

# **CONSTRUCTED WETLANDS FOR URBAN STORMWATER MANAGEMENT MOBILE, ALABAMA**

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## **Introduction**

A stormwater treatment wetland was designed and installed near the USDA Service Center and 4-H Pavilion in Mobile, Alabama. These wetland systems are a functional and aesthetically pleasing alternative for urban and recreational developments. Stormwater wetlands perform by temporarily storing stormwater runoff in shallow pools that create favorable growing conditions for emergent and riparian wetland plants. The stormwater storage, contact area, microtopography, and the emergent plants together form an ideal matrix for the removal of pollutants normally associated with urban development. Emergent wetland vegetation such as, canna lily (*canna spp*), giant bulrush (*scirpus californicus*), maidencane (*Panicum himitomon*) and blue flag iris (*Iris virginicur*) are quite attractive; typically providing green space, bird habitat, and even educational opportunities. Up to 80% of influent suspended sediment and phosphorus can be removed in these systems.

The Jimmy Carter Plant Materials Center located in Americus, Georgia has released giant bulrush (*Scirpus californicus*) and giant cutgrass (*Zizaneopsis miliacea*) as new proven wetland native plant materials for constructed wetlands.

Storm-water treatment wetlands are small, constructed ecosystems designed to enhance storm-water quality that has suffered as a result of urbanization and development. These natural systems can be aesthetically integrated into a variety of developments as part of the functioning drainage and landscaping. Typically, storm-water control basins are designed only for detention (to minimize downstream flooding) and are located away from active use areas. These detentions ponds are often relegated to the status of a “back lot” function. However, by integrating aesthetic features and minor design modifications, storm-water runoff basins can be designed to treat storm water as well.

## **Treatment Processes**

To function, the wetland must be designed to create a shallow basin of soil, plants, water and detritus that collectively remove several types of pollutants through physical, chemical and biological processes. These processes all occur naturally and are only enhanced by design. Sedimentation is the dominant removal process for particulate

pollutants operating within a storm-water treatment wetland. Sheet flow conditions across the wetland reduce runoff velocities. In addition, hydraulic resistance and physical filtration are supplied by the vegetation, which enhances sediment removal. The root network of the plants helps secure sediments, reducing the potential for resuspension. A second removal process is the adsorption of pollutants to the surfaces of bottom sediments, wetland vegetation and organic detritus. Adsorption is a key removal process for phosphorus, trace metals and certain hydrocarbons.

## An Aesthetic Alternative

The stormwater treatment wetland is an aesthetic alternative. Instead of being an eyesore, purposely hidden from view, the stormwater wetland can provide strong visual values, open-space elements, wildlife habitat characteristics, and green space. These attributes are created through the use of proper water elevations and vegetation types. Ornamental vegetation (flowering wetland plants) can be used to strengthen visual appeal. The use of many species of plant is critical to proper design, allowing a more natural competition for survival to occur over time.

A stormwater treatment wetland was designed and constructed adjacent to the USDA Service Center and 4-H Pavilion in Mobile, Alabama. Specific objectives of this project were to : 1) minimize nutrient, pesticide and suspended sediment loadings into coastal waters of the Gulf of Mexico, 2) demonstrate the technical, functional, and aesthetic viability of wetlands systems for controlling nonpoint source water pollution in urban and recreational developments, and 3) educate the general public about new and innovative technologies for protecting our water resources.

## Wetland Landscape Plan

The wetland landscape plan was developed for the site (attached) that included a careful selection of wetland plant for the high marsh zone, the low marsh zone and the micropool. The high marsh zone consist of plant materials that can tolerate wet and dry conditions, the low marsh zones consist of emergent plants that require a higher degree of wetness to survive. The plant materials selected for the micropool consist of plants that can tolerate extended dry periods, good strong root system and sediment loads. Must be able to grow up through the sediment when inundated. Maidencane (*Panicum hemitomon*) is well adapted to wet and dry conditions that exist in the micropool and low and high marsh areas.

The wetland landscape plan consisted of plant materials for the constructed wetland and native shrubs and trees for the surrounding areas. Figure 1 shows a schematic of the design.

The plan included the following:

**Low Marsh Area**

- Giant bulrush
- Arrowhead
- Pickerel weed
- Canna lily
- Blue flag iris

**High Marsh Area**

- Flageo marshhay cordgrass
- Wax myrtle
- Hibiscus
- Gulf muhlenbergia
- Elephant ear

**Micropool Area**

- Halifax maidencane

**Upland Area**

- Sycamore
- River birch
- Willow oak
- May haw
- Fetter bush
- Button bush

The demonstration stormwater treatment wetland was constructed in January 1997. Stormwater influent and effluent are being collected to evaluate treatment performance. Constituents being monitored include suspended solids, phosphorus, ammonia, nitrate, and several common pesticides. Storm events of less than ¼ inch result in little or no runoff, and most events do not fill the treatment wetland.

## Summary

There are many advantages for using constructed wetlands for stormwater management. These systems provide significant pollutant removal using several mechanisms: sedimentation, adsorption, biodegradation, filtration, and bioaccumulation. These beneficial functions are balanced by the creation of habitat and additional landscaping.

The wetland vegetation is an important component in the treatment process that occur in constructed wetlands. There is a complex symbiotic relationship between the plants (root systems), micro-organisms, substrate, soil and nutrients in the wastewater. Wetland plants use a number of adaptive strategies to withstand varying hydrologic conditions. Restorer giant bulrush (*Scirpus californicus*) for example, can translocate more oxygen through the air spaces (aerenchyma) from the leaves to the roots than most wetland plants. Therefore, it has the ability to create a more desirable habitat for micro-organisms to live. More air, more micro-organisms and better treatment efficiency.

Maintenance of these systems is minimal (accumulated sediment removal) and applicability is widespread, contingent on land availability. While costs are not insignificant, stormwater treatment wetlands are only marginally more expensive to construct than wet ponds, but offer distinct advantages in function, habitat and aesthetics. And maybe best of all, they are simple.

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