PROJECT SUMMARY

Title:	Field Evaluation of Rain Gardens as a Method for Enhancing Groundwater Recharge
Project I.D.:	R/UW-BMP-002
Investigator:	Kenneth W. Potter, Professor, Department of Civil & Environmental Engineering
Period of Contract:	July 1, 2000-June 30, 2002
Background/Need:	In urbanized areas of Wisconsin that rely on groundwater as the primary source of water, groundwater withdrawals significantly exceed groundwater recharge rates. This can lead to environmental degradation, as it reduces the discharge of groundwater to springs, wetlands, streams, and lakes and their associated ecosystems. Rain gardens, sunken gardens that receive stormwater runoff, appear to offer a solution to groundwater loss. In a previous research project, the PI has used a numerical model to demonstrate that a rain garden with area equal to 10% of the connected pervious area can double the local groundwater recharge rate. The explanation of this surprising result is that focusing of runoff to a small, highly pervious area greatly reduces losses to evapotranspiration.
Objectives:	Before rain gardens can be widely implemented, they should be tested through carefully designed demonstration projects. The purpose of the proposed project was to construct an experimental rain garden for use in evaluating rain garden performance.
Methods:	We have constructed an experimental rain garden, at the Dane County Parks Lussier Family Heritage Center in Madison. The rain garden is essentially a lysimeter, in that it is lined so that the drainage can be collected and measured. The rain garden has an area of 5.4 m^2 and is connected to two downspouts, each draining about 55 m^2 of roof. Valves allow one or both roof areas to be connected, yielding area ratios of 0.05 and 0.10. Roof runoff is measured by means of a prerated trapezoidal flume in which a pressure transducer has been installed. Another transducer monitors the ponded depth in the rain garden. Runoff from overspill is collected in an overflow tank. To estimate soil moisture storage, Time Domain Reflectometry (TDR) probes were placed at seven depths and connected to a multiplexer, cable tester, and data logger. Seepage through the rain garden (which we take to be recharge) flows through a bottom drain to a pipe that

discharges into a seepage collection tank. The tank contains a siphon that empties and triggers a switch when it accumulates 112 liters. The tank also contains a pressure transducer for monitoring changing water levels.

Three controlled experiments were performed during the period August 26 to September 1, 2002. In these experiments water was artificially supplied to the rain garden at a rate of seven gallons per minute until the ponding level reached 15 cm. (This supply rate corresponds to a rainfall rate of about one inch per hour when both roofs are contributing.) During the experiments soil water measurements were made with the TDR system, for comparison with model results.

Results and Discussion: The modeled and experimental results match well with respect to ponding times and overflow volumes. The model also does a reasonably good job of predicting the temporal pattern of soil moisture in the rain garden. However, the modeled volume of subsurface discharge from the rain garden was significantly larger than observed. It is believed that the discrepancy is due to leakage of water through the TDR access holes. This problem has subsequently been corrected.

Conclusions: An experimental rain garden has been constructed that allows measurement of all water budget terns except evapotranspiration. Experiments to date have demonstrated that a previously developed numerical model of rain gardens provides useful predictions of rain garden performance.

Related Publications: None.

Key Words: Rain gardens; artificial groundwater recharge

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