Multipurpose Project Power

Landscape-based filtration system battles storm water pollution, provides park irrigation

By Aaron M. Reynolds

Known internationally as the "entertainment capital of the world," the city of Los Angeles also is establishing itself as a green leader in storm water pollution reduction with efforts such as the recently completed Westside Park Rainwater Irrigation Project. A first-of-its-kind landscape best management practice, the project is an example of innovative thinking, as the city contends with an average of about 24 million gal per day (mgd) of contaminated water and debris flowing through its storm drain system and into Santa Monica Bay each dry-weather day. In wet weather and heavy rainstorms, this flow can increase to billions of gallons per day.

Ballona Creek is the largest source of the storm drain system dumping into Santa Monica Bay, contributing about 16 mgd. The Los Angeles River regional watershed begins near the 3,000-ft level in the San Gabriel Mountains and discharges into the Santa Monica and San Pedro bays 51 miles downstream. Because much of the area in between is paved rather than pervious open space, however, there is limited opportunity for rainwater to infiltrate into the soil and be absorbed into the underground water table. In addition to picking up pollutants along the city streets, rain events often can turn the flood control channels into raging torrents.

The project was funded by the Proposition O Bond program ($2.4 million) and the Santa Monica Bay Restoration Commission/State Water Resources Control Board ($2 million). Both funding sources have favored multibenefit solutions over the building of single-purpose, end-of-pipe storm water treatment facilities. The single-focus approach would not have been cost-effective due to high coastal land values and the large footprints required to treat the storm water flow that is generated on a seasonal basis. Instead, smaller multipurpose local and regional projects placed in strategic locations are being implemented to mitigate many of the pollutant concerns caused by storm water-generated runoff.

TMDL In Tow

Completed in July 2011, the Westside Park Rainwater Irrigation/Baldwin Hills to Ballona Creek Project is one recent example of how the Bureau of Sanitation, Watershed Protection Div., is addressing its total maximum daily load (TMDL) issues. The site features a landscape-based filtration system on two acres. It consists of a network of ethylene propylene diene monomer (EPDM) geomembrane and subsurface irrigation chambers in a sand profile, collecting and treating runoff from 5,000 acres of subwatershed that previously flowed into Ballona Creek and to the Santa Monica Bay.

What once was an underutilized utility corridor owned by the Los Angeles Department of Water and Power has become a model of interagency cooperation within the city. Bare earth has been transformed into a community centerpiece, complete with jogging paths, a sensory garden, and a playground and fitness area. The resulting filtration is expected to reduce bacteria at local beaches, which has been a cause of failing report card grades published by local nonprofit Heal-the-Bay. Failing grades result in beach closures; good grades lead to increased tourism, an improved marine habitat, and satisfaction of storm water and pollutant reduction goals.

"Its large drainage area and its location in an underutilized utility

The Westside Park Rainwater Irrigation Project created a community centerpiece with a landscape-based filtration system.

easement with a buried stream—confined to a box culvert running through the site—helped prioritize the project within the city's Ballona Creek TMDL Implementation Plan," said Deborah Deets, a city landscape architect at the Bureau of Sanitation, Watershed Protection Div.

Originally, an open-water wetland and biofiltration system were proposed to be features of a stakeholder-supported Proposition O Project. Another alternative considered was an underground irrigation storage cistern, with a booster pump to supply a spray irrigation system, such as that normally used by the Department of Recreation and Parks. Sprayheads pose a potential for human contact with storm water, which makes disinfection (done mainly through chlorination) mandatory. Both the operational costs and residue from this process are undesirable.

Ultimately, Deets said the city opted for an Environmental Passive Integrated Chamber (EPIC) system and 45-mil EPDM geomembrane from Firestone Specialty Products.

"Instead of requiring disinfection," Deets said, "the system has demonstrated a 97.5% average reduction in *E. coli* (96.1% total coliform) in wet weather and 97.3% (95.2% total coliform) in dry weather."

The system also demonstrated a 40% reduction in metals. As the system assists in meeting the city metals and bacterial TMDL requirements, it also uses subsurface irrigation pipes in the sand profile to provide water to the park's 38,000 sq ft of natural vegetation through root uptake.

Reusing storm water is at the heart of the Westside Park project, where offsite surface runoff is diverted from an existing storm drain to a lift station that filters water through a screen, removing floatable waste and heavy sediments.

Once the chambers reach storage capacity, the significantly cleaner surplus water is discharged toward a dry creek and back into a storm drain.

Flawless Execution

The project was a collaborative effort between many individuals and agencies. The Department of Public Works, Department of Recreation and Parks, and Department of Water and Power share ownership and responsibility for creating and maintaining a regional model of storm water treatment and irrigation technology.

Division Manager of the Watershed Protection Div. Shahram Kharaghani, Ph.D, P.E., BCEE, provided overall direction during the conceptual and funding phase. The project design and engineering was overseen by the city's Bureau of Engineering Prop O Program, as managed by Kendrick Okuda, P.E. City design teams comprised of engineers and landscape architects from both the Department of Recreation and Parks and the Department of Public Works executed the entire project. The awarded contractor, PPC Construction Inc., installed the system over 12 months.

In keeping with the project's

environmental objectives, construction crews worked around a large tree designated to remain on site. Native soil was excavated around the tree's root zone to accommodate aggregate import of the EPIC profile. Workers placed the EPDM geomembrane upright liner walls around the perimeter of and adjacent to the root zone, installing them at an elevation of 9 in. above the subgrade base elevation.

The water management system provides adequate moisture to the tree's root system by slow, 3-D capillary movement of water through the sand profile. Adhesion and cohesion properties of capillary action siphon the moisture against gravity, up and over the buried vertical EPDM wall, and into the tree's root zone. Turf area perimeters have the geomembrane upright wall to finish grade, preventing unwanted capillary influence to nonvegetative zones.

With the EPDM geomembrane in place, PPC installed the network of EPIC chambers followed by a thin layer of gravel, which covers the chamber's outside holes and provides efficient lateral water movement. Then, 12 to 14 in. of medium washed sand was installed and compacted over the chambers.

The non-pressurized, gravity-driven chamber system was divided into multiple laser-level subgrade bench elevations to accommodate the park's existing long, narrow surface slope, which has a 30-in. vertical difference from the highest turf elevation to the lowest. Irrigation water lifted from the drainage channel follows a serpentine flow pattern across each level subgrade bench from high point to low point.

There are 15 chamber sections, some containing multiple benches, each with one inlet and one drain outlet. The vertical elevation between subgrade benches varies between 1 and 2 in., creating a consistent finish grade slope with reliable and coherent irrigation distribution, drainage and a flow rate of 1 to 2 gal per minute per inlet. It also allows filtration of water before it enters the Santa Monica Bay.

"Using this system enabled us to successfully resolve many issues on a very short timeline," Deets said. "So far the turf is doing well, and if it continues to demonstrate success, we'd like to use it elsewhere. It is in ground, so now it is in the hands of the Department of Recreation and Parks maintenance staff. This definitely represents a change in their standard irrigation methods, and the project was required to supply a potable spray irrigation system as a backup, which unfortunately could lead back to more familiar methods. Recreation and Parks employs some of the smartest and most capable maintenance staff anywhere in the country. They understand the big picture, so they know the value of successfully operating this system." SWS

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