

Chapter 2

LOOKING TO THE PAST TO UNDERSTAND THE PRESENT

THE SEARCH FOR WATER

The history of water use in the Tucson area is primarily one of reaching out farther and farther to provide enough good water for a growing community. From the first water suppliers who brought water from springs or the Santa Cruz River to today's Central Arizona Project (CAP), which lifts water 2,900 feet through 14 pumping plants, delivering it 335 miles from the Colorado River, people have looked for new and reliable sources of good quality water. Attempts to persuade people to conserve water also have been part of the picture for more than 100 years, as have been projects to utilize new technologies to increase supplies. People have proposed various projects over the years including dams to capture flood waters so this resource could be used rather than "wasted." Tucson also has experienced occasional water quality problems for more than 100 years. And finally, politics has played a ma-

ajor role in many significant water decisions over the century.

Santa Cruz River

The first people who lived in the Tucson area got their water from the Santa Cruz River or from springs that bubbled to the surface at the base of Sentinel Peak (now called "A" Mountain), Black Mountain near San Xavier Mission and several other spots. Enough water was available to satisfy the needs of a few thousand people, including irrigating crops. In fact,

Chapter Two summarizes Tucson's water history from the days of carrying water in olla or buckets from rivers and springs to our ability today to turn on the tap and get as much water as we desire. This change demonstrates how for over 100 years we have looked to more distant sources for a dependable water supply, starting with a pipeline from the Santa Cruz River and continuing into the present with the CAP canal carrying water from the Colorado River. The chapter also shows that the influence of politics on water affairs began early in Tucson's history.

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Figure 2-1 Rincon Mountain Water truck from the early twentieth century. Photo: Arizona Historical Society/Tucson.

Santa Cruz River water has been used to irrigate farms for at least 2,000 years. The Santa

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Figure 2-2 A well at Fort Lowell in the 1880s. Photo: Arizona Historical Society/Tucson.

Cruz River was not a big river like the Colorado or Gila rivers, but the river did flow most of the time in the Tucson area. The Hohokam caught edible fish in the Santa Cruz, and early pioneers hunted water-loving muskrats. When Father Kino came to the area in the late seventeenth century, he stated that he believed there was plenty of water – enough to support a large town of 5,000 people.

Fort Lowell's Waterworks

When the U.S. Army established Fort Lowell near the Rillito Creek in 1873, the water supply in the area was plentiful. Acequias (canals) brought water from the river; windmills pumped groundwater from about 35 feet down; and storage tanks held water at points of high elevation to provide running water to all the

buildings. But problems arose. The windmills often were inactive for days at a time, and even when water filled the storage tanks, the water was hot and unappealing. Diseases were blamed on the bad water which was polluted by livestock, people and unsanitary water storage facilities. "Squatters" diverting surface water for their farms provoked conflict. Debate raged about whether to purchase a steam-powered pump to get water

from greater depths or import water from Sabino Canyon. The military built larger storage tanks, installed the steam pump and abandoned the Sabino Canyon project. By the time the fort was closed in 1891, the water problem had been solved by installing additional wells.

19TH CENTURY SUPPLIES

Before the American Civil War, Tucson women washed their clothes in the Santa Cruz River, with a guard nearby as protection against Apaches. Drinking water was available from a well inside the walled city or from the well on Bishop's Farm. El Aegypti Spring (near the Wishing Shrine, south of the present Tucson Community Center) was a reliable water source

for many years, but few people dared to venture alone so far outside of town, even for water.

After the end of the Civil War and the defeat of the Apaches in the late 1860s, more and more people moved to Tucson, which became Arizona's most important city. The services of a water carrier were needed to supply the growing population. The water carrier got his water from El Aegypti to deliver to homes in bags on his burro. Later Adam Saunders and Joe Phy modernized the system, using a two-wheeled cart for delivery at five cents a bucket. At this high price, fresh water was seldom used for watering plants. Instead people used waste water from their washing for this purpose. Adam Sanders built a bath house at El Ojito, where

"A tenacious eastern dream to convert the desert into a garden characterized Tucson Basin water control history since the Gadsden Purchase in 1854. The reactions of American settlers to a series of water supply crises demonstrated the persistence of this theme. When faced with each crisis, Americans responded by applying an increasingly sophisticated technology to the problem of water scarcity." Kupel, page 162.

rich and poor alike (but only males) could get their occasional bath for twenty five cents. A daily bath was considered a downright "waste of water." W.C. Davis installed Tucson's first personal bathtub in a home on Congress Street sometime in the 1880s. The uses of water were increasing.

Entrepreneurs built dams in the Santa Cruz River near the base of Sentinel Peak, backing up water into lakes which were used for

boating and fishing as well as to power flour mills. These lakes were destroyed by floods during the 1890s and not rebuilt.

Obtaining a reliable supply of potable water was a problem even in the early days. In 1870, John Bourke complained of the many holes in the town which he said were abandoned wells. "... wells, which were good and sweet in the first months of their career, but generally became so impregnated with 'alkali' that they had to be abandoned; and as lumber was worth twenty five cents a foot, and therefore too costly to be used in covering them, they were left to dry up of their own accord, and remain a menace to the lives and limbs of belated pedestrians." He describes an incident in which an inebriated citizen fell down an empty 25-foot well.

The area near Sentinel Peak was dominated by farms with a network of irrigation ditches that directed water from rivers and springs. These uses left little water in the river north of the Congress Street Bridge. During the 1870s, the city made three attempts to increase the water supply. The city contracted to have artesian wells drilled, but that effort failed. The city awarded another contract to a well driller who was to receive one block of city land for every successful well drilled, but that effort also came to naught. Some entrepreneurs south of town started building a canal to bring water to Tucson from Canoa (near present-day Green Valley), but that, too, proved unsuccessful. By the 1880s, many people had their own windmills, but the windmills often were still during the dry months when little wind was blowing. The demand for water had become so great that springs were no longer dependable.

The then-recently formed Tucson Water Company gets credit for first successfully tapping a new water source. With a franchise from the city, the company built a distribution system to bring water from Valencia Road to downtown Tucson via a redwood flume laid in the river and a 4.5-mile-long water pipe made of sheet metal coated with tar. Following this success, the Tucson Water Company in 1889 installed its first steam-driven pumping plant and dug a 40-foot deep well, capable of pumping 1,250 gallons per minute. Water came to town along the alignment of what is now Osborne Street, which is why a diagonal street is there today instead of the north-south, east-west grid common in other older sections of town.

This new water source would have solved the supply problem if Tucson's population had not continued to grow and if droughts did not periodically occur. In 1892, the City Council debated limiting irrigation to nighttime hours because of water shortages, but did not pass the ordinance. The mayor, however, ordered the water supply to city parks be cut off. It was not until 1903 that the City Council (which now

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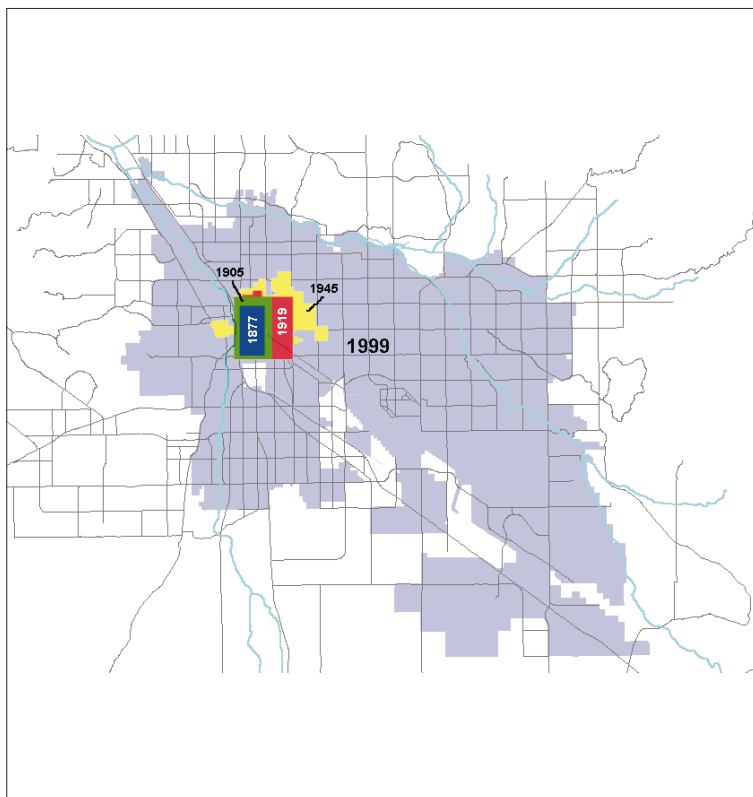
Figure 2-3 The Parker and Watts Water Company office in the late nineteenth century. Photo: Arizona Historical Society/Tucson.

owned the water company) passed an ordinance limiting irrigation to between 5 a.m. and 8 a.m. and between 5 p.m. and 8 p.m., with a maximum fine of \$50 for violations.

EARLY 20TH CENTURY EXPANSION

In 1900, the City of Tucson bought the Tucson Water Company and its southside wells for \$110,000 and formed the Water and Sewerage Department. Hetty Green, a wealthy New York financier, bought the bonds to finance the purchase. Things did not go smoothly at first. In 1908, Mayor Heeney decided to remove the water superintendent without consulting

Figure 2-4 The growth of the City of Tucson.



the City Council. As Councilman Moses Drachman explained, “The row which this precipitated lasted to December of that year and finally resulted in the council removing Mayor Heeny from office for misconduct.” (Many other differences of opinion and accusations of scandal also contributed to the mayor’s dismissal.) Also in 1908, the city faced its first water crisis when a new residential district was established, way out in the country between the University of Arizona and the railroad tracks. The windmills installed on home sites couldn’t

produce enough water so residents demanded that the city extend the water system to service the district. The city authorized the water superintendent to spend \$260,000 to expand the system northward. In 1911, when citizens started complaining of their water bills, which were based on a flat rate per month, the city installed meters, at first only for the complainers and later for everyone. From then on people paid according to use.

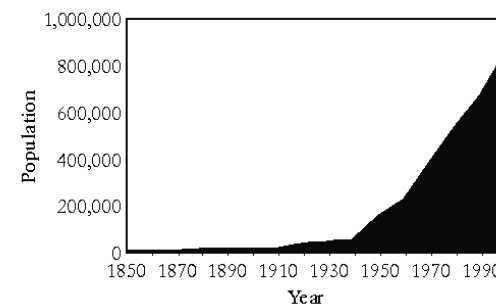
In 1914, another bond issue financed six new wells and a reservoir, at the far east side of town at Second and Campbell. A new pumping technology was installed that could produce one millions gallons of water per day from one well. Windmills could extract water from shallow wells, but the new gas or electric pumps were much more efficient and could lift

water from greater depths.

By 1920, water shortages again were a problem, and the City Council again banned watering except between 5 a.m. and 8 a.m. and 5 p.m. and 8 p.m. with a maximum fine of \$50 for violations. The City Council also hired a staff person to provide water conservation information to the public. Meanwhile more wells were dug north of town to improve the water supply and increase water pressure for fighting fires. Over the years, more wells were added ei-

ther by buying private water companies or by digging wells, until a peak of 61 wells was reached on the north side, eight of which are still active today. By that time the system had expanded and parts of the city were as much as 80 feet higher than downtown. To accommodate the situation, the city was divided into two separate pressure zones. Water circulated separately in each zone, because it could not easily be lifted to the higher areas. In later years, the zones were connected with booster stations.

Figure 2-5 Population of Pima County, 1850 to date.



Source: Arizona Department of Economic Security.

Wells were generally around 50 feet deep at this time, but water levels were dropping, and people with shallower wells had problems. Groundwater pumping near the Santa Cruz River began to affect river flow, but not until the 1940s did this pumping finally caused the water table in the area to drop so low that the river flowed only during floods. During the 1930s and 1940s, population growth slowed. In response, the water system expanded less rapidly, although the city drilled ten new wells

and purchased several water companies during this period.

Growth and Controversy

After World War II the pace of population growth quickened, and by the 1950s, the southside and northside wells could no longer produce enough water. *The Arizona Daily Star* headline read “More Water is Urgently Needed.” (July 23, 1952) “Living in desert country, where a rainbucket on the roof wouldn’t provide more than a good shampoo, it is natural to wonder if the city can furnish sufficient water to meet this modern expansion. The answer is a big YES, according to Water Superintendent Phil J. Martin, Jr., if the proposed \$5,500,000 water revenue bond issue is given the nod by voters Aug. 12.”

The big bond issue passed, and a series of wells was drilled between 1954 and 1968 along Old Nogales Highway, south of Valencia Road on the edge of the San Xavier District. Some private wells in the area also were purchased, for a total of 34 wells, 15 of which are still active today. The area is called the Santa Cruz Wellfield. This additional pumping contributed to further lowering of the area’s water table, causing the extensive mesquite bosque south of San Xavier Mission to die in the 1950s. Water problems at San Xavier intensified.

By the 1960s, population had increased to the extent that even these three established wellfields did not provide enough water. The city began to purchase farms in the Avra Valley to the west to gain access to their wells. The plan was to bring the water to the city through a large pipeline. During its period of peak oper-

ation, 27 wells were operating in the Avra Valley area, 20 of which are still active. The city also purchased land along the San Pedro River north of Benson to obtain water rights. The plan called for construction of a pipeline over the mountain pass to bring San Pedro River water to Tucson. This pipeline was never built, and the city ultimately sold the land.

During this time, the city also was buying water companies and their wells throughout the city limits. When a new area was annexed, the city would offer to buy the water company. Having all the water service under city control had the advantage of providing uniform water service and assuring adequate pressure for fire fighting (See Figure 2-6). Some areas such as Flowing Wells and Winterhaven never came under city control. The collection of almost 300 city-owned wells in the central city area is referred to as the Central Wellfield, although it is not a coherent system, but rather a collection of former private systems and some city-drilled wells. In 1998, 185 wells were active in this area

Starting in the 1960s the city adopted a policy of buying water companies outside city limits. The city also extended its water service outside city limits in areas not served by other companies. The purpose of this strategy was to enable the city to engage in basinwide management of water supplies. This would promote

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Figure 2-6 One of Tucson’s first fire brigades. An adequate water supply to fight fires has long been an important civic planning goal. Pressure and volume must be sufficient to fight fires during times of peak summer demand. Photo: Arizona Historical Society/Tucson.

more equitable water service and allow sharing of costs to augment the supply. This patchwork of water systems often caused problems. Water mains had to be connected to the central system in most cases, and the quality and size of the wells and pipelines varied greatly. Serving water outside city limits also meant that many customers would have no vote on water matters and no representation on the City Council that decided water issues.

CONTROVERSY OF 1975-76

The 1970s were a period of turmoil for the community. Advocates of “controlled growth”

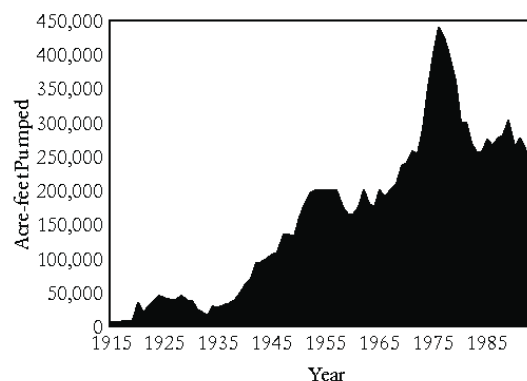
gained a majority on the City Council and also were a significant presence on the Pima County Board of Supervisors and in the Pima County delegation to the Legislature. Congress had approved the CAP, and Tucson had to decide whether to contract for CAP water. The controlled growth advocates were skeptical about CAP, questioning its cost, need, long-term reliability and the quality of the water. They also argued that controlling sprawl was an appropriate strategy to discourage a rapid increase in the cost of water. They supported much stronger water conservation efforts and less agricultural use of water.

Controlled growth advocates on the Tucson City Council soon found an opportunity to press for change by dealing with the pressures facing the Tucson Water Department. The distribution system was expanded rapidly in the early 1970s to keep up with growth. Revenues from relatively low water rates were not enough to keep up with increasing costs and there was not enough system capacity to meet peak demand during hot summers, such as the summer of 1974. To address the problem, a consultant's report recommended a six-year program of improvements to the distribution system, to be financed by bond sales, higher water rates and system development charges. Water rates would be designed to recover the actual costs of providing service, including a "lift charge" for providing water to customers at higher elevations, such as those in the foothills. System development charges would be applied to new customers to help pay for expansion of the system.

In 1976, the City Council voted for a water rate increase designed both to keep up with in-

flation and to recover actual costs of delivery. The new rates included the lift charge and retained the progressive rate structure (i.e., people who use water above certain amounts were charged higher rates for water consumed above that amount) which was first used in Tucson Water's rate structure in 1974. The new rates were adopted in June, and water bills of some customers in the high lift zones quadrupled from June to July, while bills of many others doubled.

Figure 2-7 Groundwater pumping in the Upper Santa Cruz River Basin from headwaters to Pinal County.



Source: Arizona Department of Water Resources.

The pro-CAP and pro-growth forces encouraged an angry public to revolt, and the City Council majority was recalled even though they rescinded the lift charge in August. After discovering that rates had been raised not to control growth, as had been assumed, but to

build distribution systems and gain new water supplies to meet expected growth, their successors retained the rest of the new rate structure and even raised the rates again. The impact of the recall continues to this day, with City Council members and water staff reluctant to make major changes to water rates in fear of angering water customers. "Remember the recall" remains a formidable slogan.

At the next regular election in 1978 controlled growth advocates were defeated in the Board of Supervisors and the Legislature, and the City Council approved Tucson's CAP sub-contract. The sub-contract was for the entire metropolitan area, based on the assumption that the city system would continue to expand. The Council also approved water conservation programs, and Pete the Beak, cartoon star of the Beat the Peak program, was hatched. The program was originally designed to encourage landscape watering at non-peak hours, thereby delaying the need for expanding the system of water mains and reservoirs. The program, however, also had the effect of encouraging water conservation more generally.

During the 1980s, the city increased its water conservation efforts, partly in response to the requirements of Arizona's new Groundwater Management Act. Tucson had some of the lowest rates of per capita water consumption in Arizona because of these programs and the perceived high cost of water. The metropolitan area expanded rapidly beyond the central area into higher elevations. Since the main water supplies were at the lower elevations, this meant water had to be pumped uphill and stored in reservoirs, to flow by gravity to customers. The fact that all customers pay the

same rate no matter where they live is an advantage to those living in more distant and higher areas.

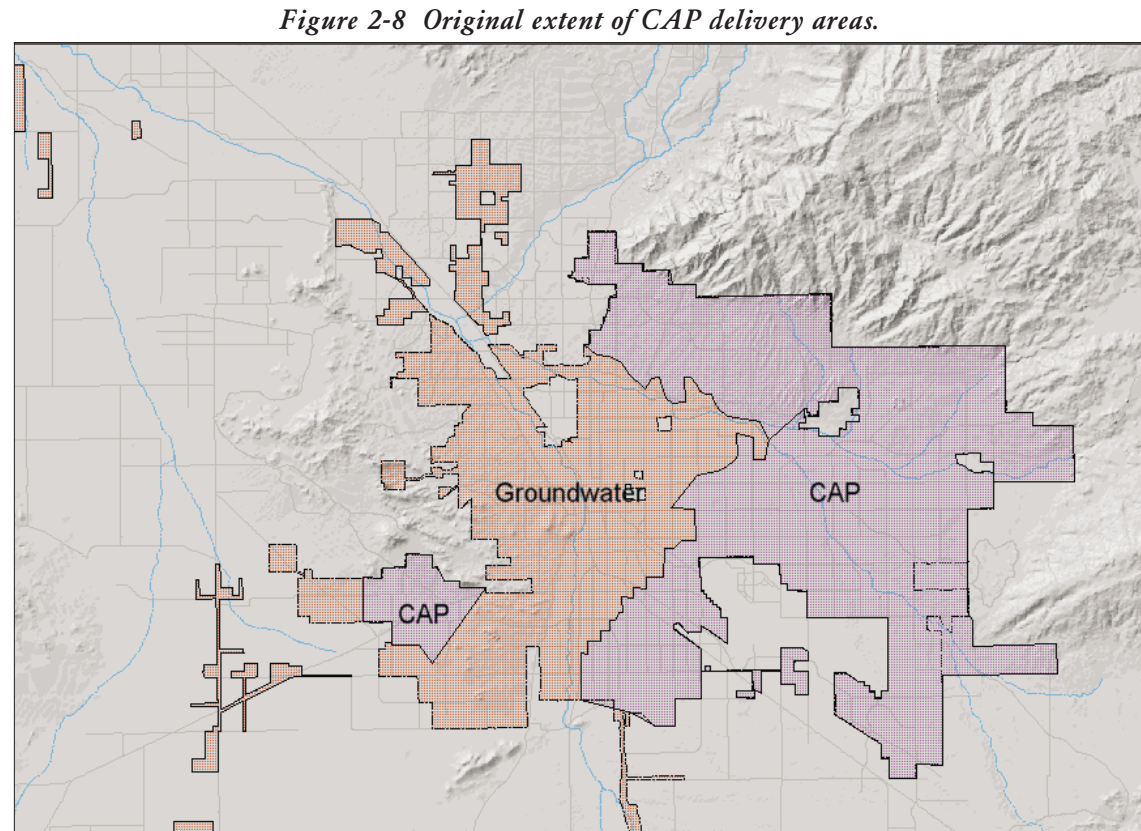
CENTRAL ARIZONA PROJECT

The CAP is a system of canals, pumping stations and storage facilities that brings water 336 miles from the Colorado River at Lake Havasu east to the Phoenix area and then south to the Tucson area. Fourteen pumping plants lift water 2,400 feet in elevation to the terminus.

The CAP idea preceded Arizona statehood. In the early years of the twentieth century some visionaries talked about bringing Colorado River water to central and southern Arizona. At the time this seemed infeasible. Meanwhile events were transpiring to make the vision a reality.

In the 1920s, six of the seven Colorado River states agreed to divide the river water. Arizona was the sole dissenter and did not go along with the agreement for more than twelve years. Meanwhile Hoover Dam was built in the 1930s, along with other Colorado River projects. When a large aqueduct was built to supply southern California with Colorado River water in the 1940s, Arizonans took notice and began lobbying for their own project. By 1960, all major Arizona politicians and political interests were behind the project. Congress approved CAP in 1968.

The original project included dams on the upper Gila River in New Mexico, the middle Gila River in Arizona, the San Pedro River, and the Verde River at Fort McDowell. Ultimately none of these dams was built. Instead changes were made to some existing dams, and a new



Sources: Tucson Water; Pima County Technical Services; Water Resources Research Center.

dam was added along the Agua Fria River. Construction began.

President Carter expressed doubts about the project-building approach to solving western water problems, and demanded changes in Arizona water laws to promote conservation. The Arizona Legislature responded to the threatened loss of CAP funding by passing the Groundwater Management Act of 1980. A three-county water district was formed to man-

age the project after completion and to develop water subcontracts with cities, farms, mines and other prospective users.

Completed to Tucson by 1990, the project faced problems. Few farms or mines signed CAP contracts, not even those that once enthusiastically supported the concept. Farmers found the cost too high and the supply too unreliable. The mines were concerned that the quality of the water would affect their mining

processes. The cost of extending pipelines to individual farms and mines also was a significant factor. The City of Tucson was virtually the only commercial customer for CAP in Pima County, although water was allocated to the Tohono O'odham through a legal settlement.



Figure 2-9 Aerial view of the Central Arizona Project canal. Photo: Central Arizona Water Conservation District.

Since Tucson Water has by far the largest municipal CAP contract, its customers, by supporting CAP, pay the majority of the costs to augment the water supply. Farms, mines and water companies meanwhile can continue to

pump groundwater at a relatively low cost. Many people believed that other water users in the basin should be required to use CAP water and/or to share the costs of those switching to renewable supplies. Arizona law, however, has no provisions to enforce such a requirement.

To many people, however, CAP water represented a long-awaited water source to benefit the Tucson area. With CAP on-line, less groundwater would be pumped. CAP's Colorado River water, however, differed from the groundwater to which most people in the area were accustomed. CAP water is harder and contains more total dissolved solids than local groundwater. Despite this situation officials believed that citizens would find the new water source to be acceptable.

As the CAP canal neared completion in 1989, the Tucson City Council adopted the Tucson Water Resources Plan for the 110-year period, 1990-2100. It called for an aggressive phase-in of direct use of CAP water, combined with recharge and recovery of excess CAP water in early years, recovery of recharge credits, reuse of effluent and some continued use of groundwater. There was a heavy media campaign surrounding the introduction of CAP water, including a well publicized taste-test, TV and radio ads, and direct-mail fliers. The only substantive warnings about water quality were directed at kidney dialysis patients, those on restricted salt diets, and aquarium owners. In general, the introduction of CAP water was expected to go smoothly.

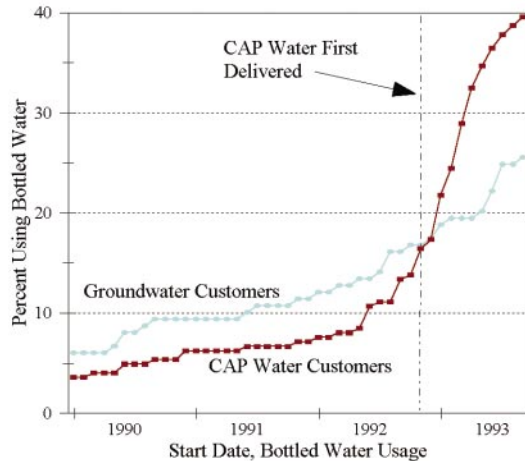
Starting in November 1992, CAP water was delivered to approximately 84,000 customers, or about 58 percent of the connections in the Tucson Water service area. Problems were soon

reported by some customers. Many people complained of red, brown or yellow-colored water coming from their taps. Some reported broken pipes, damage to water-using appliances such as water heaters or evaporative coolers, skin rashes, and even dead fish in aquariums and damage to pools.

Many customers receiving CAP water sought to avoid some of these unpleasant effects by buying bottled water or in-home treatment systems, such as filters installed under the sink. Figure 2-10 shows the increase in bottled water usage by Tucson Water customers in response to the introduction of CAP water in November 1992. Purchases of both bottled water and in-home treatment systems have been rising on a national basis for a number of years, and aggressive marketing of bottled water by a growing number of bottled water outlets led to an increase in bottled water usage for all Tucson Water customers over this time period. However, customers switched from groundwater to CAP water increased their bottled water usage more than ten fold, compared to a tripling in the rate of bottled water usage for those kept on groundwater.

Research by the Water Resources Research Center revealed a similar pattern for purchases of in-home water treatment systems, as customers with in-home treatment systems increasing four-fold to nearly 20 percent. The study also documented dramatically higher rates of plumbing and water-using appliances failing in households switched to CAP water. While an accurate estimate of all costs could not be made, the study suggested that Tucson Water customers receiving CAP water were incurring many millions of dollars of expenses per year

Figure 2-10 Percent bottled water users over time, CAP vs. groundwater customers.



Source: Water Resources Research Center.

to avoid and compensate for the decreased water quality.

The City Council debated the possibility of ending direct delivery of CAP water, but in August 1993 twice voted by narrow margins to keep delivering CAP water. In October 1993, deliveries were halted to the east side of the CAP delivery area, which generally had a high number of older galvanized steel water mains and was most heavily affected.

As more complaints were reported, Tucson Water responded by adding a corrosion inhibitor to the water as it left the treatment plant. However, maintaining effective corrosion inhibitor levels throughout the distribution system proved difficult. The utility also began frequently adjusting the chemistry of the water in an effort to control the problems. Several different levels of pH adjustment were tried for

varying lengths of time. These frequent changes in pH level were later identified as probably contributing to the problem rather than correcting it.

The City of Tucson also set up a program to handle damage claims. While not admitting fault or responsibility for damages, the City offered to pay up to specified amounts to reimburse for specific types of damage. As of 1995, the City had paid over \$1 million dollars in damage claims, and has since added to this amount.

Public exasperation with the delivery problems grew as damage to homes mounted and the extent of the problem became apparent. In May 1994, voters surprised some observers by approving \$31 million in bonds for improvement of the water delivery system, mostly to replace old galvanized steel or iron water mains.

All CAP water deliveries had to be halted in November 1994 to allow for repairs to siphons in the CAP system, and City Council voted not to resume deliveries. By this time, the head of Tucson Water and the CAP plant manager had resigned, and the utility's reputation had been seriously damaged in the eyes of many citizens.

Petitions were circulated for a ballot issue to limit future direct delivery and in November 1995, voters approved the Water Consumer Protection Act (WCPA), which outlawed direct use of CAP water unless it was treated to the quality of Avra Valley groundwater and was free of disinfection by-products (See chapter 7). The WCPA had the effect of shifting the focus

for how to use CAP water in Tucson to artificial recharge. In 1997, voters reaffirmed their opposition to direct use of CAP water in favor of its recharge and use by farms and industry, by defeating a ballot initiative which would have repealed or substantially changed many of the provisions of the WCPA. Some citizens also joined a class-action lawsuit against the City. Resolution of this litigation is pending.

TODAY'S WATER PROVIDERS

Tucson Water now has four major wellfields – Southside, Santa Cruz, Central and Avra Valley – along with a large number of wells scattered throughout the city, and a few small isolated systems in remote areas. In addition, more than 30 water companies operate well systems in the Tucson area. The largest of these are Metropolitan Domestic Water Improvement District, Oro Valley Water Department and Flowing Wells Irrigation District. Other significant water pumpers include the University of Arizona, Davis-Monthan Air Force Base, Cortaro Marana Irrigation District, Farmers' Investment Company (FICO), Farmers' Water Company and the ASARCO Mining Co. Finally, approximately 22,000 individuals and businesses have their own wells. No one agency coordinates or regulates the activities, of all these users; instead, the Arizona Department of Water Resources (ADWR), the Arizona Corporation Commission (ACC), the Arizona Department of Environmental Quality (ADEQ), the Central Arizona Water Conservation District (CAWCD), the U.S. Environmental Protection Agency (EPA) and the courts all have roles in managing water supply, water

quality and water rates. (See Chapter 7 for additional information on regulatory agencies.)

AGRICULTURAL WATER USE

People have been irrigating fields in the Tucson area for at least 2,000 years. Before the Spaniards arrived, most crops were grown in the summer, taking advantage of monsoon

Mining Index described Tucson farming: “Eight streams of water run through the Santa Cruz Valley opposite Tucson. Five of these ditches are 7-feet wide that now contain a foot and a half of running water. The other three are narrower and contain less.” John Davidson started to build a canal to irrigate 3,500 acres, but the floods of 1887 washed it out before it was finished.

An important technological advance in the 1890s enabled wells to be drilled in various locations, powered with wood-burning steam engines and, later, gas or electricity. In 1891, a University of Arizona professor reported that water could be pumped from underground to irrigate the campus. About that time, the first farm in the area began to use pumped groundwater. From then on, groundwater pumping increased steadily. With the new technology, wells could be drilled to much greater depths. On the

Canoa Ranch south of Tucson a well was drilled to 500 feet, hitting water at 300 feet. The new steam pump could produce a flow of 2,000 gallons per hour.

In 1892, Frank and Warren Allison built a new ditch for irrigation that was later extended to lands beyond St. Mary’s Hospital and constructed a reservoir near the old Warner Dam

site. By 1895, they had built more ditches and acquired another source of water known as “Flowing Wells” near Sentinel Peak as well as the Tucson Farms Company south of town. This later developed into the Flowing Wells Irrigation District which stretched from far south of town all the way to Marana. That district continues to exist (although greatly reduced), supplying water for urban use on the northwest side of town through its wells.

In the 1890s, new legal systems of apportioning surface water were developed, with the first people to file water claims having the first rights to surface water. Water use increased to the extent that by 1910, all of the water flowing in the Santa Cruz River in the downtown area (other than during floods) was being diverted for agricultural or municipal purposes. With the growth of agriculture around Sentinel Peak new irrigation canals were soon insufficient, and water disputes arose.

ONGOING SEARCH FOR WATER QUALITY

Sewers and Wastewater Treatment

Before the 1890s, Tucsonans used outhouses for their sewage. In the 1890s, when water was first piped to houses, people drained their sewage into cesspools. In 1900, the city opened its new Water and Sewerage Department and laid the first public sewers along Main Avenue between 17th Street and St. Mary’s Road. The untreated sewage was delivered by open ditch to a small farm where it was used for irrigation. In 1914, people were complaining of the odor.

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Figure 2-11 San Xavier Mission. The water table was high enough to obtain water with a windmill. Photo: Arizona Historical Society/Tucson.

rains. The Spaniards introduced winter crops that needed irrigation. They also introduced cattle and horses, animals that affected water supplies as well as vegetation near the streams. The first Anglo farmers continued in the Spanish pattern, with cooperative irrigation systems run by an irrigation master responsible for fairly distributing water. In 1886, the Arizona

When the farm had a sufficient supply of sewage, a new farm was opened along the Santa Cruz River at Roger Road, four and a half miles northwest of downtown, and a new pipeline was constructed to deliver sewage water to the farm. The city considered the farm a profitable business, but the arrangement met with increased complaints. In 1928, the first treatment plant was built which reduced the solids content of the sewage. After treatment the sewage was delivered to the farm. The facility was expanded and improved in the 1940s, with the sewage still used for irrigation.

As population increased, Tucson could no longer be responsible for the sewage needs all residents, so citizens formed a sanitary district to serve residents outside city limits. It was not until 1961 that the district built a new sewage lagoon near Ina Road and the Santa Cruz River. The Roger Road treatment plant was expanded in 1960 and again in 1968. The Sanitary District was dissolved in 1968, and Pima County took over wastewater management for the area outside Tucson. In 1975, Tucson opened a Wastewater Reclamation Facility at Randolph (Reid) Park which provided wastewater for the golf course, but the facility was closed in 1995. Pima County built a new advanced treatment plant at Ina Road in 1977.

By the 1970s, both city and county officials felt a need to combine their efforts, and they formed the Metropolitan Utilities Management (MUM) Agency for better basinwide management of wastewater facilities in the metropolitan area. Tucson and Pima County, however, continued to operate separate facilities. For the first time, however, they adopted

basin-wide sewer connection fees and sewer user fees, charging the approximate cost of providing services. In 1976, elected officials dissolved MUM. Tucson and Pima County then signed an intergovernmental agreement in 1979, stipulating that Pima County would own and operate all the wastewater systems for both city and county, but that Tucson would retain rights to 90 percent of the wastewater coming from metropolitan area treatments plants. The city deeded to the county its Roger Road Treatment Plant and its other wastewater facilities. Between 1980 and 1984, the Roger Road Plant was expanded and upgraded in stages. The federal government paid a large share of construction costs, sparing county taxpayers much of the expense of the expansions.

In 1985, Pima County began a project to export sludge from the wastewater process for agricultural use in the Marana area, thus lessening the burden on the nearby landfill. In 1987, a system for transferring sludge from Roger Road to Ina Road was completed. As a result, neither plant sends sludge to landfills.

In the late 1980s and early 1990s, both the Roger Road and Ina Road plants were expanded and modified and various smaller facilities were built, including the Catalina out-fall sewer and a facility in Avra Valley. Work to further expand the Roger Road facility was recently completed, and work is about to begin to expand the Ina Road plant. Pima County funded a University of Arizona wetlands research project to determine how effectively water hyacinths (and later other plants) could treat wastewater.

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Figure 2-12 Woman washing clothes in the Santa Cruz River, with the ruins of the Convento in the background. Photo: Arizona Historical Society/Tucson.

Recharging Reclaimed Water

In 1983, the City of Tucson constructed a tertiary treatment plant to further treat wastewater from Pima County's Roger Road plant for use on golf courses and other turf. Over the years mains were installed to deliver water to various facilities on the far east side of town and in the central area. Today effluent is delivered to over 200 water consumers, including 13 golf facilities, 25 parks and 30 schools.

Starting in the 1980s the city began recharge experiments, with pilot projects along the Santa Cruz River opposite the Roger Road Wastewater Treatment Plant. Recharge involves adding water to the aquifer. Monitoring determined the rate recharge was occurring and detected changes in water quality. The city subsequently developed other recharge projects. The project with the largest anticipated full-scale capacity is the Central Avra Valley Storage and Recovery Project.

In the 1960s, the city experimented with a series of ponds for wastewater treatment using effluent from Roger Road. Then Tucson Water Director Frank Brooks used to boast of the high quality of the water by eating fish caught in those ponds. The last of the ponds was eliminated in the 1980s in response to fears that water leaching out of the ponds to groundwater was being contaminated by old landfill mate-

rial. In 1998, the city opened its first constructed wetland to the public — the Sweetwater Wetland near the Roger Road Treatment Plant.

OTHER WATER QUALITY PROBLEMS

Treatment of sewage has been the major water quality challenge for many years, but by no means the only one. During World War II Tucson became a center of airplane construction and maintenance. Several plants located near the Tucson Airport regularly used solvents to degrease aircraft parts. Solvents were not known then to be a health hazard, and the waste products were often evaporated in unlined ponds or allowed to run into washes. A few employees expressed concern at the time, but it was not until the 1970s that people on the south side of town noticed the occurrence of an unusually high incidence of certain illnesses. The Arizona Department of Health and the EPA began studies to determine the cause. As a result of these studies and legal action, officials came to believe that trichloroethylene (TCE) had reached the groundwater and was probably creating health problems such as lupus and birth deformities. A citizen group, Tucsonans for a Clean Environment (TCE), formed on the southside to ensure that the

problem was taken resolved to the benefit of the residents.

Since most of the manufacturing companies had long since left town, Hughes Aircraft (now Raytheon), the Tucson Airport Authority, the U.S. Air Force and the City of Tucson shared the burden of cleaning up the contaminated water. The city shut down three production wells and brought water from other wells to area customers. Hughes and the city installed a clean-up facility, under EPA oversight. What to do with the water after the TCE was removed became a major concern. The issue was later addressed as part of the anti-CAP initiative or Proposition 200. This passed and became the Water Consumer Protection Act. Tucson voters stated that water from polluted sources could not be used in the city system, even if federal Safe Drinking Water standards were met.

ADEQ has identified a number of other water quality problems in the Tucson area, including 17 groundwater contamination sites. The sources of contamination include historic landfills, manufacturing plants, mining and agricultural activities, aircraft waste disposal, and gas station and dry cleaning operations. In some cases the contamination exceeds federal Safe Drinking Water standards, and groundwater from the affected areas cannot be used for drinking unless treated to meet those standards. (See Chapter 6).