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

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Introduction

Maumee Bay State Park (MBSP) Beach Health

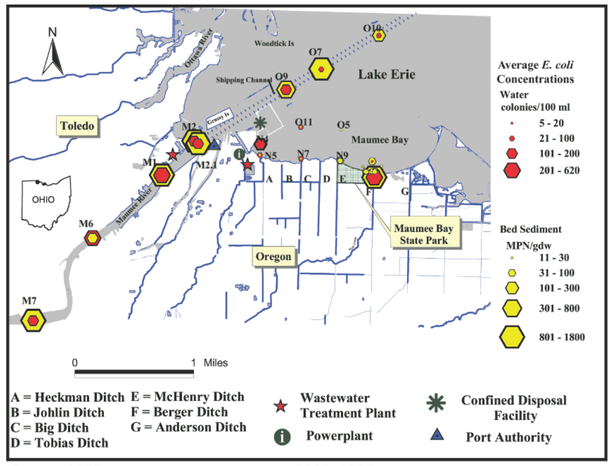
Problem – Nonpoint Source Pollutants (NPSP) in Lake Erie

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.



Francy, 2005 - http://pubs.usgs.gov/of/2005/1386/

Solution – Natural Treatment Systems

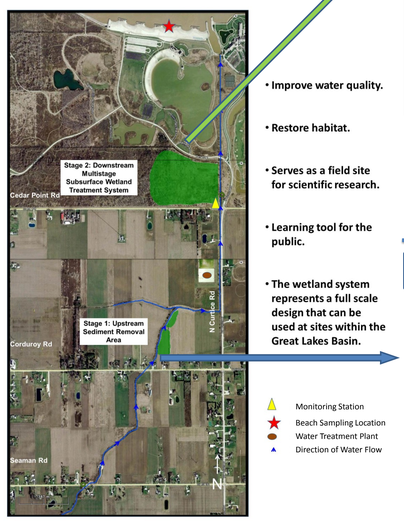
A two-stage treatment system consisting of a wetland within MBSP and a section of Wolfe Creek were restored to intercept NPSP.

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



- Improve water quality.
- Restore habitat.
- Serves as a field site for scientific research.
- Learning tool for the public.
- The wetland system represents a full scale design that can be used at sites within the Great Lakes Basin.

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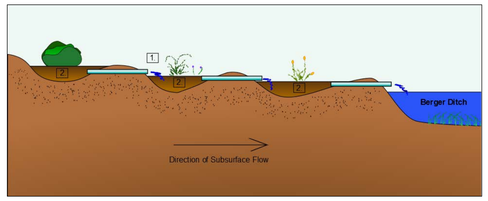
Treatment Wetlands

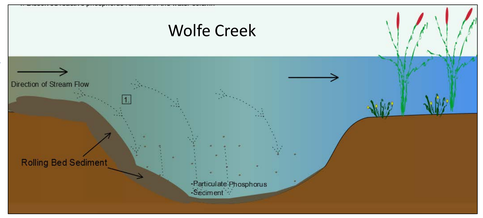


**Treatment Wetlands to be completed October 2014

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

Treatment wetlands act as a "polishing" step in the two-phase treatment system. They remove dissolved phosphorus, bacteria and fine-grained particles.

Sedimentation Pond



** 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

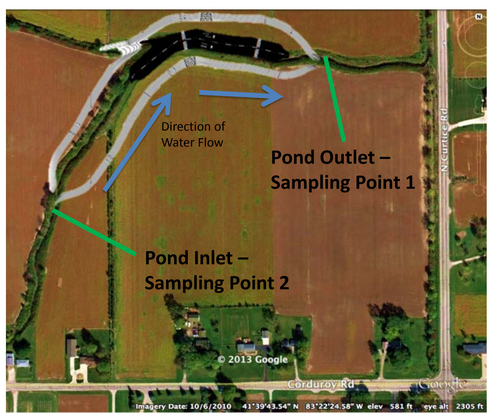
The sedimentation pond removes rolling bed sediment and sand-sized particles during low flow. The sedimentation pond has the capacity to remove 20 years of sediment from Wolfe Creek and has the option to be dredged to extend the lifespan.

Low Flow

High Flow after a Precipitation Event

Observations and Implications for the Maumee Watershed

Sedimentation Pond



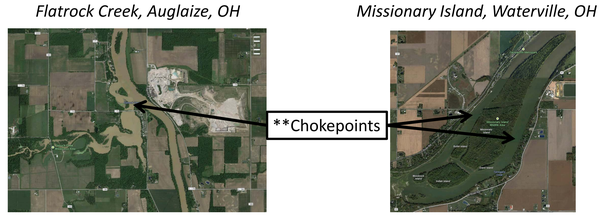
Water Quality Improvements (7-18-14 through 9-22-14)

Ranges in Daily Reductions:
E. coli: 99.7 % – 42.1 %
Total Suspended Solids: 96.9 % - 45.6 %
Total Phosphorus: 98.0 % - 53.1 %
Dissolved Reactive Phosphorus: 100 % - 17.7 %

- **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. coli* 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

Flatrock Creek, Auglaize, OH — *Missionary Island, Waterville, OH*



Acknowledgments

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