular site. In many cases, a combination of sources can and should be used.

The City is currently using approximately 13,000 acre-feet/year (or 42 percent) of its effluent allocation in the reclaimed system. The County is using approximately 1,000 acre-feet/year (or 27 percent) of its effluent allocation in the reclaimed system. To put these numbers in a context of customer usage, a new golf course uses approximately 600 acre-feet of water per year and a park uses approximately 20 acre-feet/year.

As part of its Water Plan 2050, Tucson Water has established a goal of expanding the amount of its effluent allocation dedicated to reclaimed by 10 percent over the next 10 years. As part of its Sustainability Action Plan, the County has established a goal of doubling the number of County parks using reclaimed water. Currently the County uses 285 acre-feet of reclaimed water for parks. Doubling this would translate to a 25 percent increase in its effluent allocation dedicated to reclaimed. A 10 percent expansion goal for the City and 25 percent goal for the County are considered reasonable targets in the short term to provide parameters for prioritizing customers while still maintaining other uses of effluent for environmental purposes and aquifer augmentation.

Price Incentive

One of the barriers to expansion of the reclaimed system is that many potential customers do not have a financial incentive to do so. The most significant cost component of reclaimed water is the capital investment to construct the distribution system. Because Tucson Water finances this investment with revenue bonds, the rates charged for reclaimed water must recover the cost of infrastructure construction, minus a subsidy paid for by Tucson Water customers.

This approach has worked well in extending the system to customers with high water use and a revenue source, such as golf courses. For private customers that have the ability to pay, this financing system makes sense and should continue.

For customers with groundwater pumping rights, the cost to pump groundwater is considerably less than purchasing reclaimed water. Groundwater costs are typically \$100-\$200/acre-foot to pump whereas the reclaimed rate for a typical customer is approximately \$700/acre-foot. Joining the reclaimed system also typically includes making on-site improvements, which add to the price disincentive.

Capacity Issues

There are three major components to consider regarding overall capacity of the reclaimed system: supply, treatment and distribution. Supply involves the volumes and times of the day/year that effluent can be captured at the Roger Road Wastewater Treatment Plant. Currently sufficient volumes of effluent are available for the Tucson Water Reclaimed Treatment Plant and the Sweetwater Recharge Facilities to treat, store and deliver the customer demands through the year. With the construction of the Plant Interconnect connecting the Roger Road and Ina Road wastewater plants, there may be a decrease in the overall volume of water available to capture for use in the reclaimed system. Construction of additional recharge capacity is expected to provide the necessary storage and recovery capacity to meet current and some known future demands on the reclaimed system.

The quality of effluent is critical to both supply and treatment issues of system capacity. Tucson Water's long-term goal, as part of the ROMP program is to permit the reclaimed system to A+ water or equivalent which will expand reclaimed uses and has regulatory compliance benefits.

During peak demand months of the year, the reclaimed system currently is operating at its distribution system capacity. As an example, the 24-inch reclaimed distribution main that supplies Dove Mountain and Oro Valley demands is at maximum capacity today. No additional demands can be put on that

line for approximately six to eight months of the year. During the winter rainy season, demands are typically low and there is available capacity for future unknown demands. Without significant expansion of the existing distribution system there is insufficient capacity during high demand periods to provide for future extensions of the reclaimed system beyond its current configuration.

Institutional Constraints

The City of Tucson operates the water utility, the County operates the wastewater system, and the City operates the reclaimed water system. According to the WaterReuse National Reclaimed Water Database, there are many different institutional arrangements in the United States for the ownership/operation of reclaimed water systems. These arrangements, like ours, reflect the unique circumstances of each community with no single arrangement being right for every locale. Even given this, it is still important to recognize that with two governments, many departments, and varying effluent entitlements, maximizing the use of reclaimed water becomes a complex endeavor and cooperation and coordination is critical.

ADEQ & ADWR Regulations

Modifications to state regulations regarding reclaimed water would make it possible to use reclaimed water for more projects by providing flexibility and incentives. Areas that could be addressed include:

- Alternative operational and permitting strategies to achieve a Class A+ or equivalent rated reclaimed system

Class A water is distinguished from Class A+ water by the total nitrogen concentration. Class A water may be high in nitrogen, but Class A+ water must have a total nitrogen concentration at or below the drinking water standard of 10 mg/l. Currently, Tucson Water's reclaimed water quality matches Class A+ standards during parts of the year but not all of the time. The Utility's long-term goal is to operate the reclaimed water system as a Class A+ facility, which expands the options for reuse and has the following regulatory compliance benefits:

- Allows unrestricted application rates for irrigation uses,
- Eliminates liner requirement for lakes, ponds, and storage impoundments, and
- Simplifies annual reporting so that volumes, uses, and acreage for each end user need not be tracked by the Utility.

Also, switching to A+ reclaimed water would lift the Consent Order requirements and allow Tucson Water to handle system releases and other compliance issues without a heightened alert status for each occurrence.

It is expected that the treatment processes to be constructed under the ROMP program will produce, without filtration, reclaimed water that meets Class A+ quality except during storm events. During those brief periods of increased inflow, the turbidity level in the effluent may rise above the Class A+ reclaimed water quality standard of 2.0 NTU as a 24-hour average. Permitting to A+ may be achievable without additional filtration using ADEQ's rule provision A.A.C. R18-11-103(C) allowing the use of alternative treatment methods. Joint discussions with ADEQ will be necessary to clarify these permitting requirements. Pima County will continue to be responsible for permitting its facilities to B+ and Tucson Water will be responsible for permitting to A+.

- Alternative permitting requirements for riparian restoration projects

Surface water discharges must meet Arizona's Surface Water Quality Standards. ADEQ requires reclaimed water used in a stream ecosystem restoration project to meet water quality standards for an effluent-dependent aquatic habitat. This approach imposes strict standards that require Whole

Effluent Toxicity Testing (WETT) and de-chlorination of reclaimed water prior to discharge. Monitoring for WETT regulates the acute and chronic impact of a discharge on aquatic organisms with the intention of protecting fish and other aquatic wildlife. Reclaimed water must be dechlorinated to meet the residual chlorine acute aquatic and wildlife standard of 11 ug/l, and chlorine is typically removed by adding another chemical, sodium bisulfite, to the reclaimed water.

WETT and dechlorination are appropriate for streams like the Santa Cruz River where perennial flow occurs and aquatic wildlife are present. However, these regulatory requirements have been a barrier to riparian restoration taking place in areas such as Tucson's Atterbury Wash. Many ecosystem restoration projects focus on ephemeral stream habitat development and enhancing terrestrial species without creating aquatic environments. WETT and dechlorination requirements result in many of these projects becoming infeasible.. One way to encourage riparian enhancement would be for ADEQ to establish in its Surface Water Quality Standards rule a new designated use for "Ecosystem Restoration." This step would set new water quality standards that facilitate using effluent for this purpose and that reflect realistic terrestrial biologic impacts, considering our arid western setting. Alternatively, ADEQ could revise the Surface Water Quality Standards rule to allow more flexibility in their Net Ecological Benefit (NEB) determination for riparian restoration projects, entertain the use of site specific standards (as was done to accommodate the Yuma East Wetlands project), or allow variances.

- Use of groundwater savings facility credits to attract new reclaimed customers

ADWR is responsible for the groundwater savings programs in which approved facilities may replace groundwater use with reclaimed water use on a one-for-one basis. For each acre-foot of groundwater that is replaced with reclaimed water, a stored water credit is earned by the provider of the reclaimed water. This credit can be used to pump groundwater in the future and has a value that can be used towards offsetting the increased price of reclaimed water compared to groundwater. Groundwater savings programs could be a valuable tool in getting groundwater users to convert to reclaimed water; however, ADWR's position has been that groundwater users that have reclaimed water service readily available to them are not eligible.

4. Recommendations to Maximize the Use of Reclaimed Water

1. Prioritizing Reclaimed Customers

The City and County should seek to increase the amount of their effluent allocations used in the reclaimed system by approximately 10 percent (or 1,300 acre-feet) and 25 percent (or 270 acre-feet) respectively over the next 10 years. These targets are based on work done for the Tucson Water 2050 Plan and the Pima County Sustainability Action Plan and provide a framework for customer prioritization in the near-term. With these targets in mind, the City and County should work together to identify, prioritize, and pursue additional reclaimed customers based on the following criteria:

- Proximity to existing reclaimed infrastructure
- Cost to join to the system
- Energy, operating, and maintenance costs
- Potable and groundwater savings
- Opportunity to mitigate environmental impacts of existing groundwater pumping
- Turf areas that provide greatest public benefit
- Availability of other water resource options

2. Overcoming Financial Barriers

The City and County should pursue the following approaches aimed at overcoming existing financial barriers to expanding the reclaimed system:

- Expand financing options to include the use of General Obligation bonds and other funding mechanisms that expand Tucson Water's ability to pay for extensions to the reclaimed system without relying solely on paying customers and revenue bonds.
- Maintain the current policy that private customers with a revenue source (e.g. golf courses, industrial) who can pay the full costs of reclaimed should pay, however explore options to encourage potential customers who currently have no financial incentive to join the system to join, such as phased-in rates and expanded potable water ratepayer subsidies.
- Work to lower the costs of operating the reclaimed system through efficiency improvements to the system.
- Incorporate the consideration and evaluation of the use of reclaimed water into the City and County development review processes (for both new growth areas and infill projects).

3. Overcoming Regulatory Barriers

The City and County should jointly advocate for policy and rule changes (through ADEQ and ADWR) to overcome regulatory barriers to maximizing the use of reclaimed water:

- Alternative operational and permitting strategies to achieve a Class A+ or equivalent rated reclaimed system
- Use of groundwater savings facility credits to attract new reclaimed customers
- Alternative permitting requirements for riparian restoration projects

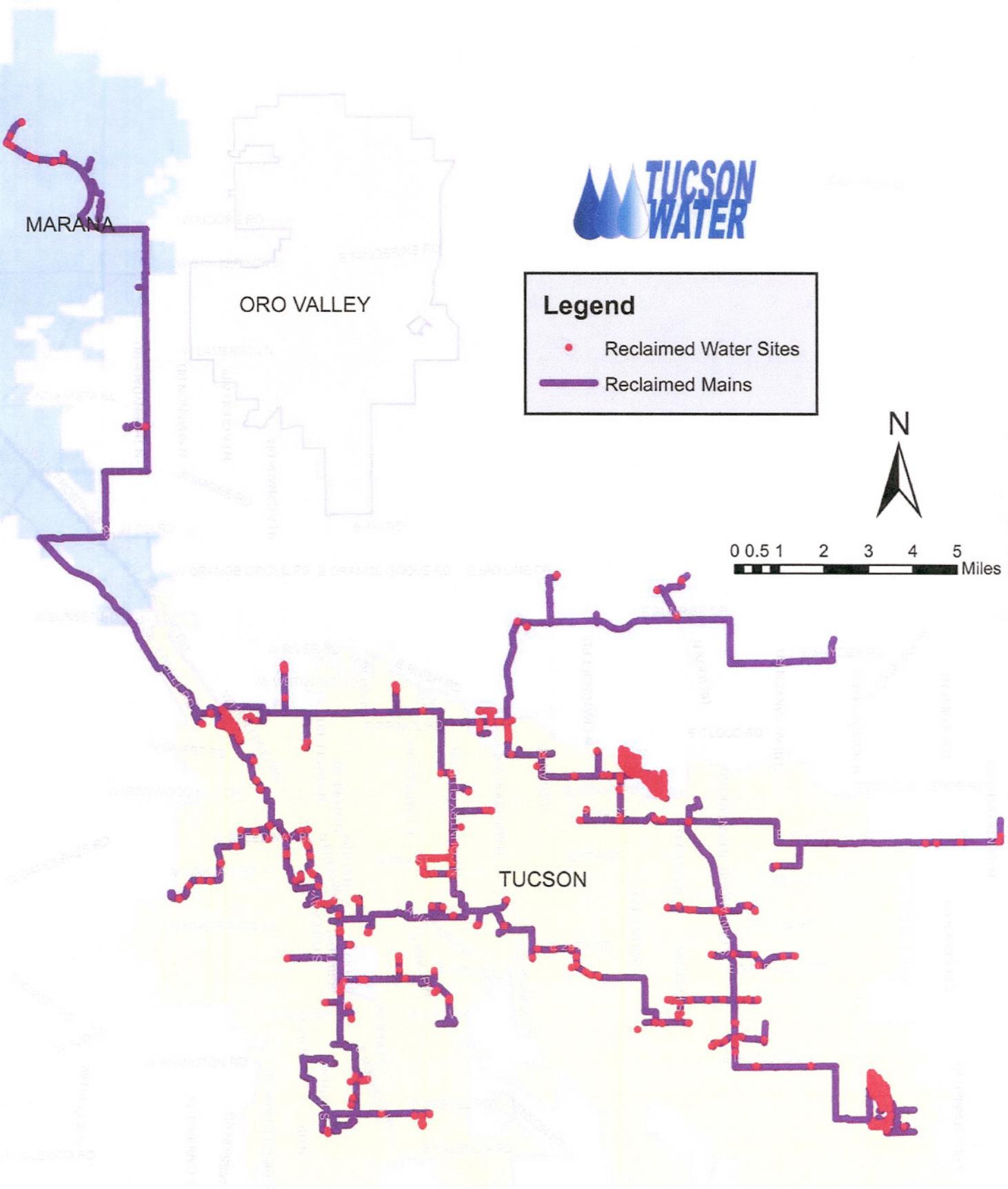
4. Multiple Benefit Public Projects

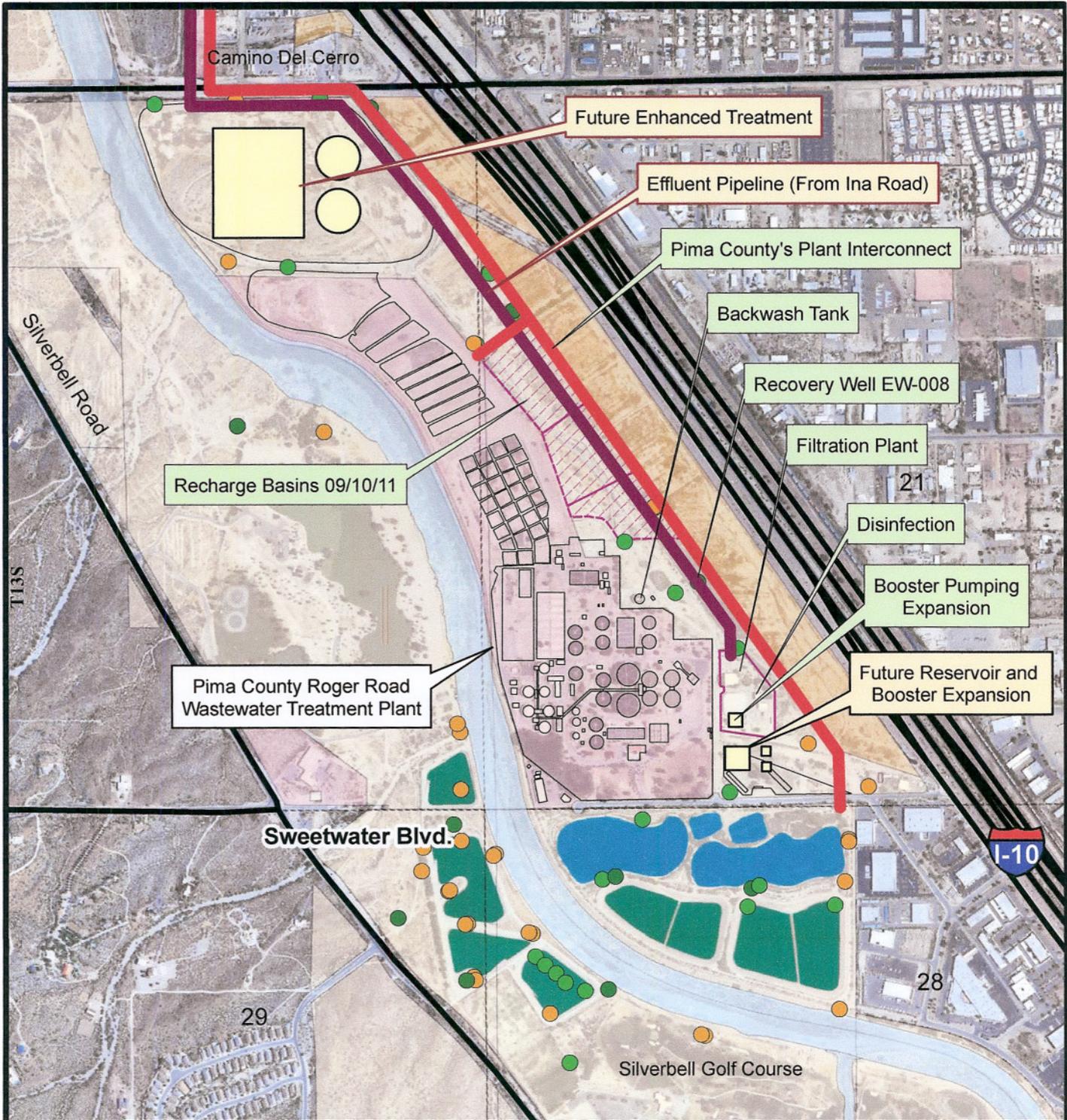
The City and County should pursue cost-effective, multiple-benefit public projects that utilize reclaimed water to accomplish goals such as aquifer augmentation, riparian restoration, wetlands, habitat protection, environmental enhancement, turf irrigation, and recreational opportunities.

5. Consider Use of Reclaimed Water within the Broader Context of Sustainability

- The City and County should maintain a balance of effluent use over time continuing to dedicate effluent to the reclaimed system, to environmental purposes, and to aquifer augmentation. Other technical papers in Phase 2 will address environmental needs for water and aquifer augmentation.
- The City and County should evaluate the use of reclaimed water for particular sites with the goal of maximizing the community's overall water resource portfolio. Reclaimed water may not always be the best option. The key is matching up the most effective and resource-efficient water source with a particular site and its needs.

Tucson Water Reclaimed Water Sites 2007





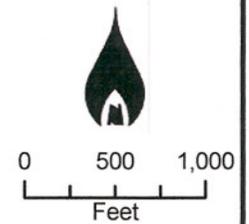
Legend

- City Property
- Pima County Property
- Arizona State Property
- Proposed Recharge Expansion Basins
- Sweetwater Wetlands

- Sweetwater Recharge Basins
- Major Roads
- Reclaimed Production Well
- Monitoring Well
- PIEZOMETER

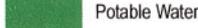
CIP Projects

- 2008-2011
Booster Pumping Expansion
- 2012-2018
Future Reservoir



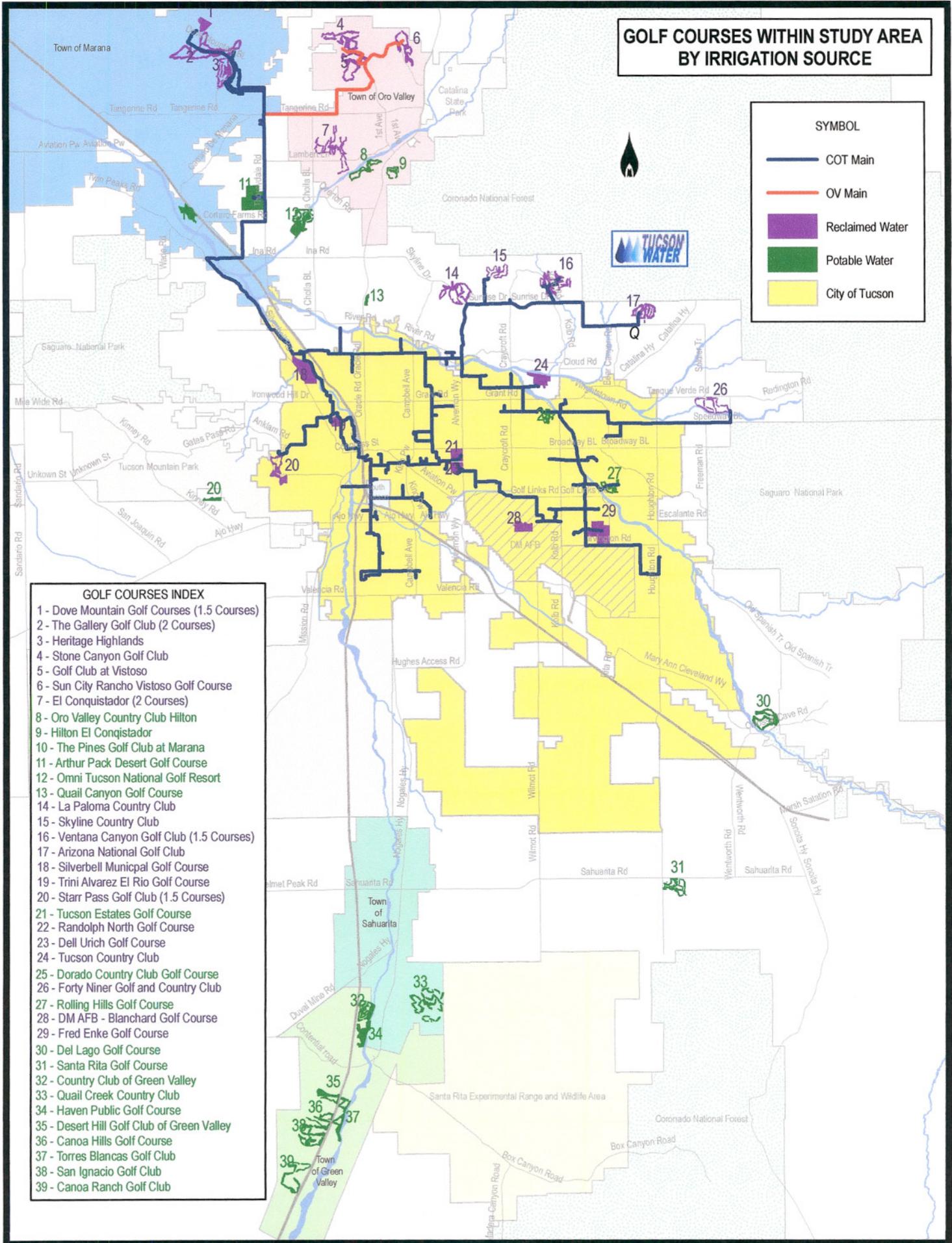
**GOLF COURSES WITHIN STUDY AREA
BY IRRIGATION SOURCE**

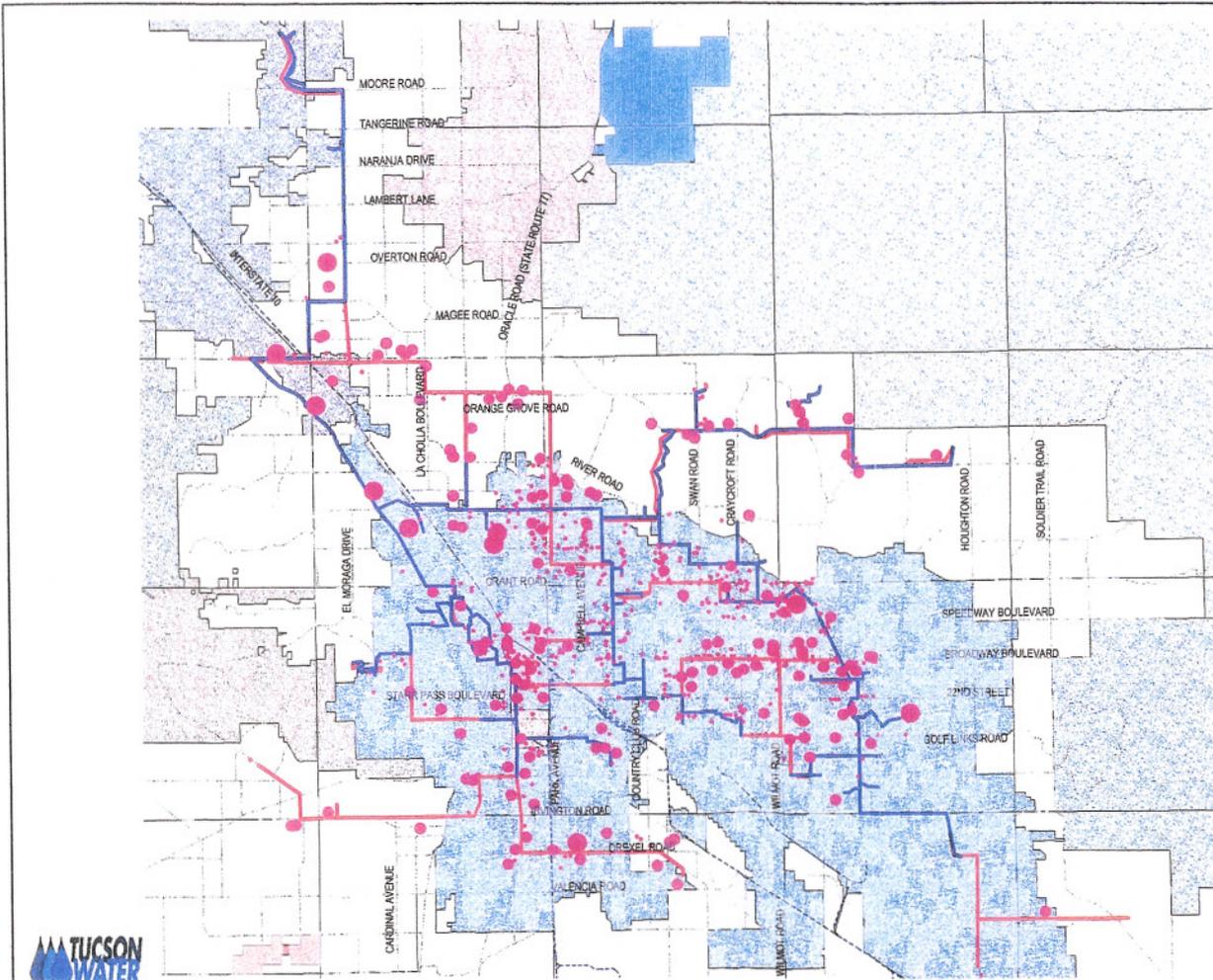
SYMBOL

-  COT Main
-  OV Main
-  Reclaimed Water
-  Potable Water
-  City of Tucson



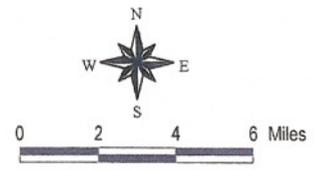
- GOLF COURSES INDEX**
- 1 - Dove Mountain Golf Courses (1.5 Courses)
 - 2 - The Gallery Golf Club (2 Courses)
 - 3 - Heritage Highlands
 - 4 - Stone Canyon Golf Club
 - 5 - Golf Club at Vistoso
 - 6 - Sun City Rancho Vistoso Golf Course
 - 7 - El Conquistador (2 Courses)
 - 8 - Oro Valley Country Club Hilton
 - 9 - Hilton El Conquistador
 - 10 - The Pines Golf Club at Marana
 - 11 - Arthur Pack Desert Golf Course
 - 12 - Omni Tucson National Golf Resort
 - 13 - Quail Canyon Golf Course
 - 14 - La Paloma Country Club
 - 15 - Skyline Country Club
 - 16 - Ventana Canyon Golf Club (1.5 Courses)
 - 17 - Arizona National Golf Club
 - 18 - Silverbell Municipal Golf Course
 - 19 - Trini Alvarez El Rio Golf Course
 - 20 - Starr Pass Golf Club (1.5 Courses)
 - 21 - Tucson Estates Golf Course
 - 22 - Randolph North Golf Course
 - 23 - Dell Ulrich Golf Course
 - 24 - Tucson Country Club
 - 25 - Dorado Country Club Golf Course
 - 26 - Forty Niner Golf and Country Club
 - 27 - Rolling Hills Golf Course
 - 28 - DM AFB - Blanchard Golf Course
 - 29 - Fred Enke Golf Course
 - 30 - Del Lago Golf Course
 - 31 - Santa Rita Golf Course
 - 32 - Country Club of Green Valley
 - 33 - Quail Creek Country Club
 - 34 - Haven Public Golf Course
 - 35 - Desert Hill Golf Club of Green Valley
 - 36 - Canoa Hills Golf Course
 - 37 - Torres Blancas Golf Club
 - 38 - San Ignacio Golf Club
 - 39 - Canoa Ranch Golf Club





EXPLANATION

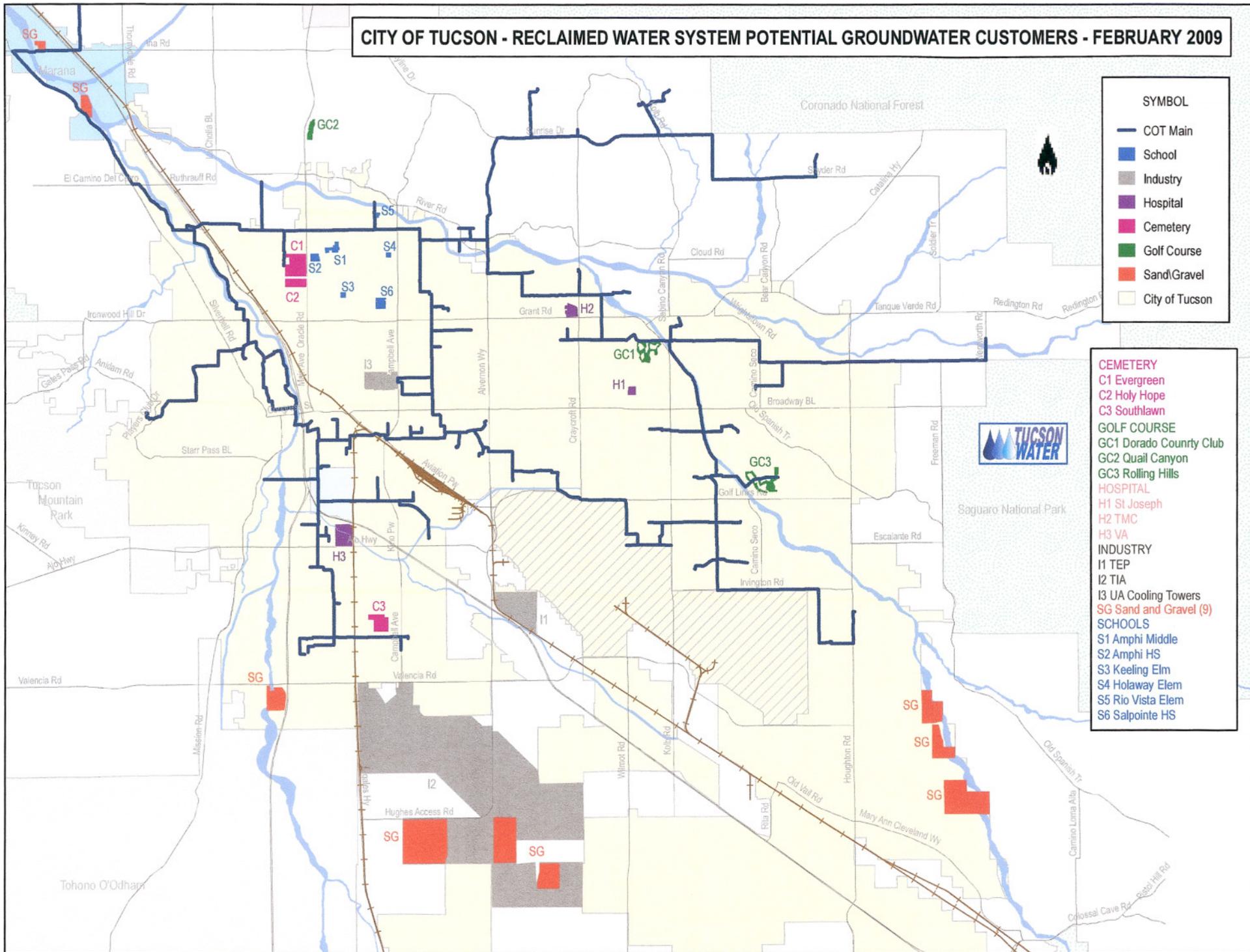
- Potential In-Fill Sites
- 0.1 - 10 af/year
 - 10 - 100 af/year
 - 100 - 560 af/year
- Existing Pipeline
- Proposed Pipeline (Alternative 5)
- Railroad
- Streets and Roadways
- CATALINA STATE PARK
 - CORONADO NATIONAL FOREST
 - MARANA
 - ORO VALLEY
 - PASCUA YAQUI INDIAN RES
 - SAGUARO NATIONAL PARK
 - SAN XAVIER INDIAN RES
 - SANTA RITA EXP RANGE
 - SOUTH TUCSON
 - TOHONO O'ODHAM NATION
 - TORTOLITA MT. PARK
 - TUCSON
 - TUCSON MT. PARK



TUCSON WATER
 RECLAIMED WATER SYSTEM MASTER PLAN
 IDENTIFICATION OF POTENTIAL IN-FILL CUSTOMERS

MALCOLM PIRNIE, INC.
 FIGURE 9-1

CITY OF TUCSON - RECLAIMED WATER SYSTEM POTENTIAL GROUNDWATER CUSTOMERS - FEBRUARY 2009



SYMBOL	
	COT Main
	School
	Industry
	Hospital
	Cemetery
	Golf Course
	Sand/Gravel
	City of Tucson

CEMETERY	
C1	Evergreen
C2	Holy Hope
C3	Southlawn
GOLF COURSE	
GC1	Dorado County Club
GC2	Quail Canyon
GC3	Rolling Hills
HOSPITAL	
H1	St Joseph
H2	TMC
H3	VA
INDUSTRY	
I1	TEP
I2	TIA
I3	UA Cooling Towers
SAND AND GRAVEL (9)	
SCHOOLS	
S1	Amphi Middle
S2	Amphi HS
S3	Keeling Elm
S4	Holaway Elem
S5	Rio Vista Elem
S6	Salpointe HS

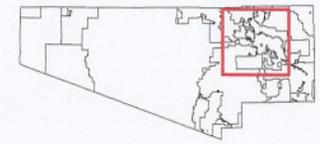


PROPOSED PIMA COUNTY PARKS RECLAIMED WATER CONNECTIONS

-  EXISTING RECLAIMED LINE
-  PROPOSED RECLAIMED LINE
-  PIMA COUNTY PARKS

- 1 - ARTHUR PACK REGIONAL PARK
- 2 - AUGIE ACUNA LOS NIÑOS NEIGHBORHOOD PARK
- 3 - BOSQUE DE LOS RIOS PARK
- 4 - CASAS ADOBES NEIGHBORHOOD PARK
- 5 - DAN FELIX RECREATION AREA
- 6 - DENNY DUNN NEIGHBORHOOD PARK
- 7 - EBONEE MARIE MOODY NEIGHBORHOOD PARK
- 8 - EMILY GRAY JUNIOR HIGH SCHOOL
- 9 - LAWRENCE DISTRICT PARK
- 10 - MANZANITA POOL PARK
- 11 - MEADOWBROOK NEIGHBORHOOD PARK
- 12 - MISSION RIDGE NEIGHBORHOOD PARK
- 13 - NORTHWEST YMCA PARK
- 14 - RICHARDSON NEIGHBORHOOD PARK
- 15 - ROY DRACHMAN AGUA CALIENTE REGIONAL PARK
- 16 - TED WALKER REGIONAL PARK
- 17 - THOMAS JAY LITTLETOWN REGIONAL PARK
- 18 - THREE POINTS VETERANS MEMORIAL PARK
- 19 - TUCSON MOUNTAIN PARK
- 20 - WILDWOOD NEIGHBORHOOD PARK

Pima County Index Map



Index Map Scale 1:1,500,000

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Scale 1:70,000



03/18/2009

MAP #6

