SW 12th Avenue Green Street Project

SW 12th Avenue between SW Montgomery and SW Mill
Portland, Oregon

PROJECT SUMMARY

Project Type:	Stormwater retrofit of an existing downtown street – demonstration project
Technology:	A treatment train of four consecutive street stormwater planters
Major Benefits:	• The planters capture runoff from approximately 7,500 square feet of paved surfaces. They treat and infiltrate most of the runoff they receive, providing volume and flow control and water quality benefits. • Runoff is managed onsite, instead of entering the storm drain system that feeds directly into the Willamette River. • The planters improve the existing urban streetscape by adding attractive greenspace. • The planters are designed to safely accommodate pedestrians, on-street parking, and vehicle access.
Cost:	The total project construction cost, including project management (but not design), was $38,850. Of this, construction of the stormwater planters cost $34,850, or $4.65 per square foot of impervious area managed. The remaining $4,000 was required for ancillary street and sidewalk repairs and landscaping adjacent to the planters; these costs may not be needed for other similar projects.
Constructed:	May-June 2005
Maintenance	The City of Portland will maintain the facilities.

Features

- This was Portland's first Green Street project to transform existing landscape to street stormwater planters that manage street runoff and safely maintain on-street parking.
- The design provides water quality treatment and maximizes infiltration of the runoff. Each facility can pond about 7 inches of stormwater runoff and retain it for infiltration.
- The award-winning design successfully integrates stormwater management into an urban environment.

Stormwater Street Planters at SW 12th and Montgomery
Portland, Oregon

BACKGROUND

This Green Street project converted a previously underused landscape area between the sidewalk and street curb into a series of landscaped stormwater planters designed to capture, slow, cleanse, and infiltrate street runoff. Built in the summer of 2005, the project demonstrates how both new and existing streets in downtown or highly urbanized areas can be designed to provide direct environmental benefits and be aesthetically integrated into the urban streetscape. Although the project has a strong functional component, it is the integration of the landscaped stormwater planters into the urban environment that has gained the interest of the design community, developers, policy makers, and local citizens in the City of Portland's commitment to promote natural systems to manage urban stormwater runoff.

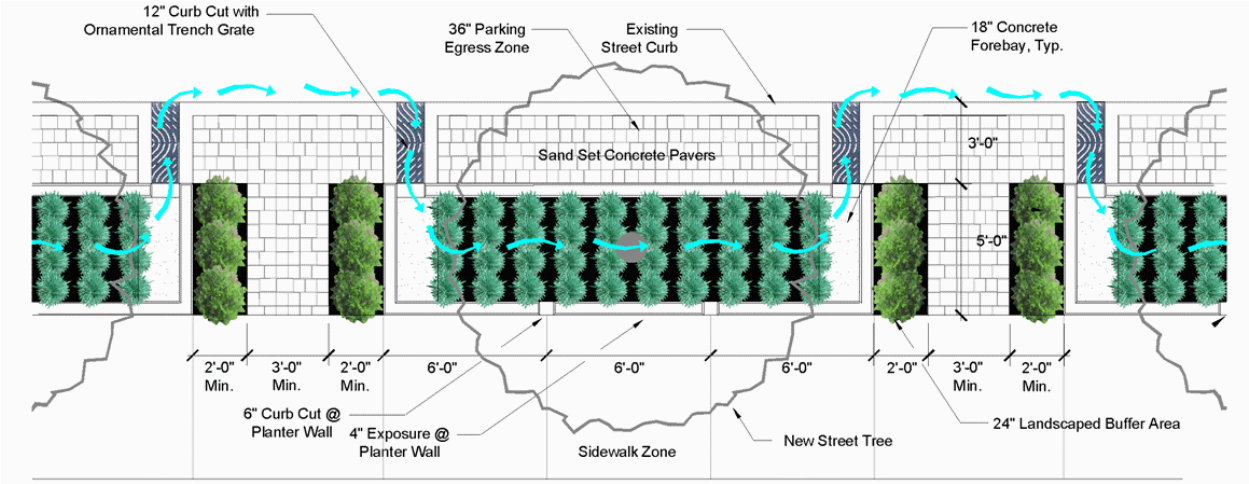
How do the Street Stormwater Planters Work?

- Stormwater runoff from the street flows downhill along the existing curb until it reaches the first of four consecutive stormwater planters.

- A 12-inch-wide trench drain channels the street runoff into the first stormwater planter. The trench drain moves the water under the vehicle step-out area and into the facility. The runoff is directed over a concrete pad, where sediment and debris are deposited for easy removal.

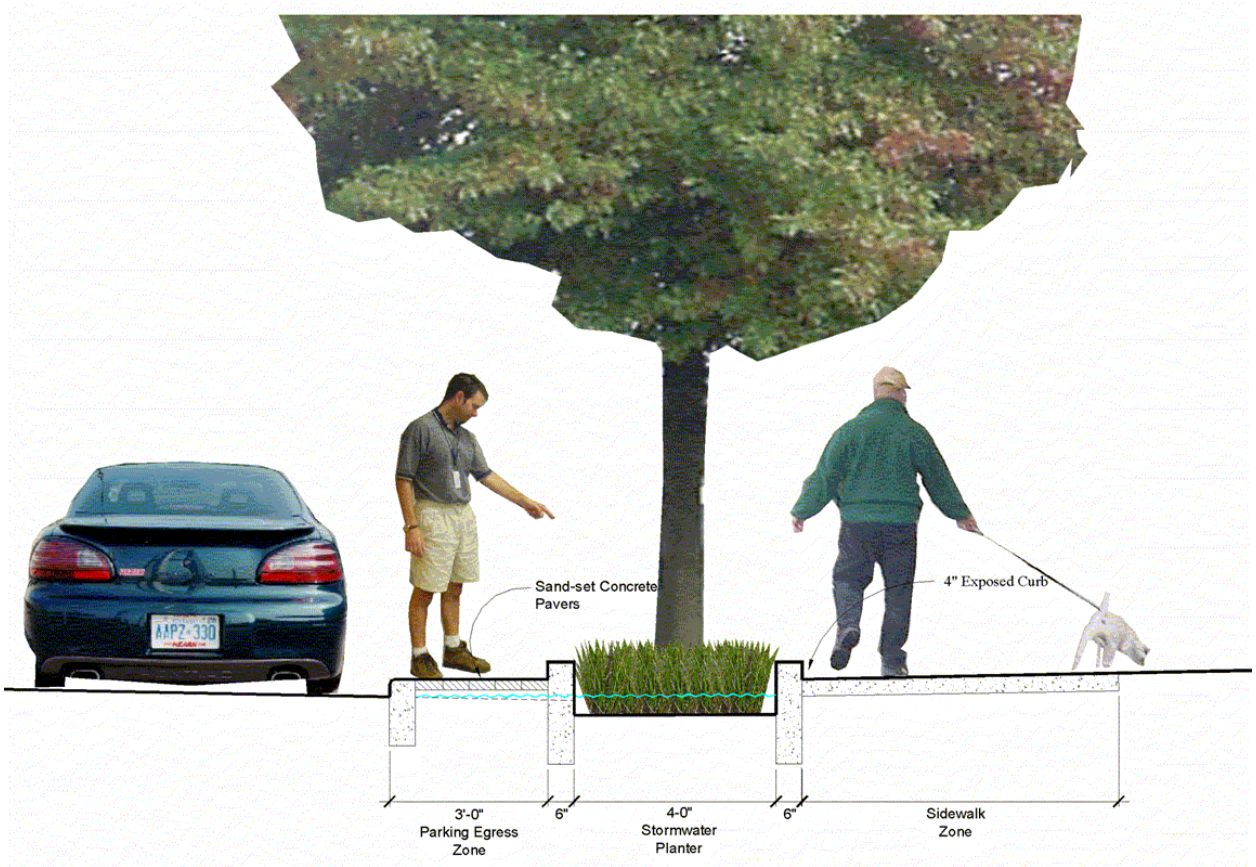
- Stormwater is allowed to pond to a depth of 7 inches before infiltrating through the soil at a rate of approximately 4 inches per hour. During large storm events, water may enter the planter at a rate faster than the soil can infiltrate, resulting in a ponding depth greater than 7 inches. In that case, the runoff exits a second curb cut, flows back into the street, and enters the second (downhill) planter. This process continues for the third and fourth planters. If the fourth planter ponds to capacity, it overflows to the existing storm system.

- The adjacent sidewalk slopes toward the planters, and sidewalk runoff enters the planters through curb cuts.



SW 12th Avenue Stormwater Planter ~ Enlarged Plan

N.T.S.



SW 12th Avenue Stormwater Planter ~ Typical Cross Section

N.T.S.

SITE SELECTION CRITERIA

- **Traffic Impacts**: The project was not expected to have any traffic impacts.
- **Stormwater Catchment Area:** The size of the catchment area, approximately 7,500 square feet, was considered fairly representative of conditions in the surrounding area.
- **Utility Conflicts:** An existing gas service line to the adjacent building was the only subsurface utility that intersected any of the stormwater planters (the third one). The existing shut-off valve was located and preserved with a plastic standpipe for easy access. The existing street lighting remained in place.
- **Loss of Parking Spaces:** The project did not affect existing on-street parking.
- **Street Slope:** The moderate street slope (2 percent) was suitable for the project.
- **Suitability for Monitoring:** The configuration of the local combined sewer allowed for placement of a flow monitor. There is also a rain gage near the project to measure rainfall events.
- **Soil Infiltration Rates:** Specialized infiltration tests were not required at the site. (See "Geotechnical Evaluation," below.)
- **Available Space:** The existing underused landscape area was 8 feet wide from face of curb to sidewalk edge. This allowed for 3 feet of flat area for parking egress and 5 feet for the stormwater planter, including 6-inch-wide perimeter curbing around the planters.

STORMWATER CAPACITY AND SYSTEM CONFIGURATION

Stormwater Management Goals

The stormwater management goal was to maximize the capture, treatment, and infiltration of street runoff, while providing a visual amenity for the neighborhood.

Geotechnical Evaluation

An infiltration test was not required before construction because adequate documentation already existed concerning the well-draining characteristics of the local soils. The Natural Resources Conservation Service soil survey for Multnomah County classifies the soils as 51C-Urban Land and well-drained Multnomah soils. The surface horizon typically is dark brown loam about 16 inches thick. Soil below this depth is gravelly sand to a depth of approximately 60 inches or more.

Inlet to Stormwater Street Planter

System Configuration

Catchment Area (street, driveway, sidewalk):
- 7,500 square feet

Planter Details (applies to each of the four facilities):
- Dimensions:
  - Length: 18 feet
  - Width: 4 feet (not including 6-inch-wide perimeter curb)
  - Depth: Approximately 13 inches from sidewalk grade to finish grade of planter
- Maximum ponding depth: Approximately 7 inches
- 6-inch-wide perimeter curb around each planter: 4 inches high
- Total landscape area: 72 square feet
- A 3-foot-wide parking egress zone made of sand-set concrete pavers provides for vehicle access.
- A 2-foot-wide landscape buffer at each end of the planters directs people safely around the facilities.

Overflow:
- Overflow from each planter exits through a second curb cut back into the street. Final overflow exits through a curb cut in the last planter and enters the existing storm inlet in the street.

Additional Information:
- A design modification placed asphalt berms (1 inch high) on the downhill side of each curb cut to help runoff make the 90-degree turn into the planter.
- No rock sub-base was used underneath the planters.
- An 18-inch-wide concrete pad at each planter's uphill curb cut dissipates flow and collects sediment and debris.

Landscaping

The facilities were excavated throughout to 24 inches below grade and backfilled in 6- to 9-inch lifts with a three-way mix of sand, topsoil, and compost. The mix was tilled into the native soil and spread to create a flat cross section. (See illustration on page 3.)

Each facility was densely planted with *Juncus patens* and a *Nyssa sylvatica* tree. Both types of vegetation appear tolerant of the wet and dry soil conditions. The stiff structure of the *J. patens* helps slow the passage of water, and the root structure helps infiltrate water into and through the soil. The evergreen characteristic of the *J. patens* also helps minimize weed growth. A row of *J. patens* was planted next to the concrete pad in each facility to hold back sediment and debris and keep it from entering the facility.

Planting internal and external to the facilities

The plants were installed at a density greater than required by the City's Stormwater Management Manual. This was done to reduce maintenance requirements (weeding, watering, etc.) and to create an aesthetically appealing landscape quickly.

The types of vegetation external and adjacent to the facilities were selected for their drought tolerance, low maintenance, evergreen foliage, and short stature; the typical mature height of the plants is approximately 24 inches. Plants included *Nandina domestica* 'Moon bay'; *Liriope muscari* 'lilac beauty'; and *Polystichum munitum* (under the existing trees).

PROJECT COSTS

Street planter construction and landscaping costs for the project totaled $38,850, including project and construction management and ancillary construction costs (but not including design).

Stormwater Street Planters under construction: Grading (far left); Formed concrete walls (center); Forming the concrete trench and sediment collection pad (far right)

- **Curb Extension Construction**
  The core construction activities cost $29,950, or approximately 77 percent of the total project cost. This included sawcutting and removing existing landscaping and hardscape, excavation, concrete curb installation, sand-set concrete unit pavers installation, curb cuts and ornamental grate installation, soil import and preparation, and final grading.
- **Landscape Construction**
  The landscape construction activities cost $4,900, or approximately 13 percent of the total project cost. This included fine grading, plant procurement, plant material, and pea gravel mulch installation.

- **Ancillary Construction Activities**
  Miscellaneous street and sidewalk repair work cost $4,000, or approximately 10 percent of the total project cost. This included re-landscaping of a small area just south of the facilities, under existing trees, for visual continuity. These ancillary construction and landscaping tasks contributed to higher project costs.

As Green Street projects become an accepted practice, it is likely that design and project management costs will decline.

MAINTENANCE AND MONITORING

Maintenance

Sediment collecting behind the juncus on the concrete pad

Maintenance of the facilities includes hand weeding (no chemicals are allowed), plant trimming, plant replacement, and debris and sediment removal.

Portland Parks and Recreation staff maintained and hand-watered the planters and adjacent landscaping during the 2-year plant establishment period. There is no permanent irrigation system.

City staff removed sediment from the planters four or five times during the first 2 years. A landslide upland of the facilities in winter 2006 and debris from adjacent fruiting trees contributed to heavier-than-average sediment loading during that time.

The maintenance frequency for these types of facilities depends on the site. City staff will monitor long-term maintenance needs. Maintenance visits will occur at least four times a year; additional visits will occur if needed because of sediment accumulation.

Monitoring

The City will monitor the facilities for hydraulic performance, maintenance requirements, metal- and petroleum-based constituents, and the success of the vegetation. Because of the difficulty of collecting stormwater samples, water quality monitoring will not occur.

SUCCESSES AND LESSONS LEARNED

- Where communities struggle with ever-increasing impervious areas and degraded water quality, these simple landscape approaches can have a measurable positive impact.

- A flow test at this site indicated that the stormwater planters are effective in reducing the peak flow of a 25-year storm event by at least 70 percent. (This value is site dependent and may not be the same at a different location.)

- The final project design resulted from several discussions among design and engineering staff from various bureaus (Transportation, Maintenance, and Environmental Services). All bureaus agreed that the design would not pose safety issues for pedestrians or for people getting in and out of vehicles.

- In the first 2 years of operation, the first two planters filled often with sediment and debris (to a depth of 1-3 inches). City staff removed the sediment by hand with a shovel and rake. The facilities appear to manage much more than the drainage area that was assumed during design. The inlet just upstream of the facility and another inlet at the base of an overpass frequently clog with leaves and other debris, resulting in significant additional flow and resultant higher levels of sediment.

- It is difficult to force curb runoff to turn 90 degrees into curb openings during heavy storm flows. The momentum of the runoff becomes more problematic as the slope of the street increases. Small asphalt berms have been installed to encourage flow to enter the facilities and appear to be working well. Other options can include angled entries, gutter depressions, or other methods to ease the transition of flow from the curb into the facility.

Asphalt berm at facility inlet to help direct stormwater flow into the stormwater planter