TOTAL WATER MANAGEMENT: RESOURCE CONSERVATION IN THE FACE OF POPULATION GROWTH AND WATER SCARCITY

INTEGRATED SYSTEMS, REGIONAL PLANNING, AND THE ECONOMICS OF WATER RECLAMATION AND BENEFICIAL REUSE

By Trevor Hill, Graham Symmonds, Wesley Smith, and Paul Walker

INTRODUCTION

Water management in Arizona and the arid southwestern United States is being influenced by two increasingly synchronous and alarming trends: explosive growth and water scarcity.

The intersection of these factors – a future certainty – will drive water policy to extreme measures. In the absence of action now, those measures will both arrive sooner and be significantly more expensive. Sustainability in the future will depend solely on what action is taken today to preserve and extend the region's limited and increasingly valuable water resources.

The State of Arizona is in the crosshairs of the collision between growth and supply. In the absence of action today, as a landlocked state, Arizona must rely on non-renewable groundwater supplies and limited surface water supplies in order to meet the needs of its current and future populations. Exacerbating the issue is the fact that the state is entering its 13th year of drought, whilst leading the nation in growth. Arizona must take the initiative now to establish regional conservation practices, develop and deploy regional infrastructure, and develop alternate water resources in order to meet the needs of today's – and tomorrow's – customers. In the absence of such planning, Arizona residents will be subjected to continuous scarcity concerns, and ultimately will face materially increased costs for an essential commodity.

With the uncertainty of surface water resources and dwindling groundwater aquifers, recycled water exists as the only water source experiencing an increase in availability.[1] While broad based water recycling programs have become sound public policy and have been widely adopted around the globe in regions facing water scarcity, the State of Arizona has taken relatively minor steps to promote this renewable resource.

[1] Under Arizona's Groundwater Management Act, there are three sources of water: Surface Water - from local rivers and lakes or Central Arizona Project Water ("CAP") from the canal system connected to the Colorado River and its reservoirs, Groundwater from underground aquifers, and Recycled Water, which the Act calls 'Reclaimed Water' - wastewater that has been highly treated and made safe for numerous non-potable uses. Global calls its "treated and reclaimed wastewater" "Recycled Water."

This paper discusses water scarcity and compares current policy in the State of Arizona with examples from other regions. It also identifies factors that hamper broad utilization of recycling and focuses on the drivers for alternate water sources in the State. Water recycling applications throughout the world are discussed, as are the benefits of direct reuse over recharge.[2] Finally, the paper evaluates and analyzes the economics of recycled water infrastructure deployment. In doing so it presents theoretical and empirical data supporting both the concept and reality of deploying and using recycled water to the greatest extent possible.

ADDRESSING SCARCITY – THE ROLE OF RECYCLED WATER

Despite being one of the driest states in the country, the impetus for full development of recycled water resources have not occurred in Arizona. By contrast, the State of California has been in the vanguard of water reclamation. California took the lead in advancing water recycling some years ago with the creation of Title 22, Division 4 in the California Code of Regulations. It was Title 22 that defined the standards for recycled water and allowed its use to irrigate food crops, parks and playgrounds, school yards, residential landscaping, and unrestricted access golf courses.

The California Constitution, Article X, Section 2 addresses water use by establishing a "beneficial use" policy:

> It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the *waste or unreasonable use* or unreasonable method of use of water be prevented, and that the conservation of such water is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare [emphasis added].

[2] The US Geological Survey defines recharge as "The process involved in the absorption and addition of water to the zone of saturation." Reuse is defined by the US Environmental Protection Agency as "The use of wastewater or reclaimed water."

California Water Code[3], Section 13500 further clarifies the State's water policy by directly supporting water recycling:

> The Legislature hereby finds and declares that *the use of potable domestic water for nonpotable uses,* including, but not limited to, cemeteries, golf courses, parks, highway landscaped areas, and industrial uses, *is a waste or an unreasonable use of the water* within the meaning of Section 2 of Article X of the California Constitution *if recycled water is available* [emphasis added].

In 2001, the California State Assembly established a mission to evaluate the water policy framework of the State and its ability to increase the use of recycled water.[4] The result was a June 2003 report titled "Water Recycling 2030 – Recommendations of California's Recycled Water Taskforce" that concluded "recycled water could free up enough fresh water to meet the household water demands of *30 to 50 percent* of the additional 17 million Californians"[5] expected to populate the State by 2030 [emphasis added].

Examples of water scarcity and the drastic impact that it has on society are dramatically evident in Australia. Prolonged drought has brought severe water shortages to this "First World" Nation. In Brisbane, Queensland, as water reserves dropped to under 20% capacity, the government imposed Level 5 water restrictions on April 10, 2007. In addition to mandatory bans on outdoor uses, residents are being asked to make significant indoor water use savings to lower residential use from 180 liters per person per day (47 gallons per person per day) to 140 liters per person per day (40 gallons per person per day).[6] Similar scenarios are found throughout Australia where recognition of the impending crisis has been accompanied by policy shifts towards maximizing of use of recycled water.

[3] California Law consists of the State Constitution, Statutes, and 29 Codes covering various subject areas, one of which is the Water Code
[4] Assembly Bill 331, Chapter 590, Statues of 2001
[5] "Water Recycling 2030 – Recommendations of California's Recycled Water Taskforce", June 2003
[6] "No Rain, No Water, Big Problem – Water reuse should ease water supply strain in Brisbane, Australia", Water Environment & Technology, August 2007, p 60-63

In Sydney, the Government of New South Wales has included in their 2006 Metropolitan Water Plan a fourfold increase in reuse to 70 billion liters per year (over 50 million gallons per day) by the year 2015.[7] In October of 2006, the New South Wales government cut agricultural irrigation from the River Murray by 20%, an additional 32% cut came weeks later, most recently, regional agriculture receives a zero allocation from the River.[8]

The Government of Western Australia initiated the development of a water plan in 2007, stating that "the State Government has given water and the management of water resources strategic priority. This will continue into the future given climate change and variability, resource scarcity and continued increases in demand."[9] Within the report, the Government announced plans to recycle 20% of its water by 2012 and 30% by 2030[10] when population is expected to increase by 40%. It is interesting to note that, also within the report under the heading "Priority Actions 2007-2011", the Government listed "Use and recycle water wisely" as number one.[11]

Whether by progressive thought or a crisis response to extreme scarcity, the water recycling programs in California and Australia serve as examples of sound water policy. Despite similarities in population growth and resource scarcity, the State of Arizona lags amazingly far behind. While political leaders and regulators have established lofty goals in other regions, Arizona remains passive in its approach to water recycling.

In the Arizona Drought Preparedness Plan, drafted in 2004 by the Governor's Drought Task Force, water recycling is barely mentioned:

> "Effluent, or treated wastewater, can be treated to a quality that can be used for purposes such as agricultural irrigation, turf grass watering, industrial

[7] "2006 Metropolitan Water Plan Executive Summary", NSW Government, April 2006.
[8] "A River Ran Through It", Claire Scoby, The Observer, August 5, 2007.
[9] "State Water Plan 2007 Summary", Government of Western Australia.
[10] Ibid
[11] Ibid

cooling, or maintenance of riparian areas. Effluent has the potential to replace a potable water supply when potable water quality is not necessary for the use."[12]

"Effluent has the potential to replace a potable water supply..." is a far cry from "the use of potable domestic water for non-potable uses...is a waste or an unreasonable use of the water... if recycled water is available" (California Code) or "30% recycled water by 2030" (Western Australia).

FACTORS HAMPERING BROAD UTILIZATION OF RECYCLED WATER

While the regulatory environment in Arizona has adopted stringent standards for Class A+ Reclaimed Water and provides the framework for reuse[13], water providers have not embraced this resource. There are three factors that hamper broad utilization of recycled water in the State:

- A lack of policy direction from elected officials and state agencies
- A lack of integrated service suppliers[14] which are capable of providing the service
- Need for regional planning: to address the economic reality that recycled water use can only be achieved on a regional scale

Policy

Given the critical nature of water scarcity in Arizona, the current regulatory framework for water conservation is surprisingly weak. Utilities have limited obligations to conserve and there are no requirements to use recycled water. With rapid growth, finite water resources, and the reality of sustained drought, the State must do more.

[12] "Arizona Drought Preparedness Plan – Background & Impact Assessment Section", Governor's Drought Task Force, October 8, 2004.
[13] Arizona Administrative Code (AAC) R18-11-303 defines Class A+ Reclaimed Water and references a number of approved uses including irrigation of food crops, recreational impoundments, residential landscape irrigation, school ground landscape irrigation, open access landscape irrigation, toilet and urinal flushing, fire protection systems, vehicle and equipment washing, and snowmaking.
[14] Integrated Service Suppliers are those defined as providing water, wastewater and recycled water services.

Recent initiatives by the Arizona Corporation Commission (ACC) indicate that some progress is being made. For example, in certain cases the ACC has banned the use of groundwater to serve golf courses and similar amenities. More importantly, the ACC has made conservation-focused rate designs a priority. The Arizona Department of Water Resources (ADWR) is currently developing “Best Management Practices” (BMP’s) for water conservation. While some of the draft BMP’s appear to be useful, recycled water is not even mentioned. Glossy brochures and “Water – Use It Wisely” advertisements will only go so far. Long term sustainability requires moving toward regional water reclamation and reuse.

Reliance on the individual consumer for conservation will not ultimately serve to address water scarcity in the State. While individual efforts are helpful on the margins, radical reduction in water use must be initiated by the Utility. It is the Utility that can impact the individual, and the Utility that should bear the burden of long-term resource management.

Integration

Integrated service suppliers provide both water and wastewater services within a region. In situations where an integrated supplier does not exist, opportunities to make use of recycled water are difficult. Obviously, it is the wastewater utility that collects wastewater, treats it to regulatory standards, and distributes recycled water – often to the economic detriment of the water utility.[15] In some cases, water utilities have litigated over the right to distribute recycled water claiming they have such a ‘right’[16],

[15] The use of recycled water in lieu of potable water means a diminished demand for the potable water produced by local water companies – reduced water sales diminish the water company’s revenues.
[16] See Arizona Water Co. v. City of Casa Grande, No. CV2000-022448 (Superior Court, Maricopa County), Minute Entry dated March 27, 2002. AWC claimed a 'right' to sell City effluent to the Reliant Power Plant. AWC lost and appealed. The Court of Appeals, in an unpublished opinion, upheld the ruling against AWC. Arizona Water Co. v. City of Casa Grande, No. 1 CA-CV 02-0671 and 1 CA-CV 02-0724 (Arizona Court of Appeals), Memorandum Opinion filed October 14, 2003. AWC also lost a related case in federal court. See Arizona Water Co. v. City of Casa Grande, 33 Fed. Appx. 309 (9th Cir 2002)(unpublished opinion).

despite not owning the resource. This litigation further stifles recycled water's potential application. When water and wastewater utilities are placed at odds, neither party advances the use of this valuable resource.

Reducing the volume of water for potable uses directly reduces the costs of treatment to meet the National Primary Drinking Water Standards (obviously, the fewer gallons delivered, the fewer gallons treated, and the lower the costs of treatment). Considering the ever tightening regulatory environment for safe drinking water, reducing the overall capacity requirement of treatment systems means fewer such systems are required, and those that are required, because they treat less water, have lower operating and maintenance costs. The result is a partial sheltering of the consumer from the adverse financial impacts meeting future regulatory requirements of the Safe Drinking Water Act. Saving $0.50 to $2.00 per thousand gallons[18] is a very significant benefit to the consumer, and these funds can then be used for financing large-scale water recycling initiatives.

In addition to the technical aspects of integration, there are policy and financial benefits from integration. A joint Swedish-Polish research study viewed integration of water, wastewater and waste handling as part of a "municipal ecology". The study points out that the advantages of integration include "combinations with the energy sector...improved technical functions, possibilities in a large organization to employ qualified staff, simplification of fee collection system, and less environmental emissions and resources depletion."[17]

Regional Planning

Integration of water and wastewater service providers is a key element of planning for

[17] Current operation and maintenance costs associated with Arsenic treatment within a regional system range from $0.50 to $2.00 per 1,000 gallons of treated water. Treatment costs are likely to increase as other regulated contaminants are identified and must be addressed in the future.
[18] Integration of Water and Sanitation – A Challenge to Reach Sustainability Goals, B. Hultman, E. Plaza and T. Stypka.

total water management. Large-scale planning allows for the realization of a more diverse customer spectrum for recycled water and ensures that the benefits of recycled water are felt regionally. One can imagine that a single development may choose to deploy a significant recycled water scheme to reduce groundwater use, only to have those savings squandered by a neighboring development built solely on the basis of groundwater.

The concepts of total water management - “highest and best use for recycled water” and “the right source for the right use” are pillars of the new paradigm in the water industry. These foundations cannot be constructed without integrated and regional planning. Ultimately, this will drive the deployment of dual water mains and maximize the use of recycled water regardless of scarcity. But in the face of scarcity, these tenets become paramount.

THE IMPETUS FOR ALTERNATIVE WATER SOURCES

There are certain realities that must be collectively addressed in order to ensure long term water sustainability in the State of Arizona and that must form the backbone of any sustainable water policy for the state:

- Growth will continue
- As growth continues, underground aquifers will ultimately reach a rate of withdrawal that will exceed rates of natural recharge
- Surface water in the region is over-allocated and has been impacted by sustained drought, legal disputes over available supplies, and environmental policies regarding required stream flows
- Treatment costs are soaring and are unquantifiable in the future
- Public opinion will evolve as resource availability scenarios change

Growth

Arizona and the southwestern United States continue to experience unprecedented growth. Climate, cost of living, economic opportunity, and other considerations draw hundreds of thousands of people to the region every year.[19] This influx of new residents has served to enhance the state's quality of life. Entrepreneurs bring new business and opportunities. Recreational and cultural activities continue to evolve and develop. The region has become more attractive as it grows. Despite the recent adjustments in the housing market, all economic indicators point to prolonged growth in the Arizona and the southwest United States. In fact, RL Brown in his July 28, 2007 publication The Phoenix Housing Market Letter states "the metro Phoenix new-housing market remains one of the best spots on the planet for new home builders, developers, and the trades."[20]

Limits on Groundwater Supplies (Aquifers)

The situation in Pinal County, Arizona serves to effectively illustrate the limits of groundwater and the impracticality of relying on it as a sole source to support growth. According to the U.S. Census Bureau, the County (located south of Maricopa County) has grown by 51% since the 2000 Census - largely as an exurb of Maricopa County. The aquifer in the Pinal Active Management Area (AMA) is naturally recharged at an average rate of 82,500 acre-feet a year.[21] This means that 82,500 acre-feet per year (the equivalent of roughly 26,883 million gallons) is available in perpetuity. Current regulation requires that each equivalent dwelling unit (EDU) be supported by a demonstrated perpetual availability of 0.5 acre-feet per year.[22] Calculations based on

[19] U.S. Census Bureau, 'Arizona's Maricopa Leads Counties in Population Growth Since Census 2000', http://www.census.gov/Press-Release/www/releases/archives/population/009756.html - which states, in part, "Maricopa County Arizona gained 696,000 residents between 2000 and 2006, the largest numerical increase of the nation's 3,141 counties…Arizona became the nation's fastest growing state between 2005 and 2006."
[20] "The Phoenix Housing Market Letter", RL Brown Housing Reports, Volume 272, July 28, 2007.
[21] Hydrologic studies completed in December 2004 as part of an evaluation of the Pinal AMA's groundwater budget determined that the AMA's renewable groundwater supplies total 82,500 acre feet on a long-term average annual basis.
[22] Arizona Department of Water Resources internal protocol.

this data indicate that 165,000 EDU's can be developed in the Pinal AMA given groundwater as the only water resource. Yet, entitlements currently within the County exceed 650,000 EDU's – a threefold discrepancy between water supplies and projected water demand.[23] It is a fact that conservation and alternatives to groundwater utilization will be required to support the anticipated growth.

Over-allocation of Surface Water

The Colorado River provides a large percentage of the southwestern United States with the necessary water resources to promote growth and opportunity. Great engineering accomplishments throughout the twentieth century have tamed the river and diverted its flows to the population centers of the region. Arizona's claim to Colorado River water emanates from the original 1922 Colorado River Compact, and the state's share of the river was determined by the U.S. Supreme Court in Arizona v. California, 376 U.S. 340 (1964) – however, recent studies have shown that the supply data the Court relied upon was from an abnormally high flow period – and the Colorado River's 16.5 million acre-feet per year allocation likely overstates its actual production, by two to five million acre-feet per year.[24] Flow measurements conducted from 1906 to 1995 recorded an average annual flow of 15.2 million acre-feet and recent studies indicate that average annual flow in the Colorado River Basin may be 13.5 million to 14.6 million acre-feet.[25]

[23] The Morrison Institute for Public Policy, in their July 2007 report "The Future at Pinal", identified 653,277 units, mostly single-family homes, that have been entitled on private land within Pinal County.
[24] See, e.g., Colorado River Basin Water Management, 'Evaluating and Adjusting to Hydroclimatic Variability', National Research Council of the National Academies, 2007; and 'The Tree-Ring Record of Severe Sustained Drought' by David Meko, Charles W. Stockton, and W.R. Boggess, published in American Water Resources Association's Water Resources Bulletin, Vol. 31, No. 5, October 1995; and 'Two Perspectives on Drought: Paleoclimate and Climate Change' as presented by Gregg M. Garfin for the University of Arizona at the New Mexico Rural Water Association Annual Conference, March 21, 2005.
[25] An original landmark Colorado River tree-ring-based reconstruction study was completed at the University of Arizona in 1976 and estimated a long-term average flow of 13.5 million acre-feet per year. A 2006 collaboration between the University of Arizona's Laboratory of Tree-Ring Research, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the University of Colorado estimates the average water flow at 14.6 million acre-feet per year.

Periodic droughts, extending over a number of years also impact the actual amount of surface water available. Prudent water management must take into account these emerging realities.

Cost of Treatment

The provision of potable water in Arizona is governed by AAC R18-4 *et seq* which embodies the requirements of the Safe Drinking Water Act into the Arizona regulatory environment. The United States Environmental Protection Agency (USEPA) is required by statute to maintain a Contaminant Candidate List (CCL) and evaluate a minimum of five contaminants on the CCL during each review period for possible regulation, based on the potential for human health impacts. Technology's ability to detect constituents down to part-per-trillion levels and the ever increasing scrutiny of the effect of the environment on human health demand that regulatory parameters become inevitably more stringent. Regardless of the identity of the next regulated contaminant, there can be no doubt that there will be a treatment requirement for all but the most pristine water sources.

Wise water resource management must account for both quality and quantity of the resource, yet also must take into account the cost to the consumer. By establishing dual water main systems – one potable and one non-potable – the costs of treatment can be dramatically reduced, and as water treatment is essentially a process of contaminant removal and concentration, the production of concentrated residuals can be significantly curtailed. In the case where dual water mains supply recycled water, a significant reduction in the overall potable water demand can be realized – reducing the volume of water required to be treated meet the National Primary Drinking Water standards.

Evolution of Public Opinion

As water becomes increasingly scarce, public perception of alternative water sources tends to shift, and changes in public perception enable modifications to water policy. Utilization of alternate water sources in the safest, most practical applications become the best available solutions. Throughout the world, public policy has evolved as the realities of scarcity begin to be addressed. Drastic turnabout in public opinion can be documented in communities where water resources became less abundant and alternative sources were required to maintain quality of life.

In Arizona, and throughout the southwestern United States, water utilities must make the investment in public education and community involvement to address the realities of growth and scarcity and foster support for inevitable changes in water policy. The communities examined later in this paper provide robust evidence of the evolution in public opinion and openness to water recycling.

WATER RECYCLING APPLICATIONS

The concept of water reclamation and recycling is not new. Indeed society has been recycling water in some form or another for hundreds of years – the most common approach has been to treat wastewater and return it to rivers, streams and washes. Global Water's utilization of highly treated recycled water in and around the City of Maricopa, is neither unique nor is it on the cutting edge of technology, but it does differ in that Global's recycled water is reused (for uses not requiring potable water) instead of being returned to rivers. The advances of the past 150 years in wastewater treatment have allowed the production of recycled water to be more consistent and achieved with a higher degree of reliability – Global Water's focus is to use that increased reliability and safety to increase the use of recycled water.

The WateReuse Association estimates there are 1,500 water reuse utilities throughout the United States delivering recycled water for a myriad of end uses, more than half of which were established in part due to water scarcity or preservation and protection of available resources. From the WateReuse Association's National Database of Water Reuse Facilities and other sources, a compendium of eleven water utilities in the United States and Australia has been developed and is included as **Appendix A**. These utilities are providing recycled water for a full spectrum of end uses.

Five of the reclamation applications are located in arid environments with limited availability of renewable water supplies and make use of dual distribution systems supplying homes and businesses for irrigation and toilet flushing, see Table 1.

Utility Name and Location	Year Implemented	Number of Current Connections
Irvine Ranch Water District, California	1967	3,812
El Dorado Irrigation District, California	1999	3,437
Tucson Water, Arizona	1984	900
Mawson Lakes, Australia	2005	4,300
Rouse Hill, Australia	1995	16,500

Table 1

Irvine Ranch Water District

Located in Orange County, California, the Irvine Ranch Water District (IRWD) services a 133 square mile area that includes the City of Irvine and portions of Costa Mesa, Lake Forest, Newport Beach, Orange, and Tustin. IRWD makes use of imported surface water to accommodate 35% of the service area's domestic supply.[26] The remaining 65% comes from local wells. IRWD currently makes use of reclaimed water to offset 20% of their total water needs. Situated in a semi-arid region with an annual rainfall of 12 to 13 inches, water scarcity issues initiated the water recycling program forty years ago. Design and construction of reclaimed water infrastructure was completed as the community developed. As agricultural fields converted to rooftops, businessmen and planners, along with the water supplier, made a sound decision to utilize recycled water within the community.

[26] According to the IRWD Fact Sheet, dated July 2005, approximately 35 percent of IRWD's drinking water is purchased from the Metropolitan Water District of Southern California. Imported water comes from the Colorado River via the Colorado River Aqueduct and from Northern California via the State Water Project.

IRWD operates under the philosophy that water is too valuable to be used just once. "Every gallon of recycled water used…means a gallon of drinking water that can be saved for potable uses. Recycled water…reduce[es] the need to import expensive water and help[s] to keep water rates low."[27] The primary recycled water uses include landscape irrigation for parks, school grounds, golf courses, freeway landscaping, and irrigation of common areas managed by homeowners associations (HOAs). A majority of residences in Irvine have front yards that are owned by the HOA's and are thus irrigated with recycled water.

Utilization of recycled water was expanded in 1990 when the District, with support of the State of California, developed a policy requiring all new buildings over fifty- five feet high to install a dual distribution system for flushing toilets and urinals in areas where reclaimed water is available. In 1991, IRWD became the first water district in the nation to obtain health department permits for the interior use of reclaimed water from a community system. Reclaimed water currently makes use of dual-plumbing for toilet flushing in IRWD's facilities as well as in several high rise office buildings constructed with dual piping systems. Potable water demands in these buildings have dropped by as much as 80% due to reclaimed water use.[28]

The IRWD recycled water program is supervised by the California Department of Health Service and the Orange County Health Agency and the IRWD works in conjunction with these agencies to protect the public health while making the best use of reclaimed water. IRWD has established procedural guidelines and general design requirements for recycled water facilities that include construction specifications regarding pipe spacing and identification, guidelines for use, backflow prevention, and cross connection testing.[29]

[27] Taken from the IRWD Fact Sheet, dated July 2005.
[28] The IRWD website (www.irdw.com) represents that "in a typical office setting, approximately 80 percent of the water is used for toilet flushing. By using reclaimed water instead of drinking water to flush toilets, major savings can be realized."
[29] "Procedural Guidelines and General Design Requirements", Irvine Ranch Water District, Revised April, 2005 indicates in Section 5.1 that "all on-site facilities using recycled water will have an annual cross connection test unless otherwise approved by the state and county health agencies based on a case by case basis."

El Dorado Irrigation District

The Serrano development, located in the Sierra foothills community of El Dorado Hills, California near Sacramento, is serviced by the El Dorado Irrigation District (EID). In 1999, EID obtained approval from the State of California[30] to use recycled water to irrigate the front and back yards of residential units constructed in Serrano. Prior to the implementation of residential use, the community made use of reclaimed water on its golf courses, parks and greenbelts and was recognized by the California WateReuse Association as the "Project of the Year" in 1998. With the application of advanced water reclamation, homes are equipped with dual plumbing (potable water for interior use and reclaimed water for landscape irrigation). The recycled water is delivered through a dedicated pressurized "purple pipe" system.[31] This system "puts Serrano in the forefront of the trend toward environmental sensitive development and greatly improves the community's ability to remain lush and green during normal drought cycles."[32] In 2005, Serrano received the National WateReuse Award of Merit, recognizing the community for its innovative and concerted efforts in using recycled water.

In managing the recycled system, EID has developed an extensive set of policies and procedures to best serve the public. EID has established guidelines for water reuse and has created design and construction standards for both non-residential sites and residential dual plumbed homes. The standards included backflow prevention, trench details, and information regarding automatic controllers for onsite irrigation. They also included material standards and requirements for identifying above ground infrastructure.

[30] The California Code of Regulations, Title 22, Chapter 3, Division 4 defines the standards for recycled water used for surface irrigation and allows for its use to irrigate food crops, parks and playgrounds, school yards, residential landscaping, unrestricted access golf courses, and any other irrigation use not prohibited by other sections of the Code.
[31] Plumbing codes require that pipes containing reclaimed water be purple to prevent accidental cross-connection with potable water systems.
[32] Taken from the Serrano website (www.serranoeldorado.com). It should be noted that the community uses water recycling and reuse as a market differentiator, promoting its sensitivity to environmental issues.

Inspection procedures are in place during installation and the system is checked periodically to ensure continued compliance with all regulatory agencies.[33] All designers and contractors working with dual-plumbed communities are required to attend an EID workshop explaining the uses and regulations of recycled water before any design or installation begins. Refresher training is conducted every eighteen months.

EID promotes a public education program to continually inform their customers about the value of recycled water and how it can be safely utilized to supplement the water inventory. Monthly recycled water workshops for homeowners and publications periodically address different reuse issues. EID advocates reuse not only as good public policy in times of population growth and resource scarcity, but promotes the fact that its dual-plumbed household customers use 20% less water than single-plumbed household customers.[34]

The success of advanced reclamation and dual-plumbing in Serrano has prompted the El Dorado Irrigation District to expand the program to all new communities within their service area that can feasibly connect to the backbone recycled water infrastructure. In addition to the 3,500 homes in Serrano, roughly 600 residences outside of the development make use of recycled water for front and back yard irrigation and another 1,400 are in development.

Tucson Water

Development in Tucson, Arizona historically relied on groundwater to meet its water supply needs. Over time, withdrawals from the regional aquifer system surpassed the

[33] "Recycled Water Use Guidelines for Residential Dual Plumbed Homes", El Dorado Irrigation District, June 2003, Section 2.2.C.

[34] Taken from the El Dorado Irrigation District brochure titled "This Community Uses Recycled Water for Landscape Irrigation."

natural recharge and caused groundwater levels to fall. Despite aggressive demand management programs and a populace with a strong environmental ethic, Tucson began to see the declining water levels resulting in measurable land subsidence, increases in pumping costs, and the gradual loss of riparian habitats.

In order to address these issues, the City of Tucson Water Department (Tucson Water) recognized that renewable water supplies, including recycled water would be needed to satisfy projected water demand.[35] Tucson Water constructed Arizona's first community reclaimed water system in the early 1980's consisting of one filtration plant, ten miles of pipeline, and two customers. In subsequent years, the system has grown to 160 miles of pipeline and delivers almost 13,000 acre-feet to more than 900 irrigation customers annually. Functions of the reclaimed water system are governed by an institutional framework of effluent entitlement[36] and use is regulated by the Arizona Department of Environmental Quality (ADEQ) and the Arizona Department of Water Resources (ADWR) through a series of permits. Current (2007) sources of reclaimed water are capable of supplying 15,750 acre-feet per year and are projected to increase by 22,250 acre-feet per year by 2015.[37]

Reclaimed Water System Design Standards have been developed by Tucson Water that address pipeline conveyances, private plumbing requirements, backflow prevention, on-site storage, water meters, utility separation, identification marking, and air gaps. Inspection protocols and procedures are established that include application for service and a formal user agreement, a backflow permit, site inspection, and dye testing[38] to ensure that there is no cross connection with the potable system.

[35] Tucson Water addressed renewable water supplies in their "Water Plan: 2000-2050" dated November 22, 2004 which was presented to the Mayor and Council of Tucson.
[36] Effluent ownership is governed by a series of inter-governmental agreements (IGA's). The basic framework was established in 1979 in an IGA between the City of Tucson and Pima County and has expanded to include the Bureau of Reclamation, the Metropolitan Domestic Water Improvement District, and the Town of Oro Valley.
[37] "Reclaimed Water System Status Report – 2007", Tucson Water Department, p. 6.

Mawson Lakes

Mawson Lakes is a community in suburban Adelaide, South Australia that is currently home to 10,000 residents. Australia is enduring a prolonged drought and reservoirs are at critically low levels. Conditions have deteriorated to a point that recently the South Australian Government suspended domestic outdoor watering for the months of July and August 2007 to help conserve water.[39] The restrictions banned the use of household sprinklers, hoses, and irrigation systems for those months. These restrictions were in addition to previous limitations on nurseries, car washing, pools, spas, fountains, and ponds.

In the face of water scarcity, Mawson Lakes and South Australia Water (SA Water), which provides service to the community, implemented advanced water reclamation to extend utilization of this valuable resource. Home construction began in 2005 and the development features a dual water supply system, supplying drinking water and recycled water to homes via completely separate mains. The community employs advanced reclamation, where not only are lawns irrigated, but toilets are flushed with reclaimed water. As a result, Mawson Lakes has demonstrated a 50% reduction in water use, saving 800 megaliters (211 million gallons) annually.[40] The use of recycled water is not mandatory but residents of the community are required to accept the terms and conditions of a Recycled Water Supply Agreement. Within the Agreement, any customer that elects not to use recycled water must pay for the internal alterations required to irrigate and flush toilets with drinking water.[41]

[38] A dye test is conducted after the reclaimed meter and backflow prevention assembly are installed. Dye is added to the irrigation system on the customer's side of the new reclaimed water meter. At the time of testing, the irrigation system is not connected to the reclaimed water meter. Potable water is used to conduct the test. The inspector turns on each drinking water faucet and the presence of dye indicates a cross-connection. All cross-connections must be eliminated prior to the initiation of recycled water service.

[39] "News Release", Government of South Australia, June 17, 2007 (announcing July 2007 restrictions) and "News Release", Government of South Australia, July 24, 2007 (announcing the extension of the restrictions into August 2007).

[40] From South Australia Water website (www.sawater.com.au) What's New – News Room – "$16 million recycle system saves water."

[41] Mawson Lakes Recycled Water Supply Agreement, Terms and Conditions of Supply.

In April 2006, SA Water and the Government of South Australia published a Recycled Water Plumbing Guide with the intent to "ensure proper installation of the recycled water service and provide a clear guide for safe use of recycled water."[42] The document provides guidelines for use and installation and includes information on water mains, meter assemblies, approved products, and details on commissioning the system. An extensive public education program continues to inform and update customers on issues that range from how a recycled water system works to the proper use of the resource.

Rouse Hill

Australia's largest residential recycled water scheme is the Rouse Hill area located in northwestern Sydney. Since commencement in 2001, over 16,500 homes are using 1.9 billion liters (roughly 500 million gallons) each year to flush toilets, irrigate landscapes, and wash cars. On average, the Rouse Hill scheme has reduced demand for drinking water by 35%. Eventually 35,000 homes will be served. Water reclamation and recycling have been staples of Sydney Water's resource policy for the last decade. In fact, across greater Sydney more than 20 recycled water systems recycle 22 billion liters (almost 6 billion gallons or roughly 18,000 acre-feet) each year[43]. This renewable resource has proven valuable during the drought conditions that are currently impacting the region.

Periodic droughts are a feature of Sydney's climate and have shaped water policy in the area. Over the past 120 years, the region has experienced three prolonged droughts – one in the 1890's, a second in the 1940's, and is currently in the midst of the third. Questions regarding climate change and uncertainties about rainfall patterns only complicate planning for water in the future. The New South Wales (NSW) Government, which wholly owns Sydney Water, has advocated extensive reuse as policy and has included water recycling as a major component of their Metropolitan Water Plan. NSW states in an

[42] "Recycled Water Plumbing Guide", Government of South Australia, SA Water, April 2006, p. 3.
[43] From Sydney Water website (www.sydneywater.com.au).

executive summary of their 2006 Plan that "wastewater can be safely recycled and used in industry, agriculture and in new homes for garden watering, toilet flushing and other non-drinking uses. Recycling can…diversify the system with a supply source not relying on rainfall."[44]

DIRECT REUSE VERSUS RECHARGE

Direct reuse of recycled water is relatively straightforward. Wastewater is treated to a high level at a reclamation facility for reuse and, rather than discharging the product unused into the environment, purple pipe (plumbing code requires that the pipe color be purple to reflect its recycled status) moves the water from the treatment facility to its point of use. While recharging recycled water into the underlying water table is an important aspect of resource management, it is inferior to direct reuse. Recharge is a method of achieving seasonal resource equalization (i.e., storing recycled water in winter months for withdrawal and use in summer months), but it falls short in the "highest-and-best-use" category. There are a number of benefits that direct reuse has over recharge.

- Water is pumped once and then used repeatedly, reducing pumping and SDWA treatment costs
- Recharge facilities are complicated by local geology, wildlife and cultural concerns
- Recharge has the potential to increase salinity in the aquifer
- Contaminants of emerging concern may be better addressed by direct reuse
- Recharge is often conducted in areas remote from the use of the water resource

<u>Water is Pumped Once</u>

Groundwater requires a substantial amount of energy to lift it from the aquifer to the surface. The cost of groundwater extraction is in the order of $0.80 per 1,000

[44] "2006 Metropolitan Water Plan Executive Summary", NSW Government, April 2006.

gallons. Once on the surface, it can be distributed and redeployed for $0.10 per 1,000 gallons. Recharge requires that the water be removed once from the aquifer, distributed to homes, treated, pumped back into the aquifer (if using vadose zone wells or Aquifer Storage Recovery (ASR) wells), then recovered (pumped out again) from the aquifer, and treated again for SDWA compliance (as noted at a cost ranging from $0.50 to $2.00 per 1,000 gallons). The result is a three-fold increase in energy costs.

Recharge Facilities are Complicated

Recharge basins and wells are notoriously difficult to operate and maintain. Often soils (particularly in Arizona) do not percolate well, and they can be compromised by fines or bacteriological growth. Vadose zone and ASR wells require routine maintenance and have a useful life of 5 to 7 years. Furthermore, wildlife and cultural concerns greatly diminish the areas available for recharge and discharge.

Recharge and Salinity in the Aquifer

When a direct reuse scenario is implemented, the amount of water withdrawn from the underlying aquifer is less than that required when recharge is utilized (water already on the surface is recycled, supplementing the need for additional groundwater). As a result a direct reuse scenario has much less impact on the aquifer. Operating under a recharge scenario, more water is extracted from the aquifer and is replaced with water of a potentially significantly higher total dissolved solids (TDS) level. The result is increased salinity in the aquifer. This concept is more fully discussed in **Appendix B**.

Contaminants of Emerging Concern

Much research is ongoing to evaluate contaminants of emerging concern (CEC) in municipal effluents and recycled water. CEC's include endocrine disrupting compounds (EDC), pharmaceuticals and personal care products (PPCP). By creating a continuous loop of non-potable water on the surface, direct reuse minimizes exposure of CEC's to the underlying aquifer. More information on EDC's and how they relate to direct reuse and recharge are presented in **Appendix C**.

Remote Recharge

Recharge is often conducted in areas remote from the water resource use. Because of land requirements needed for recharge and recovery, recharge areas are often well outside impacted areas. Direct reuse allows the water resource to be employed where it is required. Decentralized water reclamation and direct reuse allow for the minimization of material and resource flux – a key concept of sustainability.[45]

THE ECONOMICS OF WATER RECYCLING

The introduction of water reclamation and reuse into a region has substantial impact on water conservation and long term sustainability. The front end financial outlay required to execute a regional water reclamation plan is a sound investment and is good public policy when analyzed in the broader contexts of growth, resource scarcity issues, and resource quality issues.

As growth continues in Arizona and scarcity issues become paramount, the price to acquire water rights will continue to escalate. Pricing for surface water rights within the southwestern United States has surged upward; this trend will continue. In addition to acquisition considerations, the ever tightening regulatory environment presents a future laden with ever more stringent treatment requirements. Recent regulatory changes governing the maximum contaminant level (MCL) of arsenic have added significant costs to the operation of water utilities, both in capital investment for new infrastructure and in increased operating expenses. When the costs associated with reclamation are analyzed within the emerging water acquisition and treatment realities, the economics further shift in favor of reuse.

[45] Water Recycling and Decentralized Management: The Policy and Organizational Challenges for Innovative Approaches – Daniel J. Livingston, Nyree Stenekes, Hal K. Colebatch, Nicholas J. Ashbolt and T. David Waite.

Water reuse activities also allow for the maintenance of greenspace in the urban/suburban environment. This has a significant impact on overall temperatures in the region, and can significantly reduce overall power costs. Demand for electricity in United States cities increases by 3 to 4% for every one degree Celsius increase in ambient temperature.[46] Urbanization has increased the overall temperatures 0.1º to 1º C per decade in the past 50 years.[47] The maintenance of greenspace "measurably affects the thermal behavior of different sites within a city. Maximum temperatures within the greenspace of individual building sites may be 3º C cooler than outside the greenspace."[48] Significant power savings can be achieved by ensuring that water resources are available for greenspace activities.

Global Water, through its regulated utilities, Santa Cruz Water Company and Palo Verde Utilities Company, has made significant investment in water reclamation treatment and transmission infrastructure throughout developing communities in and around the Cities of Casa Grande and Maricopa, Arizona. This investment lays the foundation for long term total water management opportunities in the area, supporting growth while addressing scarcity and obviating treatment to meet the Safe Drinking Water Act (SDWA) for a significant volume of water. An analysis of the systems in the Maricopa/Casa Grande Region (MCGR) provides an opportunity to examine the economics of recycling.

MODELING AND ECONOMIC ANALYSIS

Modeling was developed to analyze capital investment for infrastructure, system operations and maintenance costs, and the rate requirements associated with various water resource scenarios. This model was calibrated from field experience and data accumulated from Santa Cruz Water Company and Palo Verde Utilities Company. The model is a quantitative analysis. The qualitative impacts of implementing a regional reclamation program (community amenities, recreational opportunities, power savings by employing greenspace etc.), while warranting consideration, were not included.

[46] Quantifying the Impact of Trees: The Chicago Urban Forest Climate Project – D.J. Nowak and E.G. McPherson.
[47] Ibid
[48] Ibid

The analysis was structured as follows:

- Parameters such as underlying regional conditions, population density, consumptive demand, and availability of recycled water were defined
- Quantifiable assessments were developed for relevant parameters (capital expenditures and Advances In Aid of Construction (AIAC), operations and maintenance, capital structure, and profit and loss)
- Three water resource scenarios were identified for evaluation:

    - Groundwater Only/No Treatment – Assumes complete reliance on groundwater within the region. In this scenario, the underlying water source is assumed to meet compliance with all regulatory mandates without a requirement for significant treatment facilities

    - Surface Water – Assumes that surface water is acquired and delivered to the region for use in lieu of groundwater

    - Groundwater with Arsenic Treatment – Assumes that groundwater must be treated for compliance with one of the 90 regulated contaminants of the SDWA to meet changes in the Maximum Contaminent Levels (MCL)

- Each water resource scenario was evaluated in the context of no reclamation, basic reclamation, and advanced reclamation:

    - No Reclamation is defined as employing groundwater for all water uses in a single-plumbed community

    - Basic Reclamation is defined as reusing water produced by a water reclamation facility for irrigation of common areas, Homeowners Association (HOA) open spaces, community amenities and schoolyards o Advanced Reclamation is defined as a dual-plumbed, highly distributed network of delivery of recycled water for the best and highest uses possible

Detailed discussion of baseline parameters is included as **Appendix D**.

ANALYSIS OF RESULTS

Modeling allowed for analysis of many different areas including:

- Water savings
- Baseline Costs (both capital costs and cost to the customer)
- The impact of surface water acquisition
- The impact of treatment

Results depicting front-end capital expenditures (infrastructure) and cost to the consumer (monthly billing) are summarized in the following Table 2 (calculation sheets are included as **Appendix E**) and analysis is made in the pages that follow.

Water Resource Scenario	Level of Reclamation	Infrastructure Total (per EDU)	Monthly Billing (per EDU/Mo)
Groundwater/No Treatment	None	$6,494	$83.19
Groundwater/No Treatment	Basic	$6,694	$80.99
Groundwater/No Treatment	Advanced	$8,214	$85.94
Surface Water	None	$12,428	$164.26
Surface Water	Basic	$10,533	$133.45
Surface Water	Advanced	$11,610	$132.33
Arsenic Treatment	None	$6,945	$104.03
Arsenic Treatment	Basic	$6,985	$94.48
Arsenic Treatment	Advanced	$8,472	$97.87
EDU - Equivalent Dwelling Unit • EDU/Mo - Equivalent Dwelling Unit Monthly			

Table 2

Water Savings in Groundwater Only/No Treatment

Water recycling results in substantial water savings, reducing demand by 35% (basic recycling) to 43% (advanced recycling).

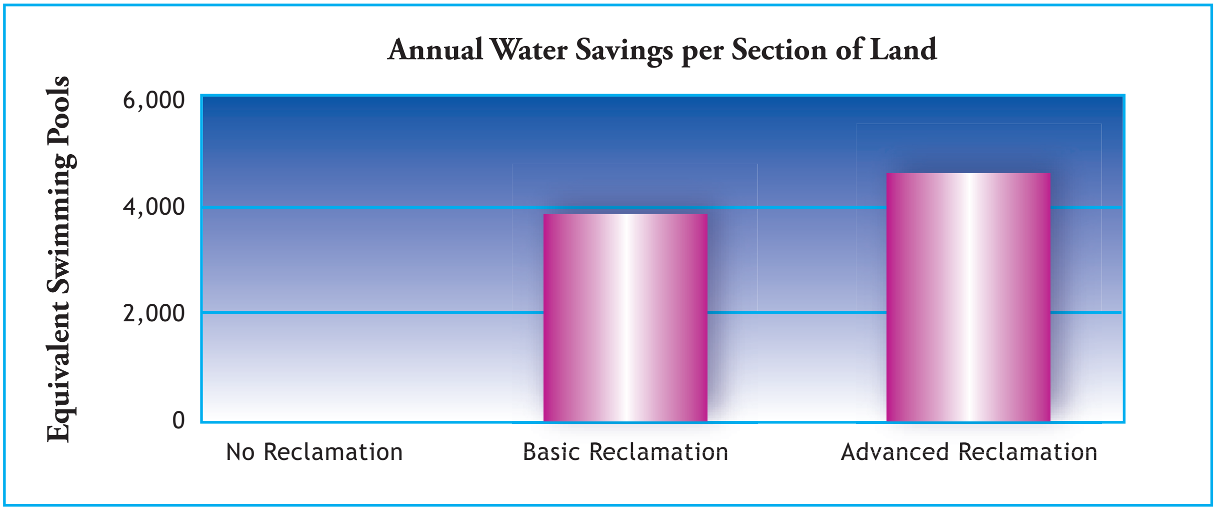


Table 3

The water savings associated with basic and advanced reclamation is tremendous, see (Table 3). Without reclamation, groundwater consumed on an annual basis within a section of developed land is approximately 273 million gallons (the equivalent of 10,919 swimming pools). The incorporation of basic reclamation to the section reduces consumption to 177 million gallons annually (7,065 swimming pools), a savings of 35%. [49] Advanced reclamation reduces the consumption to 156 million gallons (6,248 swimming pools), representing a 43% savings.[50]

As a result of these water savings, more growth may be sustained within the same volume of potable water. An additional 1,222 units may be serviced through the introduction of basic reclamation. Advanced reclamation increases that number to 1,481 units, this increase in

[49] (10,919-7,065)/10,919 = 3,854/10,919 = 0.35 (35%)
[50] (10,919-6,248)/10,919 = 4,671/10,919 = 0.43 (43%)

housing density yields other environmental benefits ranging from reduced transportation demand, increased community coherence, and increased local business development opportunities.[51]

Baseline Costs (Groundwater Only/No Treatment Scenario)

When analyzed in the Groundwater Only/No Treatment scenario it is apparent that the front-end capital costs associated with basic reclamation are only slightly higher (+3%) than those associated with the provision of no reclamation. Capital costs for Advanced reclamation are higher than that of basic reclamation (it should be noted that, while capital costs are higher, costs to the consumer are lower – as discussed below).

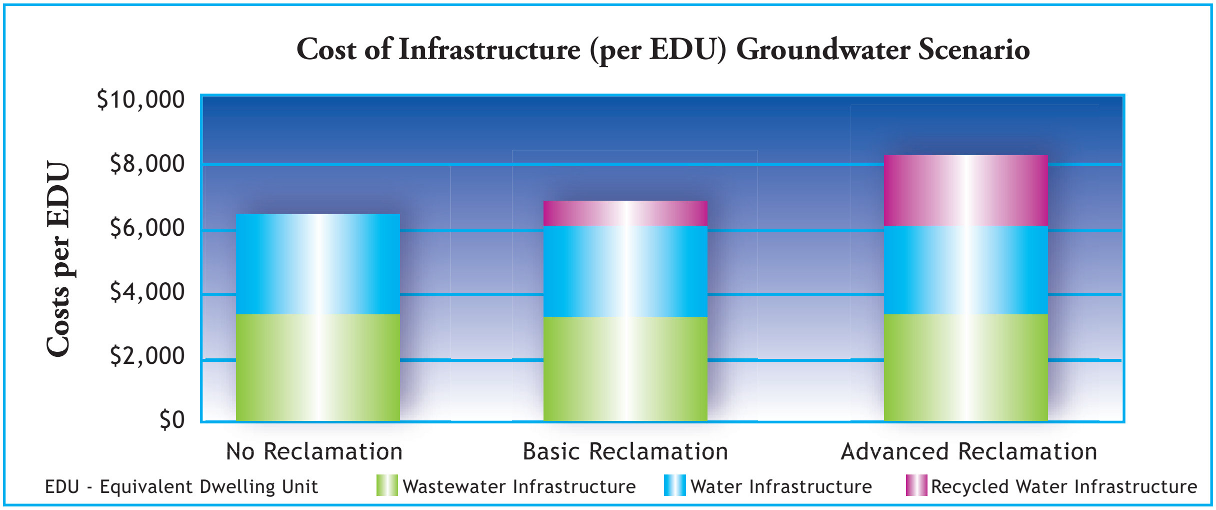


Table 4

Basic reclamation requires the installation of pipes and infrastructure to distribute recycled water from the water reclamation facility to its point of use (see Table 4). This is a non-pressurized system, where water is delivered at atmospheric pressure to Recycled Water Retention Structures (typically lake-type facilities). The point of use, from the perspective of the utility, is the onsite retention structure from which the development draws to irrigate common areas,

[51] See work of Urban Land Institute, generally, and Urban Land Institute/National Multi-Housing Council/American Institute of Architects' "Joint Forum on Housing Density", Feb. 7, 2002.

parks, ball fields, school grounds, etc. The cost of the pipeline is offset by a downsizing of facilities that treat and distribute potable water. These include well sites and distribution centers (storage and pumping). Total cost per EDU without reclamation is calculated to be $6,494. Cost per EDU with basic reclamation calculates to $6,694 (an increase of 3.1%).

Advanced reclamation includes all aspects of basic reclamation but adds infrastructure to distribute recycled water directly to each residence for irrigation purposes rather than simply delivering to centrally located retention structures. Under this scenario, each individual property has two meters, one for potable water and one for recycled water. Distribution must be pressurized, requiring construction of recycled water distribution centers for storage and pumping (typically large water tanks in excess of 1,000,000 to 2,000,000 gallons). Advanced reclamation also requires construction of in-parcel distribution pipelines. Cost per EDU is $8,214 (an increase of 26.5% when compared to no reclamation).

Operating under the Groundwater-only Scenario, cost to the consumer can be reduced by 2.6% when employing basic direct reuse. When advanced reclamation is utilized, the cost increases slightly (+ 3.3%).

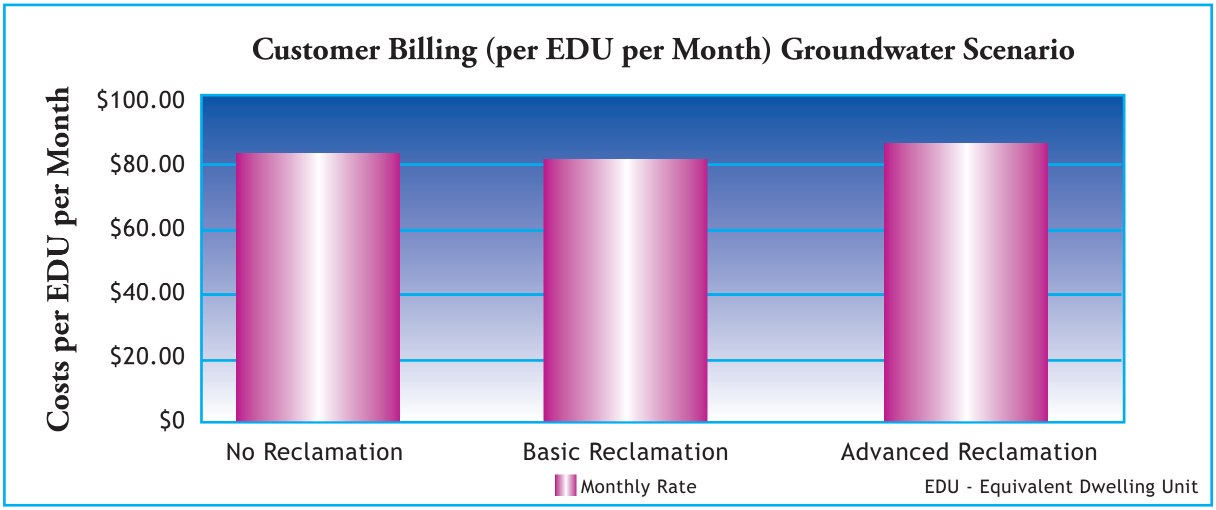


Table 5

While capital costs are slightly more expensive, implementation of basic water reclamation creates a scenario where the consumer recognizes a cost savings on monthly billing (see Table 5).

Without water reclamation, rates associated with the groundwater-only scenario are in the order of $83.19 per EDU per month. Reuse creates a decrease in treatment of potable water, reducing costs to the consumer. Consumer billing with basic reclamation will decrease to $80.99 per EDU per month (-2.6%). Advanced reclamation utilizes a pressurized distribution system, including storage and pumping. As a result, monthly costs to the consumer increase to $85.94 per EDU per month (+3.3%) when compared with the no reclamation scenario.

A comparison of water savings to capital cost and consumer billings in Table 6 illustrates that significant opportunities can be achieved through minimal front end capital investment.

Water Resource Scenario	No Reclamation	Basic Reclamation	Advanced Reclamation
Water Savings in Gallons/Year/Section	0	96,347,624 35% Savings	116,784,998 43% Savings
Additional EDU's Liberated @ 216 Gallons/EDU	0	1,222	1,481
Capital Cost per EDU	$6,494	$6,694 +3.1%	$8,214 +26.5%
Consumer Billing per EDU/Month	$83.19	$80.99	$85.94

EDU - Equivalent Dwelling Unit • EDU/Mo - Equivalent Dwelling Unit Monthly

Table 6

Impact of Surface Water

Introduction of surface water has substantial impact on the economics of water reclamation. When the cost associated with a perpetual water right is added to the equation, cost per EDU increases by over 90% (from $6,494 to $12,428). In this scenario, water reclamation offers substantial savings in front end capital cost. When factoring in surface water, a

savings of over 15% can be realized with basic reclamation ($12,428 per EDU drops to $10,533 per EDU). Advanced reclamation recognizes a cost savings of almost 7%.

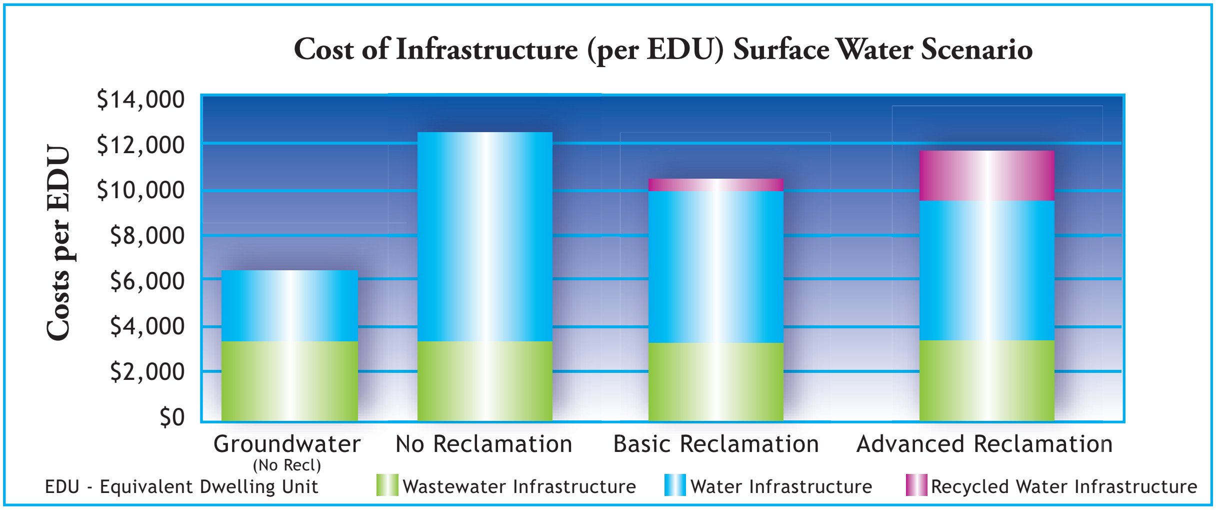


Table 7

The emerging reality of groundwater scarcity necessitates acquisition of renewable surface water as a supplemental resource. Research into the water rights market in the southwestern United States indicates an ongoing upward surge in prices. It is anticipated that this price surge will continue as growth and scarcity issues become increasingly polarized (see Table 7). For purposes of analysis, a baseline value for acquisition of surface water rights was established at $11,000 per acre foot.[52] The impact on front end capital requirements and cost to the consumer is staggering. Total front end capital cost per EDU increases from $6,494 per EDU (utilizing groundwater) to $12,428 per EDU when the cost of surface water acquisition is included (an increase of 91.4%). This value can be decreased substantially by utilizing water reclamation in the regional plan. By recycling water, the need for incremental surface water supplies is diminished. With basic reuse the cost drops to $10,533 per EDU (a decrease of 15.3% of the surface water scenario with no reclamation). Advanced reclamation in the surface water scenario calculates to $11,610 per EDU (a decrease of 6.6%).

[52] Discussion of $11,000 price per acre foot is included in Appendix D.

In the surface water scenario, the cost of treatment has a great impact on the cost to the consumer -- monthly billings nearly double ($83.19 per EDU per month with groundwater, $164.26 per EDU per month with surface water). By utilizing recycled water in lieu of surface water, consumer costs can be reduced by 18% to 20%.

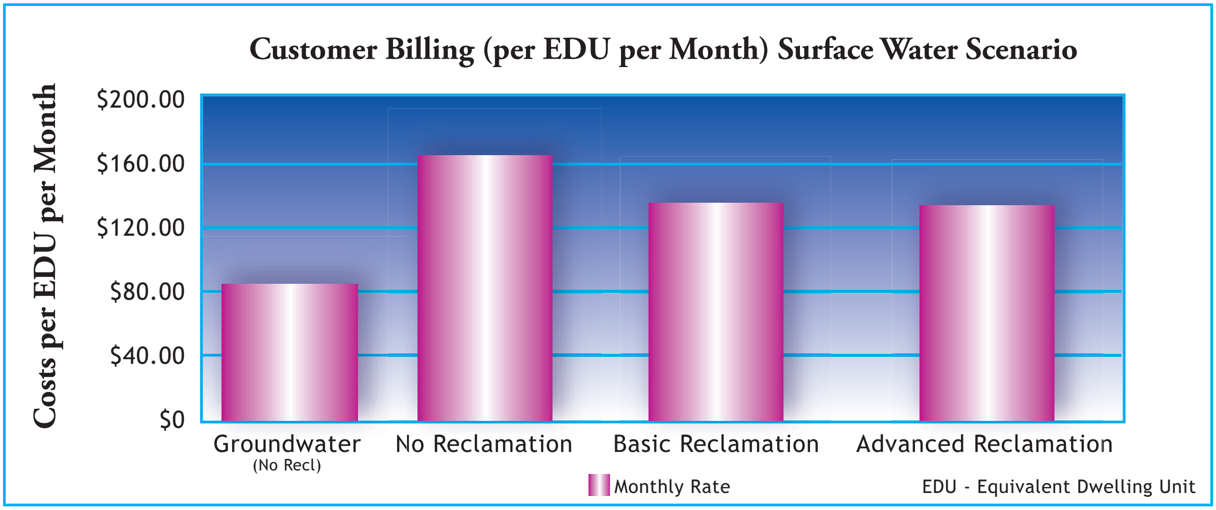


Table 8

In the surface water scenario, monthly billings calculated to $164.26 per EDU (see Table 8). Basic reclamation reduces that number to $133.45 per EDU (-18.8%) while advanced reclamation reduces the monthly billing even more to $132.33 per EDU (-19.4%).

Impact of Treatment

Treatment considerations have impacts on capital costs. When the cost associated with arsenic removal equipment is added to the model, cost per EDU increases by over 7%. When treatment is factored in, a slight savings of 0.6% can be realized with basic reclamation. In-parcel distribution pipelines increase the cost of advanced reclamation by 18% when compared to the no reclamation-groundwater only/no treatment scenario. Note that the model conservatively assumes that treatment is required for only one contaminant. In the event that the next regulated contaminant requires a separate and distinct treatment system, the effect on cost is compounded.

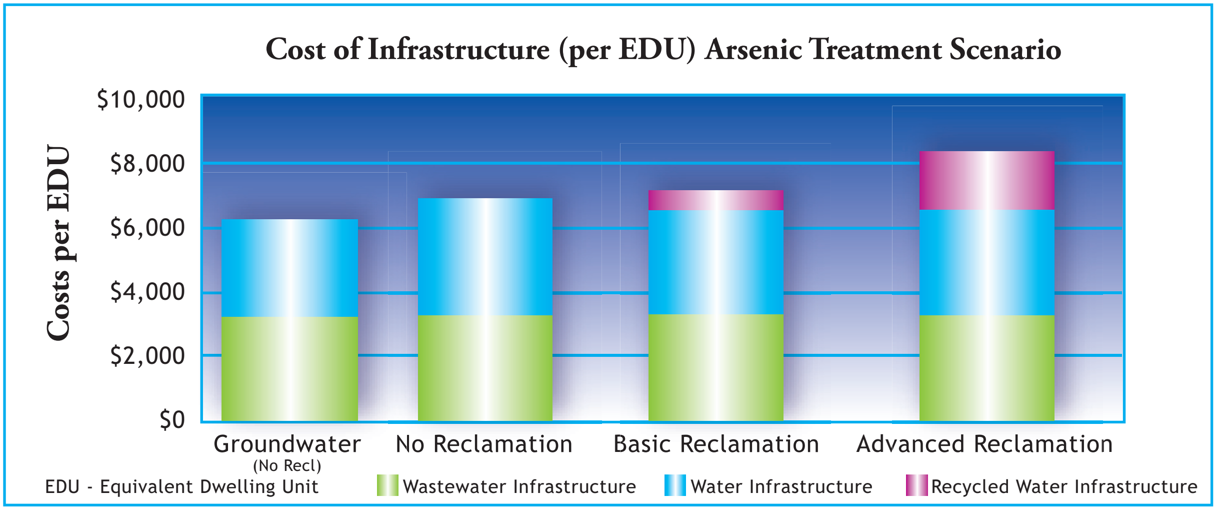


Table 9

The cost per EDU increases from $6,494 per EDU (utilizing groundwater that does not require treatment) to $6,945 per EDU when the cost of treatment is included (an increase of 11.1%), (see Table 9). With basic reuse the cost drops to $6,985 per EDU (a decrease of 0.6% of the treatment scenario with no reclamation). Advanced reclamation in the treatment scenario calculates to $8,472 per EDU (an increase of 18.0%).

When treatment is required, monthly billing to the consumer will increase by over 25%. Water reclamation in this scenario offers a savings to the consumer.

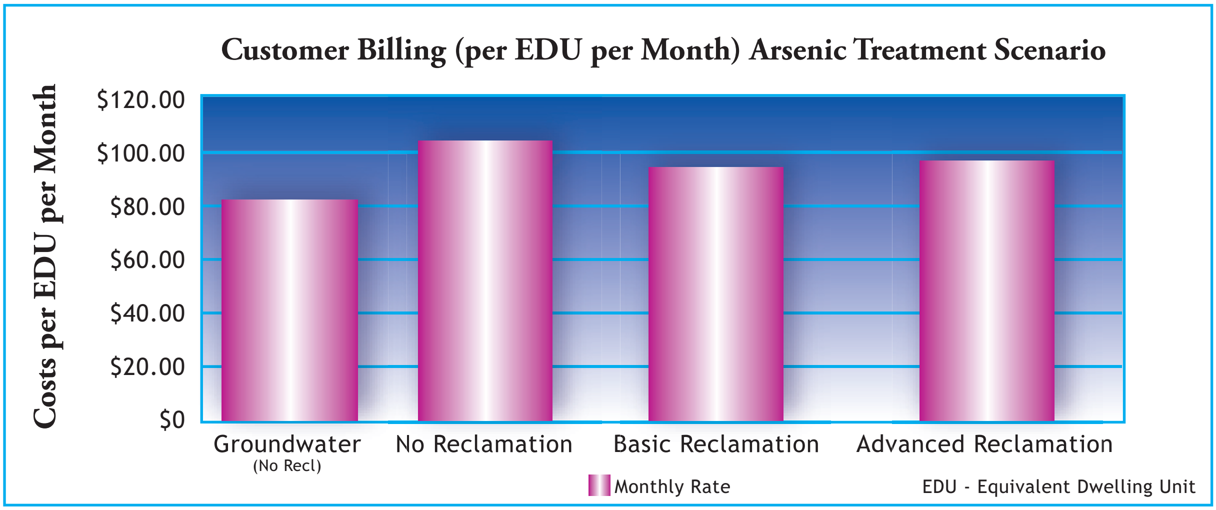


Table 10

Monthly billings within the treatment scenario calculated to $104.03 per EDU (an increase of 25.1% when compared to the scenario where groundwater does not require treatment), (see Table 10). Basic reclamation reduces that number to $94.48 per EDU (-9.2%). Advanced reclamation reduces the monthly billing under treatment scenarios to $97.87 per EDU (-5.9%).

CONCLUSIONS

According to a 2006 Arizona Department of Water Resources presentation on Arizona water issues, the State is dependent upon three sources of water as listed in Table 11 below[52]:

Water Source	Available Annual Water Supply in Arizona Million Acre-Feet (MAF)	% of Total
Surface Water		
Colorado River	2.8	35.6%
In-State Rivers	1.4	17.8%
		53.4%
Ground Water	2.9	36.8%
Reclaimed Water	**0.77**	**9.8%**

Table 11

Based on these figures, over-allocated rivers and extended periods of drought have the potential to impact 53.4% of the State's water supply while another 36.8% of its reserve relies on depleting underground aquifers. Reclaimed water exists as the only water source experiencing an increase in availability (9.8% and growing). The State must move aggressively to support and mandate water recycling as a long term solution to water scarcity.

An effective recycling program can only be deployed by an integrated services provider with the ability to plan regionally and construct infrastructure – early, in advance of development

[52] "Arizona Water Issues" presentation of ADWR, at Valley Forward Association meeting, March 16, 2006.

– of the appropriate size and capacity. The benefits of recycling can also be exploited by an integrated utility through common-trench construction, consistency of recycling objectives, commonality of standards and economies of scale for labor.

Global Water is not on the vanguard of successful water reuse programs. In fact, there are thousands of applications throughout the world. Much can be learned and emulated from utilities that have been implementing water recycling for some time.

- From examining the Irvine Ranch Water District, it is apparent that much can be accomplished if the benefits of reclamation are recognized early and if recycled water is a part of the planning process from the beginning. Arizona has a unique opportunity in this regard – growth is driving the development of new communities. Deploying recycled water infrastructure while these communities sit on the drawing table is far superior to attempting a retrofit later, when the scarcity reality is more pronounced.
- The El Dorado Irrigation District has demonstrated that implementation of advanced water recycling serves to lower the customer's monthly water bill.
- Tucson Water determined that, despite a populace with a strong environmental ethic, aggressive demand management alone cannot necessarily curtail depletion of underlying aquifers.
- The Australian community of Mawson Lakes shows that recycled water can be safely and dependably used to flush toilets in private residences.
- Rouse Park, in suburban Sydney, Australia, is an example where large scale water reclamation planning has been of significant benefit during times of prolonged drought. These are but five examples of dual-plumbed applications that were driven by scarcity.

Recycled water has been safely utilized throughout the world for several decades. In preparation for a March 2007 referendum on recycled water use, the Local Government Association of Queensland, Australia commissioned a study by the University of NSW. The report by Stuart Khan and David Roser, of the UNSW Centre for Water and Waste Technology, reviewed recycled drinking water schemes in the US and Singapore. "Despite more than 40 years' experience, no clear deleterious health effects…have been observed," the authors wrote.[54] Recycled drinking water in the schemes was of equal quality to that from traditional sources – or better.[55]

Direct reuse, ultimately using dual piping networks (one for potable water and one for pressurized recycled water), offers the most practical and inexpensive way to make use of reclaimed water. While recharge remains a method of achieving seasonal resource equalization, direct reuse is preferable as a mechanism to reduce pumping costs, reduce the mass loading of residual contaminants on the receiving environment and reduce the volume of water treated to National Primary Drinking Water Standards and used by customers.

Deployment of recycled water infrastructure offers substantial water savings, ranging from 35% to 43%. This savings allows for increased housing density with numerous environmental benefits. In the context of residential density, this increase in unit serviceability allows population cores to be developed with existing resources. Accordingly, growth need not seek out new sources of water thereby increasing consumption of raw, native or otherwise desirable open space.

From an economic standpoint, analysis shows that while the implementation of dual water mains and water recycling may be more expensive (up front), they are less costly (to the consumer). Under the likeliest scenarios, i.e., groundwater must be treated to SDWA standards and surface water must be purchased and delivered to customers, the practice of water recycling has an immediate and profound impact on water scarcity management.

With the emerging concerns of groundwater scarcity and impending treatment considerations, the economics of reclamation have shifted sharply in favor of water recycling. Regions across the globe are vigorously changing their water policy, and emplacing billions of dollars in infrastructure to achieve water savings up to 50%.

The introduction of water reuse provides substantial benefits in the arid southwestern United

[54] From the article "All-clear for recycled water." The Courier Mail, January 22, 2007.
[55] Ibid

States. The pressures of drought, growth and aquifer overdraft are conspiring to limit the availability of water resources in the area. Significantly, these impacts can have a dramatic impact on the quality of life in Arizona. Consequently, it is in the public interest to maximize the availability of alternative water resources, and to minimize the consumption of limited groundwater and surface water resources. It is therefore critical that water recycling form a pillar of water policy in Arizona. Policy in Arizona lags surprisingly behind other areas. The emerging realities of population growth and water scarcity have already impacted the region's future. Failing to act now will accelerate that impact.

Arizona is now at a crossroads – its growth is incessant and historic, its water supplies diminished by 13 years of drought, its CAP water system has been thrice proven to be over-allocated – the time for decisive, progressive action is now.

By making the safest and best use of reclaimed water, the demand for expensive surface water and the requisite substantial drinking water treatment will be greatly reduced. Thus saving up front capital and acquisition costs and forever reducing operating and treatment costs for Arizona residents – all while ensuring that the State's water resources are used for their highest and best use.

It is widely accepted that a culture of conservation is in the public interest, and that utilizing less water per capita is also in the public interest. It is interesting to note that the very capital intensive advanced water recycling model provides long term rate protection to ratepayers – another key element of sound water policy. The only remaining question is whether the State's leaders will act now to protect the public interest for the next generations of Arizonans.

APPENDIX A – COMPENDIUM OF UTILITIES

Utility Name and Location	Number of Years Practicing Water Reuse	List of End Use Types	Driver for Water Reuse	Rate Information	Total Annual Volume of Water Reused (ac-ft/yr)	Miles of Water Reuse Distribution System
Irvine Ranch Water District, CA (IRWD)	40 (since 1967) (dual plumbing since 1991)	Residential landscape irrigation 3742, commercial 13, industrial 2, and agricultural 55 (total 3812 reclaimed water connections) in 2005	Scarcity	$1.18/1000 gallons for non-agricultural landscape irrigation base rate; $0.79/1000 gallons for commercial and industrial	22,434	245 miles of pipelines, 8 storage reservoirs, and 12 pumping stations
Notes Service area of 133 mi2. Reclaimed water makes up over 20% of the water used in the IRWD service area. Water scarcity initiated water recycling program - semiarid region (an annual rainfall of 12 to 13 in). **An ordinance was enacted in 1990** requiring all new buildings over 55 ft high to install a dual distribution system for flushing toilets and urinals in areas where reclaimed water is available. In 1991, IRWD became the first water district in the nation to obtain health department permits for the interior use of reclaimed water from a community system. Reclaimed water is currently used for **toilet flushing** in IRWD's facilities as well as in several high rise office buildings constructed with **dual piping systems**. Potable, or drinking water demands in these buildings have dropped by as much as 75 percent due to the reclaimed water use.						
Serrano, CA	8 (since 1999)	3437 active accounts in 2006 (3277 dual recycled residentials, 139 commercials/industrials (irrigation), 8 construction meters, 13 recreational turf)	Scarcity	$1.096/1000 gallons for Residential (plus $106 basic charge for Commercial/ Industrial)	2,782	N/A
Notes Serrano is one of the first master-planned communities to use recycled water to irrigate the front and backyards of residential units. Homes are equipped with **dual plumbing** (potable water for interior use and reclaimed water for landscape irrigation). A dual plumbed home pays 50% of the normal (all potable) connection charge for delivery system capacity (i.e., $2,323 rather than $4,646). The Serrano El Dorado **Owners Association** made an agreement with the El Dorado Irrigation District to supply reclaimed water from the districts' WWTPs for irrigation purposes.						
Tucson Water, AZ	23 (since 1984)	Residential front yard irrigation - 900 sites (14 golf courses, 35 parks, 47 schools, > 700 single family homes)	Scarcity	$2.14/1000 gallons (usage charge) + service charge	11,350	160 miles
Notes The use of reclaimed water is regulated by the ADEQ and the ADWR through a series of permits. Water scarcity initiated water recycling program. In 2005, reclaimed customers saved 4.2 billion gallons of drinking water, enough for 39,000 families for a year.						

WWTP - WasteWater Treatment Plant • ac-ft/yr - Acre Feet per Year • ADEQ - AZ Dept. of Environmental Quality • ADWR - Arizona Department of Water Resources

Utility Name and Location	Number of Years Practicing Water Reuse	List of End Use Types	Driver for Water Reuse	Rate Information	Total Annual Volume of Water Reused (ac-ft/yr)	Miles of Water Reuse Distribution System
Mawson Lakes, Australia	2 (since 2005)	Toilet flushing, residential yard irrigation (4300 homes by 2010)	Scarcity	Set at 75% of the price of mains drinking water (AUD $2.91/1000 gallons for 2004/05 financial year, 1 AUD = 0.884 USD)	N/A	N/A
Notes Mawson Lakes is a fully planned 620 hectare (2.4 mi2) community. **All homes and businesses are dual plumbed and use recycled water for front yard irrigation and toilet flushing.** This reduced usage of drinking water by 50% as compared to the Adelaide average. Recycled water from two sources - SA Water's Bolivar WWTP and the City of Salisbury's wetlands (treated stormwater). An anticipated saving on the use of surface water by about 210 MG per year by the Mawson Lakes community. An average household in Mawson Lakes could save approximately AUD $30 each year.						
Rouse Hill, Australia	12 (since 1995)	Toilets flushing, residential yard irrigation, car washing (more than 16,500 homes)	Scarcity	AUD $2.70/1000 gallons plus quarterly service charge AUD $4.69 (in 2007)	1,540	N/A
Notes Rouse Hill, a suburb of Sydney, has Australia's largest residential recycled water scheme. Rouse Hill put an initial dual system in operation in 1995. **All customers are dual plumbed with both potable and reclaimed water lines inside for toilet flushing.** The reclaimed water system also provide water for fire protection, not as a water conservation measure, but to reduce the size of the potable water pipelines. On average the Rouse Hill scheme has reduced demand for drinking water by 35 percent.						
St. Petersburg, FL	30 (since 1977)	Irrigation for 9,992 residential lawns, 61 schools, 111 parks, and 6 golf courses (total 10,284 active customers) in 2006	Discharge limit	Unmetered service: $14.36/mo. for first acre + $8.22/mo. for each additional acre; Metered service $0.42/1000 gal. ($14.36 min.); plus 10% tax within City limits, rates outside City limits are 125% of City rates (Nov `06)	40,700 (four WRFs)	291 miles, 3909 valves, 316 fire hydrants
Notes One of the oldest **dual distribution systems** in the U.S. The dual distribution system has reduced potable water usage by 50%. In response to a state legislative act that required either advanced treatment or zero discharge to Tampa Bay, the City Council adopted the concept of zero discharge through wastewater reuse. A treated wastewater main ties all four plants together in a complete loop.						

AUD - Australian Dollar to U.S. Dollar Exchange Rate • USD - United States Dollar • WWTP - Watse Water Treatment Plant • ac-ft/yr - Acre Feet per Year

<table>
<tr><th>Utility Name and Location</th><th>Number of Years Practicing Water Reuse</th><th>List of End Use Types</th><th>Driver for Water Reuse</th><th>Rate Information</th><th>Total Annual Volume of Water Reused (ac-ft/yr)</th><th>Miles of Water Reuse Distribution System</th></tr>
<tr><td>Marin Municipal Water District, CA (MMWD)</td><td>16 (since 1991)</td><td>Residential yard irrigation, toilet flushing, car washes, industrial cooling, commercial laundries (over 250 customers)</td><td>Conservation</td><td>$2.18/1000 gal. (70% of potable water, $3.07/1000 gal.) plus service charge</td><td>2,200</td><td>25 miles</td></tr>
<tr><td colspan="7">Notes
MMWD was the first water supplier in California to use recycled water for car washes, air conditioning cooling towers, and commercial laundries. First dual-plumbed new office building was built in San Rafael in the mid-1990s.</td></tr>
<tr><td>Orange County Water District, CA</td><td>16 (since 1991)</td><td>Urban irrigation, Industrial (cooling)</td><td>Scarcity</td><td>N/A</td><td>7,700</td><td>N/A</td></tr>
<tr><td colspan="7">Notes
Green Acres Project; distributes tertiary treated wastewater for uses in Fountain Valley, Huntington Beach, Costa Mesa, Newport Beach, and Santa Ana.</td></tr>
<tr><td>West Basin Municipal Water District, CA</td><td>12 (since 1995)</td><td>Landscape irrigation, cooling towers, refineries, street sweeping, toilet flushing</td><td>Scarcity</td><td>N/A</td><td>33,000</td><td>75 miles</td></tr>
<tr><td colspan="7">Notes
West Basin Water Recycling Facility is the largest recycled water plant of its type in the United States, and produces six different qualities of recycled water.</td></tr>
<tr><td>City of San Jose, CA</td><td>10 (since 1997)</td><td>Residential/ commercial toilet flushing, industrial cooling and process water, landscape irrigation</td><td>Conservation</td><td>$1.68/1000 gal. (71% of potable water) for irrigation, $1.09/1000 gal. (46% of potable water) for agricultural irrigation</td><td>27,800</td><td>105 miles</td></tr>
<tr><td colspan="7">Notes
In 1989 the cities of San Jose, Santa Clara and Milpitas in California launched the South Bay Water Recycling (SBWR) program to bring a reliable and sustainable water supply to the South Bay area. Most of the final treated water from the San Jose/Santa Clara Water Pollution Control Plant (167 MGD) is discharged as fresh water through Artesian Slough and into South San Francisco Bay. About 10% is recycled through SBWR pipelines around the South Bay where it is ultimately used for residential/commercial irrigation and toilet flushing.</td></tr>
<tr><td>El Paso Water Utilities, TX (EPWU)</td><td>44 (since 1963)</td><td>Residential/ commercial yard irrigation,industrial cooling, irrigation - golf courses, schools, parks, recharge</td><td>Scarcity</td><td>$1.14/1000 gal. (70% of potable Block 1 rate, $1.63/1000 gal.)</td><td>6,850</td><td>40 miles</td></tr>
<tr><td colspan="7">Notes
EPWU has delivered recycled water since the 1960s realizing scarcity of water resources. EPWU is operating the first wastewater treatment plant in the world to meet drinking water standards for its reclaimed water, and the other three plants meet the highest possible quality rating of Type I reclaimed water. Four facilities - Northwest WRF, Fred Hervey WRP, Haskell Street WWTP, Roberto Bustamante WWTP.</td></tr>
<tr><td colspan="7">WWTP - Watse Water Treatment Plant • ac-ft/yr - Acre Feet per Year • MGD - Million Gallons/Day</td></tr>
</table>

APPENDIX B – DETERMINATION OF ENVIRONMENTAL IMPACT RECHARGE VERSUS REUSE

In order to assess the relative merits of recharge versus re-use on the environment, in particular the underlying aquifer, a model has been developed to represent the following conditions:

1. *Water-only*
   Under this scenario, it is assumed that a non-integrated water-only solution has been deployed. There are no water demand reductions and, hence, all water for all uses must be treated from the aquifer.

2. *Recharge of Reclaimed Water*
   This scenario assumes that all reclaimed water treated from a water reclamation facility is directly recharged to the aquifer via vadose zone or ASR wells. No water is re-used in this scenario.

3. *Basic Re-Use of Recycled Water*
   This scenario provides recycled water for common area irrigation. Excess recycled water is recharged to the aquifer by vadose zone or ASR wells.

4. *Advanced Re-Use of Recycled Water*
   Under this case, recycled water is deployed for use as flush water in residential toilets, for use in residential irrigation, and for the uses included in the Basic Re-Use scenario. Shortfalls of this non-potable source to meet demand are made up with untreated surface water.

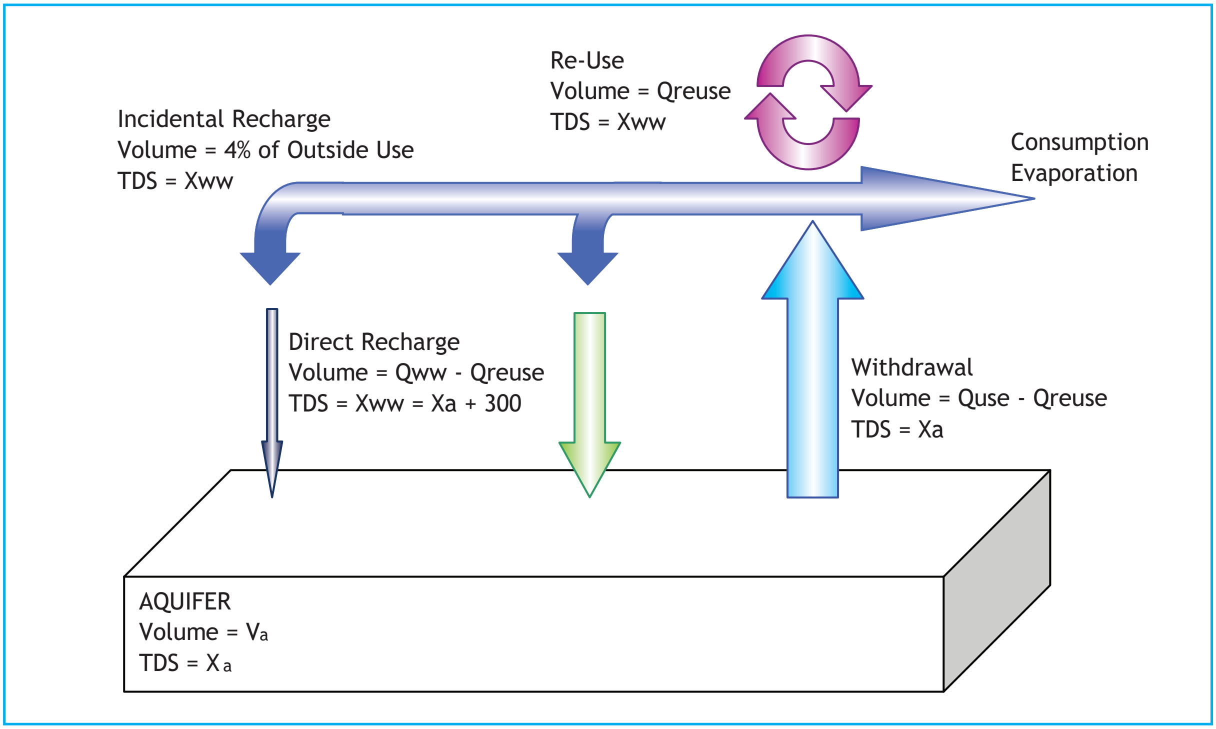
The model evaluates the impact of the above scenarios on total dissolved solids (TDS) in the aquifer and the impact on the overall available volume of the aquifer. This analysis is based on mass balance and volumetric considerations. The output of the model is termed the Impact

Factor, which represents the sum of the absolute values of the TDS and volume impacts. The model is run in a time sequence of EDU-days.[1]

The model employs volumetric consumptions derived from empirical data collected from Global Water's Santa Cruz Water Company system located in Maricopa, AZ. This system is presently operating in the "Basic Re-Use" mode.

Model Architecture

The model architecture for the four scenarios is shown in the accompanying figures. The control volume for the model is depicted below:



[1] The impact experienced over 1 EDU-day is equal to the effect of one EDU operating for one day. 1000 EDU-days is equivalent to one EDU operating for 1000 days, or 1000 EDUs operating for 1 day.

Model Results

The model shows that the water resources management plan that has the least impact on aquifer water levels and TDS is that of Advanced Re-Use. This can be explained simplistically by examining the impact of recharge versus re-use. Under the recharge model, the volume removed from the aquifer is larger than under the re-use model. All of the water in the recharge case is consumed or produced reclaimed water of a higher TDS than the original supplied water (in the case of the model, 300 mg/L higher). This high TDS water is injected directly into the aquifer, with the resultant increase in aquifer TDS.

The various total impacts on the water resources can be combined to develop an Impact Factor. This factor is simply the change in percentage of TDS in the aquifer, combined with the absolute value of the reduction in aquifer volume. When plotted against time, it is apparent that the recharge model results in a greater overall impact. The least impact is determined to be that of Advanced Re-Use where smaller volumes are removed from the aquifer, correspondingly smaller volumes are recharged, with the concomitant reduction in mass loading of TDS on the aquifer.

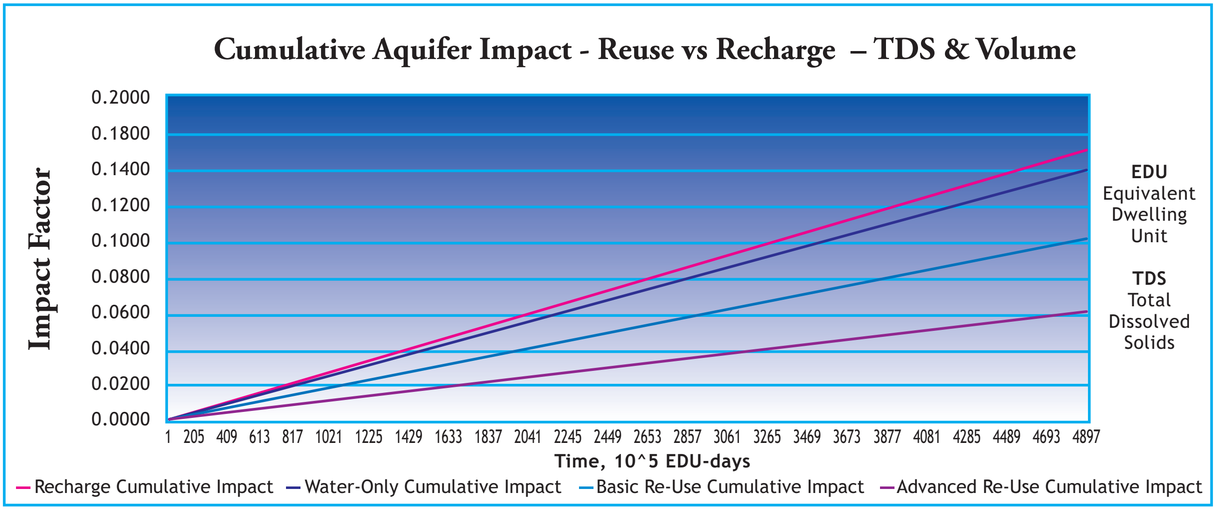


Table 1

Specifically:

1. The volume of high TDS water recharged directly to the aquifer under the Recharge scenario is significantly higher than under the Basic or Advanced Re-Use scenarios. This increases the mass loading on the aquifer.
2. The volume of water required to be withdrawn from the aquifer under the Recharge scenario versus the Advanced Re-Use scenario is significantly higher. This effectively removes low TDS-water from the aquifer at a greater rate and replaces it with a higher TDS water.

Direct Impact on Aquifer TDS

The following graph shows the impact of the four scenarios on the TDS concentrations in the Aquifer:

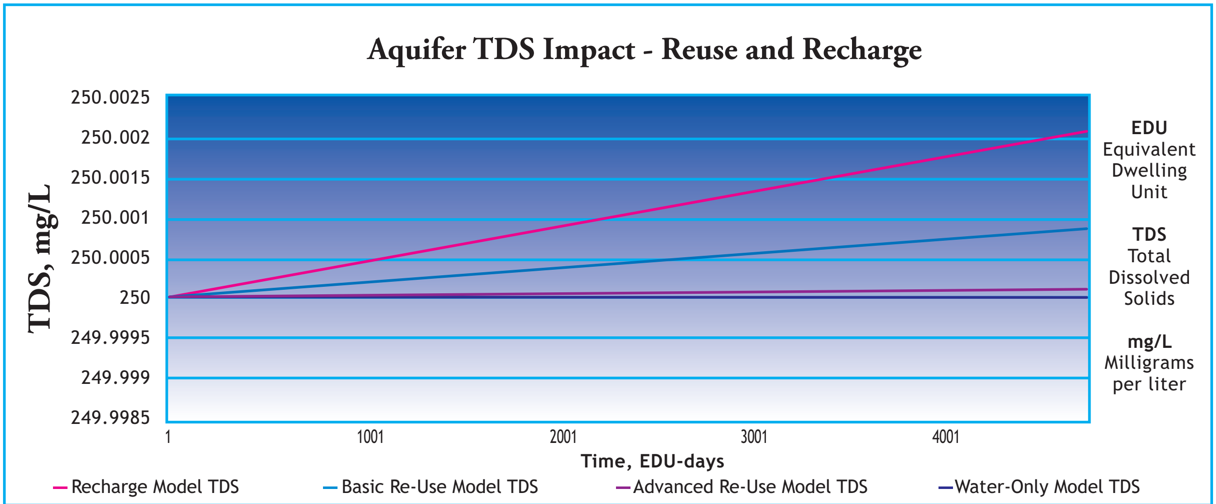


Table 2

Direct Impact on Aquifer Levels

The following graph shows the impact of the four scenarios on the water volume in the Aquifer[2]:

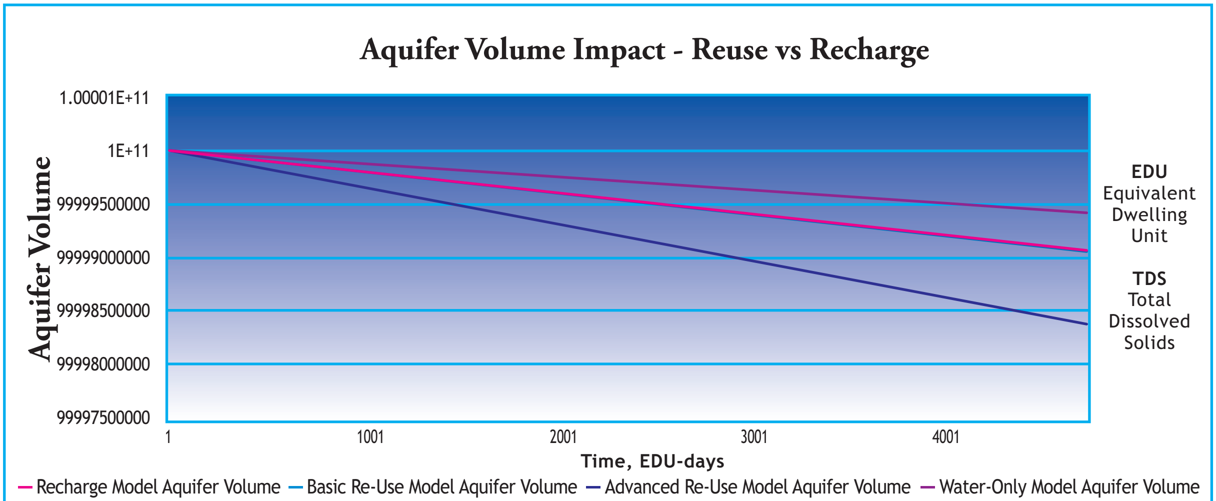
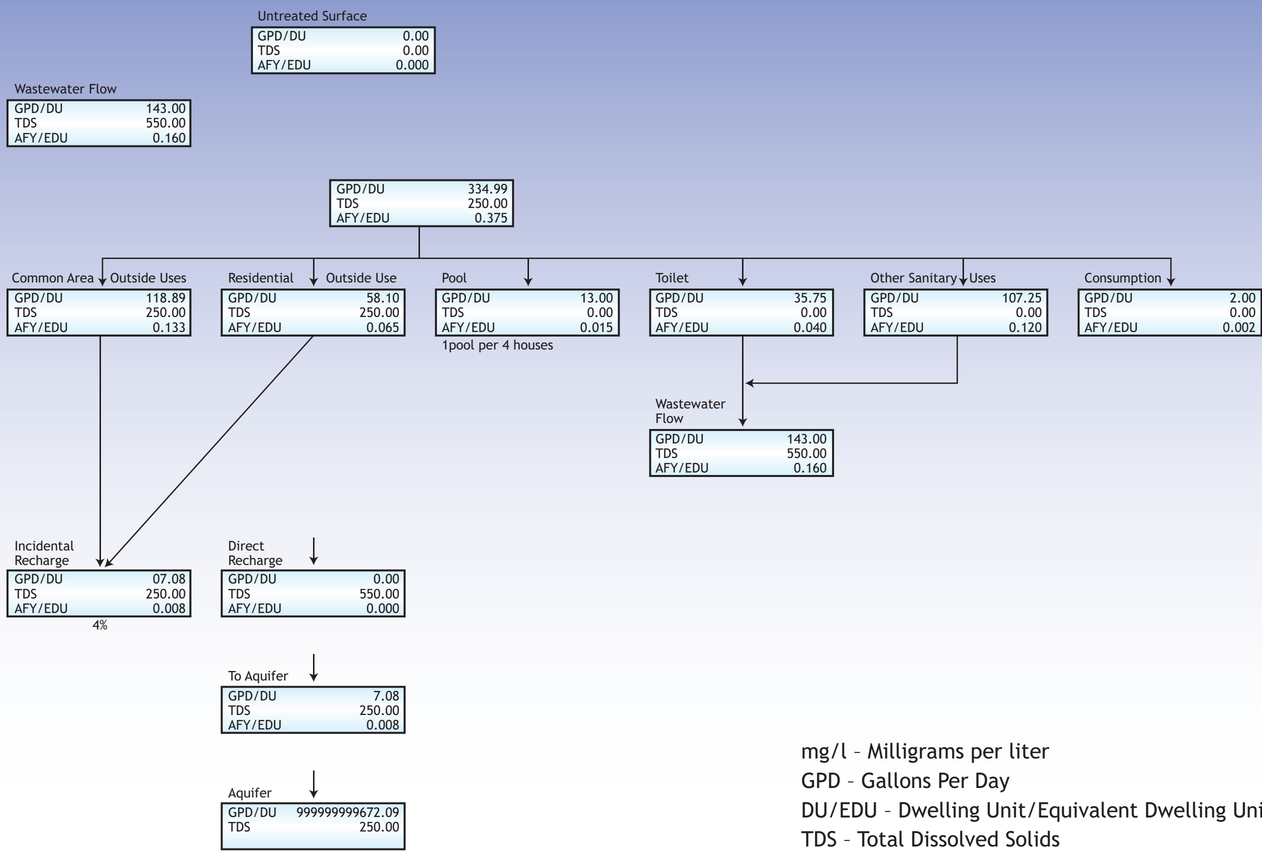


Table 3

[2] In the case of Recharge and Basic Re-Use, the aquifer volume impact is the same – only one line can be seen on the graph, but the results are coincident.

Aquifer Impact Model - Water Only

Aquifer Volume	1,000,000,000,000	gallons
Aquifer TDS	250	mg/l
Human Contribution	300	mg/l
EDUs	100,000	

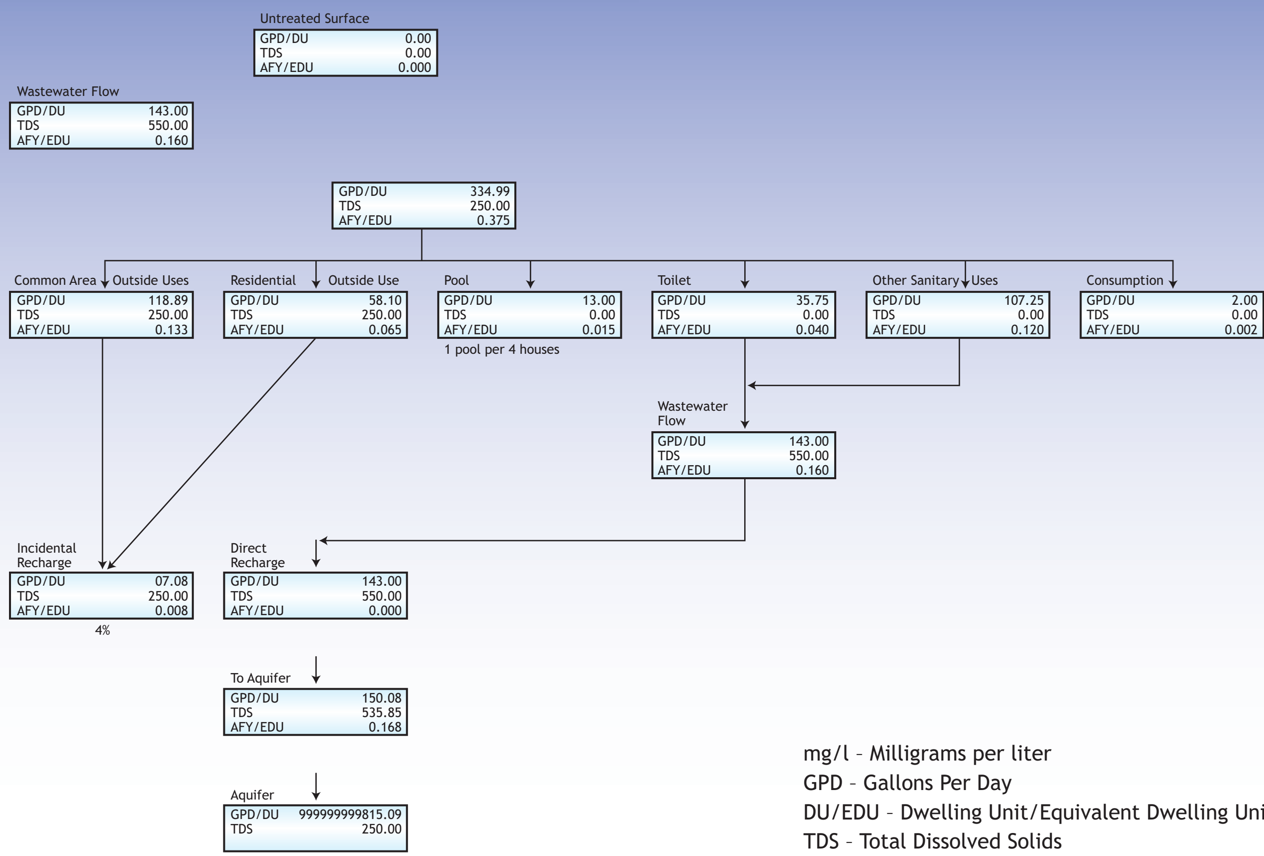


mg/l – Milligrams per liter
GPD – Gallons Per Day
DU/EDU – Dwelling Unit/Equivalent Dwelling Unit
TDS – Total Dissolved Solids
AFY – Acre Feet Per Year

Table 4

Aquifer Impact Model - Recharge

Aquifer Volume	1,000,000,000,000	gallons
Aquifer TDS	250	mg/l
Human Contribution	300	mg/l
EDUs	100,000	



mg/l – Milligrams per liter
GPD – Gallons Per Day
DU/EDU – Dwelling Unit/Equivalent Dwelling Unit
TDS – Total Dissolved Solids
AFY – Acre Feet Per Year

Table 5

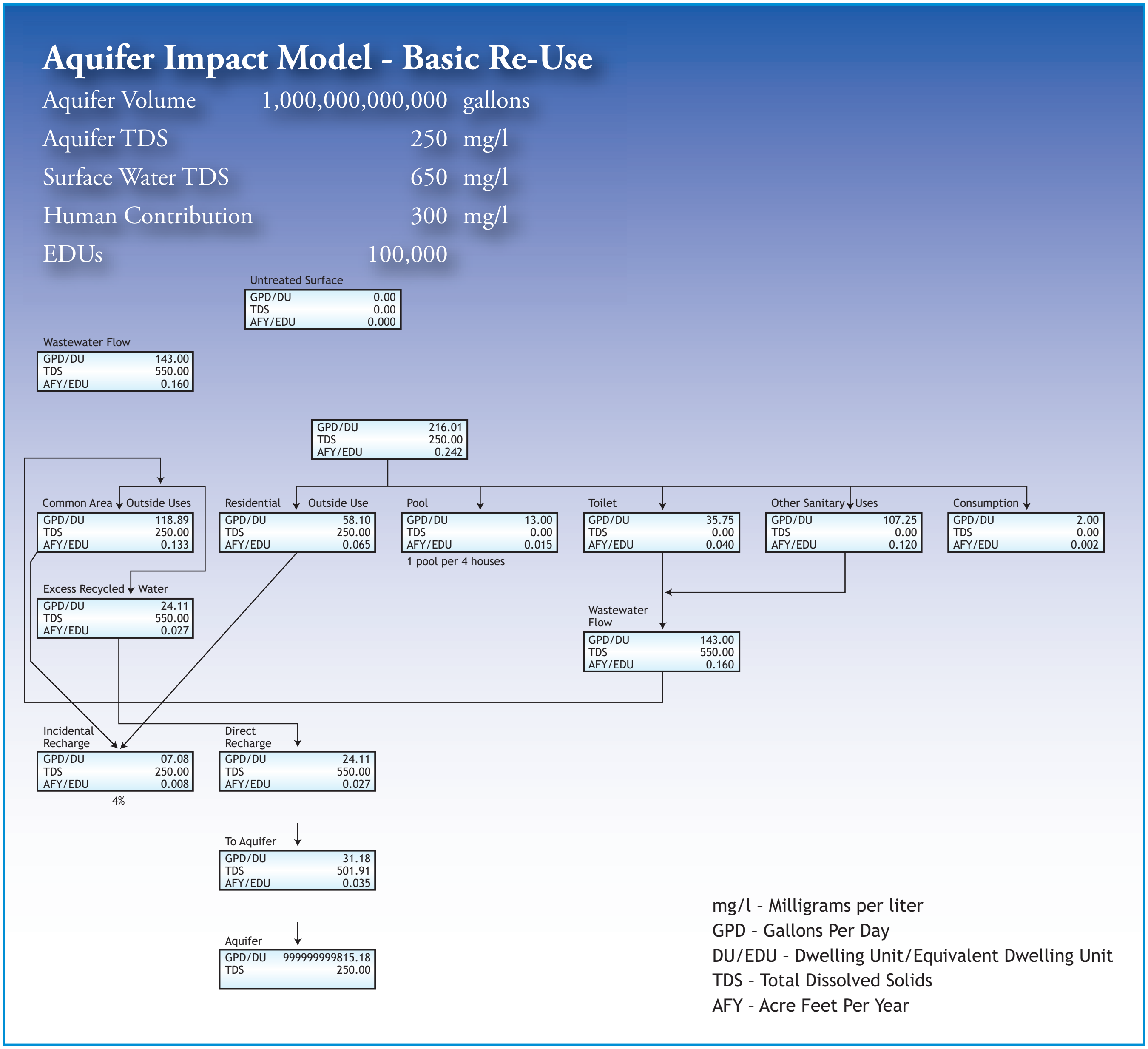
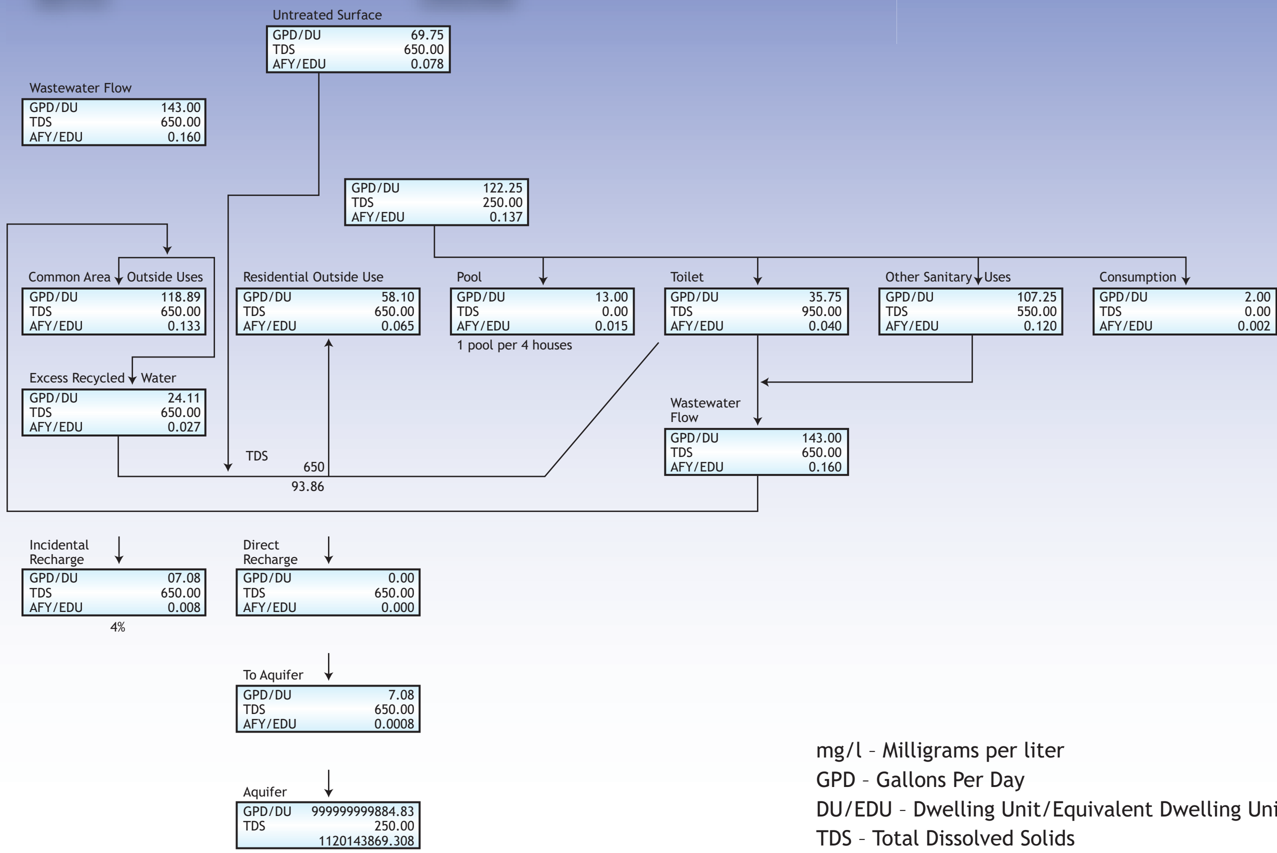

Aquifer Impact Model - Basic Re-Use
Aquifer Volume 1,000,000,000,000 gallons
Aquifer TDS 250 mg/l
Surface Water TDS 650 mg/l
Human Contribution 300 mg/l
EDUs 100,000
Untreated Surface
GPD/DU 0.00
TDS 0.00
AFY/EDU 0.000
Wastewater Flow
GPD/DU 143.00
TDS 550.00
AFY/EDU 0.160
GPD/DU 216.01
TDS 250.00
AFY/EDU 0.242
Common Area Outside Uses
GPD/DU 118.89
TDS 250.00
AFY/EDU 0.133
Residential Outside Use
GPD/DU 58.10
TDS 250.00
AFY/EDU 0.065
Pool
GPD/DU 13.00
TDS 0.00
AFY/EDU 0.015
1 pool per 4 houses
Toilet
GPD/DU 35.75
TDS 0.00
AFY/EDU 0.040
Other Sanitary Uses
GPD/DU 107.25
TDS 0.00
AFY/EDU 0.120
Consumption
GPD/DU 2.00
TDS 0.00
AFY/EDU 0.002
Excess Recycled Water
GPD/DU 24.11
TDS 550.00
AFY/EDU 0.027
Wastewater Flow
GPD/DU 143.00
TDS 550.00
AFY/EDU 0.160
Incidental Recharge
GPD/DU 07.08
TDS 250.00
AFY/EDU 0.008
4%
Direct Recharge
GPD/DU 24.11
TDS 550.00
AFY/EDU 0.027
To Aquifer
GPD/DU 31.18
TDS 501.91
AFY/EDU 0.035
Aquifer
GPD/DU 999999999815.18
TDS 250.00
mg/l – Milligrams per liter
GPD – Gallons Per Day
DU/EDU – Dwelling Unit/Equivalent Dwelling Unit
TDS – Total Dissolved Solids
AFY – Acre Feet Per Year

Table 6

Aquifer Impact Model - Advanced Re-Use

Aquifer Volume	1,000,000,000,000	gallons	3,068,887.31
Aquifer TDS	250	mg/l	
Surface Water TDS	650	mg/l	
Human Contribution	300	mg/l	
EDUs	100,000		



mg/l – Milligrams per liter
GPD – Gallons Per Day
DU/EDU – Dwelling Unit/Equivalent Dwelling Unit
TDS – Total Dissolved Solids
AFY – Acre Feet Per Year

Table 7

APPENDIX C – CONTAMINANTS OF EMERGING CONCERN

There is a significant volume of work focused on contaminants of emerging concern (CEC), including endocrine disrupting compounds (EDC) and pharmaceuticals and personal care products (PPCP) in municipal effluents and recycled water. While the direct health effects of these constituents remains uncertain, there is no doubt that they exist in wastewater, see Table 8.

Environmental EDCs have varying routes of exposure depending on their inherent physicochemical properties, as well as external conditions such as their specific use, and environmental conditions such as temperature, UV-radiation, and microbial content.[1]

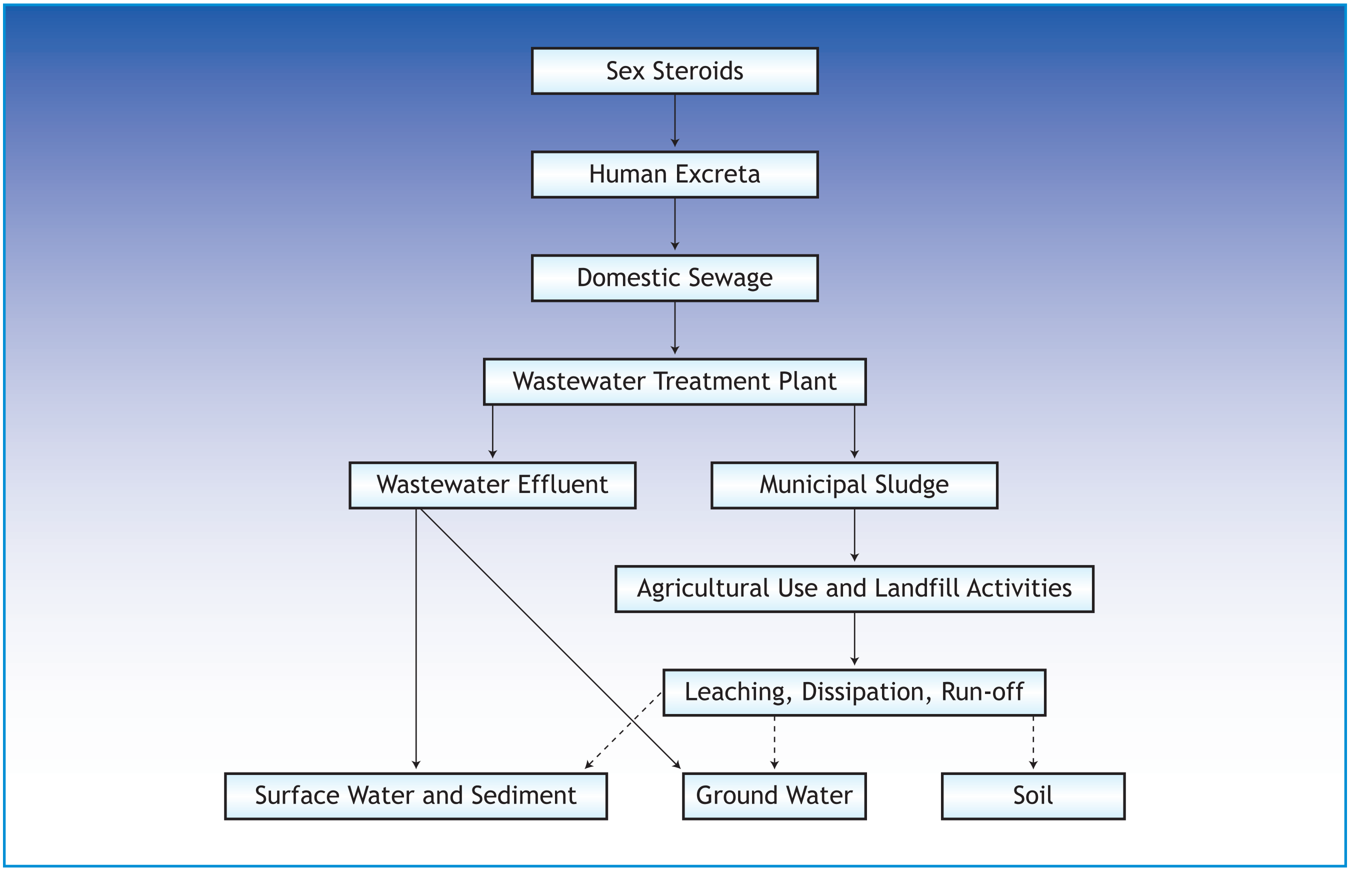


Table 8

EDC & PPCP REDUCTION STRATEGIES

Water reclamation facilities can be effective at achieving some removal of these CECs, but without specific targeted treatment will likely not be capable of removing 100%. There is some evidence that these compounds may be deactivated under normal irrigation uses through a combination of solar UV and upper soil layer metabolic effects.

Biological Treatment Processes

The extent of removal of EDCs in activated sludge sewage treatment has been reviewed and studied extensively with emphasis given to the fate of alkylphenol polyethoxylates (APEs) and steroid estrogens. While APEs such as nonylphenol polyethoxylates (NPEs) could represent a significant fraction (up to 10%) of the DOC (dissolved organic carbon) entering sewage treatment plants, these compounds are successfully eliminated in an activated sludge environment by biodegradation.[2]

Soil-Aquifer Treatment

In a study at Lawrence Livermore National Laboratories, the impact of the vadose zone and saturated zone on attenuating EDCs was significant[3]:

> NP[4] [4-nonylphenol] was not detected in LPGC [Las Positas Golf Course] groundwater (detection limit, 11 ng/L) despite average concentrations of 3000 ng/L in the irrigation water (i.e., LWRP [Livermore Water Reclamation Plant] tertiary-treated effluent)...

[1] ENDOCRINE DISRUPTORS IN THE ENVIRONMENT (IUPAC Technical Report) Prepared for publication by J. LINTELMANN, A. KATAYAMA, N. KURIHARA, L. SHORE, AND A. WENZEL.
[2] Endocrine Disrupting Chemicals (EDCs) and Pharmaceuticals and Personal Care Products (PPCPs) in Reclaimed Water in Australia. Guang-Guo Ying, Rai Kookana1 and TD Waite.
[3] Environmental transport and fate of endocrine disruptors from non-potable reuse of municipal wastewater B. Hudson, H. Beller, C. M. Bartel, S. Kane, C.Campbell, A. Grayson, N. Liu, S. Burastero, November 16, 2005.
[4] The hormonal and toxicological properties of NP have resulted in the banning of NPEOs for domestic and industrial use in many parts of Europe. Ibid.

> Maximum concentrations of the APEO[5] [Alkylphenol ethoxylates] metabolites AP1EC and AP2EC in LPGC groundwater were from 130- to 360-fold lower than in irrigation water. Since hydrological modeling indicates that irrigation water was diluted only 33 to 73% with local precipitation in the aquifer, attenuation of these compounds during transport through the vadose zone and saturated zone (e.g., by sorption of the APEO metabolites) must have been very substantial. High sorptive attenuation of NP is consistent with laboratory column studies and modeling conducted for this project.

A similar study performed in Germany found when soils were loaded with double deionised water, digested sludge, EDC spiked digested sludge, or solely a mixed EDC solution containing 4-nonylphenol, 4-tert-octylphenol (OP), bisphenol A, 17â-estradiol, and 17á-ethynylestradiol, in most cases, EDC concentrations decreased with increasing soil depths.

It was concluded that "adsorption to the soil matrix and/or biodegradation prevented a direct EDC transport to groundwater."[6]

Direct Photolysis

Direct exposure to sunlight has been found to be effective in EDC degradation in some instances with almost complete degradation within 100 hours.[7]

[5] Alkylphenol ethoxylates (APEOs), a class of nonionic surfactants, and their metabolites are the most prominent group of EDCs identified in wastewater and treated wastewater. In particular, nonylphenol ethoxylates (NPEOs) constitute the largest subgroup of the APEOs (encompassing more than 80% of the world market). Municipal wastewater treatment (including biological treatment) tends to result in efficient elimination of the parent APEOs but formation of biologically refractory metabolites including the following: alkylphenol mono- and diethoxylates, alkylphenol carboxylic acids (e.g., NP1EC and NP2EC; Figure 1), and 4-nonylphenol (NP). NP is a metabolite and representative of the APEO (and specifically, NPEO) class of endocrine disruptors that has recently been reported to have a wide distribution in surface waters and is well documented to be present in effluents of wastewater treatment plants (WWTP) at mg/L concentrations. Ibid.

[6] Mobility and fate of endocrine disrupting compounds (EDCS) in soil after application of sewage sludge to agricultural land. Dipl.-Ing. Dirk Vogel, Dr.-Ing. Martin Gehring, Dr.-Ing. Lars Tennhardt, Dr.-Ing. Diethelm Weltin, Prof. Dr.-Ing. habil. Bernd Bilitewski.

[7] Endocrine Disrupting Chemicals (EDCs) and Pharmaceuticals and Personal Care Products (PPCPs) in Reclaimed Water in Australia. Guang-Guo Ying, Rai Kookana1 and TD Waite.

SUMMARY

The beneficial reduction of EDCs in the soil matrix means that fewer EDCs and PPCPs reach the aquifer under direct re-use than would be found under direct recharge. Accordingly, it is a better management strategy to keep CECs from the aquifer by encouraging the use of recycled water as a continuous loop of non-potable water, or as an irrigation source.

APPENDIX D – BASELINE PARAMETERS

Underlying Regional Conditions

Analysis was based on the regional planning developed and currently being implemented by Global Water and its utilities within the Maricopa/Casa Grande Region (MCGR) in Pinal County, Arizona. The planning area represented by the region is roughly 300 square miles and will be serviced by multiple facilities. A far reaching network of collection and distribution pipelines will extend throughout. The region is on the fringes of the Phoenix metropolitan area so development, for the most part, is new. Installation of infrastructure has and will continue to be completed without the impediments traditionally encountered in built-up urban areas.

Global Water has constructed, or has plans to construct, standardized facilities within the region. Each well site, water distribution center, treatment plant, etc. is similar in design and functionality and is modified only to accommodate conditions related to a particular location. All planning is regional so pipelines are sized to service the area at full build out.

Population Density

A population density of **3.5 Equivalent Development Units (EDU) per acre** was used. That factor applied to a section of land (640 acres) results in 2,240 EDU to be constructed and serviced.

Consumptive Demands

Consumptive data from Santa Cruz Water Company provided an indication of total water resource demand within the service area and its distribution, see Table 9. The following parameters were developed based on four years of operation within the Maricopa/Casa Grande Region (MCGR):

Description	Consumption (Gal/Day/EDU)
Residential/Commercial Potable Water Demand	216
Wastewater Production (Equates to Inside Uses of Potable Water)	143
Outside Uses of Potable Water	73 (34% of Potable Water Demand)
Common Area Irrigation Requirements	118
	EDU - Equivalent Dwelling Unit

Table 9

It should be noted that the original development for Rancho El Dorado did not contemplate the provision of recycled water for some of the developments – as a result, some of the developments in the test area use potable water for irrigation. Since 2004, Global has required all new development common areas to be irrigated by recycled water exclusively.

Overall, Santa Cruz Water Company exhibits one of the lowest per unit water consumptions in the state. The Potable Water Portion of the Common Area Irrigation decreases as a function of EDU's over time because this mode of operation is no longer supported in the MCGR.

Availability of Recycled Water

Empirical data derived from treatment operations in the Maricopa/Casa Grande Region (from Palo Verde Utilities Company) indicates wastewater flow averages **143 gallons per EDU per day**. This quantity converts to 0.160 ac-ft/EDU/year and, once treated, can be distributed as A+ Reclaimed Water throughout the region.

Capital Expenditures & AIAC

Unit costs for capital expenditure items were derived from standard industry norms and from actual project costs. Costs are based on a Global-typical facility or installation similar to infrastructure designed and constructed within the Maricopa/Casa Grande Region, see Table 10. The following cost categories have been included:

- Permitting Costs – Front end permitting activities such as 208, CC&N, APP, AZPDES, USF, AWS, and IUP. It includes costs for hydrologic studies, well testing, etc. For purposes of this analysis it is anticipated that roughly $1,000,000 of cost will be expended in developing and obtaining the necessary permits for a region. The size of the region will vary but, in this analysis, the region is set at ten sections. Roughly 20,000 EDU's will be developed in the ten sections. $1,000,000/20,000 EDU's calculates to **$50 per EDU**.

- Groundwater Rights Acquisition – Acquirement of water rights from the market to support a perpetual supply. Global Water currently works with developers to obtain associated groundwater rights at no expense to the Utility. For purposes of this analysis, acquisition costs are set at **$0 per EDU**.

- Well Sites – Conversion of existing agricultural wells to domestic use facilities including new casings, seals, equipment, and electrical upgrades. Also includes raw water pipelines to deliver well water to water distribution centers. Unit cost is based on costs associated with a standard well conversion in MCGR, along with an estimate for pipeline installation (one mile for purposes of this analysis) to convey well water from the Well Site to a Water Distribution Center (WDC).

	Capitol Cost	Well Capacity (GPM)	Average Daily Flow (GPM)	Average Daily Flow (MGD)	Cost per Gallon
Standard Well Site	$500,000	2,000	1,000	1.440	$0.35
Pipeline	$250,000				
Total	$750,000				$0.52
Use					**$0.55**
GPM - Gallons Per Minutes • MGD - Million Gallons/Day					

Table 10

• Surface Water Rights Acquisition – Acquisition of water rights from the market to support a perpetual supply. From the Water Strategist, January 2007, a snapshot of recent surface water transactions in the southwestern United States revealed the following Table 11:

System	Location	Cost of Water Right / ac-ft 2006	Cost of Water Right / ac-ft 2001	5 Year Increase
Colorado-Big Thompson	Northern Colorado	$10,554	$5,000	190%
Truckee River	Reno, Nevada	$27,867	$3,500	696%
Middle Rio Grande	Albuquerque, New Mexico	$7,500	$4,000	88%

ac-ft - Acre Foot

Table 11

It must be noted that water markets are still in their infancy and lack any centralized exchange. The value of water is dependent on a number of factors including reliability of the underlying water right, quantity, quality, uses, and availability of competing sources of supply. With the future water market in Arizona filled with uncertainty, an acquisition price was set at **$11,000 per acre-foot** for purposes of this analysis.

• Surface Water Treatment – Design, permitting, and construction of surface water treatment facilities including all civil, structural, mechanical, process equipment, and electrical components. Santa Cruz Water Company has designed and permitted a surface water treatment facility in MCGR, see Table 12.

Facility	Capitol Cost	Treatment Capacity (MGD)	Cost per Gallon
Maricopa Groves WTF	$15,000,000 (budget)	2.5	$6.00
Use			**$6.00**

WTF - Water Treatment Facility • MGD - Million Gallons/Day

Table 12

- Arsenic Treatment – Design, permitting, and construction of facilities to remove arsenic. Includes all civil, structural, mechanical, process equipment, and electrical components. Valencia Water Company (a Global Water company located in Buckeye, Arizona) is constructing a regional arsenic treatment facility and unit costs are based on budget for that project divided by average daily treatment capacity permitted at the facility. In this case treatment capacity is equal to the facility's designated peak hour flow (to accommodate fire flow).

Facility	Capitol Cost	Treatment Capacity (GPM)	Calculated Average Daily Flow (GPM)	Calculated Average Daily Flow (MGD)	Cost per Gallon
Sonoran Vista WDC	$2,000,000 (Budget)	3,500	1,029	1.482	$1.35
Use					**$1.35**

GPM - Gallons Per Minute • MGD - Million Gallons/Day

Table 13

- Water Distribution (Storage & Pumping) – Design, permitting, and construction of treated water storage reservoirs and distribution pumping stations. Includes all civil, structural, mechanical, and electrical components. Unit cost is based on the current budget to design, permit, and construct two Water Distribution Centers (WDC's) currently being completed in the MCGR divide by the WDC's average daily flow, see Tables 13 & 14. In this case daily capacity is equal to the facilities' designated peak hour flow (to accommodate fire flow).

Facility	Capitol Cost	Booster Capacity (GPM)	Calculated Average Daily Flow (GPM)	Calculated Average Daily Flow (MGD)	Cost per Gallon
Rancho Mirage WDC	$5,800,000 (Budget)	6,500	1,912	2.753	$2.11
Terrazo WDC	$6,000,000 (Budget)	8,000	2,358	3.388	$1.77
Use					**$2.00**

GPM - Gallons Per Minute • MGD - Million Gallons/Day

Table 14

- Water Backbone Pipeline – Water transmission mains typically 12” to 16” in diameter installed between the water distribution center and the development. Within the MCGR, backbone pipelines are installed along section lines. At build-out, two miles of pipeline will be installed to service each section of land. In determining an appropriate value, $100 per linear foot was used for water backbone. $100 per linear foot x 5,280 feet per mile x 2 miles of pipeline per section totals $1,056,000 per section of land. Assuming 2,240 EDU’s per section, cost calculates to $471 per EDU. This value was modified to **$500 per EDU**.

- Onsite Water Pipelines – Water transmission pipelines installed from the point of connection with the Water Backbone Pipeline to the EDU’s and includes the cost of a meter. Typically installed by the developer. Cost of construction escalated quickly during the period extending over 2003 to 2006 but, beginning in 2006, prices began to flatten and even decreased in some instances. The following Table 15 illustrates in-parcel water infrastructure cost for developments in the MCGR.

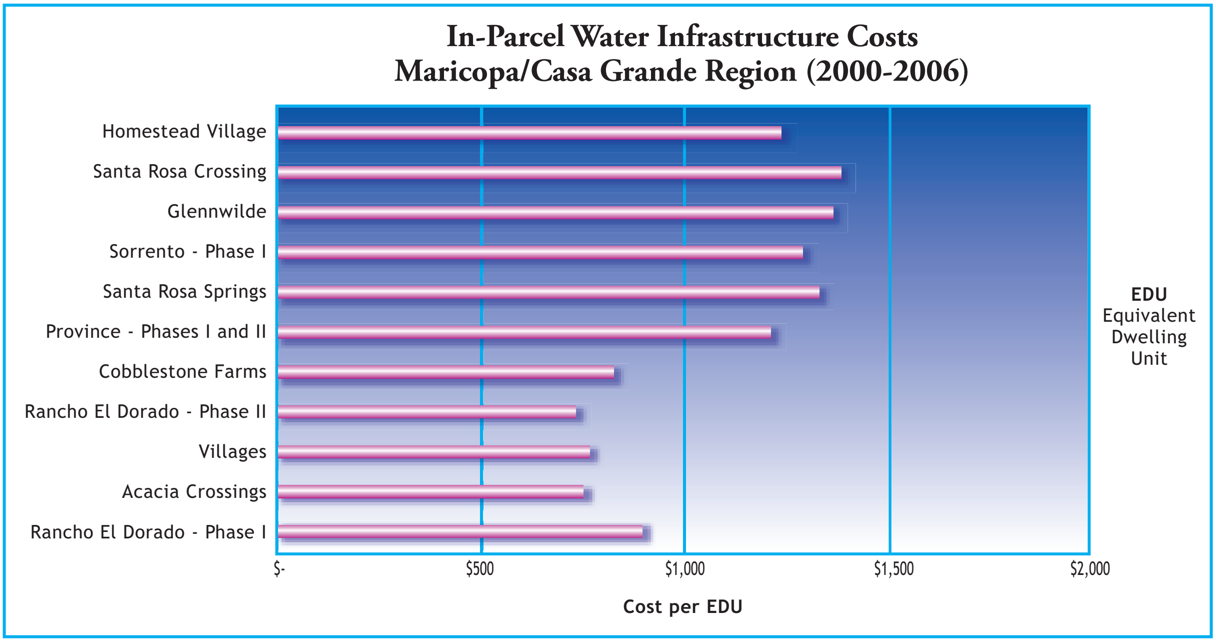


Table 15

A value of $1,400 per EDU was used for pipelines, valves and services. An additional $400 per EDU was added to account for the cost of a meter. Total calculates to **$1,800 per EDU**.

- Onsite Wastewater Pipeline – Wastewater collection pipelines installed from the EDU's to the point of connection with the Wastewater Backbone Pipeline. Typically installed by the developer. Cost of construction escalated quickly during the period extending over 2003 to 2006 but, beginning in 2006, prices began to flatten and even decreased in some instances. The following Table 16 illustrates in-parcel wastewater infrastructure cost for developments in the MCGR.

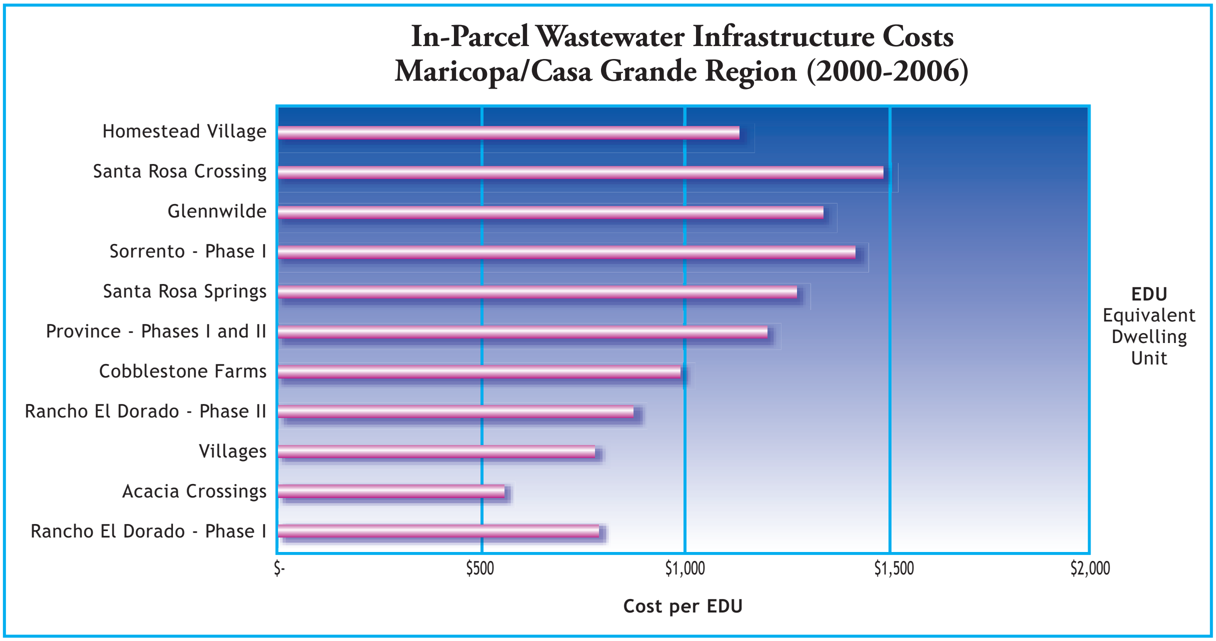


Table 16

For purposes of analysis, a value of **$1,400 per EDU** was used for in- parcel wastewater infrastructure.

- Wastewater Backbone Pipeline – Wastewater collection pipelines typically 18" to 48" in diameter installed between the development and the water reclamation center. Within the MCGR, backbone pipelines are installed along section lines. At build-out, two miles of pipeline will be installed to service each section of land. In determining an appropriate value, $150 per linear foot was used for wastewater backbone. $150 per linear foot x 5,280 feet per mile x 2 miles of pipeline per section totals $1,584,000 per section of land. Assuming 2,240 EDU's per section, cost calculates to $707 per EDU.

This value was modified to **$750 per EDU**.

- Water Reclamation – Treatment – Design, permitting, and construction of water reclamation facilities including all civil, structural, mechanical, process equipment, and electrical components. Includes influent pump station and post treatment storage and pumping (to discharge, reuse, etc.). Unit cost for analysis was developed using actual and estimated costs of current treatment infrastructure in MCGR adjusted to reflect a 3 MGD facility, see Table 17.

Project	Capacity (MGD)	Capitol Cost Total	Capitol Cost Adjusted to 3 MGD	Cost per Gallon
Campus No. 2 - Phase 1 (Excluding Headworks)	1	$10,318,945 (Budget)	$10,318,945	
Campus No. 1 - Phase 2 Expansion	+2	$11,303,675	$11,303,675	
Campus No. 2 - Headworks	6	$1,587,000 (Budget)	$1,126,070	
Campus No. 1 - Influent Pump Station	12	$2,007,000	$1,229,000	
Total	3		$23,978,440	$7.99
Use				**$8.00**
				MGD - Million Gallons/Day

Table 17

- Recycled Water Backbone Pipelines – Pipelines typically 12” to 24” in diameter installed between the water reclamation center and recycled water retention structures (lakes) within the development. These pipelines run parallel with wastewater lines in MCGR. At build-out, two miles of pipeline will be installed to service each section of land. In determining an appropriate value, $100 per linear foot was used for recycled water backbone. $100 per linear foot x 5,280 feet per mile x 2 miles of pipeline per section totals $1,056,000 per section of land. Assuming 2,240 EDU’s per section, cost calculates to $471 per EDU. This value was modified to **$500 per EDU**.

- Reclaimed Water Storage and Pressurization – Design, permitting, and construction of recycled water storage reservoirs and distribution pumping stations. Includes all civil, structural, mechanical, and electrical components. Although not identical to potable Water Distribution Center (WDC), unit cost is based on the current budget to design, permit, and construct two WDC's currently being completed in the MCGR divided by the WDC's average daily flow. In this case, because the reclaimed water distribution center will not accommodate fire flow, daily capacity is equal to the facilities' designated maximum daily flow, see Table 18.

Facility	Capitol Cost	Booster Capacity (GPM)	Calculated Average Day (GPM)	Calculated Average Day (MGD)	Cost per Gallon
Rancho Mirage WDC	$5,800,000 (Budget)	6,500	3,250	4.680	$1.24
Terrazo WDC	$6,000,000 (Budget)	8,000	4,000	5.760	$1.04
Use					**$1.15**
WDC - Water Distribution Center • GPM - Gallons Per Minute • MGD - Million Gallons/Day					

Table 18

- Onsite Recycled Water Pipelines – Pressurized recycled water transmission pipelines installed from the Reclaimed Water Storage and Pressurization facilities to the EDU's. Installed by the developer during construction of onsite infrastructure. For purpose of this analysis, installation of onsite recycled pipelines is anticipated to make use of a trench common to the wastewater pipeline. It is estimated that 80% of the cost covers materials and miscellaneous labor to install while the remaining 20% covers trenching. Because recycled water piping is similar to potable water piping, $1,400 per EDU is used as a base (determined above for onsite potable pipelines) and is multiplied by 80%, equaling $1,120 per EDU. Because the recycled water pipelines will distribute less capacity than the potable pipelines, they will be of a smaller diameter and the value has been decreased slightly to $1,100 per EDU. An additional $400 per EDU was added to account for the cost of a meter. The total calculates to **$1,500 per EDU**.

Operations and Maintenance

Unit costs for operations and maintenance were derived from industry norms or are based on values calculated from the Santa Cruz Water Company and Palo Verde Utilities Company financial statements. The following categories have been included:

- Well Sites – All rents, utility payments (power), labor, supplies, taxes, and miscellaneous expenses. Includes monitoring and compliance (sampling, testing, and lab work), see Table 19.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$413,453	1,690,346	$0.24
Use		**$0.25**

Table 19

- Surface Water Treatment – All rents, utility payments (power), taxes, and miscellaneous expenses. Labor and supplies for oil changes, lubrications, and replacement of consumable components (belts, air filters, media, etc). Includes mechanical and electrical repairs, outside rentals (cranes, pumps, etc) and procurement of chemicals. Also includes monitoring and compliance (sampling, testing, and laboratory work). Budget Operations and Maintenance costs were developed for the Maricopa Groves 2.5 MGD Facility, see Table 20.

Category	Estimated Annual O&M Cost	Cost per 1,000 Gallons
Power Consumption	$64,987	$0.07
Chemical Cost	$290,776	$0.32
Other Cost (Disposal, Module Replacement, Etc.)	$60,311	$0.07
Labor, Maintenance Materials, Testing	$100,000	$0.11
MSIDD Wheeling Charge		$0.13
Total		$0.70
Use		**$0.70**
		MSIDD - Maricopa-Stanfield Irrigation and Drainage District

Table 20

- Arsenic Treatment – All rents, utility payments (power), labor, supplies, taxes, and miscellaneous expenses. Includes monitoring and compliance (sampling, testing, and laboratory work). Depending on size and technology, Operations and Maintenance cost associated with Arsenic treatment within a regional system ranges from $0.50 to $2.00 per 1,000 gallons of treated water. For this analysis a value of **$1.50 per 1,000 Gallons** was used.

- Water Distribution (Storage and Pumping) – All rents, utility payments (power), labor, supplies, taxes, and miscellaneous expenses. Includes monitoring and compliance (sampling, testing, and laboratory work), see Table 21.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$1,229,387	1,286,414	$0.96
Use		**$1.00**

Table 21

- Water Backbone Pipeline – Valve and hydrant programs. Maintenance of PRV's. System flushing as required, see Table 22.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$122,117	1,286,414	$0.09
Use		**$0.10**

Table 22

- Onsite Water Pipelines – Valve and hydrant programs. Maintenance of PRV's. System flushing as required, see Table 23.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$122,117	1,286,414	$0.09
Use		**$0.10**

Table 23

- Onsite Wastewater Pipeline – Flushing and cleaning of collection system, see Table 24.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$38,096	447,979	$0.09
Use		**$0.10**

Table 24

- Wastewater Backbone Pipeline – Flushing and cleaning of collection system, see Table 25.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$38,096	447,979	$0.09
Use		**$0.10**

Table 25

- Water Reclamation (Treatment) – All rents, utility payments (water and power), taxes, and miscellaneous expenses. All labor and supplies for cleanings, oil changes, lubrications, replacement of consumable components (belts, air filters, media, etc). Includes mechanical and electrical repairs, outside rentals (cranes, pumps, etc), sludge hauling, and procurement of chemicals. Also includes monitoring and compliance (sampling, testing, and lab work), see Table 26.

2006 O&M Expenses Apportioned to Category	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
$1,949,554	447,979	$4.35
Use		**$4.35**

Table 26

- Recycled Water Backbone Pipelines – Valve program. Maintenance of PRV's. Since the recycled pipelines are similar to the potable water pipelines, a similar Operations and Maintenance unit cost of **$0.10 per 1,000 Gallons** is used.

- Reclaimed Water Storage and Pressurization – All rents, utility payments (power), labor, supplies, taxes, and miscellaneous expenses. Includes monitoring and compliance (sampling, testing, and laboratory work). For purpose of this analysis it is anticipated that economies of scale will be recognized within the labor component of Operations and Maintenance expenses. With a support structure in place to operate and maintain water and wastewater systems, the addition of a third recycled water system can be facilitated by expanding the labor force incrementally. The incremental labor component of recycled water Operations and Maintenance is estimated at 33% of the value calculated for potable water, see Table 27.

Category	Potable O&M Cost	Adjusted Recycled O&M Cost	Quantity Pumped (x 1,000 Gallons)	Cost per 1,000 Gallons
Utilities	$90,952	$90,952		
Supplies	$93,328	$93,328		
Labor	$915,877	**$302,239**		
Other	$129,230	$129,230		
Total	$1,229,387	$615,749	1,286,414	$0.48
Use				**$0.50**

Table 27

- Onsite Recycled Water Pipelines – Valve program. Maintenance of PRV's. Since the recycled pipelines are similar to the potable water pipelines, a similar Operations and Maintenance unit cost of **$0.10 per 1,000 Gallons** is used.

Financial Parameters

Relevant financial parameters were assigned for purposes of this analysis (capital structure, profit and loss expectations, etc).

Table of Values

The following Table 28 indicates the parameter values entered into the model for analysis.

Table of Values		Input	
Consumption Information	Water to Residential Customers (Total)	0.242	ac-ft/EDU/year
	Water to Commercial Customers (Total)	-	ac-ft/EDU/year
	Water to Res & Comm Customers for Irrigation	34%	as a % of Total ac-ft/EDU/year
	Water to HOA's for Irrigation	0.132	ac-ft/EDU/year
	Water to Miscellaneous Irrigation	-	ac-ft/EDU/year
Wastewater Available for Treatment		0.160	ac-ft/EDU/year
Population Density		3.50	per Acre
Rate Base Information (Capital Expenditures)	Permitting Costs	$ 50.00	per EDU
	Groundwater Rights Acquisition	$ -	per Ac-Ft
	Well Sites	$ 0.55	per Gallon
	Surface Water Rights Acquisition	$ 11,000	per Ac-Ft
	Surface Water Treatment	$ 6.00	per Gallon
	Arsenic Treatment	$ 1.35	per Gallon
	Water Distribution (Storage & Pumping)	$ 2.00	per Gallon
	Water Backbone Pipelines	$ 500.00	per EDU
	Wastewater Backbone Pipelines	$ 750.00	per EDU
	Water Reclamation - Treatment	$ 8.00	per Gallon
	Recycled Water Backbone Pipelines	$ 500.00	per EDU
	Reclaimed Water Storage & Pressurization	$ 1.15	per Gallon
AIAC Components	Onsite Water Pipelines	$ 1,800.00	per EDU
	Onsite Wastewater Pipelines	$ 1,400.00	per EDU
	Onsite Recycled Water Pipelines	$ 1,500.00	per EDU
Operational Expenses	Well Sites	$ 0.25	per 1000 Gallons
	Surface Water Treatment	$ 0.70	per 1000 Gallons
	Arsenic Treatment	$ 1.50	per 1000 Gallons
	Water Distribution (Storage & Pumping)	$ 1.00	per 1000 Gallons
	Water Backbone Pipelines	$ 0.10	per 1000 Gallons
	Wastewater Backbone Pipelines	$ 0.10	per 1000 Gallons
	Water Reclamation - Treatment	$ 4.35	per 1000 Gallons
	Recycled Water Backbone Pipelines	$ 0.10	per 1000 Gallons
	Reclaimed Water Storage & Pressurization	$ 0.50	per 1000 Gallons
	Onsite Water Pipelines	$ 0.10	per 1000 Gallons
	Onsite Wastewater Pipelines	$ 0.10	per 1000 Gallons
	Onsite Recycled Water Pipelines	$ 0.10	per 1000 Gallons
Rate Base Breakdown	Equity	50.00%	
	Debt	50.00%	
Monthly Wastewater Rate		$ 35.00	per Month
Cost of Recycled Water (as a % of Potable)		85.00%	
Depreciation		2.50%	
Interest		7.00%	
Tax Rate		42.00%	
Return on Equity		11.00%	

EDU - Equivalent Dwelling Unit • Ac-Ft - Acre Foot • HOA - Home Owners Association • AIAC - Advances In Aid of Construction

Table 28

APPENDIX E – CALCULATION SHEETS

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	Yes	Surface	No	Arsenic	No
LEVEL OF RECLAMATION	Basic	No	+ Advanced	No		

Consumption				
Water to Residential Customers	216	Gallons/day	0.242	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	0.132	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	0.160	ac-ft/EDU/year
Population Density	3.5	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Total Water Use	334	Gallons/day	0.374	ac-ft/EDU/year
	Recycled Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	143	Gallons/day	0.160	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ 50.00	$ 112,000
Groundwater Rights Acquisition		$ -	$ -	$ -
Well Sites	$ 0.55		$ 183.64	$ 411,347
Surface Water Rights Acquisition		$ 11,000.00	$ -	$ -
Surface Water Treatment	$ 6.00		$ -	$ -
Arsenic Treatment	$ 1.35		$ -	$ -
Water Distribution (Storage & Pumping)	$ 2.00		$ 668	$ 1,495,808
Water Backbone Pipelines			$ 500.00	$ 1,120,000
Wastewater Backbone Pipelines			$ 750.00	$ 1,680,000
Water Reclamation - Treatment	$ 8.00		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ 500.00	$ -
Reclaimed Water Storage & Pressurization	$ 1.15		$ -	$ -
AIAC				
Onsite Water Pipelines			$ 1,800.00	$ 4,032,000
Onsite Wastewater Pipelines			$ 1,400.00	$ 3,136,000
Onsite Recycled Water Pipelines			$ 1,500.00	$ -
TOTAL			$ 6,494	$ 14,546,826

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ 0.25		
Surface Water Treatment	$ -		
Arsenic Treatment	$ -		
Water Distribution (Storage & Pumping)	$ 1.00		
Water Backbone Pipelines	$ 0.10		
Wastewater Backbone Pipelines		$ 0.10	
Water Reclamation - Treatment		$ 4.35	
Recycled Water Backbone Pipelines			$ -
Reclaimed Water Storage & Pressurization			$ -
Onsite Water Pipelines	$ 0.10		
Onsite Wastewater Pipelins		$ 0.10	
Onsite Recycled Water Pipelines			$ -
	$ 1.45	$ 4.55	$ -

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 7,171,155	$ 7,375,671	$ -	$ 14,546,826
Costs per EDU	$ 3,201	$ 3,293	$ -	$ 6,494
	49.30%	50.70%	0.00%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	10,017	4,285	-	
Monthly Ops Expense per EDU	$ 14.52	$ 19.50	$ -	$ 34.02

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 7,378,826	$ 7,168,000	$ 14,546,826
Costs per EDU	$ 3,294	3,200	$ 6,494
	50.72%	49.28%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	272,984,934	116,784,998	-
	100.00%		0.00%
Equivalent Swimming Pools	**10,919**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 3,689,413	50.00%
Debt	$ 3,689,413	50.00%

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 6.08	$ 709,216	$ 26.38
Wastewater	116,784,998		Monthly Rate	$ 940,800	$ 35.00
Water to HOA and Com Areas	96,347,624	RATE @:	$ 6.08	$ 586,129	$ 21.81
Recycled Water to Com Areas	-	85.00%	$ 5.17	$ -	$ -
Recycled Water to Homes	-		$ 5.17	$ -	$ -
Total Revenue				$ 2,236,144	$ 83.19
Revenue from Water Sales		57.93%		$ 1,295,344	
Revenue from Wastewater Sales		42.07%		$ 940,800	
Rev from Recycled Water Sales		0.00%		$ -	

Hypothetical Profit & Loss		
Total Revenue	$ 2,236,144	
Expenses	$ (914,499)	
EBITDA	$ 1,321,646	
Depreciation	$ (363,671)	2.50%
Interest	$ (258,259)	7.00%
Taxable Income	$ 699,716	
Tax	$ (293,881)	42.00%
Net Income	$ 405,835	
Return on Equity	11.00%	

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Table 29

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**Yes**	Surface	**No**	Arsenic	**No**
LEVEL OF RECLAMATION	Basic	**Yes**	+ Advanced	**No**		

Consumption				
Water to Residential Customers	216	Gallons/day	**0.242**	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	**0.132**	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	**0.160**	ac-ft/EDU/year
Population Density	**3.5**	per Acre	2,240	EDU/Section

	Supply (factoring in utilization of recycled water)				
	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Total Water Use	216	Gallons/day	0.242	ac-ft/EDU/year
	Recycled Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	25	Gallons/day	0.028	ac-ft/EDU/year

	Unit Cost ($ per Gal)	**Unit Cost ($ per Ac-ft)**	**Unit Cost ($ per EDU)**	**Total per Section ($)**
Rate Base				
Permitting Costs			$ 50.00	$ 112,000
Groundwater Rights Acquisition		$ -	$ -	$ -
Well Sites	$ 0.55		$ 118.82	$ 266,166
Surface Water Rights Acquisition		$ 11,000.00	$ -	$ -
Surface Water Treatment	$ 6.00		$ -	$ -
Arsenic Treatment	$ 1.35		$ -	$ -
Water Distribution (Storage & Pumping)	$ 2.00		$ 432	$ 967,876
Water Backbone Pipelines			$ 500.00	$ 1,120,000
Wastewater Backbone Pipelines			$ 750.00	$ 1,680,000
Water Reclamation - Treatment	$ 8.00		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ 500.00	$ 1,120,000
Reclaimed Water Storage & Pressurization	$ 1.15		$ -	$ -
AIAC				
Onsite Water Pipelines			$ 1,800.00	$ 4,032,000
Onsite Wastewater Pipelines			$ 1,400.00	$ 3,136,000
Onsite Recycled Water Pipelines			$ 1,500.00	$ -
TOTAL			**$ 6,694**	**$ 14,993,713**

	Total Operating Costs (Water) ($/1000)	**Total Operating Costs (WW) ($/1000)**	**Total Operating Costs (Recycled) ($/1000)**
Operational Expenses			
Well Sites	$ 0.25		
Surface Water Treatment	$ -		
Arsenic Treatment	$ -		
Water Distribution (Storage & Pumping)	$ 1.00		
Water Backbone Pipelines	$ 0.10		
Wastewater Backbone Pipelines		$ 0.10	
Water Reclamation - Treatment		$ 4.35	
Recycled Water Backbone Pipelines			$ 0.10
Reclaimed Water Storage & Pressurization			$ -
Onsite Water Pipelines	$ 0.10		
Onsite Wastewater Pipelins		$ 0.10	
Onsite Recycled Water Pipelines			$ -
	$ 1.45	**$ 4.55**	**$ 0.10**

Breakdown of Capital Costs	**Water**	**Wastewater**	**Recycled**	**Total**
Costs per Section	$ 6,498,041	$ 7,375,671	$ 1,120,000	$ 14,993,713
Costs per EDU	$ 2,901	$ 3,293	$ 500.00	$ 6,694
	43.34%	49.19%	7.47%	100.00%

Breakdown of Operational Expenses	**Water**	**Wastewater**	**Recycled**	**Total**
Average Monthly quantities per EDU	6,481	4,285	3,535	
Monthly Ops Expense per EDU	$ 9.40	$ 19.50	$ 0.35	$ 29.25

Capital Structure	**Rate Base**	**AIAC**	**Total**
Costs per Section	$ 7,825,713	$ 7,168,000	$ 14,993,713
Costs per EDU	$ 3,494	3,200	$ 6,694
	52.19%	47.81%	100.00%

Annual Volumes	**Water**	**Wastewater**	**Recycled**
Per Section	176,637,310	116,784,998	96,347,624
	64.71%		35.29%
Equivalent Swimming Pools	**7,065**	**of Potable Water Use Each Year**	

Rate Base Breakdown	**Total**	
Equity	$ 3,912,856	**50.00%**
Debt	$ 3,912,856	**50.00%**

Hypothetical Profit & Loss		
Total Revenue	**$ 2,177,047**	
Expenses	$ (786,211)	
EBITDA	**$ 1,390,836**	
Depreciation	$ (374,843)	**2.50%**
Interest	$ (273,900)	**7.00%**
Taxable Income	**$ 742,093**	
Tax	$ (311,679)	**42.00%**
Net Income	**$ 430,414**	
Return on Equity	**11.00%**	

	Annual Volume		**$/1000 Gallons**	**Annual Total**	**$/EDU/Month**
Water to Homes	116,580,625		$ 6.23	$ 726,145	$ 27.01
Wastewater	116,784,998		**Monthly Rate**	$ 940,800	**$ 35.00**
Water to HOA and Com Areas	-	RATE @:	$ 6.23	$ -	$ -
Recycled Water to Com Areas	96,347,624	**85.00%**	$ 5.29	$ 510,102	$ 18.98
Recycled Water to Homes	-		$ 5.29	$ -	$ -
Total Revenue				**$ 2,177,047**	**$ 80.99**
Revenue from Water Sales		33.35%		$ 726,145	
Revenue from Wastewater Sales		43.21%		$ 940,800	
Rev from Recycled Water Sales		23.43%		$ 510,102	

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Table 30

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**Yes**	Surface	**No**	Arsenic	**No**
LEVEL OF RECLAMATION	Basic	**Yes**	+ Advanced	**Yes**		

Consumption

Water to Residential Customers	216	Gallons/day	**0.242**	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	**0.132**	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	**0.160**	ac-ft/EDU/year
Population Density	**3.5**	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	-	Gallons/day	-	ac-ft/EDU/year
	Total Water to Customers	143	Gallons/day	0.160	ac-ft/EDU/year
	Water to Common Areas	48	Gallons/day	0.054	ac-ft/EDU/year
	Total Water Use	191	Gallons/day	0.214	ac-ft/EDU/year
	Recycled Water to Common Areas	69	Gallons/day	0.078	ac-ft/EDU/year
	Recycled Water to Customers	73	Gallons/day	0.082	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	-	Gallons/day	-	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			**$ 50.00**	$ 112,000
Groundwater Rights Acquisition		**$ -**	$ -	$ -
Well Sites	**$ 0.55**		$ 105.08	$ 235,370
Surface Water Rights Acquisition		**$ 11,000.00**	$ -	$ -
Surface Water Treatment	**$ 6.00**		$ -	$ -
Arsenic Treatment	**$ 1.35**		$ -	$ -
Water Distribution (Storage & Pumping)	**$ 2.00**		$ 382	$ 855,890
Water Backbone Pipelines			**$ 500.00**	$ 1,120,000
Wastewater Backbone Pipelines			**$ 750.00**	$ 1,680,000
Water Reclamation - Treatment	**$ 8.00**		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			**$ 500.00**	$ 1,120,000
Reclaimed Water Storage & Pressurization	**$ 1.15**		$ 84.47	$ 189,220
AIAC				
Onsite Water Pipelines			**$ 1,800.00**	$ 4,032,000
Onsite Wastewater Pipelines			**$ 1,400.00**	$ 3,136,000
Onsite Recycled Water Pipelines			**$ 1,500.00**	$ 3,360,000
TOTAL			**$ 8,214**	**$ 18,400,151**

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	**$ 0.25**		
Surface Water Treatment	**$ -**		
Arsenic Treatment	**$ -**		
Water Distribution (Storage & Pumping)	**$ 1.00**		
Water Backbone Pipelines	**$ 0.10**		
Wastewater Backbone Pipelines		**$ 0.10**	
Water Reclamation - Treatment		**$ 4.35**	
Recycled Water Backbone Pipelines			**$ 0.10**
Reclaimed Water Storage & Pressurization			**$ 0.50**
Onsite Water Pipelines	**$ 0.10**		
Onsite Wastewater Pipelins		**$ 0.10**	
Onsite Recycled Water Pipelines			**$ 0.10**
	$ 1.45	**$ 4.55**	**$ 0.70**

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 6,355,260	$ 7,375,671	$ 4,669,220	$ 18,400,151
Costs per EDU	$ 2,837	$ 3,293	$ 2,084.47	$ 8,214
	34.54%	40.08%	25.38%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	5,731	4,285	4,285	
Monthly Ops Expense per EDU	$ 8.31	$ 19.50	$ 3.00	$ 30.81

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 7,872,151	$ 10,528,000	$ 18,400,151
Costs per EDU	$ 3,514	4,700	$ 8,214
	42.78%	57.22%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	156,199,935	116,784,998	116,784,998
	57.22%		42.78%
Equivalent Swimming Pools	**6,248**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 3,936,075	**50.00%**
Debt	$ 3,936,075	**50.00%**

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 5.36	$ 624,887	$ 23.25
Wastewater	116,784,998		**Monthly Rate**	$ 940,800	**$ 35.00**
Water to HOA and Com Areas	39,619,311	RATE @:	$ 5.36	$ 212,364	$ 7.90
Recycled Water to Com Areas	56,728,313	**85.00%**	$ 4.56	$ 258,460	$ 9.62
Recycled Water to Homes	60,056,685		$ 4.56	$ 273,625	$ 10.18
Total Revenue				**$ 2,310,136**	**$ 85.94**
Revenue from Water Sales		36.24%		$ 837,251	
Revenue from Wastewater Sales		40.72%		$ 940,800	
Rev from Recycled Water Sales		23.03%		$ 532,085	

Hypothetical Profit & Loss		
Total Revenue	**$ 2,310,136**	
Expenses	$ (828,110)	
EBITDA	**$ 1,482,026**	
Depreciation	$ (460,004)	**2.50%**
Interest	$ (275,525)	**7.00%**
Taxable Income	**$ 746,497**	
Tax	$ (313,529)	**42.00%**
Net Income	**$ 432,968**	
Return on Equity	**11.00%**	

GLOBAL WATER
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Table 31

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	No	Surface	Yes	Arsenic	No
LEVEL OF RECLAMATION	Basic	No	+ Advanced	No		

Consumption

Water to Residential Customers	216	Gallons/day	0.242	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	0.132	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year

Recycled Water

Wastewater Available for Treatment	143	Gallons/day	0.160	ac-ft/EDU/year

Population Density	3.5	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Total Water Use	334	Gallons/day	0.374	ac-ft/EDU/year
	Recycled Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	143	Gallons/day	0.160	ac-ft/EDU/year

Rate Base	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Permitting Costs			$ 50.00	$ 112,000
Groundwater Rights Acquisition		$ -	$ -	$ -
Well Sites	$ 0.55		$ -	$ -
Surface Water Rights Acquisition		$ 11,000.00	$ 4,114.00	$ 9,215,360
Surface Water Treatment	$ 6.00		$ 2,003.31	$ 4,487,424
Arsenic Treatment	$ 1.35		$ -	$ -
Water Distribution (Storage & Pumping)	$ 2.00		$ 668	$ 1,495,808
Water Backbone Pipelines			$ 500.00	$ 1,120,000
Wastewater Backbone Pipelines			$ 750.00	$ 1,680,000
Water Reclamation - Treatment	$ 8.00		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ 500.00	$ -
Reclaimed Water Storage & Pressurization	$ 1.15		$ -	$ -
AIAC				
Onsite Water Pipelines			$ 1,800.00	$ 4,032,000
Onsite Wastewater Pipelines			$ 1,400.00	$ 3,136,000
Onsite Recycled Water Pipelines			$ 1,500.00	$ -
TOTAL			$ 12,428	$ 27,838,263

Operational Expenses	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Well Sites	$ -		
Surface Water Treatment	$ 0.70		
Arsenic Treatment	$ -		
Water Distribution (Storage & Pumping)	$ 1.00		
Water Backbone Pipelines	$ 0.10		
Wastewater Backbone Pipelines		$ 0.10	
Water Reclamation - Treatment		$ 4.35	
Recycled Water Backbone Pipelines			$ -
Reclaimed Water Storage & Pressurization			$ -
Onsite Water Pipelines	$ 0.10		
Onsite Wastewater Pipelins		$ 0.10	
Onsite Recycled Water Pipelines			$ -
TOTAL	$ 1.90	$ 4.55	$ -

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 20,462,591	$ 7,375,671	$ -	$ 27,838,263
Costs per EDU	$ 9,135	$ 3,293	$ -	$ 12,428
	73.51%	26.49%	0.00%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	10,017	4,285	-	
Monthly Ops Expense per EDU	$ 19.03	$ 19.50	$ -	$ 38.53

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 20,670,263	$ 7,168,000	$ 27,838,263
Costs per EDU	$ 9,228	3,200	$ 12,428
	74.25%	25.75%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	272,984,934	116,784,998	-
	100.00%		0.00%
Equivalent Swimming Pools	**10,919**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 10,335,131	50.00%
Debt	$ 10,335,131	50.00%

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 16.32	$ 1,902,266	$ 70.77
Wastewater	116,784,998		Monthly Rate	$ 940,800	$ 35.00
Water to HOA and Com Areas	96,347,624	RATE @:	$ 16.32	$ 1,572,120	$ 58.49
Recycled Water to Com Areas	-	85.00%	$ 13.87	$ -	$ -
Recycled Water to Homes	-		$ 13.87	$ -	$ -
Total Revenue				$ 4,415,186	$ 164.26

Revenue from Water Sales	78.69%	$ 3,474,386
Revenue from Wastewater Sales	21.31%	$ 940,800
Rev from Recycled Water Sales	0.00%	$ -

Hypothetical Profit & Loss

Total Revenue	$ 4,415,186	
Expenses	$ (1,035,659)	
EBITDA	$ 3,379,527	
Depreciation	$ (695,957)	2.50%
Interest	$ (723,459)	7.00%
Taxable Income	$ 1,960,111	
Tax	$ (823,247)	42.00%
Net Income	$ 1,136,864	
Return on Equity	11.00%	

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Table 32

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**No**	Surface	**Yes**	Arsenic	**No**
LEVEL OF RECLAMATION	Basic	**Yes**	+ Advanced	**No**		

Consumption				
Water to Residential Customers	216	Gallons/day	0.242	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	0.132	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	0.160	ac-ft/EDU/year
Population Density	3.5	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Total Water Use	216	Gallons/day	0.242	ac-ft/EDU/year
	Recycled Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	25	Gallons/day	0.028	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ 50.00	$ 112,000
Groundwater Rights Acquisition		$ -	$ -	$ -
Well Sites	$ 0.55		$ -	$ -
Surface Water Rights Acquisition		$ 11,000.00	$ 2,662.00	$ 5,962,880
Surface Water Treatment	$ 6.00		$ 1,296.26	$ 2,903,627
Arsenic Treatment	$ 1.35		$ -	$ -
Water Distribution (Storage & Pumping)	$ 2.00		$ 432	$ 967,876
Water Backbone Pipelines			$ 500.00	$ 1,120,000
Wastewater Backbone Pipelines			$ 750.00	$ 1,680,000
Water Reclamation - Treatment	$ 8.00		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ 500.00	$ 1,120,000
Reclaimed Water Storage & Pressurization	$ 1.15		$ -	$ -
AIAC				
Onsite Water Pipelines			$ 1,800.00	$ 4,032,000
Onsite Wastewater Pipelines			$ 1,400.00	$ 3,136,000
Onsite Recycled Water Pipelines			$ 1,500.00	$ -
TOTAL			$ 10,533	$ 23,594,054

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ -		
Surface Water Treatment	$ 0.70		
Arsenic Treatment	$ -		
Water Distribution (Storage & Pumping)	$ 1.00		
Water Backbone Pipelines	$ 0.10		
Wastewater Backbone Pipelines		$ 0.10	
Water Reclamation - Treatment		$ 4.35	
Recycled Water Backbone Pipelines			$ 0.10
Reclaimed Water Storage & Pressurization			$ -
Onsite Water Pipelines	$ 0.10		
Onsite Wastewater Pipelins		$ 0.10	
Onsite Recycled Water Pipelines			$ -
	$ 1.90	$ 4.55	$ 0.10

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 15,098,383	$ 7,375,671	$ 1,120,000	$ 23,594,054
Costs per EDU	$ 6,740	$ 3,293	$ 500.00	$ 10,533
	63.99%	31.26%	4.75%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	6,481	4,285	3,535	
Monthly Ops Expense per EDU	$ 12.31	$ 19.50	$ 0.35	$ 32.17

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 16,426,054	$ 7,168,000	$ 23,594,054
Costs per EDU	$ 7,333	3,200	$ 10,533
	69.62%	30.38%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	176,637,310	116,784,998	96,347,624
	64.71%		35.29%
Equivalent Swimming Pools	**7,065**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 8,213,027	50.00%
Debt	$ 8,213,027	50.00%

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 13.33	$ 1,554,330	$ 57.82
Wastewater	116,784,998		Monthly Rate	$ 940,800	$ 35.00
Water to HOA and Com Areas	-	RATE @:	$ 13.33	$ -	$ -
Recycled Water to Com Areas	96,347,624	85.00%	$ 11.33	$ 1,091,885	$ 40.62
Recycled Water to Homes	-		$ 11.33	$ -	$ -
Total Revenue				$ 3,587,015	$ 133.45
Revenue from Water Sales		43.33%		$ 1,554,330	
Revenue from Wastewater Sales		26.23%		$ 940,800	
Rev from Recycled Water Sales		30.44%		$ 1,091,885	

Hypothetical Profit & Loss		
Total Revenue	$ 3,587,015	
Expenses	$ (864,609)	
EBITDA	$ 2,722,406	
Depreciation	$ (589,851)	2.50%
Interest	$ (574,912)	7.00%
Taxable Income	$ 1,557,643	
Tax	$ (654,210)	42.00%
Net Income	$ 903,433	
Return on Equity	11.00%	

GLOBAL WATER
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Table 33

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	No	Surface	Yes	Arsenic	No
LEVEL OF RECLAMATION	Basic	Yes	+ Advanced	Yes		

Consumption				
Water to Residential Customers	216	Gallons/day	0.242	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	0.132	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	-	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	0.160	ac-ft/EDU/year
Population Density	3.5	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	-	Gallons/day	-	ac-ft/EDU/year
	Total Water to Customers	143	Gallons/day	0.160	ac-ft/EDU/year
	Water to Common Areas	48	Gallons/day	0.054	ac-ft/EDU/year
	Total Water Use	191	Gallons/day	0.214	ac-ft/EDU/year
	Recycled Water to Common Areas	69	Gallons/day	0.078	ac-ft/EDU/year
	Recycled Water to Customers	73	Gallons/day	0.082	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	-	Gallons/day	-	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ 50.00	$ 112,000
Groundwater Rights Acquisition		$ -	$ -	$ -
Well Sites	$ 0.55		$ -	$ -
Surface Water Rights Acquisition		$ 11,000.00	$ 2,354.00	$ 5,272,960
Surface Water Treatment	$ 6.00		$ 1,146.28	$ 2,567,670
Arsenic Treatment	$ 1.35		$ -	$ -
Water Distribution (Storage & Pumping)	$ 2.00		$ 382	$ 855,890
Water Backbone Pipelines			$ 500.00	$ 1,120,000
Wastewater Backbone Pipelines			$ 750.00	$ 1,680,000
Water Reclamation - Treatment	$ 8.00		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ 500.00	$ 1,120,000
Reclaimed Water Storage & Pressurization	$ 1.15		$ 84.47	$ 189,220
AIAC				
Onsite Water Pipelines			$ 1,800.00	$ 4,032,000
Onsite Wastewater Pipelines			$ 1,400.00	$ 3,136,000
Onsite Recycled Water Pipelines			$ 1,500.00	$ 3,360,000
TOTAL			$ 11,610	$ 26,005,411

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ -		
Surface Water Treatment	$ 0.70		
Arsenic Treatment	$ -		
Water Distribution (Storage & Pumping)	$ 1.00		
Water Backbone Pipelines	$ 0.10		
Wastewater Backbone Pipelines		$ 0.10	
Water Reclamation - Treatment		$ 4.35	
Recycled Water Backbone Pipelines			$ 0.10
Reclaimed Water Storage & Pressurization			$ 0.50
Onsite Water Pipelines	$ 0.10		
Onsite Wastewater Pipelins		$ 0.10	
Onsite Recycled Water Pipelines			$ 0.10
	$ 1.90	$ 4.55	$ 0.70

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 13,960,520	$ 7,375,671	$ 4,669,220	$ 26,005,411
Costs per EDU	$ 6,232	$ 3,293	$ 2,084.47	$ 11,610
	53.68%	28.36%	17.95%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	5,731	4,285	4,285	
Monthly Ops Expense per EDU	$ 10.89	$ 19.50	$ 3.00	$ 33.39

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 15,477,411	$ 10,528,000	$ 26,005,411
Costs per EDU	$ 6,910	4,700	$ 11,610
	59.52%	40.48%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	156,199,935	116,784,998	116,784,998
	57.22%		42.78%
Equivalent Swimming Pools	6,248	of Potable Water Use Each Year	

Rate Base Breakdown	Total	
Equity	$ 7,738,706	50.00%
Debt	$ 7,738,706	50.00%

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 10.24	$ 1,193,869	$ 44.41
Wastewater	116,784,998		Monthly Rate	$ 940,800	$ 35.00
Water to HOA and Com Areas	39,619,311	RATE @:	$ 10.24	$ 405,730	$ 15.09
Recycled Water to Com Areas	56,728,313	85.00%	$ 8.70	$ 493,798	$ 18.37
Recycled Water to Homes	60,056,685		$ 8.70	$ 522,770	$ 19.45
Total Revenue				$ 3,556,967	$ 132.33
Revenue from Water Sales		44.97%		$ 1,599,599	
Revenue from Wastewater Sales		26.45%		$ 940,800	
Rev from Recycled Water Sales		28.58%		$ 1,016,568	

Hypothetical Profit & Loss		
Total Revenue	$ 3,556,967	
Expenses	$ (897,437)	
EBITDA	$ 2,659,530	
Depreciation	$ (650,135)	2.50%
Interest	$ (541,709)	7.00%
Taxable Income	$ 1,467,686	
Tax	$ (616,428)	42.00%
Net Income	$ 851,258	
Return on Equity	11.00%	

GLOBAL WATER
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Table 34

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**Yes**	Surface	**No**	Arsenic	**Yes**
LEVEL OF RECLAMATION	Basic	**No**	+ Advanced	**No**		

Consumption				
Water to Residential Customers	216	Gallons/day	**0.242**	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	**0.132**	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	**0.160**	ac-ft/EDU/year
Population Density	**3.5**	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Total Water Use	334	Gallons/day	0.374	ac-ft/EDU/year
	Recycled Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	143	Gallons/day	0.160	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ **50.00**	$ 112,000
Groundwater Rights Acquisition		$ **-**	$ -	$ -
Well Sites	$ **0.55**		$ 183.64	$ 411,347
Surface Water Rights Acquisition		$ **11,000.00**	$ -	$ -
Surface Water Treatment	$ **6.00**		$ -	$ -
Arsenic Treatment	$ **1.35**		$ 450.75	$ 1,009,670
Water Distribution (Storage & Pumping)	$ **2.00**		$ 668	$ 1,495,808
Water Backbone Pipelines			$ **500.00**	$ 1,120,000
Wastewater Backbone Pipelines			$ **750.00**	$ 1,680,000
Water Reclamation - Treatment	$ **8.00**		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ **500.00**	$ -
Reclaimed Water Storage & Pressurization	$ **1.15**		$ -	$ -
AIAC				
Onsite Water Pipelines			$ **1,800.00**	$ 4,032,000
Onsite Wastewater Pipelines			$ **1,400.00**	$ 3,136,000
Onsite Recycled Water Pipelines			$ **1,500.00**	$ -
TOTAL			$ **6,945**	$ **15,556,497**

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ **0.25**		
Surface Water Treatment	$ **-**		
Arsenic Treatment	$ **1.50**		
Water Distribution (Storage & Pumping)	$ **1.00**		
Water Backbone Pipelines	$ **0.10**		
Wastewater Backbone Pipelines		$ **0.10**	
Water Reclamation - Treatment		$ **4.35**	
Recycled Water Backbone Pipelines			$ **-**
Reclaimed Water Storage & Pressurization			$ **-**
Onsite Water Pipelines	$ **0.10**		
Onsite Wastewater Pipelins		$ **0.10**	
Onsite Recycled Water Pipelines			$ **-**
	$ **2.95**	$ **4.55**	$ **-**

Breakdown of Capital Costs	**Water**	**Wastewater**	**Recycled**	**Total**
Costs per Section	$ 8,180,825	$ 7,375,671	$ -	$ 15,556,497
Costs per EDU	$ 3,652	$ 3,293	$ -	$ 6,945
	52.59%	47.41%	0.00%	100.00%

Breakdown of Operational Expenses	**Water**	**Wastewater**	**Recycled**	**Total**
Average Monthly quantities per EDU	10,017	4,285	-	
Monthly Ops Expense per EDU	$ 29.55	$ 19.50	$ -	$ 49.05

Capital Structure	**Rate Base**	**AIAC**	**Total**
Costs per Section	$ 8,388,497	$ 7,168,000	$ 15,556,497
Costs per EDU	$ 3,745	3,200	$ 6,945
	53.92%	46.08%	100.00%

Annual Volumes	**Water**	**Wastewater**	**Recycled**
Per Section	272,984,934	116,784,998	-
	100.00%		0.00%
Equivalent Swimming Pools	**10,919**	**of Potable Water Use Each Year**	

Rate Base Breakdown	**Total**	
Equity	$ 4,194,248	**50.00%**
Debt	$ 4,194,248	**50.00%**

	Annual Volume		**$/1000 Gallons**	**Annual Total**	**$/EDU/Month**
Water to Homes	116,580,625		$ 8.71	$ 1,015,928	$ 37.79
Wastewater	116,784,998		**Monthly Rate** $	$ 940,800	$ **35.00**
Water to HOA and Com Areas	96,347,624	RATE @:	$ 8.71	$ 839,610	$ 31.24
Recycled Water to Com Areas	-	**85.00%**	$ 7.41	$ -	$ -
Recycled Water to Homes	-		$ 7.41	$ -	$ -
Total Revenue				$ **2,796,337**	$ **104.03**
Revenue from Water Sales		66.36%		$ 1,855,537	
Revenue from Wastewater Sales		33.64%		$ 940,800	
Rev from Recycled Water Sales		0.00%		$ -	

Hypothetical Profit & Loss		
Total Revenue	$ **2,796,337**	
Expenses	$ (1,318,367)	
EBITDA	$ **1,477,971**	
Depreciation	$ (388,912)	**2.50%**
Interest	$ (293,597)	**7.00%**
Taxable Income	$ **795,461**	
Tax	$ (334,094)	**42.00%**
Net Income	$ **461,367**	
Return on Equity	**11.00%**	

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Table 35

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**Yes**	Surface	**No**	Arsenic	**Yes**
LEVEL OF RECLAMATION	Basic	**Yes**	+ Advanced	**No**		

Consumption

Water to Residential Customers	216	Gallons/day	**0.242**	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	**0.132**	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	**0.160**	ac-ft/EDU/year
Population Density	**3.5**	per Acre	2,240	EDU/Section

Supply (factoring in utilization of recycled water)

	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	73	Gallons/day	0.082	ac-ft/EDU/year
	Total Water to Customers	216	Gallons/day	0.242	ac-ft/EDU/year
	Water to Common Areas	-	Gallons/day	-	ac-ft/EDU/year
	Total Water Use	216	Gallons/day	0.242	ac-ft/EDU/year
	Recycled Water to Common Areas	118	Gallons/day	0.132	ac-ft/EDU/year
	Recycled Water to Customers	-	Gallons/day	-	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	25	Gallons/day	0.028	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ **50.00**	$ 112,000
Groundwater Rights Acquisition		$ **-**	$ -	$ -
Well Sites	$ **0.55**		$ 118.82	$ 266,166
Surface Water Rights Acquisition		$ **11,000.00**	$ -	$ -
Surface Water Treatment	$ **6.00**		$ -	$ -
Arsenic Treatment	$ **1.35**		$ 291.66	$ 653,316
Water Distribution (Storage & Pumping)	$ **2.00**		$ 432	$ 967,876
Water Backbone Pipelines			$ **500.00**	$ 1,120,000
Wastewater Backbone Pipelines			$ **750.00**	$ 1,680,000
Water Reclamation - Treatment	$ **8.00**		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ **500.00**	$ 1,120,000
Reclaimed Water Storage & Pressurization	$ **1.15**		$ -	$ -
AIAC				
Onsite Water Pipelines			$ **1,800.00**	$ 4,032,000
Onsite Wastewater Pipelines			$ **1,400.00**	$ 3,136,000
Onsite Recycled Water Pipelines			$ **1,500.00**	$ -
TOTAL			**$ 6,985**	**$ 15,647,029**

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ **0.25**		
Surface Water Treatment	$ **-**		
Arsenic Treatment	$ **1.50**		
Water Distribution (Storage & Pumping)	$ **1.00**		
Water Backbone Pipelines	$ **0.10**		
Wastewater Backbone Pipelines		$ **0.10**	
Water Reclamation - Treatment		$ **4.35**	
Recycled Water Backbone Pipelines			$ **0.10**
Reclaimed Water Storage & Pressurization			$ **-**
Onsite Water Pipelines	$ **0.10**		
Onsite Wastewater Pipelins		$ **0.10**	
Onsite Recycled Water Pipelines			$ **-**
	$ 2.95	**$ 4.55**	**$ 0.10**

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 7,151,358	$ 7,375,671	$ 1,120,000	$ 15,647,029
Costs per EDU	$ 3,193	$ 3,293	$ 500.00	$ 6,985
	45.70%	47.14%	7.16%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	6,481	4,285	3,535	
Monthly Ops Expense per EDU	$ 19.12	$ 19.50	$ 0.35	$ 38.97

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 8,479,029	$ 7,168,000	$ 15,647,029
Costs per EDU	$ 3,785	3,200	$ 6,985
	54.19%	45.81%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	176,637,310	116,784,998	96,347,624
	64.71%		35.29%
Equivalent Swimming Pools	**7,065**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 4,239,514	**50.00%**
Debt	$ 4,239,514	**50.00%**

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 8.05	$ 939,057	$ 34.94
Wastewater	116,784,998		**Monthly Rate**	$ 940,800	$ **35.00**
Water to HOA and Com Areas	-	RATE @:	$ 8.05	$ -	$ -
Recycled Water to Com Areas	96,347,624	**85.00%**	$ 6.85	$ 659,668	$ 24.54
Recycled Water to Homes	-		$ 6.85	$ -	$ -
Total Revenue				**$ 2,539,525**	**$ 94.48**
Revenue from Water Sales		36.98%		$ 939,057	
Revenue from Wastewater Sales		37.05%		$ 940,800	
Rev from Recycled Water Sales		25.98%		$ 659,668	

Hypothetical Profit & Loss		
Total Revenue	**$ 2,539,525**	
Expenses	$ (1,047,537)	
EBITDA	**$ 1,491,988**	
Depreciation	$ (391,176)	**2.50%**
Interest	$ (296,766)	**7.00%**
Taxable Income	**$ 804,046**	
Tax	$ (337,699)	**42.00%**
Net Income	**$ 466,347**	
Return on Equity	**11.00%**	

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Table 36

THE ECONOMICS OF RECLAMATION

SCENARIO	Groundwater	**Yes**	Surface	**No**	Arsenic	**Yes**
LEVEL OF RECLAMATION	Basic	**Yes**	+ Advanced	**Yes**		

Consumption				
Water to Residential Customers	216	Gallons/day	**0.242**	ac-ft/EDU/year
Water to Commercial Customers	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - HOMES	216	Gallons/day	0.242	ac-ft/EDU/year
Water to HOA's for Irrigation	118	Gallons/day	**0.132**	ac-ft/EDU/year
Water to Miscellaneous Irrigation	-	Gallons/day	**-**	ac-ft/EDU/year
SUBTOTAL - COMMON AREAS	118	Gallons/day	0.132	ac-ft/EDU/year
TOTAL	334	Gallons/day	0.374	ac-ft/EDU/year
Recycled Water				
Wastewater Available for Treatment	143	Gallons/day	**0.160**	ac-ft/EDU/year
Population Density	**3.5**	per Acre	2,240	EDU/Section

	Supply (factoring in utilization of recycled water)				
	Water to Customers (Inside)	143	Gallons/day	0.160	ac-ft/EDU/year
34%	Water to Customers (Outside)	-	Gallons/day	-	ac-ft/EDU/year
	Total Water to Customers	143	Gallons/day	0.160	ac-ft/EDU/year
	Water to Common Areas	48	Gallons/day	0.054	ac-ft/EDU/year
	Total Water Use	191	Gallons/day	0.214	ac-ft/EDU/year
	Recycled Water to Common Areas	69	Gallons/day	0.078	ac-ft/EDU/year
	Recycled Water to Customers	73	Gallons/day	0.082	ac-ft/EDU/year
	Re. Water To Discharge/Recharge	-	Gallons/day	-	ac-ft/EDU/year

	Unit Cost ($ per Gal)	Unit Cost ($ per Ac-ft)	Unit Cost ($ per EDU)	Total per Section ($)
Rate Base				
Permitting Costs			$ **50.00**	$ 112,000
Groundwater Rights Acquisition		$ **-**	$ -	$ -
Well Sites	$ **0.55**		$ 105.08	$ 235,370
Surface Water Rights Acquisition		$ **11,000.00**	$ -	$ -
Surface Water Treatment	$ **6.00**		$ -	$ -
Arsenic Treatment	$ **1.35**		$ 257.91	$ 577,726
Water Distribution (Storage & Pumping)	$ **2.00**		$ 382	$ 855,890
Water Backbone Pipelines			$ **500.00**	$ 1,120,000
Wastewater Backbone Pipelines			$ **750.00**	$ 1,680,000
Water Reclamation - Treatment	$ **8.00**		$ 1,143	$ 2,559,671
Recycled Water Backbone Pipelines			$ **500.00**	$ 1,120,000
Reclaimed Water Storage & Pressurization	$ **1.15**		$ 84.47	$ 189,220
AIAC				
Onsite Water Pipelines			$ **1,800.00**	$ 4,032,000
Onsite Wastewater Pipelines			$ **1,400.00**	$ 3,136,000
Onsite Recycled Water Pipelines			$ **1,500.00**	$ 3,360,000
TOTAL			**$ 8,472**	**$ 18,977,877**

	Total Operating Costs (Water) ($/1000)	Total Operating Costs (WW) ($/1000)	Total Operating Costs (Recycled) ($/1000)
Operational Expenses			
Well Sites	$ **0.25**		
Surface Water Treatment	$ **-**		
Arsenic Treatment	$ **1.50**		
Water Distribution (Storage & Pumping)	$ **1.00**		
Water Backbone Pipelines	$ **0.10**		
Wastewater Backbone Pipelines		$ **0.10**	
Water Reclamation - Treatment		$ **4.35**	
Recycled Water Backbone Pipelines			$ **0.10**
Reclaimed Water Storage & Pressurization			$ **0.50**
Onsite Water Pipelines	$ **0.10**		
Onsite Wastewater Pipelins		$ **0.10**	
Onsite Recycled Water Pipelines			$ **0.10**
	$ 2.95	**$ 4.55**	**$ 0.70**

Breakdown of Capital Costs	Water	Wastewater	Recycled	Total
Costs per Section	$ 6,932,986	$ 7,375,671	$ 4,669,220	$ 18,977,877
Costs per EDU	$ 3,095	$ 3,293	$ 2,084.47	$ 8,472
	36.53%	38.86%	24.60%	100.00%

Breakdown of Operational Expenses	Water	Wastewater	Recycled	Total
Average Monthly quantities per EDU	5,731	4,285	4,285	
Monthly Ops Expense per EDU	$ 16.91	$ 19.50	$ 3.00	$ 39.40

Capital Structure	Rate Base	AIAC	Total
Costs per Section	$ 8,449,877	$ 10,528,000	$ 18,977,877
Costs per EDU	$ 3,772	4,700	$ 8,472
	44.52%	55.48%	100.00%

Annual Volumes	Water	Wastewater	Recycled
Per Section	156,199,935	116,784,998	116,784,998
	57.22%		42.78%
Equivalent Swimming Pools	**6,248**	**of Potable Water Use Each Year**	

Rate Base Breakdown	Total	
Equity	$ 4,224,938	**50.00%**
Debt	$ 4,224,938	**50.00%**

	Annual Volume		$/1000 Gallons	Annual Total	$/EDU/Month
Water to Homes	116,580,625		$ 6.61	$ 771,162	$ 28.69
Wastewater	116,784,998		**Monthly Rate**	$ 940,800	$ **35.00**
Water to HOA and Com Areas	39,619,311	RATE @:	$ 6.61	$ 262,075	$ 9.75
Recycled Water to Com Areas	56,728,313	**85.00%**	$ 5.62	$ 318,961	$ 11.87
Recycled Water to Homes	60,056,685		$ 5.62	$ 337,675	$ 12.56
Total Revenue				**$ 2,630,674**	**$ 97.87**
Revenue from Water Sales		39.28%		$ 1,033,237	
Revenue from Wastewater Sales		35.76%		$ 940,800	
Rev from Recycled Water Sales		24.96%		$ 656,637	

Hypothetical Profit & Loss		
Total Revenue	**$ 2,630,674**	
Expenses	$ (1,059,200)	
EBITDA	**$ 1,571,474**	
Depreciation	$ (474,447)	**2.50%**
Interest	$ (295,746)	**7.00%**
Taxable Income	**$ 801,281**	
Tax	$ (336,538)	**42.00%**
Net Income	**$ 464,743**	
Return on Equity	**11.00%**	

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Table 37