

Phosphorus Reduction with Passive Floating Treatment Wetlands

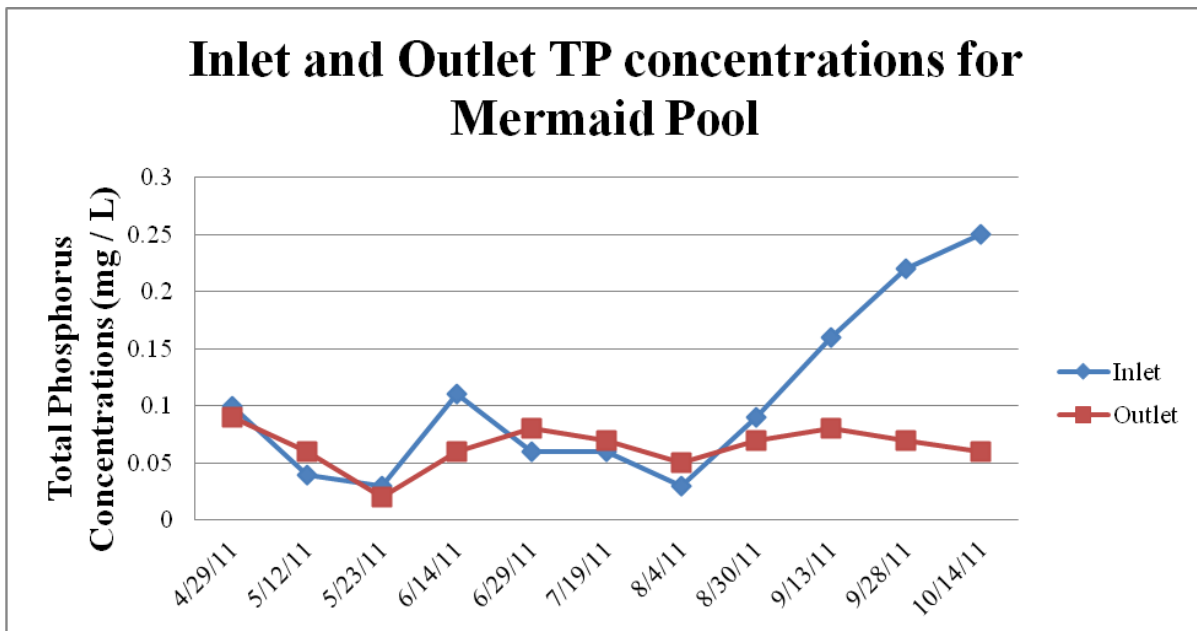
Project Location: Mermaid Pool, Somerset County, New Jersey, USA

This case study demonstrates the ability of patented BioHaven® floating treatment wetland (FTW) technology to clean water by substantially reducing total phosphorus (TP) levels. BioHavens installed in a New Jersey waterway removed an estimated 66 pounds of TP in one growing season, and were most effective when TP concentrations were greater than 0.1 mg/L.

Overview

Mermaid Pool is a one-acre waterway connecting water pumped from the Raritan River to an approximately 19-acre lake on an estate that is open to tours for the public. FTWs were installed in Mermaid Pool in 2010 and thrived. A monitoring program was conducted in 2011 to determine whether the FTWs had a measurable effect on total phosphorus (TP) levels.

The chart below shows that outlet TP concentrations were lower than inlet concentrations during seven of the 11 monitoring events. Outlet TP concentrations typically decreased when inlet TP concentrations were equal to or greater than 0.1 mg/L. These data support the theory that FTWs are most effective for phosphorus removal when TP concentrations are excessive (greater than or equal to 0.1 mg/L).



*Inlet and outlet total phosphorus concentrations at Mermaid Pool in 2011
(Courtesy of Princeton Hydro, LLC, Exton, PA)*

For the 11 monitoring events, the mean inlet and outlet TP concentrations for Mermaid Pool were 0.105 and 0.065 mg/L, respectively, for a 38 percent reduction over the 2011 growing season. During a similar monitoring program in 2003 (prior to FTW installation), the TP reduction through Mermaid Pool was 29 percent over the growing season. Therefore, BioHavens reduced the TP concentration by approximately 9 percent, beyond standard settling and assimilation activities within the pool. The net removal rate was 0.052 lb/yr of TP for each cubic foot of FTW.

The BioHavens in Mermaid Pool are passive islands without aeration, manufactured by Floating Island International. Embodiments of BioHavens that incorporate circulation and aeration have been shown in other studies to be even more effective for nutrient removal. A Mermaid Pool BioHaven is shown in Figures 1 and 2.

Installation Data

Location	Somerset County, New Jersey USA
Parameters Studied	Total phosphorus
Environment	Open waterway (pool between river and lake)
FTW Size	Total of 892 ft ² (83 m ²) of FTWs: 5 5-ft ² and 13 64-ft ² units. Thickness: 8 inches (20 cm)
Water Source	Raritan River
Installation Date	June 2010
Flow Rate	1 mgd (160 m ³ /hr)
Water Body Depth	6 ft (2 m)
Water Body Area	1 acre (4,050 m ²)
% Coverage	2.0% of pool covered by BioHavens

Over the 2011 growing season, BioHavens removed an estimated 66 pounds of total phosphorus from Mermaid Pool. This amount of phosphorus has the potential to generate up to 72,600 pounds of wet algae biomass.

Conclusions

BioHavens are a cost-effective alternative to other Best Management Practices that may not be feasible due to available space, funding or other factors. FTWs can remove phosphorus and other nutrients from water, and are apparently most effective when TP concentrations are greater than 0.1 mg/L. In addition to nutrient uptake, FTWs can create habitat for fish and other wildlife, as well as increasing both biodiversity and the general aesthetics of a lake ecosystem. BioHaven technology can enhance existing waterways with the “concentrated wetland effect,” facilitating compliance with increasingly stringent wastewater nutrient, biochemical oxygen demand (BOD) and total suspended solids (TSS) criteria.



Figure 1. BioHaven approximately two months after it was planted.



Figure 2. Close-up of the high amount of surface area within the BioHaven.