The use of membrane bioreactors (MBRs) is a hot topic when it comes to discussing process treatment alternatives for activated sludge. MBR technology has evolved in the last five years from an approach applicable for plants with capacities of up to 1 or 2 mgd to a technology that is suitable for very large plants.

**MBR Issues**

Specific issues that relate to MBR projects include:

- Piloting - is this needed or not?
- Selection of the membrane supplier - there are several to choose from.
- Location of the membranes - within the existing basins or not?
- Pretreatment - how much is required?
- Membrane cleaning - how will this impact the treatment process?
- Dealing with cleaning chemicals and residuals.
- Dealing with peak flows.

**Experience Counts**

Carollo has piloted and designed a number of MBR systems. We have developed computer modeling tools to help us quickly evaluate process issues and sizing options for our clients. Our experience with MBR technology can be a valuable tool to help you address your project needs. Project examples include:

**City of Corona, California - Wastewater Treatment Plant No. 3.** Carollo prepared preliminary design for two treatment alternatives as part of the design/build delivery of Corona’s Wastewater Treatment Plant No. 3. The project involved preliminary design (approximately 30 percent) and specifications for a conventional biological nutrient removal (BNR) activated sludge treatment plant and an advanced MBR treatment plant (manufactured by Zenon). Carollo prepared design criteria for both treatment alternatives and assisted with the permitting process. Corona selected a Zenon membrane bioreactor over conventional treatment systems. The plant came on-line in 2001.

**King County, Washington - Pilot Testing.** King County’s Wastewater Division enlisted Carollo to pilot test an MBR to assess the feasibility of treating wastewater to a level suitable for irrigation reuse. The goal of the pilot test was to provide a basis for the design of a full-scale water reclamation facility in the Sammamish River Valley. The project involved
applying reclaimed water from the test facility to small garden test plots managed by various local agricultural entities. Locating the MBR test facility at the Hollywood Pump Station along the Sammamish River Trail, a popular recreational area, exposed the public to the project and helped to foster acceptance for the use of reclaimed water for irrigation among both residents and local growers.

King County, Washington - Sammamish Valley Wastewater Reclamation Plant. Carollo provided detailed design of the Sammamish Valley Wastewater Reclamation Plant, a satellite treatment facility with an ultimate design capacity of 5 mgd. Following a six-month pilot plant program, Carollo recommended an MBR to reliably produce effluent better than the Class A requirements. Carollo pre-qualified and then pre-bid the membrane portion of the plant early in the design process, saving time and allowing the design to proceed around the selected MBR system. Four membrane suppliers completed prequalification documents: Kubota, Mitsubishi, U.S. Filter, and Zenon. King County received bids from two prequalified suppliers.

City of Redlands, California - Recycled Water Treatment Facility. Carollo, assisted by others, designed an upgrade of Redlands' existing treatment facility to provide recycled water for use as cooling water by a local power generator. Design of this MBR plant, expandable to 9.5 mgd, allows for removal of total inorganic nitrogen to a level of less than 10 mg/L to meet Basin Plan requirements, and treatment of 6 mgd of the total flow to meet California Title 22 requirements for low turbidity, disinfected effluent suitable for use in cooling towers and for crop irrigation. The plant uses immersed microfiltration membranes in an MBR followed by disinfection. This arrangement allows Redlands to install reverse osmosis (RO) downstream to meet future total dissolved solids (TDS) discharge requirements, if needed.

Bell Carter Olive Company, California - Industrial Wastewater Services. For over 15 years, Carollo has provided Bell Carter, the nation's largest black-ripe olive producer, with comprehensive industrial wastewater consulting services. A recent project included modifying the wastewater treatment process at their Corning, California, facility into a two-step MBR process. The existing aerated lagoons feed a membrane facility that separates the mixed liquor solids

Carollo designed the largest MBR on the West Coast for the City of Redlands, California, shown here under construction.

Carollo conducted MBR pilot testing using Kubota treatment technology at one of King County's treatment plants.

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Carollo’s development of a successful membrane pilot testing strategy allowed optimization of design criteria for Bell Carter’s full-scale membrane treatment facility.

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from the effluent. The addition of direct membrane filtration has reduced Bell Carter’s dependence on the costly chemicals necessary to encourage separation by dissolved air flotation. Carollo administered process pilot testing, developed the facility design criteria, and provided technical advisory consulting for the construction of the facility.

Carollo has also conducted numerous evaluations of the MBR process for plant expansions/audits, etc. Some examples include:

- City of Springfield, Missouri - Northwest Wastewater Treatment Plant Expansion.
- South Salt Lake Valley, Utah - Water Reuse Study.
- Orange County Sanitation District, California - Secondary Treatment Capacity Expansion.

Please contact us if you have questions or need more information.