Chambers for Compliance

Plastic systems meet advancing storm water management demands

By Bob Maestro

The U.S. Environmental Protection Agency (EPA) Phase II storm water and total maximum daily load regulations have been the catalyst for the development of new storm water management technologies and design solutions. The legal requirements, however, pose challenges to the engineers, developers and municipalities mandated to comply.

New advanced technologies and their applications focus on increasing storage capacity while removing pollutants such as sediment, phosphorous, bacteria and nitrogen. One increasingly popular regulatory solution is the plastic chamber system.

How Chambers Work

Open-bottom, arch-shaped high-density polyethylene infiltration chambers function in permeable and nonpermeable soil for the subsurface retention, detention, conveyance and reuse of storm water or gray water.

By taking advantage of the biological and physical properties of soil, the chambers provide a higher level of nutrient and pollutant removal than traditional methods of storm water management due to the production of a bio-mat of microorganisms on the underlying stone and soil surface. Similar to the function of a septic drainfield, the microorganisms break down pollutants and nutrients to nontoxic byproducts of carbon dioxide and water.

Chamber systems mimic predevelopment hydrological conditions by putting post-construction runoff back into the ground, close to its origin. In doing so, a system counters saltwater intrusion in coastal areas and maintains base flow to water bodies.

Storm Water Retention

When considering the use of plastic storm water chambers, most people think of the technology only as an infiltration best management practice (BMP) due to its open bottom. Chambers, however, can be highly effective for retention when a plastic pond liner or bentonite lines the trench walls and bottom.

Even with lining, plastic chamber systems are the most economical means for managing storm water runoff. In soil that naturally retains runoff (e.g., soil with high clay content), plastic chambers provide a notable level of water quality enhancement.

A bio-mat still develops, and it is more effective than one that forms on soil that percolates. Higher clay content provides more organic material, which supports higher concentrations of microorganisms. The clay soil has a higher moisture-holding capacity, which also supports a higher concentration of microorganisms and over more extended dry periods.

Storm Water Detention

Storm water detention is becoming a routine component of land development projects to prevent runoff and silt from negatively impacting water quality and the environment. Traditionally, detention was accomplished using large-diameter pipe or a storm water detention vault, which work well to manage storm water quality but do not provide any level of treatment.

Like large-diameter pipe and concrete vaults, few plastic chambers can provide large amounts of storage within a small footprint. In these types of situations, plastic chambers are installed in two or three layers.

Chamber systems offer detention application benefits. They, for example:

- Replicate the hydrology that existed prior to construction;
- Counter drought conditions by maintaining groundwater base flow to streams and other water bodies, replenishing groundwater supplies;
- Promote goals pertaining to low-impact development, U.S. Green Building Council Leadership in Energy and Environmental Design certification and zero discharge;
- Lower installation costs;
- Provide cost-effective and efficient sediment management;
- Achieve higher pollutant removal rates through soil filtration and accelerated microbial actions; and

- Offer a lower-cost, longer-term alternative to perforated pipe.

Eco-Sensitive Application

Clarksburg, Md., a densely populated community in Montgomery County, abuts Little Bennett Regional Park. Storm water runoff from the community travels to Little Bennett and Seneca creeks, ultimately flowing to the Chesapeake Bay.

Due to the sensitive ecology of the surrounding environment, the town requires new development's post-development storm water runoff conditions to equal predevelopment conditions. Furthermore, the county mandates the use of advanced filtration and groundwater recharge.

Miller & Smith, developers of an 81-unit housing community called Woodcrest, had to comply with strict regulations on a compact site for which recharge ponds were not an option. System designers from Little & Weber were charged with finding a way to store treated runoff underground.

The design team selected StormChambers from HydroLogic Solutions to control storm water runoff and remove sediment and nutrients. The designers elected to use SedimenTrap, also from HydroLogic Solutions, to catch sediment that runs into the chambers and CONTECH's StormFilter to remove oil and grease, dissolved heavy metals, herbicides and pesticides.

Chambers were installed in 11 locations throughout the development. Workers lined trenches with aggregate and topped the aggregate with geotextile netting prior to placing the chambers in the trenches. The netting allows water to infiltrate while preventing it from eroding the underlying stone and soil. Trenches were backfilled to 6 in. above the chambers with stone topped with filter fabric, and they were then backfilled

with soil. A 10-in. riser pipe centered above the SedimenTrap allows for easy removal of sediment with a vacuum truck.

Roof drain and street runoff are captured and treated in 75 chamber units. Street runoff containing oil and other pollutants from cars flows first into storm drains and then to the StormFilter for filtration. The water then moves to the chambers and slowly infiltrates through their open bottoms to replenish the natural water supply.

A Bright Future

There is significant documentation demonstrating the role of naturally occurring soil microorganisms in pollution abatement. The EPA fact sheet "A Citizen's Guide to Natural Attenuation" explains how this process works. Another good article, "Intrinsic Bioremediation of Petroleum Hydrocarbons," discusses natural microorganism elimination of soil contaminated with hydrocarbons at a U.S. Navy facility. Both documents are available for download at www.stormchambers.com.

Studies have shown that infiltration-type devices provide the highest level of storm water quality enhancement. Engineering advances driven by stricter environmental regulations will lead the industry to forward-looking BMPs that sustain development and the environment. SWS

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