Naval Water Treatment Facility to Receive Improvements Benefitting Naval Academy Campus

Improvements to the Navy's groundwater treatment plant expected to reduce both electrical consumption and wastewater volume

DistributedEnergy

Challenge

Over 1 million years ago, water seeped through the ground in coastal Maryland and collected in aquifers that are hundreds to thousands of feet underground. These aquifers, which have been the primary source of drinking water in the Maryland Coastal Plain, sadly have rapidly declining water levels – so much so that it's predicted their supplies might be depleted in parts of the state by as early as 2030.

In Annapolis, right in the midst of Maryland's Coastal Plain, the Department of the Navy operates a groundwater treatment facility that supplies all the potable water to the entire Naval Academy school campus – about 1 million gallons daily. Groundwater from the Patapsco Aquifer, 600-700 feet below the surface, is pumped from ground wells over half a mile to the plant – at a very high cost. Once at the plant, the 1 million daily gallons of groundwater undergo a multi-stage treatment process. During the sand filtration treatment, approximately 30% of that water was discarded to Annapolis's sewer system as waste water, resulting in both high fees and high electrical energy usage. Another treatment process at the plant produced large quantities of leftover residual iron oxide sludge, requiring daily removal and trucking for offsite disposal at additional cost.

As the existing treatment process was not only costly, but also produced a significant volume of wastewater – in an environment where the availability of the water source is diminishing – the Navy sought a solution both to improve water conservation at the plant and decrease its operating costs.

The Solution

Constellation designed, constructed, and financed technological improvements projected to save the Navy approximately $1.6M annually. These savings are planned to be achieved in a three-fold solution: increasing water pump efficiency, stopping the flow of process wastewater to sewers, and dewatering the sludge.

One of the largest operating costs was pumping 1,000,000 gallons of water daily more than half a mile from the wells to the plant. Constellation upgraded the pumps to variable speed drives (VFDs), which gave the Navy flexibility to not only decrease pump speed and water volume, but have the ability to increase it if needed in the future. By lowering the pump speed from 60HZ to 45HZ, they could effectively reduce electricity consumption by approximately 60%.

Constellation also addressed the wastewater issue. In the past, the plant required over 1 million gallons from the wells in order to output the daily requisite of 700,000 gallons, as more than 300,000 gallons used in the sand filtering backwash were wasted and sent to Annapolis's sewer system, resulting in high sewer fees and high electricity costs. Instead, through the new water conservation measures, the backwash water previously wasted and discarded is now diverted back for filtering and then into the system for reuse. Because the plant does not have to pump excess water to account for the wastewater, it has been able to decrease the daily pumped volume by about 30%. Without the need to discard this wastewater now, the plant is no longer paying sewer fees, and is saving in electrical costs since it is pumping around 300,000 fewer gallons than before.

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Highlights

Project

- $1.6M estimated annual cost savings
- No upfront cost, financed through the savings, with a 5 year simple payback
- Owned and operated by the Department of the Navy
- Engineered, designed and constructed by Constellation

Technical

- Approximately 318,000 gallons of water expected to be saved daily during water treatment process
- Additional 50,000 gallons/month of water expected to be saved through sludge dewatering
- New Water Pumps with Variable Speed Drives
- Redundant centrifuges and gravity thickener tanks installed for sludge dewatering
- Redundant Lamella plate thickeners for wastewater treatment

One of the most complicated segments of water treatment is the processing of iron sludge. To save water and sludge disposal costs, Constellation installed additional gravity thickeners to further separate water from sludge, and centrifuges which could spin out additional water from the sludge. Instead of being discarded, this wastewater is now piped to Lamella plate settlers for further filtering, then recirculated back to the beginning of the water treatment process for use. This process saves an estimated 50,000 gallons of water monthly that otherwise would have been trucked offsite with the sludge. And, as a result of being dewatered, the volume of sludge generated decreased, thereby reducing trucking costs for its removal.

With all these upgrades to the Academy's water treatment facility, the plant's electrical demands have decreased significantly, there is no wastewater run-off resulting in high sewer fees, and, over 300,000 gallons no longer need to be pumped daily from the depleting aquifers in the Maryland Coastal Plain.

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