

THE IMPORTANCE OF THE TUCSON WATER REGIONAL RECLAIMED WATER SYSTEM TO THE ECONOMIC VITALITY OF THE CITY OF TUCSON-PIMA COUNTY REGION

Tim Thomure, HDR Engineering, Tucson, AZ
John Kmiec, Tucson Water, Tucson, AZ

Introduction

The Tucson Water Regional Reclaimed Water System is an expansive reclaimed water treatment and distribution network that covers the majority of the City of Tucson-Pima County metropolitan area. The largest economic index that is associated directly with the success of the regional reclaimed water program is the destination resort golf industry. Historically, golf facilities in the Tucson region were developed on the use of mined groundwater. However, declining water levels in the regional aquifer system, associated land subsidence, and the loss of native riparian habitat forced the passage of state and local laws and regulations to curb groundwater use. As a result, large turf users have been encouraged and in many cases required to shift to the use of renewable water resources. Reclaimed water is the principle alternative. Through the use of reclaimed water, the destination resort golf industry is able to expand and continually invest in ventures throughout the greater Tucson community. The long-term economic vitality of the Tucson region is explicitly tied to the successful utilization of renewable water resources. Tucson Water's Regional Reclaimed Water System is an integral part of this endeavor.

Tucson's Water Resources History

The City of Tucson is located in south central Arizona, an arid region where rainfall in the lower elevations averages 11 inches per year (ADWR, 1999). Very few surface streams contain perennial flow and most of these are effluent-dominated streams located downstream from municipal wastewater treatment plants. Until the early 1990s, the Tucson community relied almost exclusively on pumped groundwater to meet water demand. Due to rapidly growing demand associated with population increases following World War II, the groundwater system transitioned from an approximate state of equilibrium to one of accelerating depletion. Despite the successful implementation of water conservation programs and the "desert landscape" ethic of Tucson area residents, groundwater withdrawals continued to increase through the end of the 20th century (Johnson et al, 2003). In order to address this issue, the City of Tucson identified two available renewable water resources which will be increasingly utilized in order to satisfy projected water demand: reclaimed water and Colorado River Water delivered through the Central Arizona Project (CAP) canal.

The Legacy of Groundwater Mining

The aquifer sub-basins located within the Tucson AMA have historically provided abundant groundwater to supply the agricultural, industrial, and municipal demands of southern Arizona. For decades, however, this groundwater resource has been used at a rate that exceeds the rate of natural replenishment. This continuous overdrafting of the aquifer has resulted in significant groundwater level declines in the areas where pumping has been concentrated. Such areas include Avra Valley, central Tucson, and the northwestern suburbs.

The historical water level declines created several negative consequences including the gradual loss of native riparian habitat; increased pumping costs; the production of lower quality water related to the need to pump from deeper parts of the aquifer; and measured land subsidence in much of the region. To address the issues associated with groundwater overdraft, a regulatory framework was developed. Three key components of the Arizona water management regulatory framework are: 1) The 1980 Groundwater Management Act; 2) The Assured Water Supply Rules; and 3) The Recharge and Recovery Program.

Arizona Groundwater Management Act of 1980

The 1980 Arizona Groundwater Management Act established the Arizona Department of Water Resources (ADWR) and created a series of Active Management Areas (AMAs) within the State. Boundaries of the AMAs were primarily determined based on the locations of groundwater basins which were being over-used to supply the growing demand for water in fast-growing parts of Arizona. The water management program established for the AMAs limited groundwater withdrawals, limited the expansion of irrigated agriculture, required new residential developments to demonstrate access to long-term dependable water supplies, and required groundwater withdrawals to be measured and reported.

Water management within the AMAs is conducted under a series of management plans developed by ADWR covering the time period from passage of the Act in 1980 through the year 2025. Main elements of the management plans are water supply augmentation, water quality, and water conservation plans for agricultural, municipal, and industrial users and providers. The management goal for the Tucson AMA is to attain “Safe Yield” by 2025. Safe Yield is defined as a balance between what enters the aquifer through natural and artificial recharge and what is withdrawn from the aquifer. Safe Yield does not directly address local water level changes – rather it is based on achieving a balance across the entire AMA.

Assured Water Supply

The Assured Water Supply (AWS) Program is the primary water management tool for municipal utilities located in the AMAs. The program is designed to ensure that growing Arizona communities have access to water supplies that are sustainable. In order to permit new developments, a water provider must demonstrate it has access to a water supply that can be sustained for a period of 100 years and meets five requirements:

- Physical, legal, and continuous availability
- Sufficient water quality
- Sufficient available financing
- Compliance with the Management Plan (Conservation)
- Compliance with the Management Goal (Safe Yield)

Various water resources can be used to meet these requirements, but the fundamental bottom line is a gradual shift away from the use of mined groundwater. The use of Colorado River water delivered through the Central Arizona Project and the development of reclaimed water systems are two of the primary methods of demonstrating an Assured Water Supply in central and southern Arizona.

Recharge and Recovery

In order to provide a secure water future, efforts to obtain and protect Arizona’s access to Colorado River water date back to the early 1900s. The development of the Central Arizona Project provided Arizonans with a way to bring the majority of the State’s Colorado River water into use; however, demand for this supply on an annual basis was not sufficient to maximize its use. To allow for better

management of the CAP and other renewable water resources, the Underground Water Storage and Recovery program was created in 1986. The recharge program was updated in 1994 with the Underground Water Storage, Savings, and Replenishment Act.

The recharge program encompasses three main types of facilities: 1) Groundwater Savings Facilities (GSF); 2) Constructed Underground Storage Facilities (Constructed USF); and 3) Managed Underground Storage Facilities (Managed USF). All three types of facilities are in use in the Tucson AMA. There are currently six GSFs, eight Constructed USFs, and two Managed USFs permitted in the Tucson AMA to recharge CAP water, effluent, or local surface water. Recharge has helped water providers throughout Arizona to better manage their water supplies. The process of recharge and recovery has also become an effective method of bringing supplies into use on an annual basis – not just for long-term storage. Specifically in the Tucson region, Tucson Water uses recharge and recovery to treat and deliver its CAP water to meet 50% of potable demand and 75% of the reclaimed water used in the region (Thomure, 2007).

The Shift to Renewable Resources

In recent years, the physical condition of the Tucson AMA groundwater system has largely improved. Water levels in Avra Valley have recovered significantly since the 1970s due to the retirement of agricultural lands and the installation of several large-scale recharge facilities. Water levels in central Tucson have gradually increased since the recharge and recovery of CAP water began under Tucson Water's Clearwater Program. Through Clearwater, Tucson Water has been able to offset an ever-increasing amount of its annual water demand with CAP water.

In addition, the creation of a major reclaimed water system has served to offset groundwater demand in the region. The development of the Arizona water management regulatory framework has largely driven the use of renewable water supplies in urban areas. However, local jurisdictions have also created policies and/or ordinances that facilitate the increased use of renewable water supplies such as reclaimed water. The City of Tucson's Mayor and Council Water Policies specifically address the use of reclaimed water in Tucson Water's service area (Tucson Water, 2007). In addition, the City of Tucson, Pima County, the Town of Marana, and the Town of Oro Valley all have ordinances that require the use of reclaimed water on new golf courses where feasible.

Development of the Reclaimed Water System

Tucson Water's reclaimed water system was one of the first in the Southwestern United States. The City's Reclaimed Water System provides water of a quality appropriate for turf and ornamental landscaping and some industrial uses. Currently, the primary use of reclaimed water in Tucson is for irrigation which is characterized by high seasonal demands. With the needs of large irrigation customers being met with reclaimed water, seasonal peaks in potable water demand are significantly reduced. Another added benefit is that certain capital improvements to the potable system may be delayed as a result of lower total and seasonal potable water demands.

In addition to serving customers in the Tucson Water service area, the City's Reclaimed Water System provides a regional service by treating and wheeling effluent supplies owned by other regional entities. For instance, reclaimed water is wheeled through the City's Reclaimed Water System to Pima County facilities and to the Town of Oro Valley for distribution and use. Additional wheeling agreements may be developed with other jurisdictions and water providers in the region as they shift toward the use of renewable resources. The Tucson Water Regional Reclaimed Water System is shown on Figure 1.

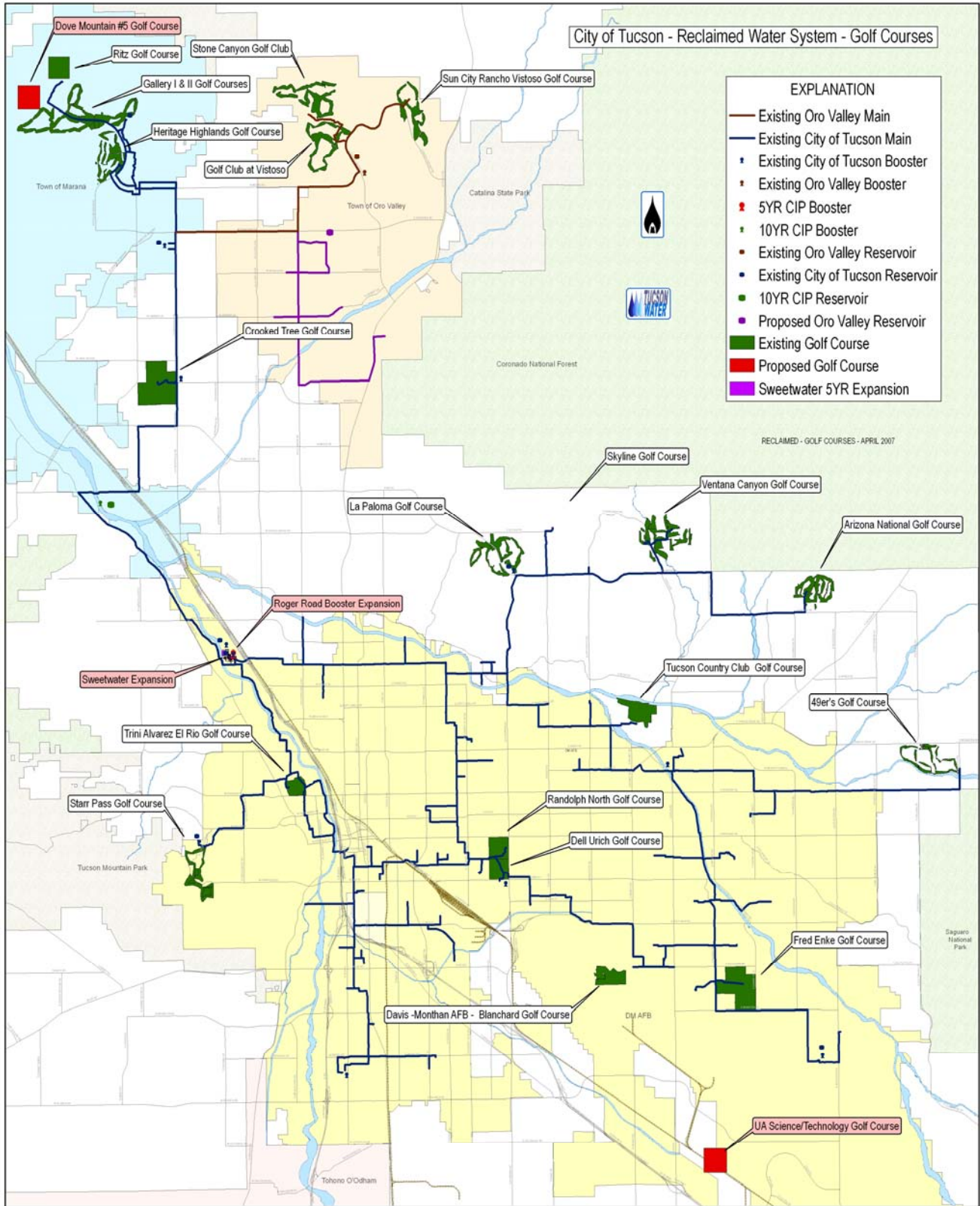


Figure 1 – The Tucson Water Regional Reclaimed Water System

First Impressions

In 1975, the City of Tucson commissioned a water reclamation plant in the central portion of the city to provide irrigation water for a large golf course complex (Pima County Wastewater Management, 2005). The Randolph Park Wastewater Treatment Plant provided enough secondary effluent, approximately 1 million gallons per day, to two co-located 18-hole golf courses (Randolph North and Dell Urich on Figure 1). This facility provided the planners and operators of Tucson Water their first experiences with reclaimed water.

By 1984, plans were set into motion for the City of Tucson to establish a commercial reclaimed water system. The system was developed to provide tertiary treatment of secondary effluent, derived from Pima County Wastewater Management facilities (the local wastewater collection and treatment agency) for the production and sale of reclaimed water. The system began operation with 10 miles of pipeline and only one customer—La Paloma, a destination resort golf course.

Major Expansions – Golf Course Anchors

Quickly realizing the potential impact, or relief, that utilization of reclaimed water would have on the regional groundwater supply and potable water production, Tucson Water went on an aggressive campaign to identify the major turf users throughout the region who would be eligible for reclaimed water use. The alignment of transmission pipelines in the system has been determined by the existing or planned locations of customer “anchors.” These anchors have often been golf courses. During those studies, it was identified that major resort golf courses provided the largest potential users for reclaimed water. Most publically owned golf courses can consume on average up to 400 acre-feet per year and destination resort golf courses can use as much as 800 acre-feet per year in the Tucson area.

As shown on Figure 1, most of the large turf facilities (destination golf resorts) are located around the perimeter of the Tucson Water service area. This perimeter is generally bounded by the multiple mountain ranges that encircle the Tucson area. The largest of the ranges, the Santa Catalinas, bound the northern areas of development in Tucson. It is here that many destination golf resorts have been located. In addition to the La Paloma resort, resorts like Ventana Canyon, Skyline Country Club, and Arizona National Golf Club have converted their irrigation systems over to reclaimed water. In the Tucson Mountains located along the western edge of the community, the City of Tucson’s El Rio Golf Course and the Starr Pass Resort became reclaimed water customers. In the central valley, two other main transmission lines were laid to the City of Tucson’s Fred Enke Golf Course and the General Blanchard Golf Course located within the Davis-Monthan Air Force Base. In the far northwest, the Tortolita Mountains contain several golf courses in the Town of Marana such as The Gallery, Heritage Highlands, and the Ritz-Carlton Resort (under construction). Between the Tortolitas and the Santa Catalinas, the Town of Oro Valley has converted three of their former groundwater golf courses to reclaimed water. These include the Golf Club at Vistoso, Stone Canyon, and Sun City.

Infill – Schools, Parks, and Residences

Once the decision to extend a reclaimed water transmission line to an ‘anchor’ course is established, the next step is to route the line effectively. The optimal route is not always a straight line. The potential exists for the utility to route new transmission mains to include potential secondary reclaimed water users. These types of users include large turf areas like parks and schools. Albeit not as large as a golf course, these turf areas are significant enough for the inclusion into the reclaimed program. The addition of infill users allows Tucson Water to move more of its overall demand to renewable supplies and allows the parks and schools to either eliminate their own well systems or use reclaimed water as a cost benefit to them.

Besides the many dozens of parks and schools that are now on the reclaimed system, the ability for single family residences to participate in this environmentally sustainable program has also been made available. Several neighborhoods within the Tucson area that had significant individual water use for irrigation purposes were identified. Many of these residential communities enthusiastically invited reclaimed water service into their neighborhoods. One neighborhood in particular, Tucson Country Club, was able to convert their golf course as well as many of the single family residents onto the reclaimed water program. The many residents who took advantage of reclaimed water service drastically reduced their individual cost to meet their irrigation needs. In addition, the use of reclaimed water at many of the single family residences has provided relief from the 'environmental guilt' that many customers proclaimed they had in using potable water for irrigation. Now they can proudly proclaim their use of reclaimed water is helping the community remain sustainable.

Over the past two decades, the Tucson Water Regional Reclaimed Water System has grown from 1 customer to over 800 accounts – less than 20 of which are golf courses. However, golf courses comprise about 68% of the reclaimed water demand by volume in the region (Tucson Water, 2007). By providing large-volume demand anchors, the relatively small number of golf courses have driven access to reclaimed water throughout the community. The reclaimed system delivers about 14,000 acre-feet of water, much of which would have been derived from potable supplies if the reclaimed water system was never implemented. Access to reclaimed water has allowed the resort golf industry to continue to develop in southern Arizona, providing economic opportunities for the local communities that might otherwise have been prohibited.

Case Study: Accenture Match Play Championship

A prime example of the inter-relationships between the resort golf industry, the regional reclaimed water system, and economic development is the Accenture Match Play Championship.

The Event

The International Federation of PGA Tours was formed in 1996 with membership from the Asian Tour, European Tour, Japan Golf Tour, PGA TOUR, PGA Tour of Australasia, and Southern Africa Tour. In addition, the Canadian Tour was named an Associate Member of the Federation. In 1999, the Federation created three jointly sanctioned championships – the Accenture Match Play Championship, the Bridgestone Invitational, and the CA Championship. These tournaments are collectively known as the World Golf Championships. The Federation's goal was to enhance the competitive structure of professional golf worldwide while preserving the traditions and strengths of the six member Tours (WGC, 2008).

The World Golf Championships feature some of the largest purses in professional golf with first prize money in excess of \$1 million. The events feature the top players from around the world competing against one another in varied formats (match play, stroke, and team).

From its inception in 1999 until 2006, the Accenture Match Play Championship was held in Carlsbad, California each year except 2001 when the event travelled to Australia. In the early 2000s, local golf interests sought the opportunity to bring this event to southern Arizona. A commitment to developing a new Ritz-Carlton golf resort complex in the Dove Mountain area of Marana, Arizona was the catalyst for bringing this world-class golf event to Arizona.

The Investment

Dove Mountain is a master-planned golf resort community located on over 6,200 acres of foothills, canyon, and mountainside terrain in the high Sonoran Desert of the Tortolita Mountains, just north of Tucson, Arizona. The Dove Mountain communities are being developed by Cottonwood Properties, a Tucson-based company. Cottonwood Properties has developed master-planned communities, retail centers, office complexes, and apartment communities in excess of \$400 million (Cottonwood Properties, 2008). Included amongst Cottonwood's previous developments is La Paloma, 800 acres of residential and commercial development in the Santa Catalina Mountains. As noted previously, La Paloma was the first commercial customer of the Tucson Water Regional Reclaimed Water System.

The Gallery at Dove Mountain is the new home of the World Golf Championships – Accenture Match Play Championship. As part of the agreement that brought this event to Arizona, the match play event will move to one of the two new Jack Nicklaus Signature golf courses to be located at The Ritz-Carlton Golf Club, Dove Mountain. This half-billion-dollar development includes a 250-room Ritz-Carlton resort hotel and spa, the Ritz-Carlton Golf Club featuring the two new golf courses, and a Ritz-Carlton branded residential community on 850 acres in Dove Mountain.

The golf and residential components are due to be completed in January 2009 while the resort is scheduled to open in the fall of 2009. When completed, this complex will be the largest project that combines golf, spa, resort, and residences together in the continental United States (Shelton, 2007).

The courses at the Ritz-Carlton Golf Club will be irrigated with reclaimed water. In fact, it is likely that the courses could not have been permitted without access to the renewable water resource. The entire Dove Mountain community depends on reclaimed water for golf course irrigation. Absent reclaimed water, Dove Mountain would not have developed into the highly desirable residential area it has become.

The Impacts

The Ritz-Carlton development and associated Accenture Match Play Tournament provide a series of economic benefits to the owners, the Town of Marana, and the broader southern Arizona community. A discussion of the hotel portion of the development can help illustrate these benefits.

From the owners' perspective, the Ritz-Carlton hotel is projected to make a significant return on the initial investment. The construction cost totaled approximately \$90 million. Room revenues for the resort are projected to grow from about \$4.4 million in 2009 to almost \$30 million in 2013. Other resort revenues are similarly projected to grow from about \$6 million in 2009 to \$37 million in 2013 (e-mail communication from Joshua Wright, 2008). These figures indicate that the total projected revenues for the Ritz-Carlton resort in 2013 are almost \$67 million – about two thirds of the initial construction cost in a single year.

These projected results are attractive to the developers, but the economic benefits to the local community are of greater interest to the local leadership and water resource managers. The Ritz-Carlton property is located within the Town of Marana. Marana currently levies a 2% sales tax with an additional 3% bed tax. By applying these tax rates to the projected resort revenues, the economic benefits to the Town of Marana can be determined. Tax revenue for the Town of Marana is projected to total about \$2.2 million in 2013 – just for the hotel portion.

Positive economic impacts extend well beyond the owners and the Town tax rolls. The Accenture Match Play Championship has been successfully leveraged to generate money for local charities. This is a significant element of the World Golf Championships and the professional golf tours that sponsor them. In 2007, the match play tournament raised \$1.5 million dollars for over 150 local charities such as The First Tee of Tucson; Special Olympics Pima County; and the Boys & Girls Clubs of Tucson, Sierra Vista, and Santa Cruz County (Accenture, 2007).

The Connection to Reclaimed Water

The Ritz-Carlton development, the Accenture Match Play Championship, and reclaimed water deliveries to the Dove Mountain area are all interrelated. One would not have happened without the others. First, the large demands for irrigation water presented by the collective Dove Mountain golf courses provided the impetus to develop the northwest branch of the regional reclaimed water system. In turn, the golf courses themselves would not have been permitted for development without access to the reclaimed water renewable water supply. Although several golf courses already existed in Dove Mountain, landing the Accenture Match Play Championship in southern Arizona was explicitly tied to the development of the Ritz-Carlton resort and the new Jack Nicklaus signature golf courses. Without any one of these elements, the others would not have come to pass. The reclaimed water system laid the infrastructure foundation for the Ritz-Carlton development and the annual economic boost that accompanies the Accenture Match Play Championship.

Summary

The connection between the destination resort golf industry and the development of an expansive reclaimed water system is readily apparent in the Tucson region. The initiation of reclaimed water use in Tucson was tied to meeting golf course irrigation demands. Virtually every major expansion of the reclaimed water distribution system over the past two decades was to reach a new golf course anchor. These expansions to meet the needs of golf irrigation opened up access to reclaimed water for parks, schools, and residential users. The Accenture Match Play Championship serves as a case study for how the reclaimed water systems supports economic development in the region.

Acknowledgements

The authors would like to thank the following individuals for their contributions and assistance with this project: Dee Korich (Tucson Water), Josh Wright, (Town of Marana), Brad DeSpain (Town of Marana), Ed Stolmaker (Marana Chamber of Commerce).

About the Authors

Tim Thomure is a project manager for HDR Engineering out of the Tucson, Arizona office. Mr. Thomure has 15 years of experience in water resource planning and environmental compliance management in the public sector, private industry, and consulting. Mr. Thomure has a B.A. in Geography from the University of Illinois and is currently completing a Master of Engineering in Water Resources from the University of Arizona. Mr. Thomure has been actively involved in the WateReuse Association and is currently the Secretary/Treasurer for WateReuse Arizona.

John Kmiec is the Environmental and Regulatory Compliance Supervisor for Tucson Water. Mr. Kmiec has 15 years of experience in regulated water utility programs and environmental compliance

management in public utilities, private industry, and consulting. Mr. Kmiec has a B.S. in Geological Science from Michigan State University and is actively pursuing a Master of Public Administration from Troy University. Mr. Kmiec has been an active member of WaterReuse and is currently the Vice President of WaterReuse Arizona.

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