



After being treated in the digester for 20 to 30 days, solids are now called sludge and spread out in drying beds under roof before being trucked to the landfill.

Photo by Susie Audibert



At a rate of about 700,000 gallons per day, treated effluent returns to the river from which it came. Note the spillway in the background where the intake for the town's water supply is located upstream.

Photo by Phil Audibert

on nutrients and metals in the effluent will go down, and a new plant is the only way we'll be able to meet those limits. Copper, in particular is a baffling problem; it reads above the allowable limits right now. "We don't know why or where it comes from," says Hendrix.

Michelle Steinberger riffles through the plans and explains that the Virginia Water Quality Improvement Fund will pay 90 percent of the cost of anything that deals with biological nutrient removal...about \$7 million. That's the main thrust behind the Chesapeake Bay Act, to rid our streams and rivers of nutrients. Never mind that most of these nutrients come from farms and suburban lawns; it just easier to come down hard on a town with a pipe that belches 700,000 gallons of effluent per day into a scenic river. That's what's called, in the water quality industry, a "point source."

Back to our story. The state will loan up to \$11 million more interest-free to build a plant that can treat two million gallons a day. The problem is, because of inflow and infiltration (remember that?), the existing plant is already treating two million gallons on rainy days, sometimes more. For \$4 million more at 4 percent, we can have a plant with a three-million gallon capacity. With the pressures of residential development still evident, despite the housing slump, one can only wonder how long that will last.

Michelle Steinberger is committed to her job. In the war on pollution, she's the one down in the trenches leading the troops. "A lot of people have misconceived ideas about the people who run wastewater plants," she says. "Actually, if you truly care about the environment and you want to make a change in the environment, this is the place to be. If you want to improve things and make things better for future generations, it's where the action is." Amen to that.

Now, who wants to go out and empty that trash can?

Outta sight, outta mind



The Orange Wastewater Treatment facility off of Spicer's Mill Road. In the foreground is one of two trickling filters, spraying effluent over a honeycomb populated by aerobic micro-organisms. The brick structure to the rear is the digester.

Photo by Phil Audibert

The story of waste, part I

It's lunchtime and you're devouring a burger, fries and a soft drink at one of Orange's several fast food restaurants.

You rise from the table and scrape the paper place mat, two paper napkins, the drink cup with straw, the cardboard french fries container and a couple of squeezed flat catsup pockets into the trash. Outta sight, outta mind.

You go to the restroom and do what we normally do in restrooms. You flush the toilet and wash your hands at the lavatory. Several gallons of water sluice your personal detritus down the drain. You dry your hands on a paper towel and toss it in the bin. All of it outta sight, outta mind.

But not quite, because, like it or not, you're still ultimately responsible for what you throw away.

It's just that the starting point of this whole

exercise, when you unwrapped that juicy burger and started to eat was oh so much more attractive than the ending point, when you jettisoned it.

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So, let's follow this stuff from the receiving end to its final resting place, because as mentioned before, we, the citizens of the most wasteful nation on the planet, are still ultimately responsible for not just what we consume but what we throw away. In this two part series on waste, we'll start with the water.

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Down the drain to the river

"They always care about the water, the river and what's going to town, but they never consider what happens when they flush." Orange Wastewater Treatment Plant Operator Michelle Steinberger sums it up in just a few words.

It's true...once you depress that lever on the toilet, or run a load of laundry or take a shower, or start the dishwasher, all that used water just magically disappears. Outta sight, outta mind.

Well not quite. It actually goes on a complex journey involving micro-organisms both aerobic and anaerobic to a treatment plant, either the one in your back yard (if you have a septic system) or the one on Spicer's Mill Road (if you live in the Town of Orange) or the Rapidan Service Authority facilities (if you live in Gordonsville or Lake of the Woods). Let's follow the Town of Orange's system.

The first problem is it leaks, whereas your backyard system probably does not. As much as 17 miles of sewer pipes run under the streets of Orange. Some of these pipes are old...half a century or more. The oldest ones are made of clay and have loose joints or are just plain broken. Tree roots have wormed their way into the system.

Water takes the path of least resistance. So after a good rain, it will flow into these pipes not out. This problem is called inflow and infiltration, "I and I" for short, and little can be done about it, short of ripping up all the streets in Orange and replacing the sewer lines.

Eventually this waste water arrives via an interceptor pipe to the Orange Wastewater Treatment plant where, through a sluice gate, it is measured for volume...usually about 700,000 gallons a day, but after a good rain, as much as 2 million or more.

At this point in the system the water is foul, dank and dark. It passes through an ingenious revolving screen system that picks out solid things and dumps them into a large trash barrel. Michelle Steinberger ticks off a list. "We've had huge toads, snakes, crayfish... live ones six inches long." What this tells them is that there is an opening in a sewer line near a stream that is letting these live critters in, but just

where, nobody knows.

When the trash barrel fills as it does several times a day, a treatment plant worker must wheel this heavy wet stinking load up a ramp by hand and empty it into a dumpster. On occasion, they have found money, as much as \$20, in this fetid bin. Donning latex gloves they gingerly extract the bills, wash them, sanitize them, dry them out, and spend them on something nice. Finders keepers.

Next in line the waste water is aerated to re-oxygenate it and to separate out grit which plays havoc with the pumps. The waste water then spends two to three hours in a 12-14 foot deep tank. Track-driven squeegees slowly rake solids that have precipitated out to a hopper. From there the solids are pumped to the digester. More on that later.



Wastewater flows from the tanks (left) where primary sludge is collected to the trickling filters (right) before eventually being piped to the river.

Photo by Phil Audibert

At this point the waste water has significantly improved in both color and odor. It is now gray water and is pumped to the top of two squat silos called trickling filters. Here the water is sprayed over a honeycomb mesh that runs the depth of each tower. On this honeycomb grow microbes that feed on nutrients in the waste water. Thanks to these little beasties, what precipitates out the bottom of the filter is considerably cleaner.

But like all living things, these critters grow, reproduce and die, and the dead ones slough off to cause what Michelle Steinberger calls "a whole other sedimentation problem." That too is sent to the digester. The resulting, almost clear, effluent is treated with chlorine to kill pathogens, then sulphur dioxide to rid it of chlorine and is piped to the river about a quarter-mile away.

At this point the wastewater is almost clear, but I wouldn't drink it if I were you. According to Orange Town Manager Cole Hendrix it is scientifically possible to clean effluent to the point that you could drink it, but it is prohibitively expensive.

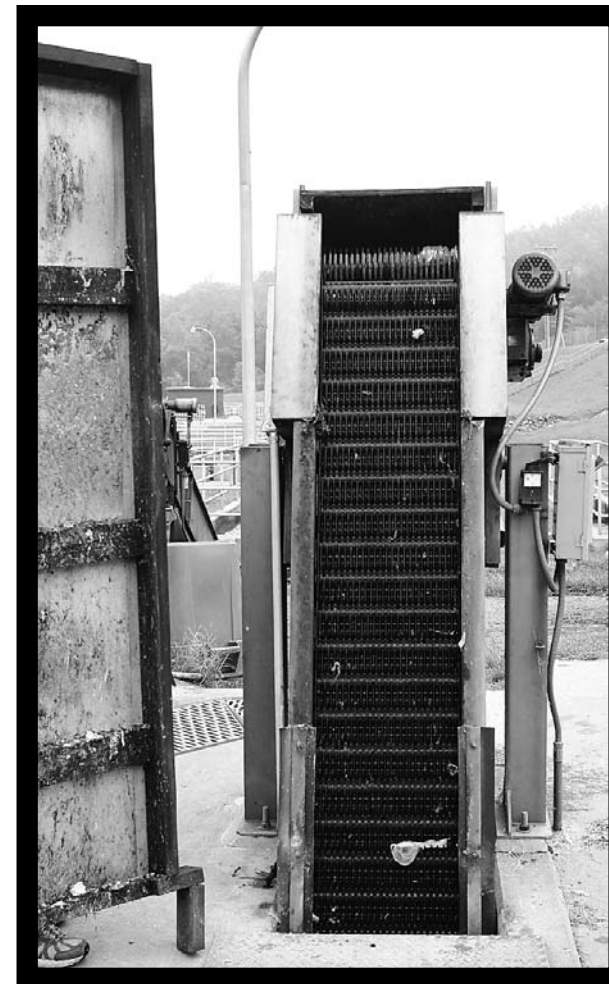
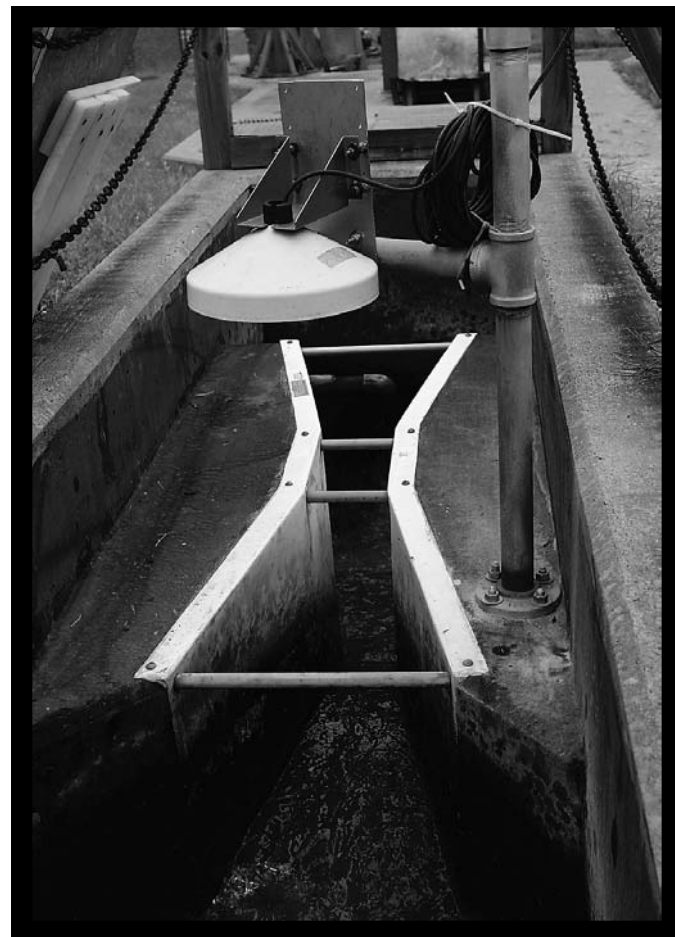
The effluent joins the Rapidan River about 100 yards downstream of the water treatment plant intake. It is the same color as the river itself, clear and green-tinted, with an occasional scum bubble floating by. On this particular day, during a dry spell in August, it is coming out at a rate of 759 gallons per minute. If you compare that flow to the river as a whole during a two week period in August, we're talking between one and three percent of the total volume of the river, which is more than the proverbial drop in the bucket.

The next group of human beings downstream who rely on the Rapidan for their drinking water are the folks at Lake of the Woods, where the Rapidan Service Authority operates both water and waste treatment plants. Next in line is the City of Fredericksburg.

Back to the digester. These are the, uh, solids. They spend between 20 and 30 days in a huge sealed and heated vat as anaerobic organisms convert them into sludge, giving off methane gas in the process. The gas is burned off, polymers are added to wring out excess moisture and the sludge is pumped to drying beds. The remaining liquids seep through a sand filter and rejoin the water treatment

It all starts here as raw sewage from the town of Orange arrives and is measured as it goes through this sluice gate at the wastewater treatment plant.

Photo by Susie Audibert



An ingenious revolving escalator picks out objects from the raw sewage and dumps it into a waiting trash can. Wastewater treatment plant employees have found everything from live aquatic animals to money in this screen.

Photo by Susie Audibert

process.

Once the sludge develops cracks like a desert floor it is dry enough to collect. It is forked, by hand, to the middle of the bed, scooped up with a front-end loader, emptied into a town dump truck and sent to the landfill for disposal. "When it dries, it smells like dirt," says Michelle, adding that even marijuana plants and cherry tomatoes have voluntarily sprouted from this rich black soil.

It is also interesting to note that the same process happens in our rural septic systems;

it's just that it takes three to five years instead of 20 to 30 days. Our septic tanks are our digesters and our drain fields are our trickling filters. By the time our effluent reaches ground water, it is theoretically safe to drink. It better be, because our neighbor's well, or even our own well, is going to bring it back up into the house to start the whole cycle all over again.

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Michelle Steinberger, who has a degree in biology, walks into the lab and spouts off a bewildering run of acronyms. "There's a host of tests," she summarizes; tests that must be conducted daily. The wastewater treatment plant operates 24-7, unlike the more glamorous water treatment plant which can be shut down at night.

Michelle and seven employees keep it running on a budget of \$700,000 a year. She points to deficiencies in the system, saying it is held together with "chewing gum and duct tape because we don't want to spend a lot of money on fixing a plant that we'll hopefully replace some day." The existing plant was built in 1990. The day it opened it was already obsolete.

She hauls out plans for a new treatment plant that will operate on a different system called "activated sludge." Gone are the trickling filters replaced by a four-stage system with disk filters and ultra violet light instead of chlorine. This is going to be a hard sell, but the town is between a

rock and a hard place, the rock being what the new Chesapeake Bay Act mandates and the hard place being what the taxpayers of Orange will tolerate.

Town Manager Cole Hendrix says the town will entertain bids on this \$22 million project in January. "We don't have any choice," he shrugs. In three or four years, the allowable limits



After further purification by trickling filters, effluent meanders through the tanks in the foreground, before being aerated again. In the final tank it is dosed with chlorine and then sulphur dioxide (to remove the chlorine) before heading to the river beyond the small brick building in the background.

Photo by Susie Audibert