



# UPDATES

AUGUST 2009

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- Survey of Stormwater BMP Maintenance Practices*
- Stormwater Sediment Particle Size Distribution and the Impact on BMP Performance*

## AUTOMATIC SAMPLING SUSPENDED SEDIMENTS IN STORMWATER RUNOFF

Contributed by Greg DeGroot

(Contact: John Gulliver at [gulli003@umn.edu](mailto:gulli003@umn.edu))

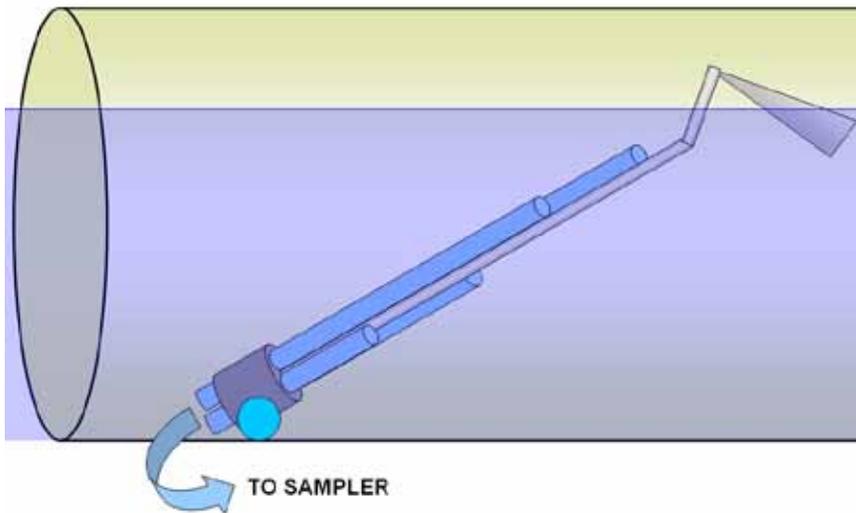
**Funded by Minnesota Pollution Control Agency and the Local Road Research Board**

Most stormwater treatment practices remove pollutants by sedimentation or filtration which captures particles and any pollutants associated with the particles. Maintenance of these stormwater treatment practices depends on design sizing criteria and the amount and settling velocity distribution of the particles within stormwater runoff for a specific site. The most common stormwater runoff sampling equipment often measures suspended sediment concentration for particles larger than coarse silts at 300 to 1600% greater than the actual sediment concentration (i.e., oversampling). Therefore, a more accurate method for sampling suspended sediments is needed to accurately assess stormwater treatment practice performance and characterize pollutant loading from watersheds.

Research at St. Anthony Falls Laboratory is improving the technology for sampling suspended solids in stormwater runoff. The current sampling apparatus design utilizes a hinged arm and fin with sampling tubes attached (see Figure). The hinge and fin provides lift which allows the sampling apparatus to span the entire flow column for a wide range of flow depths. The hinge also allows passage of debris within the pipe that could become lodged if the apparatus were fixed.

Four individual sampling tubes positioned along the arm collect equal-volume samples at different depths. The equal-length tubes combine into one tube which connects to an automatic sampler. The experimental setup is composed of an 18-inch storm sewer pipe capable of flows in excess of 5 cfs at slopes up to 2.5% and features a variable rate sediment feed system. Larger or smaller pipe diameters can be sampled by using a similar apparatus that is scaled appropriately.

The current apparatus is capable of sampling suspended solids within 10% of the actual sediment feed rate.



SCHEMATIC OF PROPOSED SEDIMENT SAMPLING APPARATUS (FLOW FROM LEFT TO RIGHT AND IS SHADED BLUE).

Figure courtesy G. DeGroot

# WELCOME

Thank you for reading our newsletter! Our purpose is to create opportunities for partnerships which are crucial to our quest for improving the methods for assessment and maintenance of stormwater BMPs.

*UPDATES is a quarterly newsletter designed to share news, current stormwater research efforts, and contact information related to the development of assessment methods and maintenance education for stormwater treatment practices. It is an outreach effort of a project sponsored by the Minnesota Pollution Control Agency (MPCA) and in cooperation with other agencies and organizations. For information, contact Andy Erickson (eric0706@umn.edu).*

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# SURVEY ON STORMWATER TREATMENT PRACTICE MAINTENANCE

Contributed by Andy Erickson (eric0706@umn.edu)

Funded by Minnesota Pollution Control Agency

## Introduction

Many stormwater management manuals and guidance documents have stated the importance and estimated frequency of maintenance for stormwater treatment practices, but few have documented the actual frequency and intensity of maintenance required to maintain a desired level of performance and efficiency. A detailed municipal public works survey on maintenance for stormwater treatment practices was developed and distributed, with the results provided below.

Survey responses were received from 28 Minnesota cities, eight Wisconsin cities, and two Wisconsin counties. The survey related to the following topics: number of treatment practices in the city, frequency of inspections, average staff-hours spent per routine inspection/maintenance, complexity of maintenance, most frequent causes of performance deterioration, and cost of non-routine maintenance activities.

## Results

Most (>50%) Minnesota and Wisconsin cities have more than 20 wet ponds and less than five dry ponds, constructed wetlands, rain gardens, infiltration basins/trenches, or porous pavements. Most Minnesota and Wisconsin cities also have no sand filters, soil filters, or underground filtration practices, although half have five or more underground sedimentation practices and filter strips/swales.

Most stormwater treatment practices are inspected or maintained once per year or less (see Figure). Inspection frequency varies significantly due to stormwater BMP accessibility and management strategy (proactive vs. reactive). Most respondents also indicated that maintenance complexity was minimal or simple for most stormwater treatment practices. Maintenance was viewed as moderate to complex most often for constructed wetlands (47%), porous pavements (46%) and surface sand and soil filters (38%). Porous pavements are fairly new in Minnesota and Wisconsin, which may explain the more frequent requirement for evaluation by stormwater professionals.

Respondents were also asked to choose from a list of possible factors that most frequently caused deterioration in the performance of their stormwater BMPs. Sediment buildup and litter & debris accumulation were reported most frequently for most stormwater BMPs and possible factors, respectively.

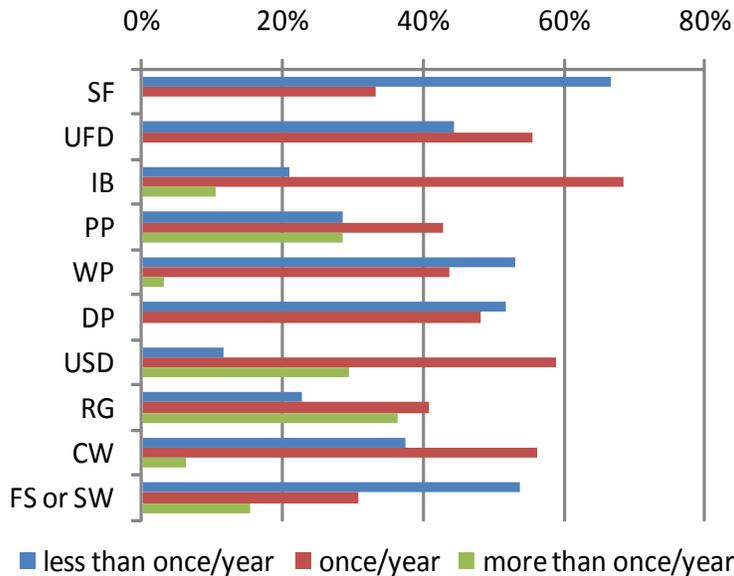
# STORMWATER TREATMENT PRACTICE MAINTENANCE SURVEY (CONT'D)

Pipe clogging was reported frequently for wet ponds and dry ponds while invasive vegetation was reported frequently for dry ponds, constructed wetlands, rain gardens, filter strips, and swales.

Maintenance for sediment removal, converted to an annual cost, was the most reported and most costly maintenance activity. There was, however, considerable variation in the maintenance costs. The highest median sediment removal costs were for porous pavement (\$1,700/yr) and underground sedimentation devices (\$1,000/yr).

## Conclusions

The results of the survey revealed that most (89%) cities perform routine maintenance once per year or less. Staff-hours per year ranged from one to four hours for most stormwater BMPs and but were significantly more for rain gardens (one to sixteen hours per year) and wetlands (one to nine hours per year). The most common causes of performance deterioration were sediment buildup and litter/debris for most stormwater BMPs. Respondents indicated that the removal of accumulated sediment incurred the largest cost of all BMP maintenance activities.



FREQUENCY OF INSPECTION AND MAINTENANCE (NOTE: SF=Surface Sand or Soil Filter, UFD=Underground Filtration Devices, IB=Infiltration Basins or Trenches, PP=Porous pavements, WP=Wet Ponds, DP=Dry Ponds, USD=Underground Sedimentation Devices, RG=Raingardens, CW=Constructed Wetlands, FS or SW=Filter strips or swales (Figure courtesy A. Erickson).

# EVENTS CALENDAR

NOTE: All travel paid for by the University of Minnesota

## August 16-20: StormCon (Anaheim, CA)

- *Stormwater Sediment Particle Size Distribution and the Impact on BMP Performance*
- *Accurate Sampling: Implications for Meeting TMDLs*

## September 24-25, 2009: Land Conservation and Clean Water Summit 2009 (Minnesota Landscape Arboretum).

Day 1: Maximizing New Opportunities: Building Capacity and Forging New Partnerships for Land Conservation. Day 2: Green Infrastructure for Clean Water: Tools for Planning, Design, and Maintenance. Conference and Registration information: <http://www.arboretum.umn.edu/landconservationcleanwater.aspx>

**October 5, 2009 through May 20, 2010:** Construction Stormwater NPDES permit classes for designers and contractors will be offered from October 5 2009 through May 20, 2010 at various locations throughout Minnesota. Please check [www.erosion.umn.edu](http://www.erosion.umn.edu) for details, registration, and a complete schedule.

**October 8, 2009:** Stormwater U (Minnetonka, MN): The Stormwater Pond Management Series (composed of three workshops: Inventory, Inspection & Testing, and Stormwater Maintenance) is sponsored by Minnehaha Creek Watershed District and Carver County. This half day workshop will focus on Stormwater Pond Inventory concept, techniques, methods, rules as well as reviewing number of case studies. <http://www.extension.umn.edu/stormwater/>

**October 16, 2009:** Stormwater U (Cottage Grove, MN): The Stormwater Bioretention Maintenance Series (composed of two workshops: Routine Maintenance and Structural Maintenance) is sponsored by Ramsey-Washington Metro Watershed District and Washington Conservation District. <http://www.extension.umn.edu/stormwater/>

**October 26-27, 2009:** Minnesota Water Resources Conference (St. Paul, MN)

- *Iron-Enhanced Sand Filtration for Stormwater Phosphorus Removal*
- *Standard Sumps as A Stormwater Best Management Practice*
- *Particle Settling Velocity and the Impact on Stormwater BMP Performance*

# NEW WEBSITE AND RESEARCH SNIPPETS RELEASED!

Contributed by Andy Erickson (eric0706@umn.edu)

The project for Assessment and Maintenance of Stormwater Treatment Practices has just launched a new website at: <http://stormwater.safl.umn.edu/>. The new website includes the Assessment of Stormwater BMPs manual; past issues of UPDATES; national and international presentations from conferences, workshops, and seminars; publications; and the first of several Research Snippets.

Research Snippets are concise project summaries intended to provide enough detail for readers to use project results but short enough to be read quickly. Research Snippets are roughly 2-4 pages long and include results and data with figures and tables, links to publications and full reports as well as author contact information. The following Research Snippets are available now for download on the new project website:

<http://stormwater.safl.umn.edu/>.

- Four Levels of Assessment for Stormwater Treatment Practices
- Survey on Maintenance for Stormwater Treatment Practices
- Cost and Effectiveness of Stormwater Treatment Practices



## PUBLICATIONS

1. DeGroot, G., Gulliver, J.S. (2009). Accurate Sampling: Implications for Meeting TMDLs. Proceedings of the 8th Annual StormCon. August 16-19, Anaheim, CA.
2. Erickson, A.J., Gulliver, J.S., Weiss, P.T., and Wilson, C.B. (2009). Survey of Stormwater BMP Maintenance Practices. Proceedings of the Universities Council on Water Resources (UCOWR)/National Institutes for Water Resources (NIWR) Annual Conference. July 7-9, Chicago, IL.
3. Erickson, A.J., Kang, J.H., Weiss, P.T., Wilson, C.B., and Gulliver J.S. (2009). Maintenance of Stormwater BMPs. Proceedings of the ASCE/EWRI World Environmental and Water Resources Congress. May 17-21, Kansas City, MO.
4. Hettler, E., Gulliver, J.S., Erickson, A., and Weiss, P.T. (2009). Stormwater Sediment Particle Size Distribution and the Impact on BMP Performance. Proceedings of the 8th Annual StormCon. August 16-19, Anaheim, CA.
5. Kang, J., Weiss, P.T., Gulliver, J.S., Wilson, C.B. (2008). Maintenance of Stormwater BMPs. Stormwater Magazine. Volume 9, Number 8, Nov/Dec. <http://www.stormh2o.com/november-december-2008/issue-40172.aspx>