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**SUSTAINABLE
WATER-RECYCLING**

The entry to the Orange County Water District and Orange County Sanitation District in Fountain Valley, Calif. offers a drought tolerant planting theme, including *Dietes bicolor*, *Eleagnus pungens*, *Rhaphiolepis 'Jack Evans'* and *Myrica californica*.

SUSTAINABLE WATER-RECYCLING

—Stephen Kelly, Editor

We've all heard about treating recycled water for typical agriculture applications, but how about purifying the same water for drinking?

Facing extended droughts and continued population growth, the Orange County Water District and Orange County Sanitation District in Fountain Valley, Calif. implemented an innovative solution to provide safe drinking water to the people of Orange County. The Groundwater Replenishment (GWR) system, believed to be the largest water purification project of its kind in the world, produces potable water from highly-treated wastewater. The \$480 million project purifies clarified secondary-treated wastewater effluent beyond drinking water standards using advanced membrane purification. This model of sustainability conserves and recovers limited water resources, reduces energy consumption (compared to imported transporting water) and supports economic vitality.

Camp, Dresser & McKee (CDM) managed the project development, final design and the bidding phases. Lynn Capouya, Inc. (LCI) was the landscape architecture firm selected to provide landscape solutions for the major entry, Research Center and Laboratory, and the Community and Treatment Process areas.

CDM designed a water treatment facility that uses microfiltration, reverse osmosis and ultraviolet disinfection to purify secondary effluent. The multi-barrier, advanced treatment approach of MF and RO, followed by UV disinfection to remove bacteria, emerging contaminants and viruses, met the stringent criteria of the California Department of Public Health prior to completion of the facility. As required by the state, OCWD appointed an independent advisory panel comprising public health, medicine and environmental engineering and biology experts for independent oversight.

The plant is highly automated, reducing the number of required operators. As a part of the project, CDM also designed supporting chemical systems, onsite buildings, an electrical substation, three water pumping stations, more than 13 miles of pipeline to

Groundwater Replenishment

System Team

CDM: Managed project development, final design and the bidding phases

Brown and Caldwell: Electrical/structural engineering

Tetra Tech: Civil, electrical, structural engineering

EHDD: Phase 1 architect

HOK: Phase II architect

Lynn Capouya, Inc.: Landscape architecture, Gerald Ohta, ASLA, project manager

Diaz-Yourman & Associates

Moraes/Pham

Lee & Ro

RBF

ODC

Beyaz & Patel

TJC

DeC Consultants

Wieland & Associates

FloScience

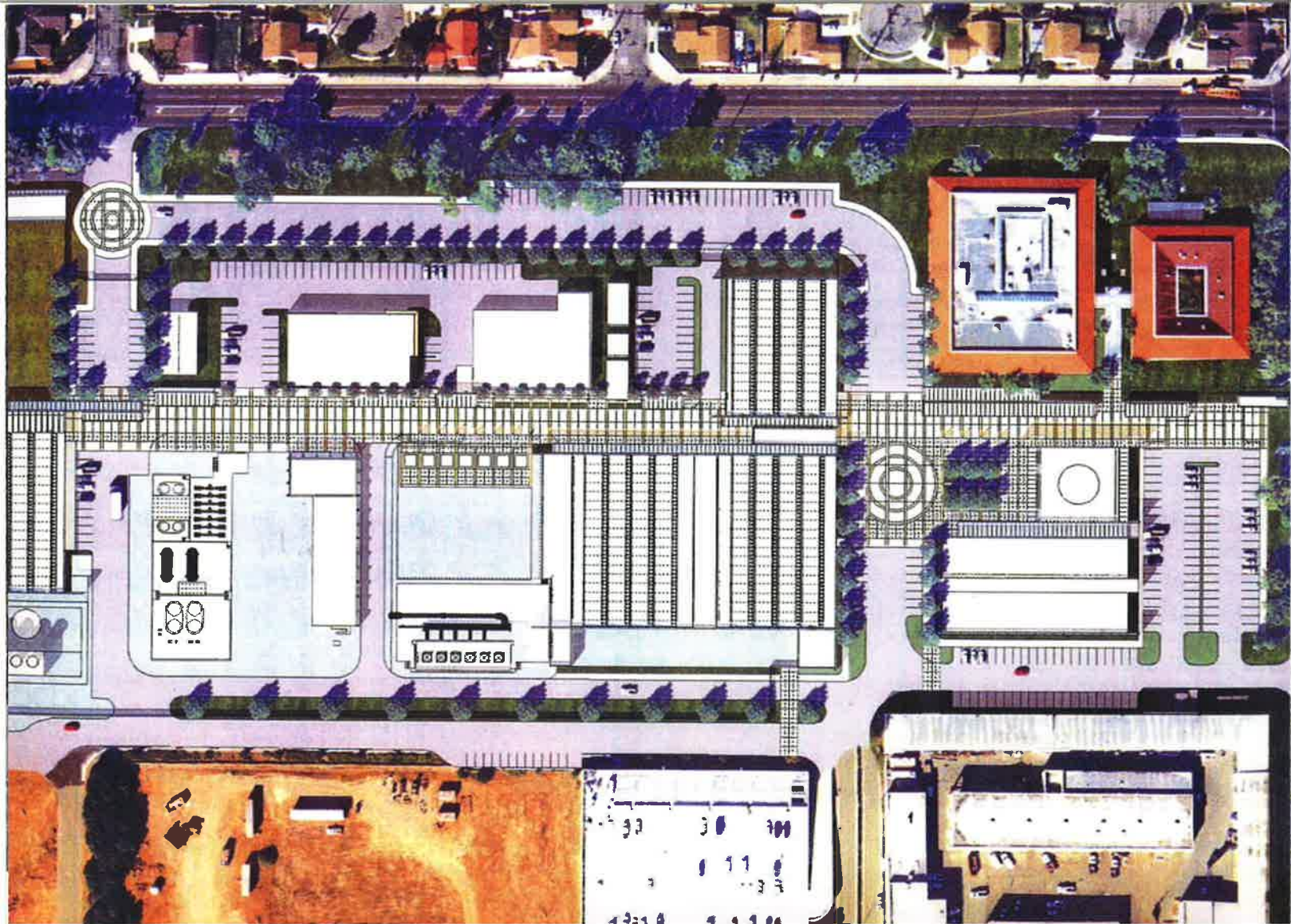
Saf-R-dig

Berryman & Henigar

RMW Paleo Associates

Workhorse Consulting

Universal Reprographics South



transport the water to recharge basins, three miles of barrier pipelines and 16 injection wells on eight different sites. CDM performed groundwater modeling to determine the optimum placement of injection wells used to prevent seawater intrusion. The treated water is injected into these underground seawater barrier wells or percolated into aquifers, replenishing the aquifer and reducing total dissolved solids. The injected water blends with existing groundwater, forming a barrier against seawater intrusion. This treated wastewater was previously discharged to the Pacific Ocean, approximately four miles south of the facility, but is now an economically feasible drinking water source for about half a million people.

Treating effluent to high standards is not only creating a reliable water supply from a previously wasted local resource but also conserves energy. Less power is required to purify wastewater than to import a similar amount of water from Northern California or from the Colorado River, reducing the regional power demand. It also ensures water demands are met even during drought periods.

The purified water produced by the system is near distilled quality, requiring that minerals be added back in for stability. The resulting water is more superior in quality than water available for recharge from imported water or stormwater.



Top: Lynn Capouya, Inc. was the landscape architecture firm selected to provide landscape solutions for the major entry, research center and laboratory, and the community and treatment process areas at the Orange County Water District/Sanitation District in Fountain Valley, Calif.

Above: The facility's parking lot looks out toward Ward Street and a residential tract. The view is mitigated with a landscaped berm.



Landscape with Sustainability in Mind

The primary goal of the landscape design was to demonstrate that conservation and energy efficiency can coexist and lend lasting and timeless beauty to the GWR campus.

Several design solutions were explored during the design feasibility phase of the project. The Landscape Architects embraced a drought-tolerant design for the facility. The selected theme was the one that focused on sustainability and water conservation consistent with the actual function of the new GWR facilities. Plant materials that were less 'thirsty', lower in maintenance and **visually appealing** were selected. Key client concerns such as: image, context, use and form were identified and utilized to create a theme in developing the plant palette.

Creation of a landscaped berm to shield the neighborhood from the facility was implemented as an early phase of development in the GWR facility Construction.

The Landscape architects worked to maintain those parts of the landscape considered to be cultural resources, such as several existing bottlebrush trees.

Expanding the existing reclaimed water system and specifying low-water volume spray and bubblers for landscape irrigation contributed to the water efficiency. Plants within a particular hydrozone were grouped for consistent watering. 'Smart' irrigation controllers, coupled with rain shut off components were also used.

This allowed systematic reduction in water use; reducing water costs, addressing current water regulations and setting an example for the community.

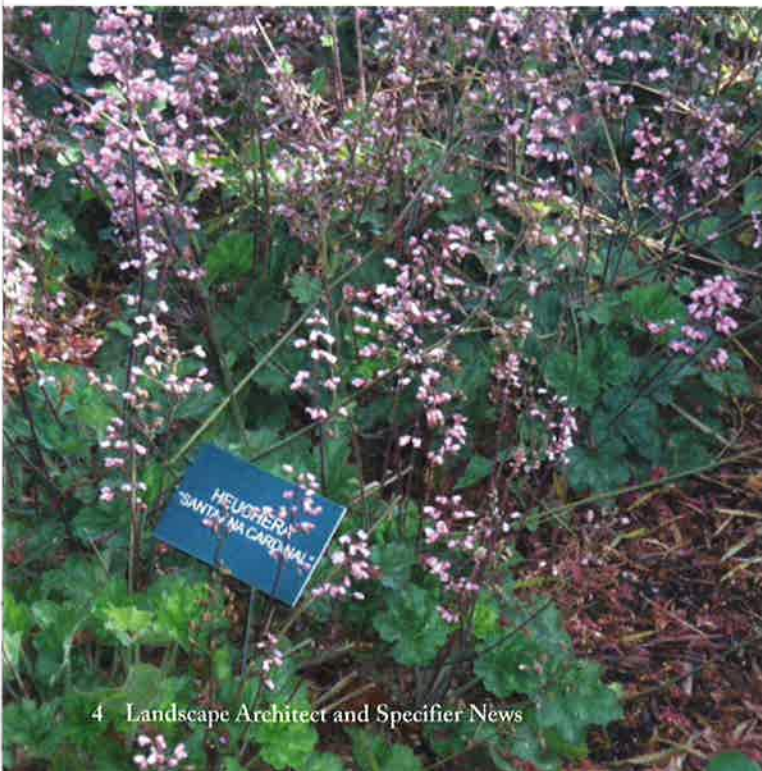
These irrigation policies combined with grading / drainage facilities such as bioswales, retention / detention basins and pavement alternatives significantly reduced storm water runoff, fostering first flush mitigation.

Other critical issues encountered during this site development included: expansive soils, with a perched water table, high salt content, including heavy metals, poor drainage and an abundant rabbit population. Through agronomic soils testing, the landscape architect was able to specify necessary soil amendments and procedures to mitigate the circumstances. Plant materials, identified as 'rabbit resistant' were also incorporated.

Every design solution addressed **sustainability**. The life cycle costs were weighed against the initial client criteria and budget constraints evaluated with each submittal.

Above: Granite boulders, 2-4 ft. dia., and plantings, such as purple fountain grass and fortnight lily, are tucked around the existing bottlebrush trees, which were protected in place.

Below: The landscape architect specified a diverse palette of drought-tolerant plant materials for sun and shade at the facility (Santa Ana cardinal coral bells, an evergreen perennial, pictured).



Top: Ward Street runs along the west side of the facility and borders a housing tract. Plantings of *Ribes speciosa*, *Heteromeles arbutifolia*, *Rhus ovata*, *Iris douglasiana*, *Eleagnus pungens* and *Cotoneaster 'Strieb Findings'* went in during the first phase of construction to ensure mature screenings when the renovated facility debuted.

Middle: A dense cover of Star Jasmine has filled in nicely to help screen the facility from the street. The Groundwater Replenishment facility incorporated and expanded the existing reclaimed water system and used low-water volume spray and bubblers for landscape irrigation.

The recycled water also benefits area residents by reducing the salinity of water in the groundwater basins. The lower mineral content groundwater ("softer" water) pumped from the basin helps reduce detergent and cleaning costs and extends the life of water heaters, boilers and plumbing fixtures.

Flagship Facility

The GWR System is one of the largest plants in the world using MF/RO/UV to purify treated wastewater into drinking water. The new, streamlined facility can produce 70 million gallons per day (mgd) of purified water in about the same spatial footprint that housed Water Factory 21, which treated 5 mgd. The facility is expandable to 130 mgd. Scaling up the innovative technology from pilot to full size required a significant increase in the membrane area, pump capacity, ancillary facilities and the number of trains, as well as heavier equipment, a larger building, and multiple chemical deliveries per day.



TREES

The tree species installed at the Orange County Water District include:



golden medallion



golden rain



flaxleaf paperbark



Chilean mesquite



pomegranate



African sumac pink trumpet

GROUNDCOVER, SHRUBS, VINES

The groundcover, shrubs and vines species installed at the Orange County Water District include:



dwarf Oregon grape



fuchsia flowering gooseberry



saltillo evening primrose



Indian Hawthorne



Pacific Coast iris



angelwing jasmine



Picture 1: The drop-off area offers a patio for employees and is a gathering spot for tours of the facility. Fortnight lily is the groundcover (foreground). The patches of pink flowers are *Lantana montevidensis*. The youthful trees are *Cassia excelsa*. The hardscape is a medium, sandblast concrete with a Lithocrete black-colored banding. Site amenities include benches and trash receptacles (Forms and Surfaces) and planters (Quickcrete Products).



Picture 2: The bottle brush trees were protected in place along Ellis Street, which runs along the north side of the facility. The planting are *Dietes bicolor*, *Eleagnus pungens*, *Rhaphiolepis 'Jack Evans'* and *Myrica californica*.



Picture 3: Chilean mesquite trees are alternated with espaliered Star Jasmine to help screen the facility from the neighborhood across the street.




Picture 4: The planter strip between the river rock blanket and the facility allows visual and physical separation. The “rock blanket” allows truck access for maintenance of well sites. The ground cover here is a mixture of *Cotoneaster 'Streib's Findings'* and *Juniperus conferta*. The bottlebrush tree is existing.

The GWR system has received favorable mainstream media coverage that includes The New York Times, NBC Nightly News, CNN, and National Public Radio.

The facility is setting the standard for recycled water projects. Industry professionals from Singapore, Australia and China have visited the facility. Similar plants are underway in Singapore, Australia and Miami.

Widespread Community Support

OCWD gained community support through public education in the 20 cities and water agencies within the service area of 2.3 million people. Outreach to citizens, businesses, local officials, state legislators, medical and science experts and environmental groups—including Surfrider Foundation, Orange County Coastkeeper, the Sierra Club and many others—garnered support with no organized opposition.

The Orange County Water District and the groundwater replenishment system have been honored with more than a dozen awards, including the EPA's Water Efficiency award and the Pisces award for advancing clean and safe water through exceptional planning, management and financing. The facility also earned the Toshiba Green Innovation award for its commitment to the environment. 

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