A CAPITAL PROJECT

Washington, D.C., infrastructure plan will treat wet-weather CSO flow

By Mike Angeli

Amid the hustle and bustle of Washington, D.C., a massive infrastructure program is underway that will result in cleaner, healthier rivers in the nation's capital. The District of Columbia Water and Sewer Authority (DC Water), under a consent decree agreement with the U.S. Environmental Protection Agency, has embarked on a multibillion-dollar long-term program to significantly reduce combined sewer overflows (CSOs) into the district's waterways. The overall long-term control plan is known as the DC Clean Rivers Project.

Similar to many older cities on the East Coast, one-third of DC Water's service area uses older combined sewer systems that carry both sanitary sewage and storm water. During heavy wet-weather events, storm water runoff can overwhelm the collection system and treatment facilities with a diluted mix of combined sewage. In D.C., this results in CSOs into the Anacostia and Potomac rivers as well as Rock Creek. During a CSO-triggering wet-weather event, it is estimated the combined sewage flow is approximately 90% storm water and 10% sanitary sewage.

Combined sewage will be captured, stored and conveyed for treatment at the Blue Plains Advanced Wastewater Treatment Plant.

The Clean Rivers Project will achieve more than a 95% reduction in CSOs system-wide through a network of diversion structures, drop shafts and massive underground sewage tunnels to capture, store and convey combined sewage for treatment at the Blue Plains Advanced Wastewater Treatment Plant (AWTP). Overall, this system will prevent billions of gallons of untreated combined sewage from overflowing into receiving waters each year.

Managing Wet-Weather Flow

Once the Clean Rivers program is in operation, diverted CSOs will arrive more than 100 ft below the Blue Plains AWTP via the Blue Plains Tunnel—a 23-ft-diameter, 4.5-mile-long CSO tunnel being excavated by a 1,300-ton tunnel-boring machine named "Lady Bird." The next challenge in the process: How can the extremely high volume of relatively diluted wet-weather flow be treated effectively?

The solution is the Tunnel Dewatering Pump Station (TDPS) and Enhanced Clarification Facility (ECF), a coupled pair of facilities able to handle the wet-weather CSO flow apart from the plant's main wastewater treatment processes. DC Water awarded the $215 million design-build contract for the TDPS/ECF project to the PC Construction and CDM Smith Joint Venture based on a proposal with the highest technical score at the lowest cost.

The Pump Station

Two deep shafts previously excavated and lined for the construction of the Blue Plains Tunnel will be converted into the new TDPS facility under the PC Construction and CDM Smith Joint Venture contract.

A 76-ft-diameter, 150-ft-deep shaft will be used as a surge/screen chamber. This shaft will contain a rock trap and coarse bar screens, and will serve to mitigate surging flow in the tunnel while protecting downstream pumps from objects larger than 2 in.

Following the coarse bar screen, combined sewage will flow through a 13-ft-diameter pump suction manifold contained within the larger second shaft. The main shaft is 132 ft in diameter and 160 ft deep, and will be converted into a six-level subsurface pump station to pump wet-weather flow more than 150 ft vertically to surface level for treatment. Initial pumping capacity will be 250 million gal per day (mgd), with the capability for expansion to 500 mgd. Five 3,000-hp electric pumps, each rated at approximately 83.5 mgd, will be installed in the current phase, with future expansion capabilities for three additional pumps.

Once the wet-weather flow arrives at the surface level of Blue Plains AWTP, it will enter the ECF. Major ECF components include fine screens, grit removal chambers, a ballasted high-rate clarification process and a disinfection system. The ECF initially will be constructed with a capacity of 250 mgd, expandable to 500 mgd within existing site constraints.

This project will allow DC Water to treat peak wet-weather flows through a rapid-rate clarification process.

The Clarification Process

A key feature of the ECF treatment process is Actiflo high-rate clarification. This process flocculates influent with microsand and polymer. The microsand causes the formation of robust flocs and acts as a ballast, significantly increasing settling velocity and decreasing sedimentation time. The microsand-ballasted flocs allow for a high-rate clarifier with short retention times, high-rise rates and a compact system footprint.

The PC Construction and CDM Smith Joint Venture will construct three Actiflo clarifiers capable of treating 83 mgd each. Concentrated sludge will be discharged from the bottom of the tank and transferred to the head of the plant. If wet-weather flow to the ECF is less than 100 mgd, the clarified water will move to secondary clarifiers at the plant. When flow exceeds 100 mgd, they will move to a chlorination/dechlorination process and discharge to the Potomac River through an 11-ft elliptical tunnel constructed in the 1930s, at the time the Blue Plains plant was originally built.

DC Water will install an integrated data collection and monitoring system across the district to provide critical, real-time observations from the collection system. The system incorporates a variety of field instruments, such as rain gauges and flowmeters, to observe and transmit data to the Blue Plains AWTP, enabling greater preparation and information on CSO flow.

This far-reaching project will provide DC Water with the ability to quickly ramp up and treat peak wet-weather flow through a rapid-rate clarification process capable of treating more than 225 mgd immediately during a wet-weather event. Additionally, the processes achieve a level of storm water treatment approaching secondary treatment. This is achieved reliably, cost-effectively and without reducing the operational efficiency of the plant's main treatment trains.

The PC Construction and CDM Smith Joint Venture began the project in November 2014, with expected completion in 2018. SWS

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