

Developing an Assessment Program for Stormwater Best Management Practices

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**Stormwater Management Practice
Assessment Project**



What is Assessment?



- Evaluation of stormwater BMP performance.
 - Purpose for Assessment:
 - Construction due diligence.
 - To meet regulatory requirements.
 - MPCA requires MS4s to “Evaluate” BMP effectiveness.
 - TMDL studies
 - To schedule maintenance.
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How is Assessment performed?



- **We Propose Four Levels of Assessment:**
 1. **Visual Inspection:** visual evaluation
 2. **Capacity Testing:** point measurements
 3. **Synthetic Runoff Testing:** testing with synthetic runoff
 4. **Monitoring:** natural runoff events
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1. Visual Inspection



Bioretention practice (rain garden) that is not functional.

Bioretention practice (rain garden) that may be functional.



Visual Inspection



Visual evidence of intermittent standing water (no vegetation in the bottom) in a soil media filter.

Dry detention pond with underdrains that does not have any visual indications of malfunction.



Visual Inspection



Is there vegetation in the bottom of the basin, trench or bioretention?

Yes No

What is the approximate vegetation cover?

- 0 – 25%
- 25 – 50%
- 50 – 75%
- 75 – 100%

Are there indications of any of the following on the banks of the basin or bioretention?

- excessive erosion
- channelization
- Other: _____

In there evidence of (illicit) storm sewer discharges? Yes No

If so, please describe: _____

Does the basin, trench or bioretention smell like gasoline or oil? Yes No

Does the basin, trench or bioretention smell like rotten eggs (hydrogen sulfide)? Yes No

Is there vegetation in the bottom of the basin, trench or bioretention? Yes No

What is the approximate vegetation cover?
 0 – 25% 25 – 50% 50 – 75% 75 – 100%

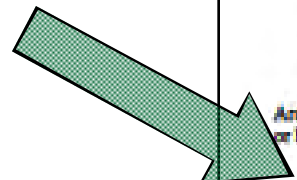
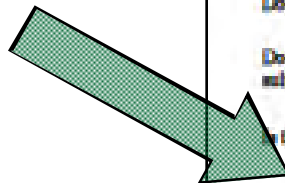
Are there indications of any of the following in the bottom of the basin, trench or bioretention?

- excessive sediment deposition
- excessive erosion
- channelization
- Other: _____

Are there indications of any of the following on the banks of the basin or bioretention?

- excessive erosion
- channelization
- Other: _____

In the bottom of the basin, trench or bioretention covered with a layer of silt and/or clay? Yes No



Visual Inspection

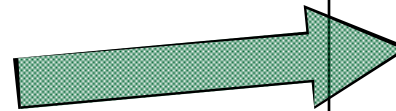


Is the inlet structure clogged, partially or completely?

- Yes
- No

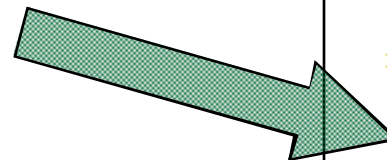
If so, what with?

- Debris
- Sediment
- Vegetation
- Other: _____



Is there any evidence downstream of the outlet structure of:

- Sediment deposition
- Erosion
- Channelization
- Other: _____



Is the inlet structure clogged, partially or completely? Yes No

If so, what with?

- Debris
- Sediment
- Vegetation
- Other: _____

Is the outlet structure clogged, partially or completely? Yes No Not Applicable

If so, what with?

- Debris
- Sediment
- Vegetation
- Other: _____

Is the inlet or outlet structure askew or misaligned? Yes No

If so, why?

- Unknown
- Ice/Frost heave
- Other: _____

Is there any evidence downstream of the outlet structure of:

- Sediment deposition
- Erosion
- Channelization
- Other: _____

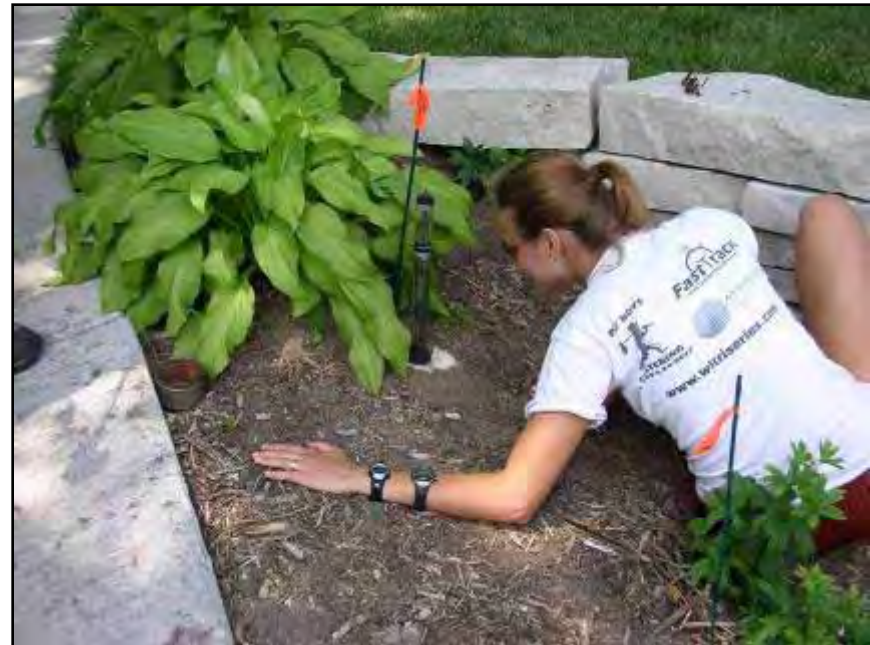
2. Capacity Testing

- Infiltration
- Pollutant storage capacity
- Sediment storage



Modified Philip-Dunne Infiltrometer measuring hydraulic conductivity

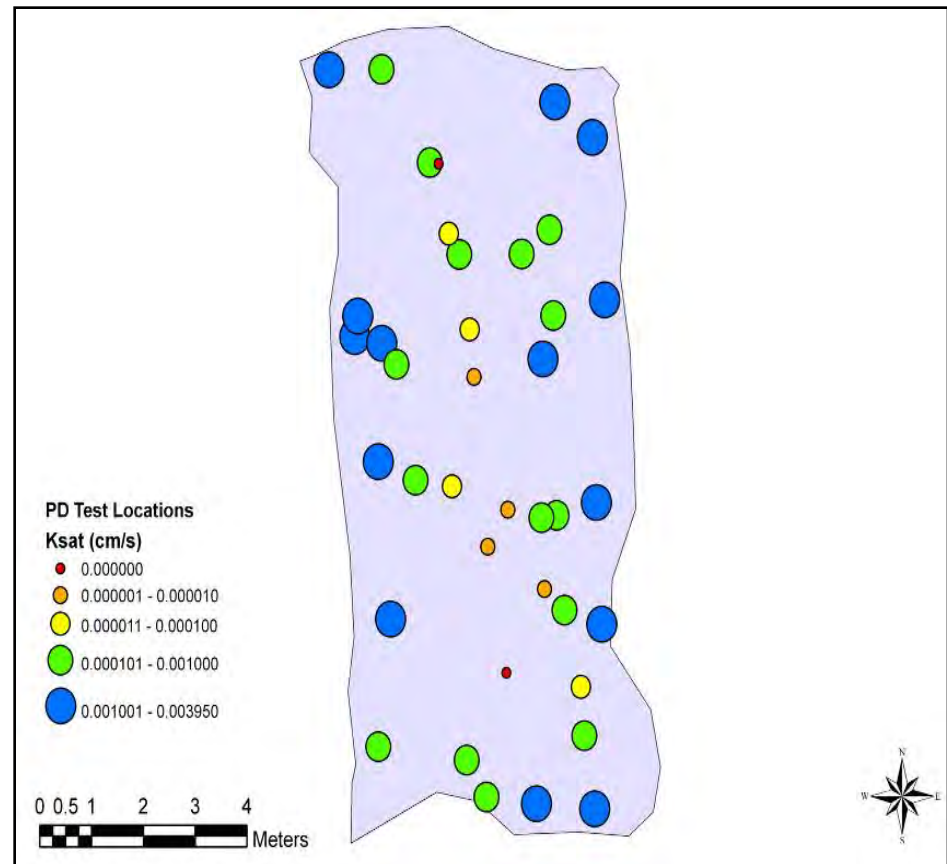
Minidisk Infiltrometer measuring hydraulic conductivity



Capacity Testing-Rain Gardens



- Burnsville (Residential LID site)
- Cottage Grove (Park and Ride)
- Duluth (UM Campus)
- Little Canada (Ramsey-Washington Metro Watershed District)
- Maplewood (Thompson Lake)
- St. Paul (UM Campus)



3. Synthetic Runoff Testing

- Pollutant retention efficiency
- Infiltration capacity



Synthetic runoff testing using a fire hydrant and controlled sediment feeding

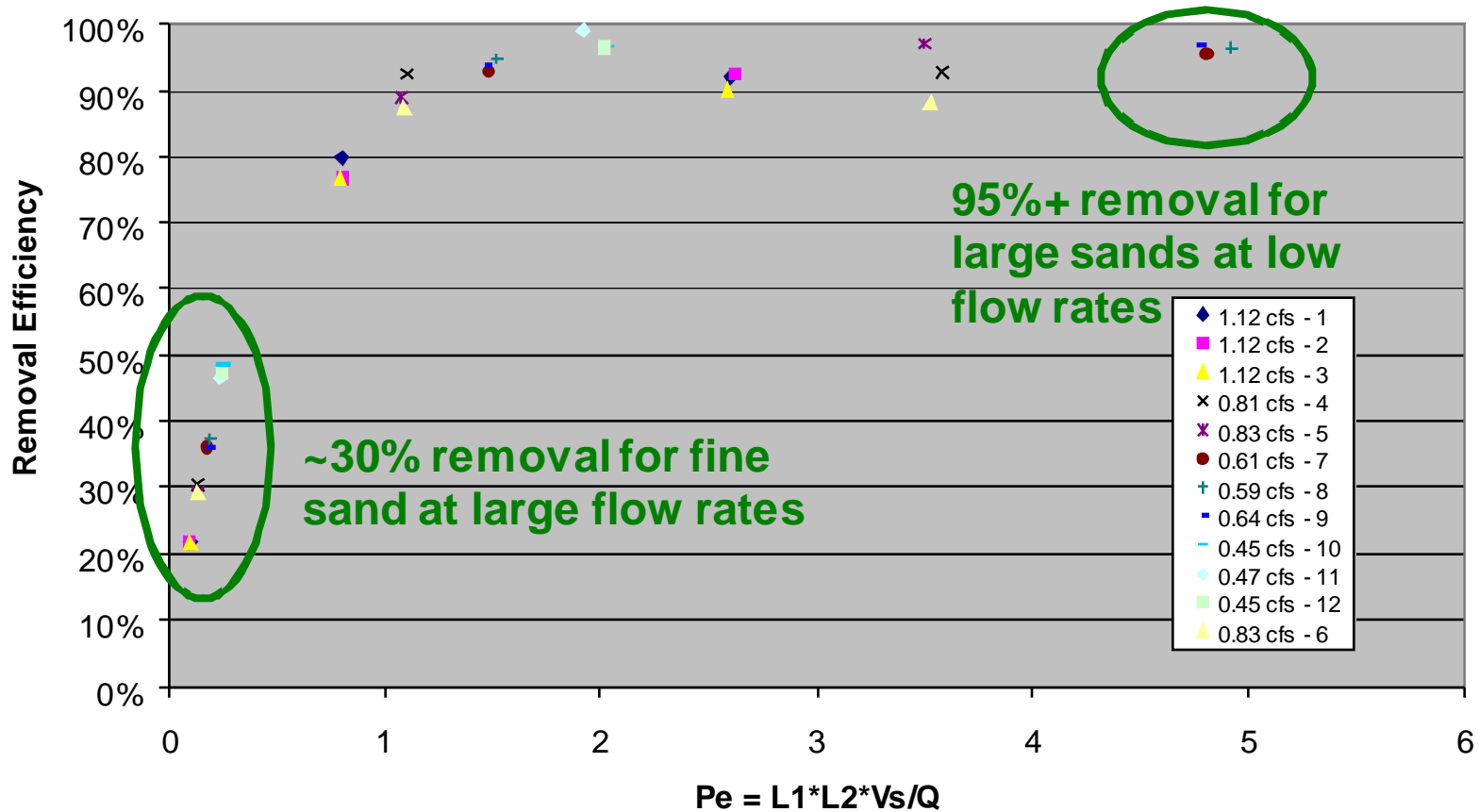
Extraction of sediment retained by an underground proprietary device



Synthetic Runoff Testing Results



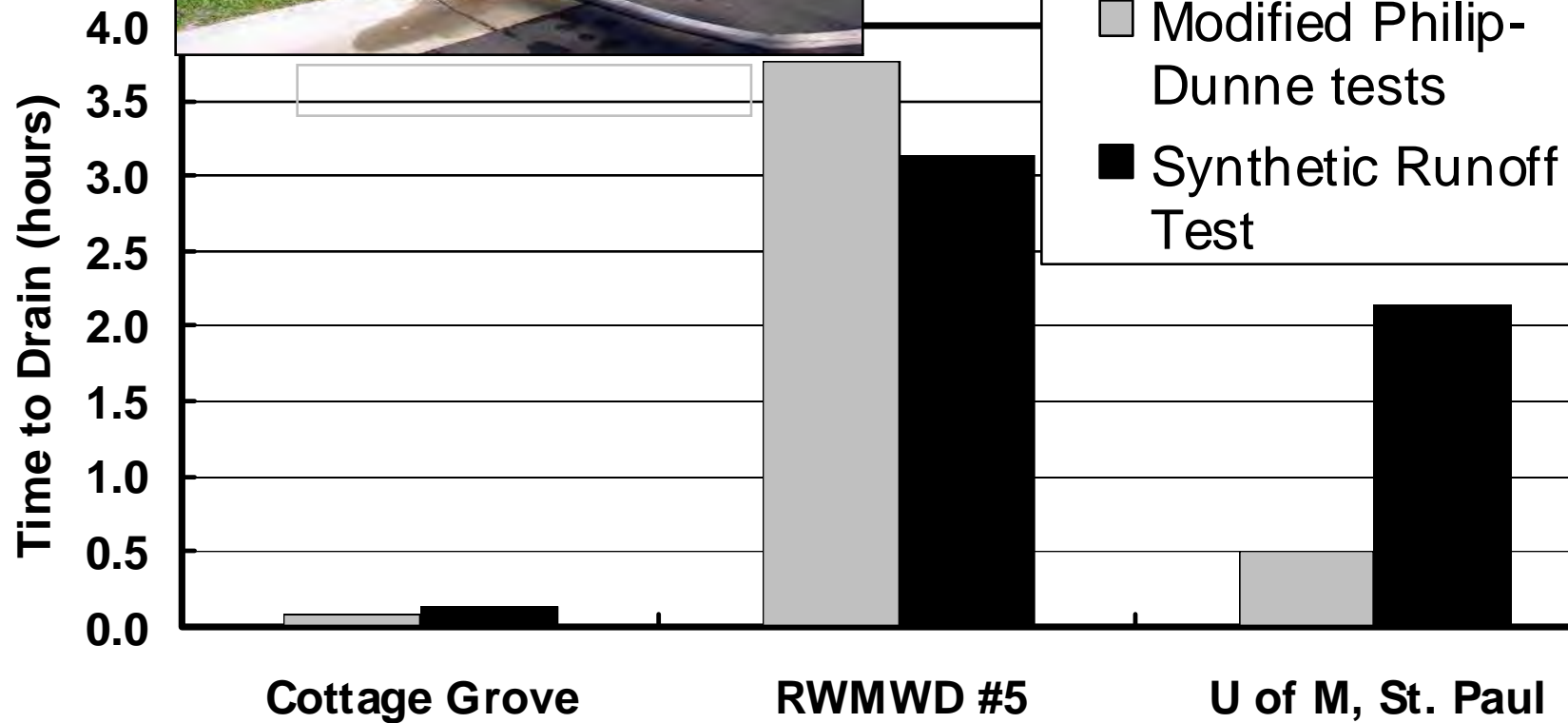
Vortechs model 2000
performance curve



Drain Time comparison



Comparison



4. Monitoring



Monitoring cabinet permanently installed near a rain garden.

Monitoring cabinet housing sampling and data storage equipment



Advantages & Disadvantages



1. Visual Inspection

■ Advantages:

- Quick
- No equipment required
- Maintenance required?

■ Disadvantages:

- Cannot determine efficiency
- Based upon judgment

2. Capacity Testing

■ Advantages:

- Small volume of water
- Rapid, simple measurements

■ Disadvantages:

- Must be spatially averaged
- Specific to measured parameters - sediment retention or infiltration

Advantages & Disadvantages



3. Synthetic Runoff Testing

- Advantages:
 - Not dependent on rainfall
 - Measures overall permeability
 - Can estimate pollutant retention by BMP
- Disadvantages:
 - Synthetic runoff approximates watershed pollutant loads
 - Need approvals
 - Need sufficient supply of water

4. Monitoring

- Advantages:
 - Can assess the most variables
 - Pollutant concentrations accurate for watershed
- Disadvantages:
 - Required effort and time
 - Requires consistent maintenance and inspection
 - Accuracy

Comparison of the Four Levels



Level	Title	Objectives	Relative Effort	Typical Elapsed Time	Advantages	Disadvantages
1	Visual Inspection	Determine if stormwater BMP is malfunctioning	1	1 day	Quick, inexpensive	Limited knowledge gained
2	Capacity Testing	Determine infiltration or sedimentation capacity and rates	10	1 week	Less expensive, no equipment left in field	Limited to infiltration and sedimentation capacity/rates, uncertainties can be substantial
3	Simulated Runoff Testing	Determine infiltration rates & capacity and pollutant removal performance	10 - 100	1 week - 1 month	Controlled experiments, more accurate with fewer tests required for statistical significance as compared to monitoring, no equipment left in field	Cannot be used without sufficient water supply, limited scope
4	Monitoring	Determine infiltration rates & capacity and pollutant removal performance	400	14 months	Most comprehensive. Assess stormwater BMP within watershed without modeling	Uncertainty in results due to lack of control, equipment left in field

Project Collaborators



- Jim Anderson – Water Resources Center
- John Gulliver – Civil Engineering
- Larry Baker – Water Resources Center
- John Chapman - Extension Service
- Ray Hozalski – Civil Engineering
- Omid Mohseni – St. Anthony Falls Laboratory
- John Nieber – Bioproducts and Biosystems Engineering
- Heinz Stefan – Civil Engineering
- Ron Struss – Extension Service
- Bruce Wilson – Bioproducts and Biosystems Engineering
- Andrew Erickson – St. Anthony Falls Laboratory
- Five Graduate Research Assistants
- Eight Undergraduate Research Assistants



Partner Projects

- Minnesota Pollution Control Agency- Development of Assessment Manual
- Minnesota Local Road Research Board – Testing of proprietary devices.
- Minnesota Metropolitan Council – Testing of rain garden capacity and proprietary devices.
- National Science Foundation – Urban bio-cycling
- Minnesota Pollution Control Agency - Thermal impacts of stormwater runoff
- WERF- Winter infiltration rates - Dakota County Soil & Water Conservation District



Projects for Next Biennium Looking for Partners and Ideas



- Certification Training for Visual Inspection
- Assessment manual to include maintenance techniques.
- Expand infiltration techniques to performance of 6 infiltration basins, 2 types of permeable pavements swales and dry ponds.
- Measurement technique for suspended solids size distribution
- Investigation of groundwater pollution caused by infiltration practices
- Watershed TMDL study with stormwater BMPs
- 2 trout stream TMDL studies

Comments?



Website: <http://wrc.umn.edu/outreach/stormwater/bmpassessment/>

Questions?



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