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NEW STORM WATER SYSTEM MAXIMIZES VALUABLE RETAIL SPACE

Not Only Did The System Have To Handle The Site's Storm Water Runoff, It Also Had To Take Care Of The Surrounding Area

HAGERSTOWN, Md. -- When remodeling a shopping center here, engineers figured out how to design a storm water detention system that would handle the expanded site's storm water runoff as well as the surrounding areas.

The trick was that there was no more land available to accommodate the larger system. Consulting engineers J. Michael Brill & Associates (Mechanicsburg, Penn.) came up with the solution; if you can't spread out, go underground. The area's karst topography, however, also presented a challenge because the prevalence of sinkholes would limit infiltration and the depth of the underground system.

The Martin's Food Store complex that opened in November 2008 is one of the first centers in Washington County, Maryland to use a subsurface structure to control storm water runoff. The system was built using corrugated high-density polyethylene (HDPE) pipe to solve the multi-pronged problem of a small footprint, an increase in water volume and the area's challenging topography.

The property previously utilized a surface detention pond for storm water runoff. The newly invigorated center has six retail stores in addition to the Martin's Food anchor.

Construction of the sub-surface storm water detention system started onsite in February 2008 and was completed three weeks later.

The storm water detention system for a new food store complex was built using 48-inch corrugated HDPE pipe and installed under the parking lot to maximize retail space.

As construction of the center was being planned, the Maryland State Highway Administration (SHA) was also making plans to widen the road. The SHA required water runoff from this expansion of Pennsylvania Avenue to travel to the Martin's system, adding an additional burden.

"We had an existing footprint of about eight acres for the site that included the surface detention basin," explained David J. Habowski of J. Michael Brill, and responsible for the site's development. "Now, we were faced with a more highly trafficked food store and other shops which would need additional parking. This expanded area would mean a higher volume of water runoff from the larger parking lot, plus even more water runoff from the road

that SHA wanted the site to handle. The question was how to fit more parking and more retail space in the same area while taking care of an increase in storm water runoff, and dealing with the sinkhole situation. We had our work cut out."

Habowski and his team found that putting the storm water system underground would provide the solution.

"In this particular situation we didn't have a lot of room to work with because of the site conditions. It was a fairly small area for the size of this 85,000 square foot building; we didn't have a lot of ground area to construct a surface pond so we definitely had to utilize a sub-surface system.

"We always want to use best management practices to maintain water quality," he said. "Because the geotechnical report came back as karst geology -- prone to sink holes -- we weren't allowed to infiltrate. So we used large diameter pipe as storage rather than an open bottom or perforated system. We're collecting all the water runoff from onsite -- and most of the area within the state road out in front of our site -- and conveying it into our system." The components specified were primarily high-density polyethylene (HDPE) pipe because Washington County does not allow the use of metal piping underground. Metal pipe can corrode while HDPE pipe is impervious to corrosion and will provide a watertight system according to the Plastics Pipe Institute (PPI), a non-profit advocacy group for the plastic piping industry.

For the site layout, Habowski had a lot of improvements to take into consideration due to the large Pennsylvania Avenue widening project. The county was to make it into a highway with two through and two turning lanes from the original, two-lane road with a single turning lane.

"Because of this county project, the drainage from the state highway right-of-way couldn't be contained near that road, so we had to convey it into the onsite sub-surface facility," he said. "Now, all the drainage associated with the widening of Pennsylvania Avenue would be collected and brought into our system."

Before the Martin's Food project and the road expansion, water was running into storm drains under adjacent North Pointe Drive and down the opposite side of the street where there is another shopping center and into its pond, and released.

"Maryland requires that the first flush be handled to protect the land from excessive erosion caused by the increased flow of water," Habowski explained. "This is a standard called the CPv – channel protection volume – that requires runoff volume from a one-year frequency, 24-hour storm be captured and

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discharged in a controlled manner during no less than a 24-hour period, so you have to set an orifice down at the bottom of the outlet structure. For the system's subsurface outlet structure we have a 6 by 9 foot box which has a baffle and orifice at the bottom to handle the CPv. The weir plate is cut out in the baffle to handle certain storm events, and acts as a trash rack as well."

Design of the System

The HDPE pipe detention system weir plates are baffles with a 'V' at the top so that when water comes over the top it spills into the next area. "This acts as a trap," explained Mike Batie, P.E., CFM, technical and engineering manager for PPI. "It separates oils and greases that may get into the system and will be taken out later as well as organics and trash. This saves the owner a lot of cleanout and maintenance for the system and helps to meet EPA, state and city regulations."

Half of the water from the site goes directly into the underground system of 48 inch HDPE pipe sections connected by a manifold system. And the other half of the site goes through a sand filter that cleans sediment from the water then releases it into the subsurface.

According to the plans, the facility will be inspected twice a year, March and September, with a vacuum truck during a dry period to clean up sediment and debris.

The system is rated to handle 72,428 cu. ft. of water, and has a footprint of 39,000+ square feet (243 x 162 ft.). It uses 6,200 feet of 48-inch corrugated HDPE pipe from PPI member company Advanced Drainage Systems, Inc. (ADS) in the structure that enables the system's capacity to handle a 100-year storm event. The system is set up on a grid pattern with the pipe in a crosshatch design. Water runoff comes in from five manholes to the manifold and into the branches also called laterals.

"You can see from the volume requirement for water storage that the footprint for the system would have required a vast area of valuable land if the open pond was kept," explained Tony Radoszewski, executive director of PPI. "This probably would have meant that one or several of the rent-paying stores might not have been built if a typical retention pond was used.

"Putting it underground provides the owners with two benefits – maximizing the land's potential and retaining the visual appeal of the center. An underground system also helps the environment because it can trap debris. We're finding that more and more sites are choosing underground systems because of these advantages and the long life they are afforded by the durable HDPE pipe.

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"Because each HDPE pipe section is around 20 feet long, there are fewer joints. This reduces labor and easily provides a secure, watertight system. Reinforced concrete pipe (RCP) comes in smaller 8-foot sections and weighs considerably more. Plus, in order to obtain the watertight level required for the project, joints would have to be grouted, which is time and labor-expensive. With these limitations, costs can easily be 35 percent more to use and install RCP than corrugated HDPE pipe," Radoszewski explained.

The hole was excavated to a depth of 14 feet with six inches of stone used as a bed. "Because we were dealing with an area close to the size of a football field we had to use a stone shooter for the bed and later to provide the cover layer on top of the HDPE pipe," said Dirk Mowen, site supervisor for Kinsley Construction, who installed the system. "The six-inch top layer of stone acts as a filter to separate contaminants. It's then covered with geotextile and then back filled with native soil." Number 57 stone was used for the bottom, to fill in between the pipe runs and for the top.

HDPE pipe is impervious to corrosion and will provide a watertight system

"Because the manifold was prefabricated at the plant and the HDPE pipe is easy to handle, we were able to install the pipe and concrete catch basins, tie in the branches and finish to a ready-to-pave point within a few weeks," Mowen said.

A series of 24 laterals, which are made of 48-inch diameter HDPE pipe, act as the storm water detention chamber and are connected to the main manifold which is fed by the five manholes. All connections between the corrugated HDPE pipe sections and to the manifold are watertight bells with ASTM F477 gasketed fittings.

"Usually 60 inch diameter pipe is called on for these types of subsurface systems," stated Habowski. "But because of the topography we needed to go with a smaller pipe. We just put in more laterals. Again, because this system would be under the parking lot, it didn't matter how much area we used.

"In this particular case, Washington County, Maryland, does not allow the use of metal piping underground. They accept only HDPE or concrete and it is written in the ordinance. Because of the size, weight and costly joints of concrete pipe, it just wouldn't work," Habowski related.

The HDPE pipe is ADS N-12® WT that has a corrugated exterior and smooth interior, providing both strength and optimum hydraulics. Because of its moderate weight, this HDPE pipe can be easily handled by a few people with minimal equipment, providing a favorable alternative to concrete pipe. And with a long 'stick' length, the number of joints are reduced, which significantly reduces potential joint issues and also saves labor and installation time.

"We basically used a crew of six with a Caterpillar 330 track hoe excavator for the majority of the installation," related Kinsley's Mowen. "The key to this efficient installation was that the manifold with the pipe connections for the laterals was pre-made in the plant, and came to us ready to put in the pit."

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The largest pipe sections that are 20 feet long weigh 620 pounds and were lifted by the track hoe and guided into place by Mowen's crew. "It was very easy to position the pipe sections and make the connections. Basically, the laterals just slipped into the bell ends of the manifold and made a watertight seal."

Not only is the weight of pipe an issue for the on-site crew, it is also a critical consideration in the delivery of product in light of today's continually soaring price for fuel.

"Five times the amount of HDPE pipe – 320 feet – can be shipped at just about one-eighth the weight of fewer – 64 feet – RCP pipe sections," PPI's Radoszewski explained. "And that weight differential means a great deal in transportation costs.

"An eight-foot length of 48-inch RCP pipe weighs more than 9,000 pounds, while a single 20-foot length of 48 inch diameter HDPE pipe weighs just more than 600 pounds. That means that the same 20-foot run, which would have to be made from nearly three sections of RCP pipe, would weigh some 22,500 pounds.

"Our data library shows that most states allow a maximum load of 80,000 pounds when trucks have from four to seven multiple axles, and the length of the truck bed is long enough to spread out the weight. So, the largest single delivery for RCP would be restricted to just 64 feet of pipe. As a comparison, even a tandem trailer can deliver 320 feet of corrugated HDPE pipe, and be way under the highway weight restrictions. This makes for safer roads and less fuel used.

"You can see with the price of diesel fuel, small permitted loads and truck efficiency of 5-7miles a gallon, the cost to deliver the more than 6,000 feet of concrete pipe for this detention system would be astronomical."

For additional information about HDPE pipe, its applications and technical information, go to the Plastics Pipe Institute website at www.plasticpipe.org.

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About PPI

The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastic pipe industry and is dedicated to promoting plastics as the material of choice for pipe applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in development and design of plastic pipe systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.