

# EchoWater Advanced Wastewater Treatment



## Project Achieves Initial Treatment Permit Compliance Milestone

The Sacramento Regional County Sanitation District (Regional San), a steward of the Sacramento River since the agency's inception in 1973, serves 1.4 million residents in the metropolitan area and treats household, business and industrial sewage.

Regional San achieved a major milestone on April 19, 2021, on its \$1.7 billion EchoWater project, completing the \$414 million biological nutrient removal facility. The facility augments traditional wastewater treatment processes to eliminate nearly all ammonia and most nitrate from the effluent (i.e., treated water) prior to discharge into the Sacramento River.

### Project History

The Sacramento River flows from the Cascade Mountains, winds along 400 miles of Northern California, and empties into the San Francisco Bay. The river significantly affects the livelihood of Californians. It's a major source of irrigation, drinking water, timber, hydroelectric power and recreation, and it's a habitat for endangered fish species, including salmon, steelhead, delta smelt and green sturgeon.

Throughout its 400-mile journey, there exists a delicate balance between nature and civilization. A wide range of human activities, including farming and wastewater discharge, can increase levels of nitrogen and phosphorus in lakes, streams, rivers and estuaries. Too much nitrogen and phosphorus in the water can have diverse and far-reaching impacts on public health, the environment and the economy. For example, excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive.

To address water quality concerns, the state agency that regulates wastewater discharge to the river issued a new permit to Regional San in 2010 with stricter discharge requirements. The new permit required the planning, design and construction of several new treatment processes, including nutrient reduction, filtration and disinfection processes. The major compliance milestones dictated by the regulators were May 11, 2021, for nutrient removal, and May 9, 2023, for enhanced disinfection and filtering.

To emphasize the project's mission, Regional San derived the name



EchoWater, describing the process of returning water to its original state, like an echo returning to its source. The billion-dollar improvements will resonate throughout the 27,000-square-mile watershed.

### The Path to Permit Compliance

Meeting the new permit conditions by 2023 required a tremendous effort in planning, design and construction of multiple treatment and support facilities. To assist in coordination and program controls, Regional San reached out to the consultant community to provide program management services. The agency selected internal dedicated staff and the Brown & Caldwell/HDR Joint Venture team to establish the EchoWater Program Management Office. The PMO initiated process studies, commissioned a pilot plant, established its office, defined treatment processes and design/construction packages, completed environmental documentation, and received financing approval.



The 2011 studies identified new treatment processes to reduce pathogens in the water, including:

- **Ammonia and nitrate removal.**  
Using a process called biological nutrient removal, the new treatment plant will eliminate nearly all ammonia and most nitrate from the effluent.
- **Filtration and enhanced disinfection.**  
Tertiary treatment and filtration will be applied to remove smaller particles and more pathogens from the effluent (as compared to the existing “secondary treatment” process).

The PMO team worked on the pilot plant project in 2012, a 0.5 MGD plant constructed via design-build, and tested various treatment technologies. Key findings from the pilot plant studies were reported to the Regional Water Board and helped define and validate the process alternatives needed for compliance. The findings from the pilot project led to at least \$100 million in construction savings and \$5 million/year in chemical savings for EchoWater. Items like filter batteries were analyzed, with the team determining that two would suffice instead of the three originally planned.

## PM/CM Team Builds From Vast Project Knowledge

Starting in 2012, the PMO took the pilot plant concepts, adapted them for the full EchoWater project and assigned final designs to selected consultants. In addition to these two new treatment processes, multiple other construction projects were needed to relocate existing facilities, provide contractor access and deliver the power and communication capabilities that would be needed. Twenty construction packages were identified, each with its own design



and construction challenges. The PMO developed a comprehensive approach to address the construction challenges and create program opportunities. This approach evolved through project validations; predesigns; development of design standards; collaboration with and oversight of all designers; development and updates of program and component risk registers; constructability reviews; and use of 4D and 5D modeling to further analyze construction sequencing and interface issues. Multiple consultant design firms, including Black & Veatch, Carollo, Jacobs, AECOM and others, were selected to provide the designs needed to keep the EchoWater on schedule.

As the project moved from design to construction, Regional San looked again to the consultant community to provide construction management services. The early construction contracts were managed by some County of Sacramento staff and by a consultant CM team led by Parsons. The Jacobs/Psomas CM team was brought on board to supplement the Brown and Caldwell/HDR JV construction managers on the major facilities.

Today, PMO staff members manage both design and CM consultants. The PMO provides all schedule and estimating support to the 20 EchoWater construction contracts. The JV also

provides operational support through the development and oversight of all commissioning activities and supervisory control and data acquisition (SCADA) programming.

## Visualization Opens Eyes, Keeps Builders in Tune on EchoWater

Peak construction occurred in 2019, with seven concurrent construction contracts and more than 500 construction workers on site daily. The multiple, simultaneous contracts required close coordination, and the PMO leveraged the EchoWater-established 3D design standards. The PMO used 4D and 5D visualization software to link the design models to the schedules for both planning and construction.

A great example of the value of utilizing 4D/5D tools occurred in 2017. Flooding in January 2017, part of Northern California's wettest winter in nearly a century, threatened the overall schedule. The Regional San plant used equalization basins to buffer the peak flow during the event, delaying work by the equalization basin contractor. The PMO review of the 4D/5D models for adjacent construction contracts showed the impact of delaying one contract created physical conflicts on work expected months later. The 4D model allowed the team to see the





construction impact and make adjustments. Working with the contractors, the team transferred scope from one project to another, keeping the critical BNR contract on schedule.

## Forty-Year-Old Valves Pose Another Challenge

With Regional San's need to maintain plant operations, the EchoWater project had to work within very limited windows for operations shutdowns. Those time frames would be challenging enough, but the plant's old valves and pumps did not always close properly to isolate areas for maintenance and upgrades. These leaky valves significantly reduced the contractor's windows for plant shutdowns.

The Effluent Valve Replacement project was initiated and completed on a fast track to alleviate this problem, and the team performed the shutdowns over two summers, completing on time and without any non-compliant discharges.

## Program Status and Results

The initial permit compliance date set by the Regional Water Board for nutrient removal was May 11, 2021. The new \$414 million BNR treatment process, designed by Black & Veatch/Jacobs and constructed by Dragados USA as a design-bid-build project, was successfully treating all plant flow on April 19, 2021, achieving the first critical milestone.

The second permit compliance date for disinfection and filtering is set for May 9, 2023. The new \$300 million TTF project, designed by Carollo/AECOM and constructed by Balfour Beatty Infrastructure, Inc., is on a timeline for potential completion six months early.

The effective implementation of an integrated owner/consultant program management and construction management staff, along with the efforts of multiple design consultants and contractors, is making the EchoWater project a 13-year success story. The new facilities will improve water quality, enhance the health of the river and result in the ability to reuse effluent that was previously just discharged. The expected total cost of the EchoWater Project will be \$1.74 billion when completed.

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**For more information on EchoWater, please contact [Ron Perkins, PE, CCM](#), Construction Services Business Class Leader.**