A new stormwater management system in Grand Rapids, Mich., is ready to hold as much as 750,000 gallons of water. Completed in September 2015, the $1.5 million underground storage unit was designed by engineering and construction company Black & Veatch, headquartered in Overland Park, Kan. Through the firm’s Grand Rapids office it provided planning, design, and construction engineering services for the city’s $400 million program that eliminates combined sewer overflow (CSO) pipelines.

Located under Mary Waters Park, the storage units will help to control flooding and reduce the amount of total suspended solids (TSS) flowing directly into the Grand River. The work, which is the largest stormwater control project in Grand Rapids’ history, is part of the city’s CSO project that began in 1988 and was completed in July 2015, three years ahead of a state-mandated deadline.

“The water quality improvements realized by this project greatly benefit the community and environment,” said Michael Lunn, environmental services manager for the City of Grand Rapids. “In this area we have affordable housing that our housing department actually had to tear down because of rot and mold due to the wetness of the area, and rebuilt the whole thing. Now there are 100 single-family homes, apartments, and duplexes which are beautiful, and the new underground system takes care of the stormwater. Before, the water would go into the Coldbrook Creek drain and during big rain events you’d see the manhole covers pop off. Now, we’ll actually store it and let it infiltrate, taking the load off the system and continue to clean the Grand River as much as possible. In some areas we also put in curbside bioswale rain gardens and people seem to like them. It spruces up a neighborhood and gives it more of a [landscape] feature than just a grass strip.”

Built more than 100 years ago, the sewer system combined both stormwater and sanitary sewage, like other community systems did at the time. The Grand Rapids sewer system has about 1,100 miles of pipe feeding 54 pump stations. Every year, an estimated 2 billion gallons of untreated surface water runoff would flow into the Grand River.

According to the city, rather than simply convey stormwater to the river, it decided to treat the flow and allow a portion of the stormwater to infiltrate into the ground. The Mary Waters Park project routes stormwater runoff from surrounding residential and commercial properties to the underground holding facility. It is nearly three times the size of a similar 270,000-gallon system installed at Grand Rapid’s Joe Taylor Park in 2010.

Prior to entering the infiltration area, TSS, large debris, and other floatable pollutants are now removed by two hydrodynamic separators plus a special row of chambers, both of which are flow-through structures that remove sediments and other pollutants. The stormwater then infiltrates through a 9-inch-deep bed of 2-inch foundation stone and into the soil below. The system will eliminate more than 11 million gallons of untreated stormwater annually from entering the Grand River based on an estimated annual average rainfall of 32 inches.

“Overall we’ve been in Grand Rapids for more than 20 years doing the combined sewer overflow separation and this was one of the final projects for the east side CSO program.” said Jim Cobb, who serves as regional team leader for Black & Veatch. “Once we completed the CSO separation we noticed there was an opportunity to include some very good green infrastructure elements, which we’ve been incorporating in the street work in the other areas of the city. There was a city park with quite a bit of property that could be utilized for a green infrastructure system that would filter the stormwater before it ended up in the Grand River.

“We started working with the parks department because they were planning to redo this park,” Cobb said. “We brainstormed and came...
up with a couple of options, one of which was a chamber system. We put both of those options into the bid document once the design was done and let the contractor select which system would work best for them and still perform in the predetermined footprint. StormTech was the system the contractor picked and ultimately installed in the 130-by 210-foot pit to give us a storage volume of 97,000 cubic feet.”

The burial depth of the underground system ranges from 11 to 15 feet and was constructed using rows of domed chambers that store the water and allow it to be slowly released. It also has a built-in filtering system called an Isolator Row.

After excavating the pit, 678 StormTech MC-4500 Chambers were installed with 12 inches of cover stone and a minimum of 24 inches of additional backfill. The chambers, a product of Advanced Drainage Systems, Inc. (ADS), were lined up in 14 rows with the last run being the Isolator Row. ADS 315WTM woven geotextile was laid over the bedding stone and underneath the chamber feet for scour protection. Additionally, ADS 601T non-woven geotextile was placed around the stone envelope. Nyloplast tees (24 inches by 24 inches) were used to accommodate 42.5-cubic-feet-per-second flow into the system.

For perimeter drainage, ADS N-12, 6-inch-diameter, dual-wall perforated corrugated high density polyethylene (HDPE) pipe was used as the underdrain, which connected to the outlet using a 6-inch INSERTATEE. Total installation time was five days.

“It’s an extremely efficient and quick installation,” Cobb said. “There isn’t a lot of heavy equipment needed except for excavation and for putting in the rock. All the rest is by hand, just picking up the pieces and locking them together.”

The StormTech MC-4500 chamber is designed in accordance with AASHTO and ASTM design standards, qualifying it for use in commercial and municipal projects. It is rated by ADS for a 75-year service life. Able to handle large stormwater volumes, the MC-4500 measures 5 feet from the bottom to the top of the corrugation and has a base of more than eight feet. The MC-4500 provides maximum storage volume per square foot of land area and can be used with a minimum of 24 inches of cover.

Constructed using the StormTech chambers, the Isolator Row enhances TSS removal and provides easy access for inspection and maintenance. Inspection ports — 6-inch Nyloplast inline drains — allow for easy access to the system from the surface. Maintenance is done by JetVac through the Isolator Row manhole, which uses a high-pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments.

“People use these systems all over,” Lunn said. “Mostly it’s to meet stormwater regulations when they’re putting in a parking lot or a big building. They’ll put these in because of the site’s runoff requirements for stormwater quantity and quality control. We’ve also used them all over but just not on this big of scale.”

The smaller system at Joe Taylor Park used 220 MC-3500 StormTech Chambers.

“This wasn’t a permit-required activity,” Cobb said. “It was an elected item that the city saw as an opportunity to do some great green infrastructure work and had the property available. It was not mandated. It was completely at the city’s own discretion to do it. Making the decision to invest in green infrastructure says a lot about the city of Grand Rapids.”

“Stormwater management runoff is now the front line of our city’s push to improve the Grand River,” said state Rep. Winnie Brinks (D-Grand Rapids) in a press release. “We can all take tremendous pride in the remarkable progress Grand Rapids has made over the past decade to clean up the river, but we can’t rest on our laurels — we still have important work to do if we want to protect and sustain the Grand River’s pristine beauty.”