ISA Extended Abstract

Planting and Selecting Tree Species for Stormwater Detention Basins

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Stormwater detention basins are depressions in the ground designed to temporarily store stormwater then slowly release it. These systems also have the ability to improve water quality through the sedimentation of particulate matter. Detention basins are typically covered with turf, however some management districts promote the use of naturalized basins which can contain wetland plants, micropools (small ponds) and vegetated (non-concrete) flowpaths. The presence of wetland-like conditions can enhance pollutant removal. Trees and shrubs may or may not be part of the design of a naturalized basin. However since naturalized basins are not regularly, if ever, mowed, trees may colonize the basin anyways.

Trees may intentionally be planted in detention basins – both turf and naturalized – to fulfill mitigation requirements, such as New Jersey's No Net Loss rules. In some communities basins can serve as a source of open space available for increasing a municipality's canopy cover. Trees can be added to basins to provide additional services as well. One of the most commonly cited benefits of incorporating trees in stormwater systems is the reduction of water temperature through shading; detention basins can be a source of thermal pollution for receiving water bodies because of the prolonged ponding of water. Trees can also enhance the wildlife habitat and aesthetics of a basin. One greenhouse study even suggests the potential for trees to improve compacted subsoils in stormwater systems through root growth. The high transpiration rates of wetland adapted species could also contribute to the reduction of stormwater volume, a challenging yet important goal to achieve in stormwater management.

There are drawbacks and potential problems that can be encountered with trees as well. Woody root growth on slopes and earthen embankments that enclose the basin can compromise their integrity resulting in slope failure. The accumulation of plant material could cause clogging of the basin inlets and outlets and in extreme cases result in volume loss. Some sources have suggested that a "sufficient" amount of mature tree trunks could limit the storage capacity of a basin, however no specific size threshold is provided. Shading and shallow root growth could prevent the growth of other low growing vegetation which would leave soil exposed and could lead to erosion within the system. The addition of trees can also lead to difficulties mowing turf basins and can restrict the ability of maintenance vehicles to access the basin for sediment removal or other activities. Tree planting is not advised in systems utilizing underdrains based the premise that the roots could damage piping. The choice to add trees into a detention basin depends on the site context, regulatory environment and project goals. Trees may be better suited for sites where water quality improvement and other ancillary benefits are a higher priority as compared to sites designed for higher volume control.

Managers also need to weigh the cost of adding trees into detention basins which can be a challenging growing environment. Several sites in the preliminary study contained less than ideal soil since the basins were excavated into the ground so that the trees were planted into B or C soil horizons that lack nutrients and organic matter. Incoming stormwater also exposes plants to higher concentrations of pollutants such as heavy metals, sediments, and petroleum products. The cycles of wetting and drying

that characterize dry detention basins favor wetland adapted plants. In extreme cases basins can fill with at least 5 feet of water that may take a day or two to drain. These conditions increase the risk of planted trees not surviving more than a few years or may inhibit optimal growth decreasing the net services that could be derived from the tree.

A preliminary survey of trees in 10 detention basins in Middlesex County, New Jersey, USA identified 17 families of trees and 20 genera that had either been planted or colonized the sites. The five most frequently occurring tree families include *Oleaceae*, *Hamamelidaceae*, *Fagaceae*, *Fabaceae*, and *Beulaceae*. The largest tree in the study was a *Salix babylonica* with a dbh of 30 cm in a turf basin. Surprisingly, while this tree was in good condition, the same basin contained two other smaller (12 and 9.5 cm dbh) specimens of the same species that were in very poor condition with about 75% dieback. Another site demonstrated a similar problem with *Fraxinus pennsylvanica*. The six planted *Fraxinus pennsylvanica (Patmore)* (8 to 9 cm dbh) that had dieback which ranged from 10 to 50% while five volunteer *F. pennsylvanica* growing near the shrubbery surrounding the outlet structure were in much better condition. It is important to note that both *S. babylonica* and *F. pennsylvanica* are classed as facultative wetland species, meaning they have a 67 to 99% occurrence in wetlands. These preliminary findings suggest that species selection alone may not be adequate to ensure tree success in detention basins. The initial planting and care of the tree along with overall basin maintenance may play important roles in improving tree survival in this setting.