PREGAME POLLUTION CONTROL

Biofiltration captures storm water runoff at South Carolina tailgate facility

By John R. Thomas

In recent years, problems with water quality and aquifer recharge have reached alarming levels. In Western and Southeastern states, freshwater aquifers are drying up from over-pumping due to record droughts and ever-increasing demand for water. At the local water treatment level, there is such heavy pollutant loading of storm water runoff that conventional water treatment cannot reduce these to safe levels for human health.

In the west, five states, including California, are predicted to run out of water in the next 10 years. In the east, Pensacola, Fla., recently was named the most polluted municipal water supply in the country, after the U.S. Environmental Protection Agency tested for 100 pollutants and found 48 present and 37 at levels above what it recommends for safe drinking water. As the population and water demands grow, finding cost-effective solutions is a must if we are to avoid drastic measures in the near future. We must begin to recognize rainfall as a valuable natural resource and not a waste product.

A Practical Solution

When coupled with biofiltration storm water design, low impact development (LID) can be an effective means for reducing pollutant loading in rivers and streams and for helping to recharge freshwater aquifers.

Often promoted as a water quantity control vehicle, the primary focus of LID and biofiltration is water quality enhancement. The biocells that are an integral part of the system design remove pollutants from runoff, break the pollutants down through microbiological activity and produce harmless substances that can be used as food for plant materials in the basins.

While there can be more savings through new construction, LID retrofitting of existing infrastructure in urban areas and municipalities also can create savings for government entities when compared with the cost of conventional renovation and maintenance.

Tailgate Time

The University of South Carolina (USC) tailgate facility at Williams Brice Stadium in Columbia, S.C., selected Sustainable Design Consultants Inc. (SDCI) to convert the 52-acre former farmers market into a parking and tailgating venue for Gamecock football weekends. This LID design resulted in significant reduction in pollution discharge and the amount of storm water runoff actually leaving the site and was about half the cost of the proposed conventional engineering solution.

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The Project Begins

The original engineering plan proposed was a conventional drainage design that would have required a complicated grading plan on the flat site in order for it to work, because a minimum of 2% grade is needed to move water across a grassed surface. This plan also had a proposed budget of $800,000.

The selected method was a biofiltration approach that allowed sheet flow to the green spaces between the parking bays. This green space featured a tent area behind each parking spot and a storage and infiltration area to capture and infiltrate the runoff. This solution also was about half the cost of the proposed engineering solution and resulted in a simple grading plan that moved runoff from the crown of the drive to the basins—a distance of about 40 ft—at a 2% grade.

With 52 acres of asphalt, concrete and old metal buildings to deal with, the demolition alone was complicated. The university was able to sell the old buildings for the salvage material in them and develop a plan to recycle the concrete and steel off site. Because a quick recovery grass was needed, Triangle Blend Bermuda grass by Pennington Seed was specified. It was determined that a soil mix of 50% reground asphalt and 50% existing top soil would be an ideal way to recycle the asphalt and provide a more stable foundation for roads and grass parking areas.

In the design process, the SDCI team modified some details and created others to meet the requirements of this facility, because it needed the infiltration BMPs to function well, but be inconspicuous, too. The larger basins were designed with an 8-in. No. 57 stone bottom layer and a 4-in. No. 89 stone "choker" layer and then approximately 36 in. of prepared soil media and a final layer of Bermuda grass. Stone infiltration basins were designed with up to 4 ft of double-washed No. 57 stone, a 4-in. choker layer of No. 89 stone and 2 to 3 in. of sand media before they were covered with Bermuda sod. This allowed them to function well without being noticeable in the landscape.

Challenges Encountered

The time constraints and complexity of this LID project, combined with near record rainfalls and construction that started out of sequence, created some challenges for the design team.

For example, SDCI specified a high-quality mulch with growth stimulants to accelerate grass growth and protect the finished basins from sediment flow from the surrounding areas. A cellulous mulch initially was used instead. During project construction, there were several high-intensity rainstorms that washed not only silt, but most of the cellulous mulch into the basins and capped them. To fix the basins that were capped, the contractor dug out the top 6 in. of basin mix and replaced it with clean media fill and then installed a silt fence to protect the basins. The team later discovered that between the rainfall events and the irrigation for the grass, the site was getting about 17 in. of water a month on the surface; the irrigation schedule had not been adjusted to accommodate the rainfall.

In order to accommodate the tailgate areas behind each parking space and the biofiltration basins, SDCI designed the parking lot islands to be 26 ft wide to allow for a 10-ft-deep tent area behind each parking space and a 6-ft-wide shallow swale to hold water as it infiltrates into the bio-basins designed into the plan.

The final area was grassed in early August 2012, allowing about three weeks before the facility opened in the fall of 2012. The new design resulted in a 95% reduction in polluted discharge from the site and a more than 90% reduction in storm water leaving the site. The final product has given USC a facility of which staff, students and alumni can be justifiably proud. This new green jewel has been the catalyst for revitalization and transformation of a sector of the city adjacent to the stadium and near the state fairgrounds. While the final outcome and community acceptance of this project have been positive, garnering four design awards, it did not happen without the normal construction trials and design solutions necessary to handle the unique aspects of a site that was about 98% impervious surface when improvements began.

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Bio-Basin Maintenance

The bio-basins at USC Gamecock Park will only need standard mowing and normal turf grass maintenance. Because they get water and nutrients from storm water runoff, irrigation is not an issue except in periods of prolonged drought. This also reduces the need for fertilizer in the basin areas. As living biological systems, they are self-sustaining and do not need renewal or any special maintenance over time. Some biofiltration systems have been in place for 40 years and continue to function today as they were originally designed to perform. SWS

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