RO/NF UF MBR Chemicals

CASE STUDY

RO | UF | MBR |

Wastewater Treatment
California, USA

TORAY

Water Replenishment District of Southern California Incorporate Direct- Coupling of Toray UF to Toray RO for High Recovery and Energy Savings

CHALLENGE

The Water Replenishment District of Southern California (WRD) manages the groundwater resources that supply water to the Los Angeles region. Recently surviving an eight-year drought, WRD established the Water Independence Now (WIN) initiative to "end the district's reliance on imported water from the Colorado River and Northern California for groundwater replenishment." As a result, WIN incorporates a suite of projects that maximizes the use of locally available water sources. The most significant component of the WIN program is the Albert Robles Center for Water Recycling & Environmental Learning (formerly known as the Groundwater Reliability Improvement Project or GRIP). Through the program, WRD aims to provide 4 million residents in the Los Angeles region with an entirely local sustainable groundwater supply, eliminating its dependence on 25,000 AFY of imported water from the Colorado River and Northern California.

The advanced water treatment facility (AWTF) treats 14.8 MGD of tertiary municipal wastewater from the San Jose Creek Water Reclamation Plant through Toray UF pressurized hollow-fiber ultrafiltration modules followed by Toray RO reverse osmosis membrane elements. The RO product water moves to a final advanced oxidation ultraviolet step. Tetra Tech (Pasadena, CA) engineered the system to meet the district's requirements, while Biwater, Inc. was hired as the original equipment manufacturer to build the treatment systems.

DIRECT-COUPLING DESIGN

Process design features focused on achieving the smallest footprint and lowest capital and operation costs, particularly energy. As a result, a direct coupling of UF to a first and second stage primary RO feeding and a third stage secondary RO for concentrate recovery is in place. The direct coupling, the method of feeding the UF filtrate directly to the RO, eliminates the need for a break tank and associated equipment to store the UF filtrate/RO feedwater. Historically, this type of arrangement reduces the risk of biological growth within the break tank, thus reducing the RO system's contamination risk in seawater desalination systems. However, as wastewater sources may contain high levels of organics, this design was essential in energy savings from the reduced footprint.

Figure 1: Albert Robles Center

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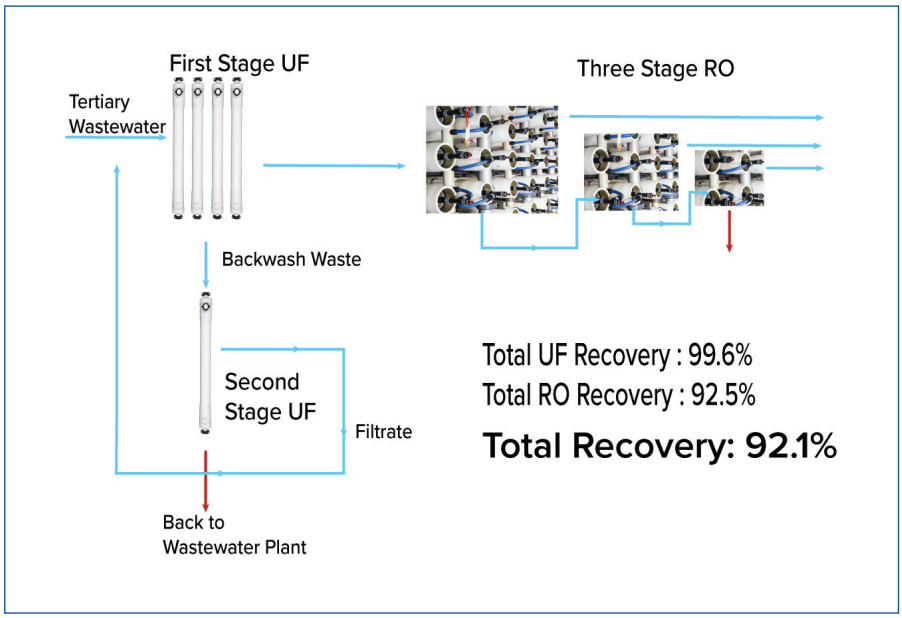

Figure 2: Direct-Coupling Design
Two Statges of Ultrafiltration
Three Stages of Reverse Osmosis

Table 1 — UF Specifications

Item	Primary UF	Secondary UF
Model	HFU-2020HN	HFU-2020N
Number of Elements per Train	80	30
Number of Trains	10	4
Membrane surface per Train	62,000 ft^2	23,250 ft^2
Net Flux (GFD)	38.0	11.9
Recovery	96%	90%
Total Recovery	99.6%	

Table 2 — RO Specifications

Item	Primary RO (Stage 1 &2)	Secondary RO (Stage 3)
Model	TMG20D-400SR	TMG20D-400SR
Number of Trains	4	2
Number of Stages	2	1
Membrane Array per Train	72:30	16
Numbr of Elements per Vessel	7	7
Average Permeate Flux (GFD)	11.9	10.3
Recovery	85%	50%
Total Recovery	92.5%	

RESULTS

Toray's PVDF hollow-fibers exhibit one of the strongest membrane chemistries in the industry, allowing the production of more filtrate per module compared to other manufacturers.

The RO system is a three-stage configuration to provide the most efficient design for high recovery (92.5%). Separating the primary RO (PRO) from the third stage RO (TSRO) units allows more operational flexibility. Operations can remove the TSRO stage for cleaning or other maintenance without affecting the PRO operation and vice versa. Selecting Toray RO for the three-stage RO process accomplished the facility's goals of higher rejection and lower energy. Also, by combining Toray UF, recovery of 99.6%, and Toray RO, recovery of 92.5%, membranes, they met the overall desired system recovery of 92.1% and an estimated energy savings of 500,000 kW/yr.

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