A Good Egg

A NEW DIGESTER, MORE BIOGAS AND A BETTER BIOSOLIDS PROCESS MEAN GREATER EFFICIENCY AND SIGNIFICANT SAVINGS IN GRANDVILLE, MICH.

By Doug Day

A panoramic view of the Grandville Clean Water Treatment Plant. (Photography by T.J. Hamilton)
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A panoramic view of the Grandville Clean Water Treatment Plant.

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THE MICHIGAN MUNICIPAL LEAGUE CITES “INNOVATIVE wastewater treatment technology” for its 2012 Community Excellence Award presented to the Grandville Clean Water Treatment Plant. Planning for the $23 million expansion and upgrade project began in 2006 after several years of the plant exceeding its former capacity of 4.4 mgd.

“The plant was hydraulically overloaded,” says Todd Wibright, plant superintendent. “We were running consistently at over 100 percent capacity.” An egg-shaped anaerobic digester was the most novel addition to the plant and is the first of its kind in Michigan. The other major addition was a biogas-fueled combined heat and power system.

Designed by Moore & Bruggink Consulting Engineers of Grand Rapids, the project included $4.5 million in renovations, along with $17.5 million for a plant expansion to increase capacity to 10 mgd. Moore and Bruggink also won the Eminent Conceptor Award for the project, the highest engineering honor presented by the American Council of Engineering Companies of Michigan. Construction started in fall 2010, and the new plant was online about six months ahead of schedule in fall 2012. Along with the egg-shaped digester and biogas system, the project included:

• New digester building
• Two mechanically cleaned screens and buildings
• Four raw sewage pumps
• Grit chamber and building
• Four primary settling tanks
• Five aeration tanks
• Two final clarifiers
• A second UV disinfection system
• Three blowers
• Five return sludge pumps

A new 7,500-square-foot building houses a state-of-the-art laboratory. Offices for the 13 staff members who used to be spread across the property have been moved to the new building, along with locker rooms, a break room and laundry. The building also has a training room that is available for public use.

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TODD WIBRIGHT

Scott Kunst, residuals manager, checks pipes in the gallery of the egg-shaped anaerobic digester (CB&I). The digester holds a million gallons and processes about 60,000 gallons daily.

profile Grandville (Mich.) Clean Water Treatment Plant

POPULATION SERVED: 70,000
FLOWS: 10 mgd (design), 6 mgd (average)
TREATMENT PROCESS: Activated sludge
BIOSOLIDS PROCESS: Anaerobic digestion
BIOSOLIDS VOLUME: 1,000 dry tons/year
BIOSOLIDS USE: Land application
WEBSITE: www.cityofgrandville.com
GPS COORDINATES Latitude 42°54′29″ N; Longitude 85°46′47″ W
The Grandville plant serves about 70,000 residents in the cities of Grandville and Hudsonville and the townships of Georgetown and Jamestown. Average flow to the activated sludge process is 6 mgd.

CB&I built the plant’s 1-million-gallon egg-shaped anaerobic digester to replace a conventional anaerobic digester. Its egg-like shape makes it easier to operate, according to Wibright: “We pump raw and waste activated sludge to the digester and then to the thickening process where we dewater it.”

The egg-shaped design allows better circulation of the biosolids, enabling improved treatment and reducing less maintenance. It also gives the plant the capability to make use of biogas.

“We were looking at various options for what to do with our biosolids and the plant footprint,” says Wibright. “We also compared digester configurations. The egg-shaped digester has a slightly higher capital cost, but the costs over the 20-year life cycle are less than with a conventional digester. There is no need to take it down and clean it. There is space at the top and bottom that allows for complete mixing, so deposits don’t settle out.”

The digester went online in spring 2012, and Wibright says it has run automatically ever since. The digester is filled to within about 10 feet of the top most of the time. “We can set the pumping and recirculation parameters to break down any foam or floating solids,” he says. “You can set it and forget it.”

Made of 1.25-inch thick steel, the 75-foot-high tank ranges from 12 to 63 feet in diameter and fit within the plant’s limited footprint. The digester was assembled in place by welding together steel plates manufactured offsite. Wibright was a bit concerned about the height because the original design was 95 feet high. “They were able to bring that down by bowing out the middle a little,” he says. The height is also reduced by having 25 feet of it below ground level, inside a concrete retaining vessel. The digester is insulated with a foam exterior, although some models use aluminum cladding.

The digester is kept in mesophilic phase at 98 degrees, providing volatile solids reduction of more than 60 percent with a 20-day retention time. The biosolids are then pumped to a day-storage tank before going to the thickening process.

“We infrequently have to use our boiler, which can also be fueled by either biogas or natural gas. We’re also using that water in a loop system for in-floor heating that provides all the heat for the new lab and operations building.”

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DIGESTER CUTS MAINTENANCE

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**SHAPE MATTERS**

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With the new digester, the plant will produce a lower volume of biosolids (about 1,000 dry tons per year), and the new solids handling equipment achieves significantly more dewatering — from what used to be a 2 percent solids product to 6 percent. The equipment includes a sieve drum concentrator (Charter Machine Co.) and a rotary press (Fournier Industries). “The biosolids are stored as a liquid in a 2.5-million-gallon tank and trucked to agricultural sites for land application,” says Wibright.

Biosolids from the Grandville Clean Water Treatment Plant are used as a beneficial soil supplement for about 30 farms with 20 miles of the newly expanded facility. While those farmers are saving money on fertilizer, they don’t pay for the plant’s product.

“At this point, we are giving it away,” says Todd Wibright, plant superintendent. “There doesn’t seem to be a method that works to get farmers to pay for the product.”

The main reason is that the Michigan Department of Environmental Quality encourages land application; there are so many other sources of biosolids in the area that farmers have no reason to pay for it. The plant upgrade and expansion in Grandville reduces the volume of biosolids and will help save money. Land application is contracted to Synagro at a cost of about 3 cents per gallon.

“It’s a less expensive option than going to a landfill,” says Wibright. He estimates the tipping fee would be $20 per ton.

At present, the biosolids are Class B, but the egg-shaped digester allows treatment to Class A with the addition of just one tank for preheating the material before it enters the digester, along with the addition of some heat exchangers. Wibright says there are no plans to do that now because there is no demand for a Class A product.
“We can set the pumping and recirculation parameters to break down any foam or floating solids. You can set it and forget it.”

TODD WIBRIGHT

BIOGAS SAVES MONEY

The facility includes an energy management system (HESCO Sustainable Energy) that consists of:

• An engine-generator set.
• Biogas fuel conditioning and cleaning system and fuel piping.
• Engine coolant heat recovery.
• A dual-fuel boiler.
• A hot-water distribution system.
• A control system that directs hot water to points in the process where it is needed and supplements biogas with natural gas when necessary.

As part of the renovation, an old unheated digester with a floating cover was converted to a 25,000-cubic-foot DuoSphere biogas storage tank (WesTech Engineering) to ensure a steady supply of fuel during times of low biogas production.

With more than 100,000 cubic feet of gas per day from the digester, the plant can generate about 280 kW. On natural gas, it can generate 360 kW; it can operate on blended fuels if need be and can switch between fuels automatically — which it tends to do about once a day, according to Wibright. The electricity powers a Turblex blower for the aeration system along with the mixing pumps and other pumps in the digester building.

The heat recovery system “produces water hot enough to circulate through the digester to keep it self-sustaining,” Wibright says. “We infrequently have to use our boiler, which can also be fueled by either biogas or natural gas. We’re also using that water in a loop system for in-floor heating that provides all the heat for the new lab and operations building.” Because of the heat recovery, the new building has just a small furnace for supplemental heat instead of a boiler.

The energy system will result in savings of $142,000 a year in electricity and natural gas at current rates. The cogeneration portion of the project is expected to have a payback of less than eight years, says Wibright: “We’re using less electricity now at 10 mgd than we did at 4.4 mgd.”

That’s just one example of what the Michigan Municipal League meant by “innovative wastewater treatment technology.”

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Awards on display in the lobby at the Grandville Clean Water Treatment Plant.