PUTTING RESEARCH TO WORK **BRIEF**

Testing a Storm Water Filtering Device for Use at Park-and-Ride Lots

The Wisconsin Department of Transportation emphasizes the control of total suspended solids in storm water runoff from highway facilities. TSS is a scientific measurement of the level of particulate matter that is suspended in a sample of storm water runoff. Particulate matter that is carried in runoff to nearby lakes and streams has the potential to cloud the waters and jeopardize aquatic life.

What's the Problem?

To identify cost-effective ways of controlling TSS, WisDOT has studied several types of emerging proprietary storm water filtration devices, or SFDs, that reduce contaminants in highway runoff. Regulations require the department to remove 20, 40 or 80 percent of TSS in runoff, depending on the situation. A previous WisDOT study field-tested an SFD for its ability to reduce TSS and contaminants in runoff from a section of Interstate 794 in downtown Milwaukee (Report No. 0092-00-03, September 2008). This device, the StormFilter, achieved a 50 percent reduction in TSS load and also reduced several other contaminants. WisDOT initiated a follow-up study to determine whether an SFD such as the StormFilter could achieve similar reductions at other types of WisDOT facilities, such as Park-and-Ride lots.

Research Objectives

WisDOT sought to evaluate the efficiency of a StormFilter at reducing TSS and contaminants in runoff from a parking lot having characteristics similar to its Park-and-Ride lots. Data from this study would help WisDOT identify and quantify the benefits of using an SFD to treat runoff at Park-and-Ride lots, and to estimate the ability of the StormFilter's cartridge filters to reduce the loads of TSS and other types of contaminants in runoff at these facilities.

Data produced in this study might also prove useful to the developers of WinSLAMM (Source Loading and Management Model for Windows), a software model developed to evaluate nonpoint source pollutant loadings and reductions in urban areas using small storm hydrology and provide cost-benefit analysis. The WinSLAMM model is used by WisDOT and many other agencies, and its developers are interested in calibrating and verifying the software for predicting the efficiencies of SFDs at removing pollutants from urban runoff.

Methodology

WisDOT partnered with researchers from the U.S. Geological Survey, Madison Gas and Electric, and the Wisconsin Department of Natural Resources for this investigation. For their study site, the researchers chose a 181-stall parking lot in downtown Madison, Wisconsin. The lot provided a vehicle turnover rate similar to that of a WisDOT Park-and-Ride lot, and researchers expected that runoff from the lot would contain concentrations of pollutants and distributions of sediment particle sizes similar to those at a Park-and-Ride lot.

A StormFilter similar to the unit used in the Milwaukee study was installed beneath the lot, and runoff was channeled to the unit through an inlet pipe. The StormFilter treated the incoming water by percolating it through a series of 26 filter cartridges filled with zeolite, perlite and granular activated carbon designed to remove contaminants.

Samples from 51 runoff events were collected at the StormFilter's inlet and discharge pipes and analyzed at the Wisconsin State Laboratory of Hygiene for levels of TSS and 32 additional pollutants. Researchers used two methods to quantify the StormFilter's efficiency at removing contaminants: efficiency ratio and summation of loads. Both ER and SOL evaluate treatment efficiency on a

Project Manager

"This study provided information on how a storm water filtration device can effectively treat runoff at an urban parking facility."

–Wendy Braun
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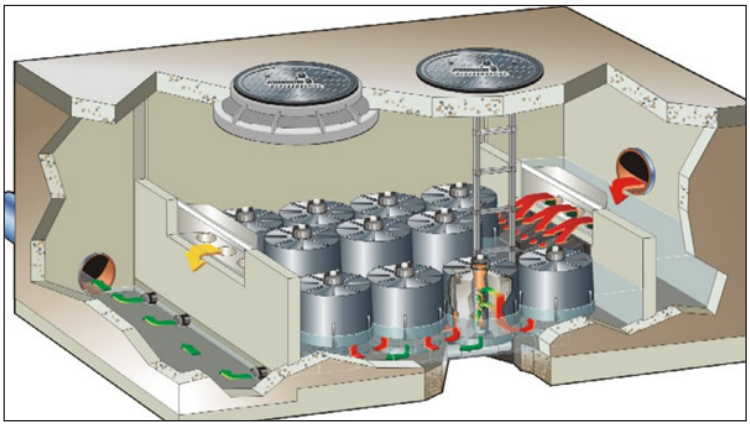

Storm water runoff from the parking lot was piped into the StormFilter (red arrows) and siphoned into a series of filter cartridges designed to remove sediment, metals, organic compounds, phosphorous and oil.

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percentage basis, but SOL also compares the sums of the incoming and outgoing pollutant loads—obtained by multiplying the concentration by the volume of precipitation—for all monitored events.

Results

The StormFilter decreased concentrations and loads of TSS (by 44 percent using the ER method, and by 32 percent using SOL), suspended sediment, volatile suspended solids, phosphorous, copper, zinc and polycyclic aromatic hydrocarbons. In the preceding Milwaukee study, the StormFilter cartridges were filled with the same media but the device achieved much greater reductions of TSS. The researchers believe this may have been caused by the different distributions of sediment particle sizes in runoff collected at the two sites. Researchers noted that other studies of storm water control practices suggest that it might be possible to reduce TSS and suspended sediment concentrations approximately 40 and 80 percent through filtration by trapping all particles greater than 63 and 4 microns, respectively.

Implementation and Benefits

Proprietary technologies such as the StormFilter that have demonstrated effectiveness in WisDOT studies can be added to the department's Facilities Development Manual as best management practices for controlling the quality of storm water runoff. With this guidance in the FDM and the data available in the study reports, WisDOT designers will be equipped with valuable tools for determining whether to include proprietary devices at Park-and-Ride lots, on highways and at other facilities, and how to design, size and locate the devices.

This brief summarizes Project 0092-05-17, "Use of a Stormwater Filtration Device for Reducing Contaminants in Runoff from a Parking Lot in Madison, Wisconsin, 2005-07," produced by the Wisconsin Department of Transportation Research Program, 4802 Sheboygan Ave., Madison, WI 53707.

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