

Designed for Generations

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South Dakota facility retrofits advanced process control system

by [Cheri Cohen](#)

Nearly 25 years ago, the consulting engineering firm Banner & Associate, Inc. designed an efficient wastewater treatment facility for the city of Madison, S.D., that featured process control, flexibility and treatment efficiency while minimizing operating and maintenance costs. Key to the system was the aspirator aeration system that supplied reliable oxygenation and mixing to the oxidation ditch.

After decades of service, the aerators will be retrofitted this spring with an advanced process aerator/mixer system that will be able to provide “more for less” to the city’s next generation. The advanced [Aire-O2 Triton](#) process aerator/mixer system, manufactured by [Aeration Industries International, Inc.](#), has the unique ability to mix and aerate independently to facilitate biological nutrient removal. Fewer units are required to meet permit, which translates into increased energy savings.

The wastewater treatment facility was constructed in 1984. Wastewater entering the plant is 70% municipal and 30% commercial/industrial. The plant’s average flow is 1.07 million gal per day (mgd), and the system’s design peak day flow is 4.04 mgd.

Current average influent characteristics are 139 mg/L BOD5 and 137 mg/L TSS. Following pretreatment and primary treatment, the wastewater flows into an oxidation ditch for secondary treatment. The oval-shaped ditch is 123 ft long with a 20-ft channel width and 9-ft depth. Effluent meets or exceeds 10 mg/L BOD and is discharged by infiltration percolation.



A ditch close-up shows bridge-mounted units.

Past: Operational Flexibility and Simplicity

Important factors in the original aeration choice were loading demand fluctuations, winter treatment efficiency, effluent discharge restrictions, maintenance considerations and of course, cost. The [AIRE-O2 aspirator](#) aeration system was chosen. Eight 20-hp bridge-mounted aerators were grouped in pairs at four locations.

"The use of eight aerators allows for a 4 to 1 turn down in oxygen transfer capability while assuring complete mixing of the ditch under all load conditions," said Connie Silva, the foreman, who has been with the facility since 1989. "We like the [aeration system]. It's readily accessible and maintenance is easy."

The aerators inject air below the water’s surface, providing a high velocity of dissolved oxygen and mixing to keep solids in suspension year-round, regardless of freezing winter temperatures. The units eliminate evaporative cooling and aerosols. The aerator’s custom-designed bridges provided

good operator access for routine maintenance.

Future: Energy Savings and BNR Capabilities



An aerial shot of the Madison oxidation ditch.

for unparalleled process control.

In February 2008, the city decided to replace the aging aspirators with six 15-hp patented [Aire-O2 Triton](#) process aerator/mixers. These aerators offered the same aspirator benefits and more. With the new aerator's higher oxygen transfer performance and mixing efficiencies, fewer units were needed. A total of 90 hp replaced the previous 160 hp in service. The system will also include new programming logic and DO probes to ensure a minimum DO level is maintained in the basin and to cycle units on and off for additional operational and energy savings.

The aerator/mixers combine fine-bubble aeration and a slow-speed mixer in a single unit. The aerator/mixer features a mixing-only mode or an air/mix mode to isolate the two functions to provide

“The city currently operates the facility to remove BOD5 only and not to nitrify,” said Jim Housiaux of Banner & Associate, Inc. “However, we feel it is appropriate to design the new aerators to handle both BOD5 and nitrogen loads that the facility would see in 20 years in the event of process or permit change.”



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