NAME:
McFarland Creek Wastewater Treatment Plant

LOCATION:
Chagrin Falls, Ohio

PLANT SIZE:
1.8 mgd capacity and peak flow of 6 mgd

INFRASTRUCTURE:
The project included the conversion of two aeration basins into two anoxic zones and four membrane basins (with additional space in previous basins), and final clarifiers for flow equalization.

The retrofit allowed the new MBR technology to produce much cleaner effluent into the nearby Aurora Branch of the Chagrin River.

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By Clare Pierson

Expanding Capacity Without Expanding Size

MBR technology solves a plant's age-old problem of needing more capacity but not having the room for it

Population growth in this country is a double-edged sword for municipal plants like the McFarland Wastewater Treatment Plant (WWTP). With people and housing developments popping up everywhere, cities need to treat more water for new residents but cannot expand physically because they are land-locked.

CT Consultants, an engineering consulting firm based in Willoughby, Ohio, conducted a needs-feasibility study at the request of the Geauga County Department of Water Resources. The firm determined that based on its use of conventional technology to that point, the McFarland WWTP would need to increase its capacity by 50%—from 1.2 to 1.8 mgd—over a 20-year span to continue serving its growing community.

Deciding to retrofit

CT Consultants not only recommended the capacity needed but researched new technology options for the plant as well, eventually deciding on MBR technology as the best available option. The technology was chosen because the MBR equipment could be retrofitted into the existing tanks and footprints, thereby reducing construction time and the space needed.

This project was the first MBR system to retrofit a conventional system in the U.S.; therefore, the engineering firm studied the practice in Japan—where it has been done for many years—before recommending it to plant officials.

"We considered other conventional processes; however, our client wanted to be sure it met the tight effluent limits without a lot of operational effort," said Tom Voldrich, director of environmental engineering at CT Consultants.

Another deciding factor was the quality of effluent that the MBR system could produce. The McFarland WWTP deposits its effluent into the Chagrin River, a state-designated resource body of water. Therefore, it was crucial that the new system would produce cleaner effluent. The system would prove to do this, reducing residual solids production by 30% after the technology went online. Finally, the new technology promised reduced operations and maintenance costs.

"The results of these benefits are [the system] allows for growth, allows revenue from continued tap-in fee revenue, improves the environment and remedies existing pollution problems," Voldrich said. "Effluent from MBR plants is much more user-friendly for nonpotable water use, [and] the cost can be competitive with conventional technology when you consider all aspects of a project."

Construction phase

CT Consultants recommended that the plant choose Enviroquip's Kubota flat-plate MBR technology for its new system. Construction on the $6.8 million retrofit began in October 2004, with the first and second trains of the system going online in the fall of 2005 and spring of 2006. The work consisted primarily of converting two aeration basins into two anoxic zones and four membrane basins. Additional space was available in the same existing basins, as well as final clarifiers for flow equalization. The MBR tanks have 14,400 membrane panels arranged in four banks of 18 cassettes.

With the technology, a new low-pressure UV disinfection process provides course bubble-diffused aeration of the effluent before it is discharged into the Chagrin River. Effluent quality from the new system was projected to include $CBOD_5$ of less than 3 mg/L; total suspended solids of 1 mg/L; levels of coliforms less than 10/100 mL; and levels of ammonia nitrogen less than 1 mg/L.

Results

The retrofit at McFarland Creek WWTP was the first and largest MBR retrofit of a conventional facility in North America. (MBR installations typically are built as new systems.) Meanwhile, successful MBR implementations seem to be occurring more and more every day.

"Certainly, receiving stream assimilation capacity limitations will drive plant expansions to high-level treatment such as MBR. As the technology becomes a 'best available demonstrated control technology' and less proprietary with numerous qualified competitors, the EPA may eventually force communities to at least consider MBR technology," Voldrich said. "Population growth will continue, while stream flows will remain constant." WWD

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