Compacted urban soils effects on infiltration and bioretention stormwater control designs

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Abstract

Prior research by Pitt (1987) examined runoff losses from paved and roofed surfaces in urban areas and showed significant losses at these surfaces during the small and moderate sized events of most interest for water quality evaluations. However, Pitt and Durrans (1995) also examined runoff and pavement seepage on highway pavements and found that very little surface runoff entered typical highway pavement. During earlier research, it was also found that disturbed urban soils do not behave as indicated by most stormwater models. Additional tests were therefore conducted to investigate detailed infiltration behavior of disturbed urban soils. The effects of urbanization on soil structure can be extensive. Infiltration of rain water through soils can be greatly reduced, plus the benefits of infiltration and bioretention devices can be jeopardized. Basic infiltration measurements in disturbed urban soils were conducted during an EPA-sponsored project by Pitt, et al (1999a), along with examining hydraulic and water quality benefits of amending these soils with organic composts. Prior EPA-funded research examined the potential of groundwater contamination by infiltrating stormwater (Pitt, et al, 1994, 1996, and 1999b). In addition to the information obtained during these research projects, numerous student projects have also been conducted to examine other aspects of urban soils, especially more detailed tests examining soil density and infiltration during lab-scale tests, and methods and techniques to recover infiltration capacity of urban soils. This paper is a summary of this recently collected information and it is hoped that it will prove useful to both stormwater practice designers and to modelers.

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Introduction. The effects on hydrology caused by IWS within bioretention cells were investigated in North Carolina. IWS cells experienced pronounced reductions on stormwater volume (99.6% and 100%), while conventional cell reduced 78% volume under the same hydrologic condition. Adsorption is considered a necessary process to remove P within bioretention, and can be modeled using isotherm equations including linear, Freundlich, and Langmuir among others. However, key control and routing elements needed for design were beyond the capability of the model, which is limited primarily to simulating storage, i.e., detention. The effects of urbanization on soil structure can be extensive. Infiltration of rain water through soils can be greatly reduced, plus the benefits of infiltration and bioretention devices can be jeopardized. Basic infiltration measurements in disturbed urban soils were conducted during an EPA-sponsored project by Pitt, et al (1999a), along with examining hydraulic and water quality benefits of amending these soils with organic composts. The role of urban soils in stormwater management cannot be underestimated. Although landscaped areas typically produce relatively small fractions of the annual runoff volumes (and pollutant discharged) in most areas, they need to be considered as part of most control scenarios. In stormwater quality.

Urban Trees Enhance Water Infiltration. Date: November 28, 2008. Urban tree roots have the potential to penetrate compacted subsoils and increase infiltration rates in reservoirs being used to store stormwater. Credit: iStockphoto/Dan Moore. Further research is needed on the effects of tree roots and detention time on water quality in structural soils. Monitoring continues at four demonstration sites around the country and updated information is posted as it becomes available at http://www.cnr.vt.edu/urbanforestry/stormwater. advertisement. Story Source