4 MINUTE READ

Great Lakes Wetland

from **Engineering With Nature: An Atlas, Volume 3.**

by **US Army Engineer Research and Development Center**

Defiance, Ohio, United States

Developing nutrient retention wetlands to improve water quality. Harmful algal blooms in Lake Erie and across the Great Lakes region have been linked to excessive phosphorus loading from numerous sources, including agricultural, urban, and suburban runoff. The Phosphorus Optimal Wetland Demonstration Project built a wetland system along a tributary of the Maumee River in Defiance, Ohio, to investigate techniques to maximize phosphorus uptake from a waterway draining large areas of row crops. Water is diverted from the waterway to the wetland when phosphorous concentrations are typically greatest and passed through a series of treatment cells. Measurements taken throughout the process show typical dissolved phosphorus reductions between 50% and 80%. Researchers also use benchtop laboratory models and a mesocosm of the wetland to test strategies to increase the system's nutrient-reduction efficiency and recommend improvements in the design and management of similar wetlands to optimize their capture and retention of phosphorous. The U.S. Army Corps of Engineers (USACE)–Buffalo District and the U.S. Army Engineer Research and Development Center (ERDC) are collaborating on

the project, with support from the City of Defiance, the U.S. Geological Survey, and LimnoTech, a private environmental and water resources engineering firm. Funding comes from the Great Lakes Restoration Initiative administered by the U.S. Environmental Protection Agency.

Article Cover: Aerial view one year after completion, showing the inundated channel and partially inundated floodplain features. (Photo by LimnoTech)

Producing Efficiencies

The wetland site was selected for its favorable characteristics (high concentration of nonpoint nutrient sources and location within a nutrientreduction priority watershed) and its soil's substantial phosphorus-storage capacity. The site was engineered to provide various elevations, including a simulated stream channel and floodplain features. A series of pumps facilitate experiments regarding hydropattern and hydroperiod, retention times, and associated implications for nutrient reduction. The wetland's operational features promote investigations of engineering approaches to optimize phosphorus removal in a way that can be scaled up to improve regional water quality and help address the challenges of harmful algal blooms.

Aerial view of the project site during construction with the four wetland treatment cells designed to optimize nutrient retention under a variety of scenarios.

(Photo by LimnoTech)

Using Natural Processes

The project restored a former forested wetland that had been ditched, drained, and planted with row crops. The reestablishment of the wetland hydrology and the reconnection of the wetland with its historical water source are significant. Phosphorous is removed through the natural processes of particulate nutrient sedimentation, sorption of dissolved nutrients to soil particles, and uptake of nutrients by the plants that thrive in the wetland. This project not only uses natural processes but also seeks to optimize those processes to maximize positive outcomes for the environment and provides a valuable template to develop additional nutrient-reduction wetlands.

Wild turkey (Meleagris gallopavo) and other wildlife frequently use the site, demonstrating the cobenefits associated with nutrient-reduction wetland establishment.

(Photo by LimnoTech)

Broadening Benefits

The Phosphorus Optimal Wetland Demonstration Project provided opportunities for public outreach and education. Multiple stakeholder and community engagement events have been conducted at the site, bringing together dozens of interested individuals from local municipalities; federal, state, and local agencies; nongovernmental organizations; and the public. Future activities will communicate to local school groups the environmental benefits of wetlands. Although the project is designed to reduce excess nutrients and improve water quality, many cobenefits have resulted, including a proliferation of wildlife and fish that frequently use the area (e.g., migratory birds and waterfowl, wild turkey, and deer).

A wide variety of wildflowers and other vegetation species proliferate throughout the year. Continuous water quality, hydrology, and meteorological monitoring data are collected at the site to inform operations and management.

(Photo by LimnoTech)

Promoting Collaboration

The project resulted from a collaborative partnership among multiple federal and state agencies, the municipality that owns the property, private sector partners, and the leadership of the binational Great Lakes Restoration Initiative. Ongoing research and monitoring activities are being led by multiple entities, including the private-sector practitioner LimnoTech (site operations and wetland internal nutrient cycling), the U.S. Geological Survey (nutrient mass balance and hydrology), USACE Buffalo District (project management), and ERDC (soils nutrient analysis and laboratory and mesocosm studies).

A soil scientist collects samples and completes a soil description in Cell 4. Measurements were used to monitor hydric soil conditions and nutrient retention through time.

(Photo by ERDC)

Project stakeholders attend a collaborative project-outreach event.

(Photo by USACE Buffalo District)

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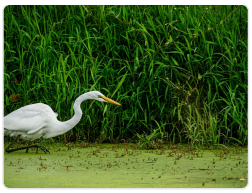

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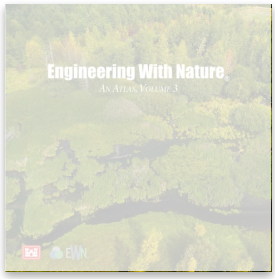

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