An Ohio retrofit project provides water quality, recreation, and improved habitat.

More Than a Detention Pond

By Warren C. High

How many times have you looked at a detention pond and thought about the potential that was wasted?

Detention ponds dot the country, and, for the most part, they are mowed and ignored. Built to hold water and discharge it over a period of time, these structures solve water-quantity problems in a reliable manner.

What if you looked at a detention pond and wondered what more could it become? In a world of diminishing water quality, wildlife habitat, and recreation, is there more that a detention pond can do? West Chester Township, OH, demonstrated that the answer is a resounding yes.

West Chester Township is a thriving community of more than 60,000 residents and 3,000 businesses located along the I-75 corridor between Dayton and Cincinnati, OH.

Township planners, engineers, and elected officials envisioned that this site would become a part of a greenway corridor that would include trails, passive recreation, and visual amenities associated with the corridor. County officials were in favor because of improved water quality and floodplain reconnection. State officials liked the project because it could become a demonstration project and for educational purposes.

Although the process of retrofitting a detention pond is similar to that for most projects, it is a little specialized and may require a larger design team with specialized skill sets. The steps include a baseline assessment, setting goals, fund-

Muskrat lodge at the retrofitted pond

ing, design, approval review and permitting, construction, and monitoring.

Baseline data collection includes a thorough understanding of the existing facility, including property boundaries, utilities, watershed size and characteristics, discharge and maintenance requirements, soils, groundwater elevations, proximity to wells, floodplain location and elevation, municipal design requirements, and a host of other factors that are site dependent and vary by region of the country.

This information is critical because it defines the constraints as well as the opportunities. An incomplete understanding in this area will affect all other project tasks, resulting in increased design and construction costs and project delay.

This task also includes working with property owners, businesses that drain into the basin, the municipality that regulates it, local utility companies, the surrounding community, and others, depending on circumstances. For this task, it is better to be inclusive and obtain input early in the process, rather than be surprised during the permitting process.

For the West Chester detention ponds, constraints included overhead electric transmission lines, sewers that bordered and bisected the site, high groundwater tables, floodplain, stringent county regulations, very little buffer from property boundaries, and private land ownership.

Opportunities included proximity to the adjacent Mill Creek, adequate separation between the basin floor elevation and groundwater levels, large size of approximately 14 acres, a willing property owner, and a willing municipality.

Funding enters into the equation of any project and affects all aspects of the project. Creativity is an important attribute when getting a project of this type funded. Retrofitting a detention basin is certainly not an ordinary endeavor—no one can make the owner do it—and there are not a lot of pots of money to draw from, certainly none that can typically fund the entire project.

Funding can vary widely. Some methods include increased parcel values on adjacent land, mitigation for other water-quality or habitat impacts, reduction in stormwater utility fees, mixed-use funds, private foundations, and state and federal grants.

The West Chester facility began with donation of the basins to the township by the developer.

The developer obtained a tax write-off, reduced annual property taxes, reduced annual maintenance costs, and removal of the ownership liability from the books. The township gained a maintenance requirement and lost some property tax money, but deemed that the benefits far outweighed the costs.

Design and construction was paid for with a Section 319 grant from the Ohio Environmental Protection Agency and was sponsored by the Ohio, Kentucky, and Indiana Council of Governments. The grant was for a little more than $300,000—not a lot for the facility size and the goals that needed to be met.

Design of a detention basin retrofit is a bit out of the ordinary and can include a hydrologist, civil engineer, botanist, geologist/soil scientist, landscape architect, and others based on site requirements and project complexity.

Viewpoints of these disciplines can be radically different, so consensus among a team typically yields the most successful design. There are few individuals with the skills necessary to understand the site, understand the goals, and work through all of the variables to meet with success.

The first design feature of the West Chester basin included recontouring the two basins to create more gentle and undulating slopes to create a more pleasing view and to increase edge effect. The basins were deepened and the bottom altered to create a series of pools, islands, and flat areas associated with the water table.

The desired design was to create habitat with submerged aquatic vegetation, emergent wetland, and swamp forest, with a large amount of edge effect and standing pools to act as a refuge for aquatic organisms in dry periods. Additional drain structures were added that allowed precise management of water levels, to alter habitat and to manage invasive plant species

Grasses, sedges, and rushes were selected based on being native; ability to withstand period inundation, salt, and pollution; wildlife value; and attractiveness.

For the West Chester bioretention ponds, the budget drove the design. The budget was divided between earthwork, water-control structures, vegetation, and design.

The bioretention ponds are functioning as expected. Post-construction water-quality monitoring has begun, and vegetative survival is also being monitored.

and nuisance animals such as beaver. Levees along Mill Creek were breached to increase the floodplain connection.

A goal of the design that warrants more detailed discussion is water quality. The West Chester basins were over-excavated, which allows for the capture and detention of a portion of the first flush. The first flush typically contains all of the spills, accumulated windborne particles, and trash that accumulate between storm events.

The first flush has been known to contain elevated levels of hydrocarbons, metals, salt, nutrients, sediment, and fecal bacteria, to name but a few pollutants. The bioretention pond acts as a natural wastewater treatment plant to sequester, convert, and remove some portion of these materials.

The first action is the physical act of settling. As the water is held for an extended time, particles settle to the bottom and leave the water column. Contaminants often attach to other particles, allowing them to settle, too.

In wastewater treatment plants, the work of removing contaminants is performed largely by a mixture of one-celled organisms, including algae, plankton, zooplankton, and fungi that uptake and convert many of these contaminants. There is a misconception that the improvement in water quality comes from the plants in the pond, when it fact it is these small organisms, typically associated with the root systems of these plants, that are the workhorses of the bioretention pond.

By providing a wide mix of vegetation types, a wide mix of water depths, and an adequate detention period, it is possible to achieve measureable water-quality improvement.

In some areas, soils may not hold water or evapotranspiration rates may dictate design modifications. Where soils are primarily clay, a substrate for plants to grow on may be necessary. A bioretention pond can be significantly enhanced using a substrate that includes gravel and organic matter to allow additional surface area for this biofilm. The one thing that you do not want to happen is for a monoculture of any one species to take over and dominate the system, which is why the variable bottom elevations and water-control structures are important.

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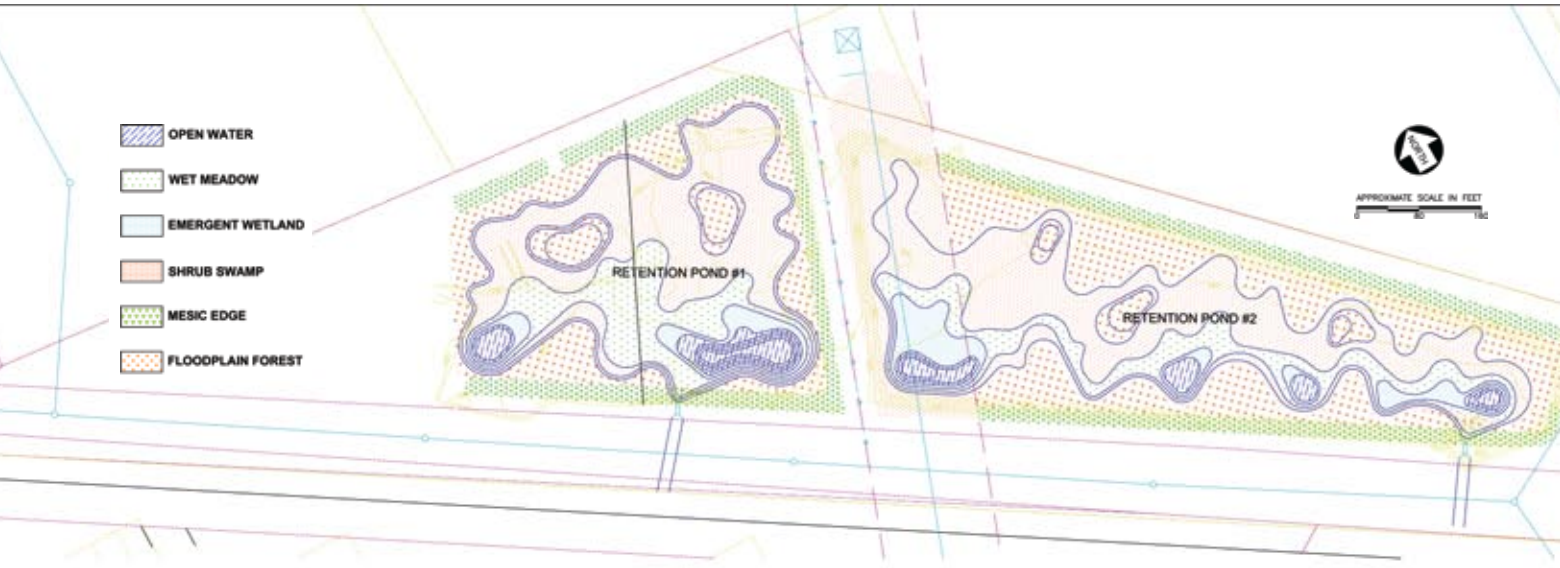
The budget for earthwork was fixed and the contours were developed to cre-



Planting plan for West Chester pond improvements, West Chester, Butler County, OH

ate a quantity that met the design goals and budget. The vegetation list was developed for each area, and the quantity and size of plants was again budget dependent.

Native grasses, sedges, and rushes were selected based on being native; ability to withstand period inundation, salt, and pollution; wildlife value; and attractiveness (showy flowers). A base seed mix with these plants was selected, and then a decision was made to use any leftover contingency funds for plugs. Trees and shrubs were also selected according to wetland habitat characteristics and then placed at the proper elevation in the basin.

Crayfish chimney

Once any design is complete, final approval needs to be obtained from project owners, funding sources, regulators, adjacent property owners, and others. These parties have ideally been involved from the beginning and have a good understanding of the design issues.

Approval needs to take into account floodplain permitting, any previous discharge requirements and any new ones, sediment and erosion control, utility protection, endangered species, cultural resources, groundwater protection, and other factors, both large and small. There are bound to be conflicting comments and requirements.

Experience has shown that the earlier in the process you start, the better things go in the end. This was the case with the West Chester bioretention basins, where the only surprise at the end was the need for some additional floodplain modeling.

For the West Chester project, the bids came in at or below estimate. This allowed for the addition of more plant materials, which were installed by volunteers, allowing the budget to go further. It also provided education for the community and created more diversity in the plant species.

To date, the bioretention ponds are functioning as expected. Post-construction water-quality monitoring has begun, and vegetative survival is also being monitored.

All of the parties to this project are pleased with the results. There have been training seminars on site, and other developers and communities are looking to use aspects of this project for their own.

Of equal importance is the approval by the wildlife community: hawks, heron, deer, fox, and other animals are seen using this resource. Over time, this facility will continue to improve in all aspects of form and function.

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