

Abstract

Eutrophication of water bodies is a significant water quality issue. This research focuses on a subsurface wetland studied with field scale lysimeters that simulate a filtration system for removing excess nutrients in enriched waters. The lysimeter study, which provides environmental control and approximates real field conditions, also enables dosing the water input to the system with various levels of Nitrogen and Phosphorus to determine the capacity and performance of the engineered system. The lysimeters also allow for monitoring of many other factors that may be correlated to the nutrient uptake measurements, such as evapotranspiration, infiltration rates, and temperatures. Anticipated results include an optimal soil media and structure, total capacities and rates of nutrient removal, efficiencies over time, and the effects of vegetation. Expected applications for this filter include wastewater treatment and filtering urban runoff before it is released to streams, and mitigation for hypereutrophic waters.

Objectives

- Optimization of Substrate/Vegetation System for Nutrient Removal
- Operational Sustainability of Economical Nutrient Removal from Filter
- Footprint Optimization for Use in Urban Applications

Research Site



Eutrophic golf course pond at Opequon research site shown above with algal bloom and to the left with its watershed

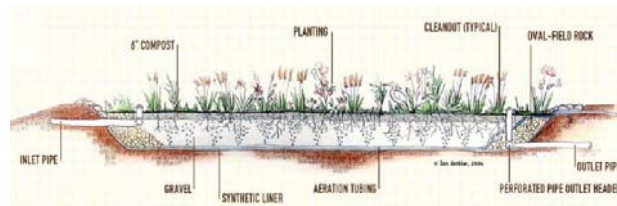
Methods

Soil chemistry, hydraulics, and hydrology are being used to engineer a substrate/vegetation system to optimize the sustainable treatment efficiency of an integrated subsurface wetland system. Previous research has shown that substrate adsorption and vegetation as well as total suspended solids (TSS) removal play an important role in nutrient uptake; this study seeks to incorporate those findings in a sustainable system (Lantzke et al. 1999). Important components of the study include the following:

- Optimizing sustainable removal of nitrogen and phosphorus
- Investigating space constraints for urban and suburban use
- Evaluation of the economic validity to the key users of this technology

The lysimeter study, which provides environmental control and approximates real field conditions enables dosing the water input to the system with various levels of nutrients along with other background conditions to determine the long term capacity and performance of the engineered system, a key deliverable of this project. Several components of the system that are important for sustainability include:

- Preventing sediment clogging and decreased flow rates
- Preventing nutrient saturation, particularly phosphorous as it doesn't have an atmospheric cycle
- Minimizing operational and maintenance costs



Current AWTS Layout (Image courtesy of Ecosolutions LLC)

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References:

Lantzke, I. R., Mitchell, D. S., Heritage, A. D., and Sharma, K. P. (1999). "A model of factors controlling orthophosphate removal in planted vertical flow wetlands." *Ecological Engineering*, 12(1), 93-105.

Research Plan

Though too early in the project to have preliminary results, efforts are currently in progress to secure funding, partnerships for research sites, and sufficient background study to start conducting experiments. The timeline for these first runs should be late spring of 2007, with a larger scale experiments following in the summer of 2007.



Research Schedule

Lab Scale Media Substrate Testing	April 2007
Coordination with Ecosolutions LLC on Opequon AWF	May 2007
Opequon AWF Study Site Construction Begun	June 2007
Trials begun at Opequon Site	August 2007
Design Complete for Prices Fork Lysimeter Study Site	January 2008
Construction Begun for Prices Fork Site	April 2008
Experiments Begun at Prices Fork Site	June 2008

Future Work

- Virginia Tech Prices Fork Farm Lysimeter Study Site
- Costa Rica Project Site