Natural Treatment Systems to Improve Nearshore Health and Reduce Nonpoint Source Pollution

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Introduction

Maumee Bay State Park (MBSP) Beach Health

Problem – Nonpoint Source Pollutants (NPSP) in Lake Erie

Phosphorus – Lake Erie algal blooms can produce toxins that impair beach health and water quality. Excess nutrients, e.g., phosphorus, are a driving force for algal proliferation.

Bacteria – Fecal bacteria at MBSP lead to beach advisories if levels exceed the Ohio EPA threshold - 235 CFU (colony forming units) / 100mL.

Sediment – Soil particles suspended in the water column carry bacteria and nutrients from land to Maumee Bay.

Wolfe Creek watershed, adjacent to MBSP, was identified as a proximal source of contamination to the beaches.

Solution – Natural Treatment Systems

A two-stage treatment system consisting of a wetland within MBSP and a section of Wolfe Creek were restored to intercept NPSP.

Sedimentation Pond (Stage 1) - Designed to slow water velocity, increase riparian zone and remove rolling bed sediment and other sand-sized particles.

Treatment Wetlands (Stage 2) – A 3-tier wetland that traps bacteria and phosphorus within soil-gravel substrate. Native plants uptake the trapped nutrients from the soil which prevents the nutrients from discharging into Lake Erie.

Design and Construction

Aerial Map of Site

Treatment Wetlands

- Improve water quality
- Restore habitat
- Serve as a field site for scientific research
- Learning tool for the public
- The wetland system provides a full-scale demonstration of a multi-staged treatment system. It is a Great Lakes Basin site.

Sedimentation Pond

- **Chokepoints**
- Pond Outlet – Sampling Point 1
- Pond Inlet – Sampling Point 2

Water Quality Improvements (7-18-14 through 9-22-14)

Ranges in Daily Reductions:

E. col: 99.7 % - 42.1 %
Total Suspended Solids: 96.9 % - 45.6 %
Total Phosphorus: 98.0 % - 53.1 %
Dissolved Reactive Phosphorus: 100 % - 17.7 %

Treatment Wetlands to be completed October 2014
1) Water traverses underground through a 3-tiered wetland
2) Bacteria, sediment and phosphorus are retained within the soil-gravel substrate and plants take up phosphorus

Sedimentation Pond was completed July 2014
1) Rolling bed sediment and sand-sized particles with attached bacteria and phosphorus accumulate at the bottom of the sedimentation pond

Observations and Implications for the Maumee Watershed

- **Sedimentation Pond** – For preliminary results after 2 months, estimations of the overall improvements in water quality on an annual basis = 10 tons (50%) of phosphorus prevented from entering Lake Erie and 75 % of E. col in Wolfe Creek prevented from entering beach waters
- If scaled to Maumee River watershed this could prevent 1,000 tons (~50 % reduction) of phosphorus from entering Lake Erie which exceeds the target value of 37 % (Phosphorus Task Force II – Final Report)
- For this to be effective in the Maumee River watershed we must implement sedimentation ponds in a variety of locations throughout the watershed
- Target locations or “hot spots” can be identified based on several attributes:
  - **Chokepoint** w/ high concentration of phosphorus and density of sediment
  - Nearby farm fields to receive collected sediment and phosphorus
  - Downstream water treatment facility – “pre-treatment” that reduces cost of infrastructure and maintenance
  - Low cost-benefit ratio
  - Goal: Utilize the above attributes to receive the “Biggest Bang for the Buck”

Possible Locations for Future Implementation

- **Chokepoint**

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Lake Erie

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