

ENVIRONMENT

Washington, D.C. Water Utility Adapts to Global Warming

Despite partisan bickering in the federal government, the local utility is busy preparing to protect lawmakers from future sea level rise

By Elizabeth Harball, ClimateWire on January 13, 2014

Upstream at the U.S. Capitol, lawmakers may dither over the right national strategies to cope with climate change and some Republicans would prefer not to believe in it at all. But downstream, the largest facility of its kind in the world is busy preparing to protect the lawmakers and the capital from a foul-smelling catastrophe that could arise if the threat of sea-level rise is ignored.

Two major, multimillion-dollar construction projects underway at the District of Columbia Water and Sewer Authority's Blue Plains facility will demonstrate to other utilities that the time to prepare is now and, despite the expense, the alternative of doing nothing in the face of global warming could flood a city and its water source with raw sewage.

The projects, a sea wall designed to protect the plant from an unprecedented 500-year storm surge and an on-site combined heat and power plant set for completion this summer, are among a handful of measures the utility is taking to cut carbon and prepare for extreme weather events.

Experts in the field say D.C. Water is an innovator among U.S. water utilities, especially with its work toward emissions reduction and energy independence.

"There's maybe about a dozen wastewater utilities who are taking up the future, so to speak, and positioning themselves to be a different type of utility -- not so much a reactive, but a proactive utility," said Lauren Fillmore, senior program director at the nonprofit Water Environment Research Foundation.

D.C. Water, Fillmore said, is "probably the leader of that group."

A sea wall for a post-Sandy world

Most of Washington's sewage collects at a 150-acre facility called the Blue Plains Advanced Wastewater Treatment Plant. According to D.C. Water employees, the sea wall that is beginning to rise around its perimeter is more a matter of necessity than innovation.

Blue Plains, which serves more than 2 million people in Washington, Maryland and Virginia, is "by far our most valuable asset, and is one that we had already been looking at from a protection and adaptation standpoint," said Maureen McGowan Holman, D.C. Water's sustainability program manager.

The plant's buildings and operations are squeezed between the Potomac River and the Anacostia Freeway, at the lowest point in the District of Columbia. It was designed as such in the 1930s to minimize uphill pumping. "Gravity continues to be our friend for a lot of different processes," Holman said.

But gravity would change from friend to enemy if a storm surge pushed waters up the Potomac and into Blue Plains. Simulations show a Category 5 hurricane would swamp virtually all the plant's tanks, reactors and other expensive equipment needed in the water treatment process.

The sea wall has been in the works for several years but seeing how 2012's Superstorm Sandy incapacitated sewage plants throughout New York and New Jersey "really got us moving," Holman said.

In 2013, D.C. Water's board approved construction of a 17.2-foot-high sea wall around the facility, designed to protect Blue Plains from a 500-year flooding event -- "which is

fairly conservative, although you look at some of the climate change models and it's like you can't be conservative enough," Holman said.

Although there has not yet been a 500-year flood in the U.S. capital's recorded history, D.C. Water is already noticing shifts in weather patterns that strain its operations. An uptick in short but intense summer storms resulted in frequent localized flooding in recent years, especially in the city's low-lying Bloomingdale neighborhood, forcing the utility to ramp up its flood response strategy and increase the number of rain gauges it relies on for local data.

The sea wall will cost an estimated \$13.2 million in discretionary funds and is slated for completion in 2021. A portion of the wall is already finished, built in tandem with the utility's \$950 million enhanced nutrient removal project, which will reduce the amount of nitrogen D.C. Water releases into the Potomac to meet upcoming U.S. EPA requirements.

"A lot of what we do here, particularly at Blue Plains, is so permit-driven ... that you can sometimes forget that you can spend billions doing all these wonderful things with the Clean Rivers Project and trying to get nitrogen out of the [Chesapeake] Bay, but if the right hurricane comes along and washes over everything, that doesn't really do anybody a whole lot of good," Holman said.

Preparing a system to keep pumps running

Even if flooding doesn't occur, extreme weather events can knock out the 25 megawatts of power D.C. Water relies on to pump, filter, aerate and disinfect the 370 million gallons of effluent flowing through Blue Plains each day.

To better cope with power outages, as well as to reduce carbon emissions and cut energy costs, D.C. Water is working with Pepco Energy Services, the district's electric utility, to build its own combined heat and power plant at Blue Plains at a cost of \$450 million. This facility has the potential to meet most of the plant's critical needs in emergency situations.

Today, the estimated 1,200 tons of treated human waste coming out of Blue Plains is trucked to nearby farms in Virginia and Maryland and used as fertilizer. The new

digester project aims to put these biosolids to better use, said Chris Peot, D.C. Water's director of resource recovery.

Using thermal hydrolysis, a technology now used throughout Europe but not yet in North America, the waste will be essentially put through a giant, superheated pressure cooker, Peot explained, which sterilizes the material and makes it easier for microorganisms called methanogens, which are waiting in four digesters, to transform it into methane.

Methane drawn off from the digestion process will then be used to power three turbines, which will generate a net 10 MW of off-grid, clean electricity. Heat recovered from the turbines will be converted into steam, which in turn will be piped back for use in the thermal hydrolysis portion.

When completed, the project will be the largest of its kind in the world. It earned the D.C. Water board's approval because it will dramatically reduce its electricity bill -- in his testimony before the Senate Environment and Public Works Subcommittee on Water and Wildlife in 2011, D.C. Water General Manager George Hawkins said the project will save the utility \$10 million each year -- close to half its current annual energy costs of \$22 million.

According to Lynn Broaddus, director of the Johnson Foundation at Wingspread's Environment Program, which recently produced a report on coordination between water and electricity utilities, it's difficult for water treatment plants to get off the grid, but many are trying to move in that direction. East Bay Municipal Utility District in Oakland, Calif., became one of the first energy-positive water utilities in 2012 with its own cogeneration facility.

Energy utilities tend to view such moves "as a disruption to their business model, so they have not wanted to deal with it traditionally," Broaddus said. "But they're going to have to, because it's happening whether they want it to or not."

Easing Washington's carbon footprint

The digester project also represents a big reduction in carbon emissions. According to Peot, the utility is currently the No. 1 single-source electricity user in the district.

"That all comes from grid power right now, of course, and that's all coal, so we're very brown," Peot said. "We have a very large carbon footprint -- we have about 140,000 metric tons of CO₂ equivalent annually."

Once the digester project comes online, it will slash Blue Plains' carbon emissions by close to 50,000 metric tons each year, Peot said: "It will have a huge impact on our organization, and because we're such a big part of the carbon footprint of D.C., it will have a positive impact on the carbon footprint of D.C. as well."

But due to the energy requirements of the nearly completed enhanced nutrient removal project, the combined heat and power plant won't ultimately result in a net emissions reduction -- an environmental trade-off that many other U.S. utilities struggle with as they add processes to meet EPA discharge requirements.

"Some of the processes that we're putting in place to preserve the [Chesapeake] Bay and meet our federal water permits do have the secondary impact, unfortunately, of being more energy intensive, resulting in more air emissions," Holman said. "We're trying to reduce greenhouse gases on one side, but we've still got to reduce nitrogen here, which means we have to increase greenhouse gases on this side."

But energy and carbon neutrality is still something D.C. Water is working toward, Peot said. "On paper ... if we have some discretionary projects and if we are aggressive with them, it's possible that we could get toward energy neutrality in the next 10 years -- which would be a huge paradigm shift for our industry."

These plans, which have not yet received final board approval, involve the installation of about 50 acres of solar panels on top of Blue Plains' water treatment plant, which would add another 8 MW of clean energy to D.C. Water's power supply, Peot said.

D.C. Water is also piloting a process using recently discovered anammox bacteria -- "anammox" stands for anaerobic ammonium oxidation -- to convert nitrogen in waste into gas under anaerobic conditions, meaning the high-energy aeration now needed to remove nitrogen could be eliminated, cutting energy needs for this process by about 20 percent.

For a water utility to pioneer processes that are not yet required or even commonly used "takes a lot of vision and forward thinking," Fillmore of the Water Environment Research Foundation said.

"With all the various environmental regulations and permits, and the way the Clean Water Act was written with the potential for just about any citizen to raise an objection, it is very admirable for people to go ahead and say, 'We want to do this better,'" Fillmore said. "Dealing with as many utilities as I do, I find that's incredibly unique."

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