

# The Best Laid Plans

Reclaimed wastewater system bounces back after slow start.

By Michael T. Thornton and James J. Strayer

**D**rought-stricken Southern Californians in the late-1980s were desperate for water—and it looked like reclaimed wastewater might be a good supplemental source for irrigation. Local flower growers and golf course operators in towns north of San Diego approached the San Elijo Joint Powers Authority (San Elijo) about the possibility of using secondary effluent to irrigate their crops and greens.

At the time, San Elijo operated a wastewater treatment and disposal facility serving the cities of Encinitas and Solana Beach, as well as a portion of the Rancho Santa Fe Community. San Elijo owned and operated a 5.25-mgd secondary treatment plant and was a joint owner of the 25.5-mgd San Elijo Ocean Outfall System. “Why let all that water flow to the ocean?” was the question at hand.

Thus began a decade of planning, design, and construction until August 2000, when San Elijo completed a 2.48-mgd tertiary treatment facility, and associated recycled water storage and distribution system. The project brought

recycled water to customers while minimizing ocean discharge of treated wastewater. At just over \$16 million, the project was finished on budget. Community members and elected officials embraced the project and the environmental statement it made.

Early on, the San Elijo Board of Directors set the expectation that the reclamation program not be a financial burden to sanitation rate payers. The recycled water program would need to be independent and financially self-sustainable. The agency would receive about \$5 million in funding from the sanitation districts, which would be repaid once the program was financially sound. The remaining funding came from Bureau of Reclamation Title 16 grant funding and a low interest loan from the State of California.

Then reality set in as the first two years of operation proved to be a struggle. Recycled water demand was down, program revenues were below expectations, and operation of the tertiary facility was challenging. This is the story of how San Elijo turned the program around—so that today it is thriving.

Revenues are up, the system is operating soundly, the customer base is growing, and expansion options are being explored.

## Slow to Connect

A 1990 project feasibility and market assessment study presented a compelling case for San Elijo to develop a reclamation program. The study identified more than 90 customers having a total irrigation demand of over 2,200 acre-ft annually. San Elijo would be the lead agency in developing the treatment, distribution, and storage systems. San Elijo would then wholesale the recycled water to the existing water districts that own the meter at the consumer’s property line. This placed a majority of the program risk and responsibility on San Elijo. In return, water districts agreed to purchase minimum amounts of recycled water annually, known as “take or pay” agreements.

Meanwhile, concerns of drought had faded for most water consumers by the late-1990s. Nonetheless, recycled water wholesale agreements were finalized with three local water districts and San



*The San Elijo Water Treatment Plant produces 2.5 mgd of recycled water. Secondary clarification process tanks are about 220,000 gal. each. Average treatment time in the tank is slightly over five hours.*

Elijo developed a backbone system through these districts targeting customers, including two golf courses, Caltrans, parks, agriculture, and the Del Mar fair grounds.

The initial planning phase had identified over 90 sites, yet the regulatory process to connect and serve these sites proved more involved than anticipated. Even with a focus on select customers, San Elijo experienced a slower rate of connection, higher costs than estimated, and usage below initial market projections (common results from early recycled water market assessments performed in the industry).

To counter the slow connection rate, San Elijo took a hands-on approach to marketing their recycled water and assisting customers in the retrofit process. This required significantly more staff time. Overall, lower revenues coupled with higher operational expenses and the need for additional minor capital improvements left the program in the red during the first two years of operation.

## Early Financial Difficulties

Another unforeseen impact was the program's tie to the cost of potable water as the main revenue source. The initial concept was to keep the price structure simple. Recycled water rates would be at 85 percent of the price of potable water. Although charging based on the potable rate is common in the industry, many agencies have a number of additional revenue sources, or have control of the price of potable water. San Elijo did not have all these options, which meant operating the program with little control over its revenue stream. If energy, chemical, or labor costs increased, San Elijo would have few options for raising revenues to counter these increases.

The original 1990's feasibility study assumed potable water rates would increase at six percent annually. However, water rates remained relatively flat for most of the 1990s. Water purveyors either elected to raise fixed charges, such as meter fees, or absorbed inflation costs in other ways. This caused San Elijo's recycled water revenue to be well below assumptions made in the initial feasibility study.

Consequently, program revenues were well lower than expenditures.

## A New Operation

Operating a reclamation program comes with a host of considerations, ranging from treatment challenges and distribution management to community acceptance. Like many agencies just entering into water reclamation, San Elijo could not anticipate the full range of operational issues and their potential costs. Adding tertiary treatment to the existing facility meant new levels of operation complexity.

For example, budget restrictions led to undersized storage reservoirs. The tertiary system was designed with a 25,000-gal onsite clear well and about 1.3 MG of offsite storage. When peak summer demand exceeded two mgd, it required treatment system operation in close coordination with the storage and distribution system. Up-front capital costs were avoided with smaller reservoirs, but the system required more staff time and additional pumping during peak energy cost periods.

## Back to the Boardroom

By year three of operations, it became apparent that a thorough system review, updated financial plan, and assessment were needed to improve the program. This culminated in San Elijo's "Recycled Water Optimization and Expansion Study" (Master Plan Update) prepared by PBS&J ([www.pbsj.com](http://www.pbsj.com)) in July 2005.

San Elijo learned that recycled water programs typically require a higher degree of collaboration with community members, public officials, and government agencies than potable water and wastewater systems. The Master Plan Update provided a means to openly discuss the challenges and opportunities of the recycled water program. Program benefits and the value of recycled water were better articulated. Stakeholders grew interested in understanding the program's financial structure and how their rate decisions affected it. Workshops helped water purveyors make informed decisions that benefited both the potable and recycled water systems. This interaction and resulting

appreciation of the issues at hand was one of the most significant benefits of the master plan process.

The Master Plan Update included analyses of the distribution system, treatment plant operation, and financial plan. All aspects were affected by two key operational scenarios developed as part of the Master Plan Update. Scenario 1 involved targeting 1,400 acre-ft/yr of recycled water sales. Scenario 1 was based on maximizing existing plant production with minimal additional capital improvements. Scenario 2 was based on constructing moderate improvements to expand recycled water usage to 1,600 acre-ft/yr of sales.

## Market Realities

The first step of the Master Plan Update was to prepare an updated market assessment. Actual meter records were obtained for non-potable customers. This data was categorized into two main groups: customers along existing pipelines, and customers who could be served only by extending the distribution system. Preference was given to routes that also provided the benefit of looping the distribution system. Because the new distribution system was initially constructed as a "back bone" system, it was linear in nature and did not contain many looped sections. Looped sections provide an alternative route to supply water to the same point and are standard practice with potable water systems due to the need for reliability. For the recycled water system, it was deemed a valuable element of future system development. Also, learning the lessons of past market assessments, the water demands were carefully analyzed to provide a reasonable estimate of probable usage. The resulting assessment included 593 acre-ft/yr of potential new use, with 378 acre-ft/yr available for connection within the next five years. Both scenario increases appeared feasible from a market perspective.

Water demand estimates were input into a detailed extended period simulation hydraulic computer model to assess both Scenario 1 and 2 sales projections. The key questions were, "Can the existing treatment and distribution system serve the demand increases? If not, what

improvements are needed and how will they affect the financial plan?" The model allowed phasing and prioritizing projects to minimize costs and maximize revenues. The hydraulic model and market assessment were valuable tools to balance distribution system needs with the financial impacts and plant capacities.

## Treatment and Distribution

From an operational perspective, the treatment and distribution operation of many small recycled water systems are highly dependent on one another. For example, the quality and chemistry of the secondary effluent affects tertiary filter operation and system disinfection, as does the volume of system storage. Recycled water systems with limited storage can require close synchronization between treatment and distribution. Systems with too much storage can struggle with low system chlorine, which can result in high bio-growth and odors in the distribution system.

The Master Plan Update facilitated a comprehensive assessment to optimize component interaction, which in turn produced a plan to improve the cost effectiveness and efficiency of the system. The three primary goals for the systems included: simplify operations and maintenance, optimize the productivity of the recycled water facility, and improve system efficiencies.

Storage was an item of particular focus in the Master Plan. Increased storage would simplify system operation and maintenance by allowing temporary troubleshooting at the plant without interrupting customer service. With additional storage, supplement potable water (which is dumped via air gaps into the distribution tanks) would not be needed as often. Additional storage would also optimize the production of the recycled water facility by providing equalization of differing filter and effluent pump rates. The storage would also improve system efficiencies by allowing additional off-peak pumping during the critical nighttime irrigation window. Therefore, additional onsite and/or off-site water storage would allow the tertiary system to operate with greater independ-

ence from system demands, allow offsite pumping during non-peak energy periods, and maintenance activity on the system without excessive reliance on potable water supplementation. This proposed improvement met all three goals of the Master Plan. It was determined that an onsite clear well expansion would be the most cost effective solution.

Furthermore, key operational upgrades were identified and prioritized into a three phase plan. Phase I includes low-cost improvements that optimize existing equipment and simplify system operations. Improvements included upgrading the filter feed pump control system to reach existing plant design capacity and modifying the existing filter system to improve reliability. Phase II builds upon the filter feed improvements to achieve the maximum filter loading rate. Additional improvements include upgrading the filter feed pumps to increase pump station capacity and adding filters to provide redundancy, allow routine maintenance, and increase recycled water production. Phase III focuses on improvements to the finished water and the plant/distribution system interface, including an increase in disinfection capacity through augmenting the chlorination facility and constructing new on-site storage.

## Eyes Wide Open

The Master Plan Update provided a critical venue to openly discuss the financial constraints and challenges the program faced. This proved an eye-opening experience for many stakeholders, and facilitated an understanding of how program successes and challenges affected each city and water purveyor. To address "external" revenue factors, several strategies were proposed. These strategies were closely coordinated with a diverse stakeholder group, and included:

- Encouraging water purveyors to consider impacts to recycled water when adopting future rate increases.
- Implementing fixed monthly charges (meter fees) for recycled water service similar to those attached to potable water service.
- Adding a nominal recycled water fee (surcharge) to potable water meter fees.

- Collecting recycled water meter capacity charges when installing new customer connections.
- Making irrigation user rates consistent among all recycled water customers.
- Revisiting the program's financial condition annually.
- Continuing to pursue new recycled water users.

Since the completion of the Master Plan, the financial condition of the San Elijo recycled water program has improved significantly. New rate schedules have been adopted by all three water districts, resulting in a 20 percent recycled water rate increase over three years. Current recycled water rates are now in line with other districts in the region. In addition, the San Diego County Water Authority, which is the regional water wholesaler, increased financial assistance to recycled water programs from \$147 per acre-ft to \$247 per acre-ft. The increase was determined appropriate to support local recycled water programs that provide diversity to the region's water portfolio. Increased revenues coupled with reduced operational costs due to improvements has resulted in the program becoming financially sound.

The Master Plan process also provided a forum for dialog to occur between San Elijo and the water districts, leading to program improvements. The water districts have provided insights for operating the program as well as shared staffing resources to install customer service connections and review expansion ideas. Once again, the qualitative benefit of the Master Plan process was the new appreciation that stakeholders gained in understanding the San Elijo recycled water system and the fostering of a working partnership between all. GE

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