

UPDATES

FEBRUARY 2009

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IMPACTS OF URBAN DEVELOPMENT AND CLIMATE CHANGE ON GROUNDWATER TEMPERATURE

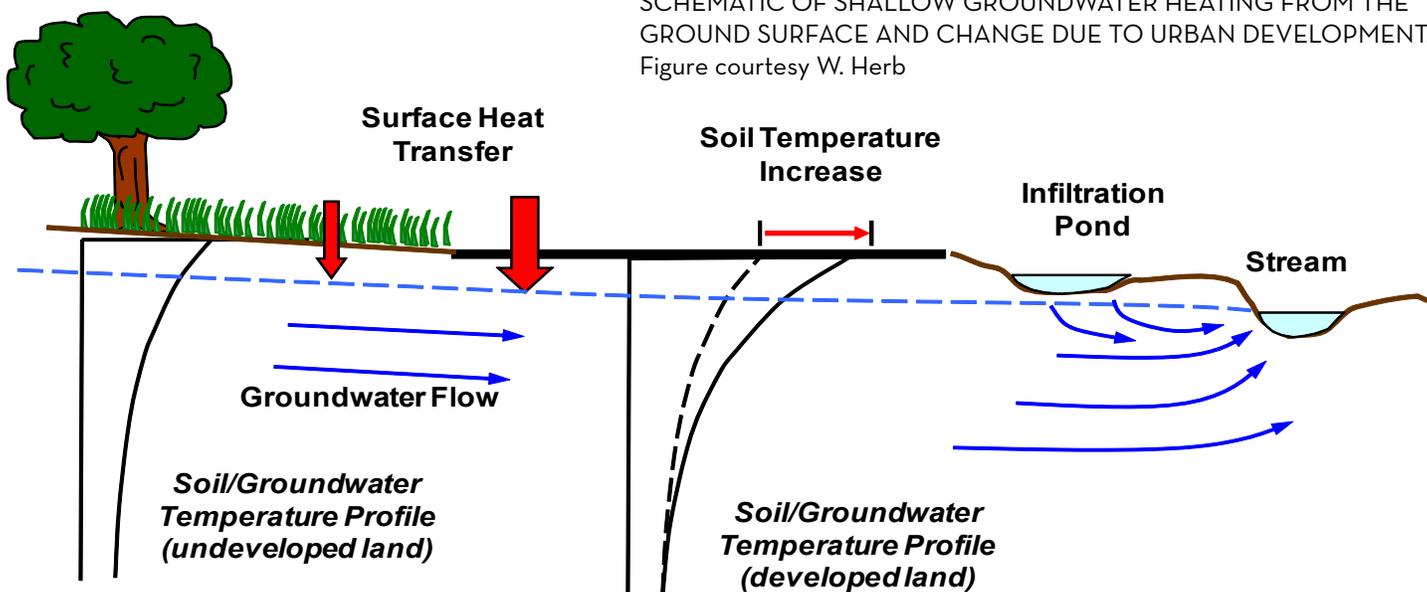
Contributed by Craig Taylor (tayl0423@umn.edu)

Funded by Minnesota Pollution Control Agency

Rising groundwater temperatures pose a significant threat to cold-water streams for which base-flow is a primary source of cool water. Groundwater temperatures, especially in shallow (quaternary) aquifers, respond to the seasonal and diurnal ground surface temperature cycles which, in turn, are modified by climate change and urban development. Considering only conduction or convection from the surface, our analysis indicates that a fully urbanized downtown area at the latitude of Minneapolis/St. Paul, MN is likely to have a shallow groundwater temperature that is nearly 3°C warmer than an undeveloped or agricultural area. Groundwater temperatures are also projected to rise in response to global warming and associated ground surface temperature increases. In the extreme case of a double carbon dioxide (2xCO₂) climate scenario, shallow groundwater temperatures in the Minneapolis St. Paul metropolitan area could rise by up to 4°C.

SCHEMATIC OF SHALLOW GROUNDWATER HEATING FROM THE GROUND SURFACE AND CHANGE DUE TO URBAN DEVELOPMENT.

Figure courtesy W. Herb



WELCOME

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

This newsletter is an outreach effort of a project sponsored by the Minnesota Pollution Control Agency (MPCA) and in cooperation with other agencies and organizations. The project team developed the online manual “Assessment and Maintenance of Stormwater Best Management Practices” (<http://wrc.umn.edu/outreach/stormwater/bmpassessment>) and continues research to revise the manual with the most current information.

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UPDATES is a quarterly newsletter designed to share news, current stormwater research efforts, and contact information related to the development of assessment methods and O&M education for stormwater best management practices. For information, contact Andy Erickson (eric0706@umn.edu).

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ASSESSMENT OF STANDARD SUMP MANHOLES FOR STORMWATER TREATMENT

Contributed by Adam Howard

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

Funded by Minnesota Department of Transportation

Proprietary underground sedimentation devices have been shown to remove inorganic particles larger than silt and are useful in highly urban areas, but their price has led the Minnesota Department of Transportation to consider standard sump manholes as an alternative for stormwater pretreatment.

Standard manholes have been a staple in stormwater infrastructure for their use as maintenance access and pipe junctions. Including a sump within a standard manhole allows for the removal of some particulate pollutants by settling, but very little data exists on both the ability of sump manholes to remove particles and how much scour occurs during high flows. A project funded by the Minnesota Department of Transportation at St. Anthony Falls Laboratory (SAFL) is seeking to fill this knowledge gap by testing full-scale standard sump manholes in the laboratory.

Two types of tests are planned for the sump manholes: performance tests and scour tests. Performance tests involve seeding the inflow with a prescribed concentration and particle size distribution of sediment to determine the percent captured within the sump. The performance will be characterized as a function of the non-dimensional Peclet number to facilitate comparison to other underground sedimentation devices. In addition, an uncertainty analysis using a bootstrap method will quantify the error associated with the predicted performance.

Over time, sump manholes collect sediment that may be resuspended and discharged during high-flow storm events. Scour tests will be conducted to determine how efficiently a sump manhole retains previously-trapped sediment during storms of high intensity. A prescribed mass and particle size distribution of sediment will be placed into the sump manhole and flows as high as the predicted 10-year storm will be applied to the system. The amount of sediment removed during the test will be measured and reported as percent removal and effluent concentration.

With the results of this research, engineers can incorporate standard sump manholes into their stormwater pretreatment design with more knowledge of their effectiveness. While sump manholes may not be appropriate for all situations, this research could result in decreased costs for some projects and stormwater credits for existing facilities.

IMPROVEMENTS IN INFILTRATION RATES OF COMPACTED SOIL WITH TILLAGE AND COMPOST

Contributed by Nick Olson
(Contact: John Gulliver at gulli003@umn.edu)
Funded by: Minnesota Pollution Control Agency and Three Rivers Park District

Soils on residential developments typically have lower stormwater infiltration rates than the soils they replace. This is due to reduced topsoil depth and increased subsoil compaction as land is reshaped and worked with heavy equipment during development. Loss of infiltration leads to increased stormwater runoff and associated downstream problems of flooding, pollutant transport, and warming stream temperatures.

Improvements in infiltration can be achieved by remediating the soil using tillage and compost addition. Tillage breaks up hard pan layers allowing water to infiltration faster and to greater depths. Compost addition reduces the density of the soil and increases water holding capacity.



DEEP TILLAGE BEING PERFORMED AT MAPLE LAKES PARK, MAPLE GROVE, MN (OCTOBER, 2008).
Photo courtesy N. Olson

An experiment is being conducted at three different sites to quantify the before and after of effects of soil remediation. Each site has been divided into three plots: control, tilled, and tilled with compost addition. Each plot will be assessed by its infiltration rate, penetrability, and bulk density. Synthetic runoff testing will also be performed. The results of this experiment will be used to determine the effectiveness of soil remediation as a stormwater management practice.

EVENTS CALENDAR

NOTE: All travel paid for by the University of Minnesota

February 3rd: 8th Annual Road Salt Symposium (Brooklyn Center, MN).

- *Road Salt Impacts on Minnesota Waters.*

March 5-6: 21st Annual Erosion Control and Stormwater Management Conference & Trade Show (Minneapolis, MN).

- *Composting Stormwater Pond Sediments to Remove PAHs.*

May 17-21: World Environmental & Water Resources Congress (Kansas City, MO).

- *Accurate Sampling for Suspended Solids*
- *Assessing Hydrodynamic Separators under High Water Flow Conditions*
- *Assessment of Standard Sumps for Stormwater Treatment*
- *Field Testing Guidelines for Certification of Manufactured Stormwater BMPs: Part II*
- *Maintenance of Stormwater BMPs*
- *Proposed Scaling Relations for Manufactured Stormwater BMPs*

U of M Erosion and Sediment Control Program

The U of M Erosion and Sediment Control Program has over 25 classes currently offered between now and May for contractors and engineers on construction stormwater. The full schedule is available at www.erosion.umn.edu. Contact 612-625-9733 or 1-800-646-2282 for more information. Some of the new class offerings are:

Regulatory Stormwater Enforcement. This seminar is for people who are responsible for inspecting construction sites for NPDES compliance through a Municipal Separate Storm Sewer System entity (MS4), the MPCA, or MPCA Joint Powers Agreement Partners. This seminar takes place on April 12, 2009, at Dakota County SWCD, Farmington. The registration fee is \$160.

Small Site Construction Stormwater Management. A new class is being offered from the U of M Erosion and Sediment Control Program called "Small Site Stormwater Management." This class will focus on NPDES Construction Permit Compliance for light construction and residential builders. This class will be held on March 4, 2009, St. Louis Park. The registration fee is \$70.

PROJECT UPDATE ON ASSESSMENT AND MAINTENANCE OF STORWATER BMPS

Contributed by Andy Erickson (eric0706@umn.edu)
Funded by Minnesota Pollution Control Agency

Following the recent publication of survey results for assessment and maintenance of stormwater BMPs, the survey audience was expanded to include over 100 communities in Wisconsin.

In addition, members of the project team are on the planning committee for Stormwater U, developing and organizing more workshops for 2009. For more information on Stormwater U and to see upcoming events, visit <http://www.extension.umn.edu/stormwater/stormwaterU.html>. Previous Stormwater U presentations include:

- November 5, 2008: Stormwater Pond Management: Easements & Vegetation Maintenance (North St. Paul, MN).
- July 31, 2008: Stormwater Pond Management: Visual Inspection (North St. Paul, MN).



STORMWATER U TRAINING WORKSHOP ON WET DETENTION POND INSPECTION AND MAINTENANCE IN NORTH ST. PAUL, MN (JULY, 2008). Photo courtesy S. Missaghi

PUBLICATIONS

1. DeGroot, G. P., J. S. Gulliver and O. Mohseni, "Accurate Sampling of Suspended Solids," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.
2. Erickson, A.J., J.H. Kang, C.B. Wilson, P.T. Weiss and J.S. Gulliver, "Maintenance of Stormwater BMPs," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.
3. Gulliver, J.S., J.J. Sansalone, Q. Guo, and G. Williams for the Scaling Sub-Committee, "Proposed Scaling Relations for Manufactured Stormwater BMPs," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.
4. Howard, A, O. Mohseni and J.S. Gulliver, "Assessment of Standard Sumps for Stormwater Treatment ," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.
5. Saddoris, D., O. Mohseni and J.S. Gulliver, "Assessing Hydrodynamic Separators under High Water Flow Conditions," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.
6. Sansalone, J., J. Benty, E. Carrasco, J.S. Gulliver, J. Hathaway, B. Hunt, M. Kayhanian, U. Khambhammettu, R. M. Roseen, B. Rushton, and T. Williams, "Field Testing Guidelines for Certification of Manufactured Stormwater BMPs: Part II," World Environmental & Water Resources Congress 2009, May 17 – 21, 2009, Kansas City, MO.