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Attenuation of dissolved stormwater runoff contaminants

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In most urban areas, sediment and water conditions are poor, showing high concentrations of polycyclic aromatic hydrocarbons (PAH), toxic metals, and other contaminants. A major source of these contaminants is stormwater runoff. The abatement of stormwater runoff pollutants is typically dealt with by structural best management practices (BMP). While effective for treating suspended solids and pollutants associated with them, most BMPs do not effectively remove dissolved constituents. Innovative stormwater treatment technologies are required to solve this problem.

We are currently demonstrating an innovative wood-fiber based filter system at a field site in Providence, Rhode Island. The principal goal of this pilot-scale project is to demonstrate that this wood filters can serve as cost-effective and environmentally friendly extension of conventional BMPs. The filter is specifically designed to attenuate the soluble fraction of PAH and heavy metals present in stormwater runoff.

This project builds on previous laboratory and proof-of-concept field tests. Under laboratory conditions, up to 95% of selected PAH compounds (e.g. pyrene) were removed by the wood filter. Removal remained at this level for several months. Slightly lower removal rates have been demonstrated for heavy metals (Copper and Zinc). During the proof-of-concept field test, it was found that heavier, typically more toxic molecular weight PAH compounds (e.g. chrysene) were more effectively removed than lighter ones and that removal was independent of season. PAH removal rates were approximately 36% for the largest filter tested. The lower than expected performance was attributed to by-pass flow and only partial submersion of the filter. Based on lessons learned, the filter system was completely redesigned. It now houses 27 individual wood filter modules in a prefabricated concrete structure with flow control. Hydraulic test have been conducted to prove that the filter does not impede the flow of the runoff.

Water samples collected before and after the filter, as well as from the filter matrix, are used to demonstrate the contaminant removal capacity of the wood filter. This presentation will summarize the major findings of this ongoing pilot-scale project and will elaborate on the filter maintenance and operation requirements.