SCCWRP #1152

Bioretention planter performance measured by lag and capture

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ABSTRACT

Bioretention flow-through planters manage stormwater with smaller space requirements or structural constraints associated with other forms of green infrastructure. This project monitored the hydrology of four bioretention planters at Stevens Institute of Technology to evaluate the system's ability to delay runoff and fully capture small rain events. The water depth in the outflow and the volumetric water content near the inflow were measured continuously over 15 months. Rainfall characteristics were documented from an on-site rain gauge. This monitoring determined the time from the start of a rain event to the onset of outflow from each planter, which was defined as the lag. The initial moisture deficit (difference between pre-event volumetric water content and maximum measured volumetric water content), approximate runoff volume, and approximate runoff volume in the first half hour were analysed to determine their effect on runoff capture and lag. During the monitoring period, 38% of observations did not produce measurable outflow. Logistic regression determined that the initial moisture deficit and approximate runoff volume were statistically significant in contributing to a fully captured storm. Despite the large hydraulic loading rate and concrete bottom, the planters demonstrate effective discharge lag, ranging from 5 to 1,841 min with a median of 77.5 min. Volumetric water content of the media and inlet runoff volume in the first half hour were significant in modelling the lag duration. These results represent a combination of controllable and uncontrollable aspects of green infrastructure: media design and rainfall.