

2007 Department of Ecology Low Impact Development Stormwater Grant Program

King County – Military Road and 272nd Street Intersection Improvement Project

Project description

This intersection improvement project incorporated two Low Impact Development (LID) technologies to meet stormwater management requirements: a bioretention area (rain garden) and permeable concrete sidewalks at the Military Rd and 272nd Street intersection. Through this project, King County sought to demonstrate that LID can be cost-effective in spite of constraints typically encountered in capital projects for arterial roadways. The LID features of this project treat the roadway runoff in a bioretention area and infiltrate rainwater falling on the permeable cement concrete sidewalk, rather than using a conventional wet vault.

Following installation of the LID features in the fall of 2007, monitoring results showed that the bioretention facility and associated stormwater monitoring equipment were not functioning as planned. Consequently, King County worked with Washington State University experts and the Department of Ecology (Ecology) to redesign and construct a new rain garden cell within the existing bioretention area, and to significantly revise the proposed water quality sampling program. In spite of the difficulties encountered, the experience gained from this demonstration project was a valuable source of information for King County's transportation infrastructure.

Lessons learned

The original design for the project's bioretention facility attempted to combine rain garden design principles with the requirements from the King County Surface Water Design Manual (KCSWDM). Although the design met KCSWDM requirements for water quality treatment and flow control, the bioretention cell did not function as a rain garden as well as expected. Some of the anticipated sheet flow from the roadway catchment area bypassed the catch basin inlet due to rutting from existing pavement wear. Consequently, the water flow within the system was not sufficient to effectively support the new plants. In addition, the equipment chosen to monitor water quality treatment performance did not work properly due to the relatively small quantities of stormwater flows.

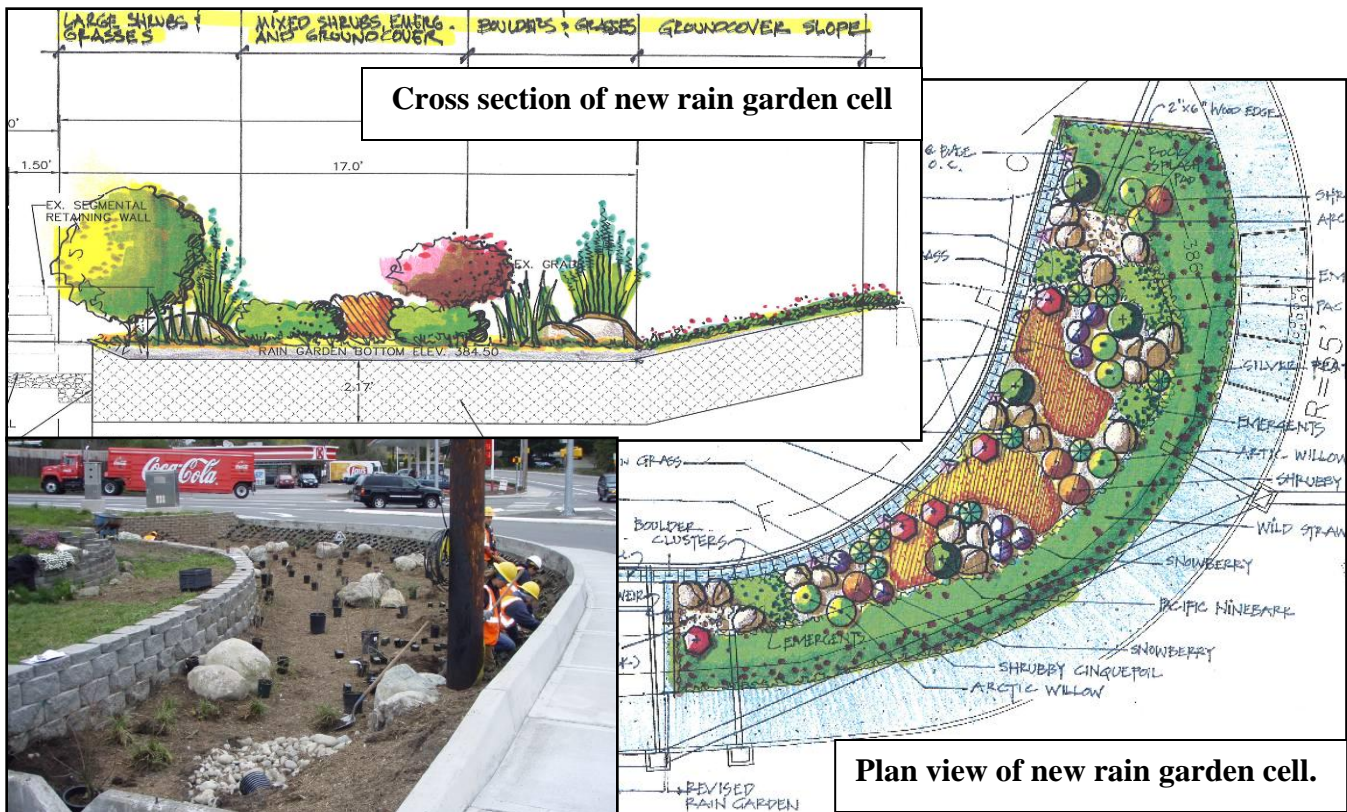
The figures that follow show the design of the new rain garden cell and photographs of the recently completed rain garden cell.



View of linear bioretention feature and permeable concrete sidewalk along Military Road South.



Demonstrating the infiltration of the permeable concrete.



New rain garden cell being planted.

King County considers the engineering and construction of the permeable sidewalk elements in 2007 generally successful. They encountered minor difficulties during installation because of the limited experience the county and the contractor had with this material. Monitoring of infiltration rates has shown substantial variability across different segments of the permeable concrete; however, a pervious concrete expert said this level of variability is typical. The pervious concrete as a whole still provides overall reduction in impervious surface area.



Pervious concrete sidewalk installation.

Projected environmental benefits

- Treat stormwater on site and reduce the quantity of pollutants being conveyed, untreated, to Star Lake.
- Reduce peak surface water flows into the downstream conveyance system from the road surfaces (originally planned for 0.34 acres and now modifications increased surface flow 0.42 acres) by an average of approximately 33% through the pervious concrete sidewalk and vegetated rain garden.
- Reduce 100 percent of suspended solids and zinc from roadway stormwater by infiltrating stormwater through the new rain garden cell in all but high flow conditions.

Cost information

The initial costs for the LID elements included \$60,000 for the permeable concrete sidewalks and \$146,000 for the rain garden. These were approximately \$44,000 less than the estimated cost for a conventional wet vault. The LID costs were part of an overall project cost of \$2,600,500. Ecology provided a grant for \$424,375. The financial contributions to the LID and overall project costs are shown in the below.

ITEM	GRANT AWARD	TOTAL PROJECT COST
LID Project Management	\$14,058	\$14,058
Develop Monitoring Approach	\$23,500	\$23,500
Material Acquisition and Construction	\$289,017	\$289,017
Education and Outreach	\$32,000	\$32,000
Implement Monitoring	\$65,800	\$65,800
Non-LID Elements (from Transportation Improvement Board)		\$640,000
Non-LID Elements		\$1,536,125
TOTAL	\$424,375	\$2,600,500



Testing infiltration of permeable concrete.

Monitoring activities

King County established a comprehensive monitoring program to evaluate a range of environmental parameters for three years. They are monitoring:

- The infiltration characteristics and maintenance requirements for the permeable concrete sidewalks.
- Water quality and quantity inflows and outflows of the bioretention facility. Analytes include total suspended solids, diesel/oil, and total dissolved copper, cadmium and zinc.
- Plant survival rates/success vs. invasive species.

King County installed automatic water quality sampling equipment to monitor water quality inflows and outflows of the bioretention facility during overflow events (in lieu of conducting periodic sampling). King County will characterize overall water quality by quantifying the proportion of stormwater inflow that leaves the system as overflow (without being infiltrated in the rain garden cell) during larger storm events. King County will also measure concentrations of hydrocarbons and metals in the soil and mulch at various depths.

Value for future projects

This project provides considerable information to future applications of similar LID techniques for transportation projects. King County staff gained direct experience in all phases of project design and construction. They could see how their initial design performed, as well as what needed to be done to reconfigure the system so it could perform successfully. Based on the funding and collaborative support from Ecology, King County was able to apply an adaptive learning approach with this LID facility that otherwise would not have been possible. King County applied these lessons learned to other road projects that involve rain gardens, which have proved to be easier and less expensive to construct.

Partners

- King County Road Services Division
- Department of Ecology
- King County Environmental Laboratory
- Transportation Improvement Board
- Tri-State Construction Co, Inc.
- Skyline Electric and MFG Company

For more information

King County created a detailed project website that includes videos (e.g., permeable concrete installation), planting lists, project updates, and links to other LID technical resources.

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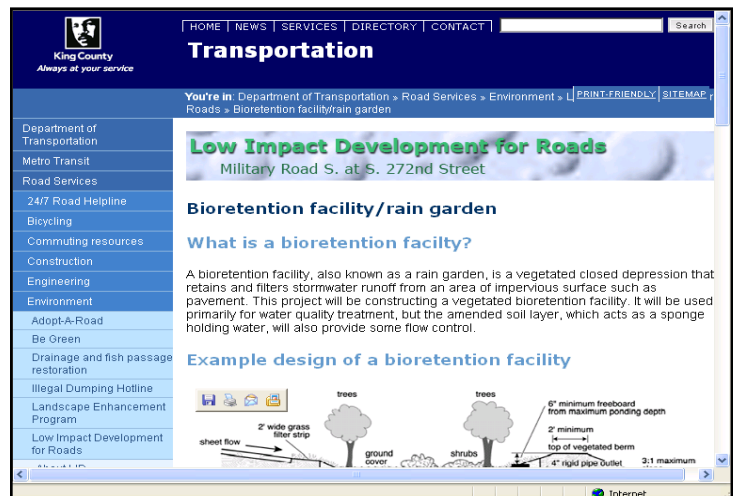
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http://www.kingcounty.gov/transportation/kcdot/Roads/Environment/LowImpactDevelopment_MilitaryRd.aspx

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