



PUTTING RESEARCH TO WORK

# BRIEF

## Putting Storm Water Treatment Devices to the Test

The Wisconsin Department of Transportation is required to improve the quality of storm water runoff from roadways under its control as part of the National Pollutant Discharge Elimination System and state regulations. One way that WisDOT is meeting this challenge is through the use of structural best management practices. These BMPs are stationary systems that can minimize the adverse effects of highway runoff by physically trapping it until contaminants such as hydrocarbons, heavy metals and inorganic salts settle out or are filtered through underlying soils or other devices.

### What's the Problem?

Structural BMPs include emerging proprietary technologies such as filtration units and hydrodynamic separators, which are relatively compact devices usually installed below ground. WisDOT would like to investigate the effectiveness of these devices, especially in ultra-urban areas where limited space or high real estate costs can preclude the purchase of land for installing traditional stormwater management practices such as grass swales and detention ponds. The department is particularly interested in assessing the devices' ability to remove total suspended solids such as fine sand and silt from runoff at post-construction sites and facilities located within municipalities. However, most performance studies of the technologies have been developed by the manufacturers and lack field testing and validation.

### Research Objectives

WisDOT sought to evaluate two proprietary technologies for practical application and effectiveness at removing a suite of organic and inorganic pollutants from runoff. One is the Vortechs system, a hydrodynamic settling device that removes pollutants by flotation and sedimentation. The other is the StormFilter, a storm water filtration device that removes pollutants by filtration and sedimentation.

### Methodology

WisDOT partnered with the U.S. Geological Survey, the Wisconsin Department of Natural Resources, the city of Milwaukee, the Milwaukee Third Ward, Milwaukee County and the manufacturers of the devices to share the cost of installing and monitoring the systems, and USGS conducted the research. The devices were installed in a parking lot beneath a well-traveled elevated section of Interstate 794 in downtown Milwaukee. Pipes were installed to conduct water from the freeway to the devices. Researchers monitored runoff events for flow and water quality at the inlet and outlet of each device.

Investigators collected 33 water quality samples for the StormFilter and 45 for the Vortechs system. The samples were analyzed at the Wisconsin State Laboratory of Hygiene for levels of 32 pollutants based on performance information from the manufacturers and on the types of pollutants WisDOT is interested in controlling. Researchers employed two methods to assess the devices' efficiency at removing pollutants: efficiency ratio and summation of loads. Both ER and SOL use flow and water quality data at the inlet and outlet of a device to produce a number quantifying its pollutant removal efficiency.

### Results

The average concentration and total load of most of the pollutants were lower in the outlet samples collected at the devices. Higher levels of chloride and total dissolved solids were found at the outlets of both devices, and levels of dissolved zinc were also higher for the Vortechs. Road salt brine in both devices appeared to increase effluent concentrations of chloride and total dissolved solids. The SOL analysis showed:

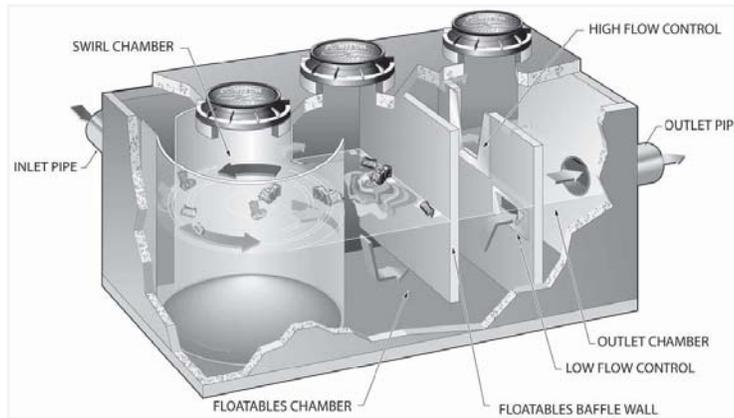
- The StormFilter reduced the load of total suspended solids by 50 percent, suspended sediment by 89 percent, total phosphorous by 38 percent, dissolved copper by 16 percent, total copper by

Project Manager and  
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*"This study verified that proprietary storm water devices can reduce contaminants in urban runoff, but removal to regulatory standards is problematic in some situations."*

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The Vortechs removes sediment and other pollutants from storm water by gravitation in a swirl chamber, then removes oil and floating debris with a baffle wall.

## Investigators



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66 percent, dissolved zinc by 20 percent, total zinc by 68 percent and chemical oxygen demand by 14 percent.

- The Vortechs reduced the load of TSS by 25 percent, suspended sediment by 49 percent, total phosphorous by 10 percent, total copper by 27 percent and total zinc by 16 percent.

The TSS reductions were of particular interest to WisDOT. Researchers concluded that similar reductions could be expected if the devices were installed at other Wisconsin freeway sections, particularly in urban areas.

## Implementation and Benefits

The results of this research will help WisDOT develop cost-effective strategies for managing storm water from existing highways, predict the environmental impact of storm water runoff from new construction, and enhance the scope and validity of environmental impact assessments. The department may consider implementing the StormFilter, Vortechs or similar devices at urban locations or sites such as rest area parking lots and truck weight enforcement facilities. Cost-benefit analyses would be designed to assess long-term operation and maintenance costs associated with the devices and traditional systems.

## Further Research

WisDOT sponsored an additional research study to further investigate the effectiveness of the StormFilter: Use of a Stormwater Filtration Device for Reducing Contaminants in Runoff from a Parking Lot in Madison, Wisconsin, [Project No. 0092-05-17](#). Completed in September 2008, this study confirmed the system's effectiveness.

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*This brief summarizes Project 0092-00-03, "Effectiveness of a Hydrodynamic Settling Device and a Stormwater Filtration Device in Milwaukee, Wisconsin," produced by the Wisconsin Department of Transportation Research Program, 4802 Sheboygan Ave., Madison, WI 53707.*

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