



## Chester County Stormwater BMP Tour Guide

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| <b>BMP:</b>       | <b>Constructed Treatment Wetland and Wet Ponds</b>   |
| <b>Site Name:</b> | Applebrook Golf Course Community<br><b>See Tour Guidelines below – Schedule Tour &amp; obtain directions in advance.</b> |
| <b>Location:</b>  | East Goshen Township, ADC Map Coordinates: 33-B2, B3, C3   |
| <b>Watershed:</b> | Ridley Creek (Stream Designation: EV)  |
| <b>Land Use:</b>  | Recreation, Residential, Small Office buildings  |

**Description:** BMPs at this site include a single constructed treatment wetland and two wet ponds.

A **constructed treatment wetland** is an artificial shallow basin with a permanent pool of water that promotes the growth of wetland vegetation. Plantings used in a treatment wetland are selected based on their ability to treat stormwater and enhance its quality. Treatment wetlands are designed to achieve water quality objectives. They must tolerate the range of soil moisture conditions and water levels, including periodic inundation following storm events. This treatment wetland was constructed in a low-lying area near natural wetlands in the Ridley Creek floodplain to take advantage of inflows of water between storm events and maintain soil moisture. Wetlands may be constructed in combination with stormwater detention facilities to help control peak flows into the wetland and stabilize flows through the wetland. Stabilizing flows into and out of wetlands is essential during seed germination and establishment when plants are most sensitive to surrounding conditions. Preventing the disruption of plant communities is critical to ensuring optimum pollutant-removal efficiencies.

A **wet pond** is a stormwater management structure that maintains a permanent pool of water and has additional capacity above the permanent pool for detaining stormwater runoff. There are two wet ponds at this site. The smaller wet pond has the preferable elongated shape and is accessible via East Boot Road. The larger wet pond, located in the middle of the site and visible from Paoli Pike, is comprised of two cells. When the first cell fills up, water spills over into the second cell. This pond receives treated wastewater from a township-owned wastewater treatment facility. Water is pumped from this pond and used in the site's fertigation system (See description of fertigation under *Other Site BMPs*, below.)

Wet ponds can include design features to enhance their performance filtering and controlling stormwater. For example, a wet pond can have a sediment forebay to trap coarse sediment; an energy dissipator at inlets to reduce the velocity of entering stormwater; and aquatic benches to provide a shallow-water environment for emergent wetland vegetation, protect shoreline from erosion, provide habitat, and enhance biological pollutant removal.

**Functions:** **Constructed treatment wetlands** perform multiple functions. Through physical, biological, and chemical processes, treatment wetlands can efficiently remove a wide variety of

# SITE 3

pollutants, including suspended solids, nutrients, (nitrogen and phosphorus), heavy metals, toxic organic pollutants, and petroleum compounds. Wetland plants, algae, and bacteria provide opportunities for the biological uptake of pollutants. Wetlands also provide physical and chemical pollutant filtering opportunities. These processes enhance the quality of stormwater runoff from the golf course and residential development. The wetland also plays a role controlling the quantity of stormwater. Wetlands reduce peak runoff rates and stabilize flow to adjacent natural wetlands and streams. Functioning wetlands provide stable habitat for plants and wildlife, including sensitive and native endangered species. **Wet ponds** remove pollutants from runoff by permitting suspended particles to settle to the pond bottom and through biological uptake by plants, algae, and bacteria.

Constructed as designed, these two BMPs can approximate the pollutant removal efficiencies below.

|                                      | <u>Constructed Treatment Wetland</u> | <u>Wet Pond</u> |
|--------------------------------------|--------------------------------------|-----------------|
| • Total Suspended Solids             | 76 %                                 | 80 %            |
| • Total Phosphorus                   | 49 %                                 | 55 %            |
| • Total Nitrogen                     | 30 %                                 | 35 %            |
| • Metals (including copper and zinc) | 42 %                                 |                 |
| • Bacteria (such as coliform)        | 78 %                                 |                 |

**Regulatory Note:** *Stormwater wetlands that are constructed entirely outside waters of the state and explicitly designed for stormwater management, are not subject to the provisions of Sections 401 and 404 of the Federal Clean Water Act. (PA Handbook.) At this site, because the constructed wetlands are located in the floodplain and are adjacent to existing naturally occurring wetlands, the constructed wetlands at this site would be subject to the Federal Clean Water Act regulations.*

**Operation and Maintenance:** The Chester County Conservation District considers constructed wetlands to be low to moderate maintenance stormwater BMP. Operation and maintenance requirements for constructed treatment wetlands include the following:

- Inspect and manually adjust water level as necessary (critical during plant establishment)
- Inspect and adjust outlet structures as necessary to compensate for sediment accumulation (outlet structures must be free of floating and submerged plant material to permit unobstructed visual inspection)
- Inspect dikes, embankments and hydraulic control structures regularly and after major storm events
- Inspect vegetation to ensure the wetland plants are growing and that invasive plants are controlled (invasive plants must be removed manually to prevent damaging wetland plants)
- Ensure structures (i.e. outlets, conveyances) are in good condition
- Under normal circumstances, sediment removal is rarely needed since its removal would disturb stable vegetation (prevent excessive sedimentation from occurring by controlling erosion in the drainage area)

**Cost Factors:** Site conditions can significantly influence cost of constructing wetlands. Factors affecting cost include land costs, sloping topography, soil permeability, and presence of bedrock at or near the surface, and the cost to purchase and plant wetland plantings. Importation of soil suitable for plant growth in an area with clayey or rocky soils may be necessary and would add to

the cost of construction as would the need for a liner in places where reduced percolation and water conservation is necessary.

## Other Site BMPs

**Grass Swales.** A grass swale is a constructed open-channel drainageway that directs surface runoff as an alternative to a concrete-lined swale or conventional storm sewers. Grass swales are well suited to either flat or rolling terrain. Grass swales provide an opportunity to filter pollutants present in runoff as water moves through the swale. Controlling upstream erosion prevents excessive sediment accumulation in channel; if excessive siltation occurs, sediment must be removed. Grass swales provide the ancillary benefit of reducing runoff peak rates and increasing opportunities for infiltration. To promote infiltration opportunities, underlying soils should remain uncompacted.

**Fertigation.** This site's fertigation system uses water from the large wet pond, which receives treated wastewater effluent from the Township's nearby sewage treatment plant. Water is pumped from the pond for use in golf course irrigation and fertilization. This fertigation system allows fertilizers to be introduced to the irrigation water in solution. According to site contacts, fertilizers applied in solution allow for almost 100 percent of the fertilizer to be used by the grass, in contrast, when dry fertilizer application is employed only about 20 percent of the fertilizer is used. This method of golf course fertilization requires less water and less fertilizer.

**Cold Water Discharge.** The stormwater pond is pumped from the bottom so that the coldest water is returned to Ridley Creek.

**Open Space.** The development includes approximately 70-acre parcel of wetlands donated by the developer to the Township as open space. There is a conservation easement on this land, which restricts the cutting/mowing of vegetation to permit wetland plants to grow to maturity. The eased land is located between Paoli Pike and the development and includes the constructed treatment wetland, the natural wetland, the stream, and its adjacent floodplains.

## For More Information

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|------------------------|--|
| Tour Guidelines:       | Tours must be pre-arranged by contacting the golf course superintendent, the site contact  |
| Owner:                 | Belber/Fuchs/Pohlig at Applebrook Associates   |
| Site Contact:          | Jared Viarengo, Site Superintendent, (610) 647-7666 Extension 10   |
| Designers/Contractors: | Chester Valley Engineers, (610) 644-4623 (Dan Meier)<br>Hanse Golf Course Design, (610) 651-2977 (Gill Hanse)<br>Designed in Cooperation with Willistown Conservancy<br>Del Val Soil and Environmental Consultants, Tom Cordrey 215-345-5545 |
| Township Contact:      | Mark Miller (610) 692-7171   |

## References

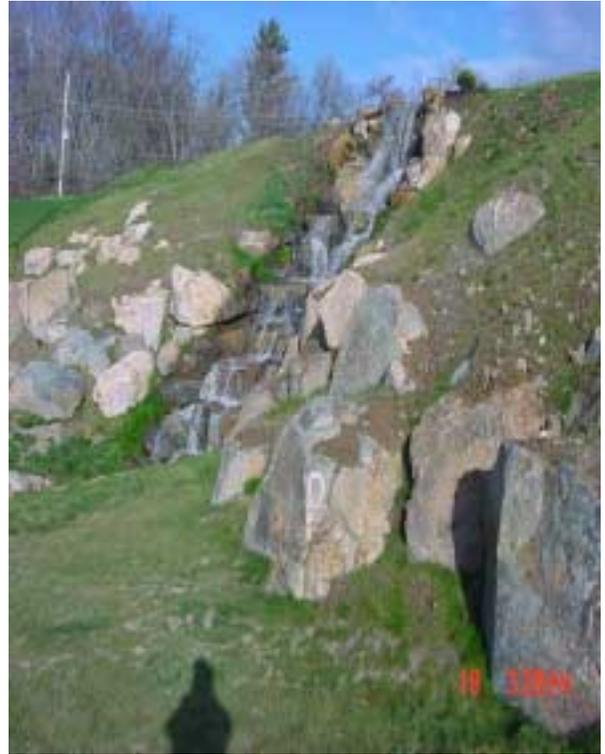
Center for Watershed Protection. *A Review of Stormwater Treatment Practices* (published presentation).

*Pennsylvania Handbook of Best Management Practices for Developing Areas*. Spring 1998. CH2MHILL.

**Site 3 - Applebrook Golf Course Community**



View of wetlands from Paoli Pike. On the tour, you will see the wetland from the other side of pictured fence.



Pond water is pumped up to waterfall and returns to pond through grass swales enhancing aeration.



View of large pond and wetlands from Paoli Pike. Note: both managed and naturalized areas of golf course.