Water and sewage

O'Fallon Wastewater Treatment Plant

UNITED STATES

O'Fallon, MO

Owner
City of O'Fallon

Engineer
Woodard & Curran

General contractor
River City Construction

Dates of work
2020/08 2020/09

Main figures

Controlled Modulus Columns (CMC)™
646 EA.

Earthquake drains
1,342 EA.

Description

Operated by the city's Water and Sewer Department, the sewer system in O'Fallon, MO, includes a vast collection system and full scale, state-of-the-art regional wastewater treatment plant with a capacity of 15 million gallons per day. It is complete with three equalization basins, a Class A bio-solids dewatering and handling facility, 17 wastewater pumping stations and large capacity interceptor sewers ranging up to 48 in in diameter. The collection system consists of more than 200 miles of interceptor and collector lines with a little more than 6,000 manholes. Originally constructed in 1984, the O'Fallon Wastewater Treatment Plant was to undergo upgrades and additions in 2020. Included in the proposal was the construction of a new, 48,675 sq-ft Biological Nutrient Removal (BNR) Tank, a 407 sq-ft Splitter box, a new High Flow Discharge Pump Station, a new blower building, and upgrades to the existing clarification process. Other proposed updates would include: Ancillary site piping to tie the new systems into the overall treatment train; a new cascade aerator; improvements to the plant outfall. Menard Group USA was contracted to provide ground improvement to support the construction of the BNR Tank and a Splitter box situated on compressible and liquefiable layers. The selected techniques were Controlled Modulus Column (CMC)™ rigid inclusions and earthquake (EQ) drains.

Ground conditions

The site consists of a soft clay layer which extend to depths of up to 35 ft below the ground surface -- this layer was compressible and was prone to static settlement issues. The underlying sand layers were potentially liquefiable to depths of 42 ft. The combination of static and seismic settlement could potentially adversely impact the tank's and Splitter box's foundations. The owner required a design that would prevent damage during a seismic event, while keeping the plant fully functional as a critical facility to the community.

Solution

The baseline design called for stone columns to mitigate both static and seismic settlement. This would have required deep stone columns penetrating through the liquefiable sand to maximum depths of 50 ft. Menard proposed a solution to treat these two settlement contributors separately. The CMCs extended through the soft clay in the top 25 ft and terminated in the upper sand to handle the static loads and increase bearing pressure. The EQ drains extended through the deeper sand to mitigate liquefaction and to reduce seismically induced settlement. This combination resulted in an economical solution compared to the deep stone columns. A total of 646 CMCs were installed to an average depth of 36 ft and a maximum depth of 52 ft. EQ drains, 1,342 total, were installed to an average depth of 42 ft and maximum depth of 50 ft. Bearing pressures varied across the mats, with design pressures up to 3,350 psf. Among the site challenges was the presence of underground power lines that ran through the east edge of the working pad. This forced Menard to eliminate 14 drains and to move six others. Menard successfully installed CMCs and earthquake drains to support a BNR Tank and a Splitter box as part of an upgrade to a wastewater treatment plant in O'Fallon, MO. The creative use of these techniques allowed for the mitigation of settlement of the overlying clay layer and liquefaction of the underlying sand layer.