Stormwater Ponds Overview

A constructed basin situated to receive local stormwater runoff and hold designated volumes of runoff for specified periods of time. The objectives are to improve water quality through settling and biological uptake, and prevent downstream channel degradation or flood damage through storage and outflow rate reduction.

Design Criteria (for new construction)

- Irregularly shaped with minimum length to width ratio of 1.5:1
- Permanent pool volume of 1800 cubic feet per acre draining to pond.
- Permanent pool depth 3' minimum, 10' maximum at deepest points
- Extended detention (ED) storage sufficient to treat V_{wq}
- Pre-treatment required (sediment forebay sized at 10% of pond area recommended)
- Stabilized emergency overflow and energy dissipation at all outlets
- Side slopes not to exceed 1V:3H

Benefits

- Able to effectively reduce many pollutant loads and control runoff flow rates
- Relatively straightforward design procedure
- Potential wildlife habitat and aesthetic or recreational enhancement
- May be used as temporary sedimentation basin during construction

Limitations

- Relatively large space requirement
- Tends to increase water temperature and may cause downstream thermal impact
- Potential for nuisance insects or odor
- Problematic for areas of low relief, high water table, or near-surface bedrock
- Possible safety concerns

Description

Stormwater ponds are constructed basins placed in the landscape to capture stormwater runoff. The pond is graded and outlet structures are designed in such a way that specified volumes of water (part or all of the $\mathbf{V_{wq}}$, **Vcp**, $\mathbf{V_{P10}}$, and $\mathbf{V_{P100}}$) are either held until displaced by future runoff or detained

Stillwater, MN

for a specified period of time. While the runoff is being held in the pond, sediment and associated pollutants settle to the bottom. Pollutants can also be removed from the stormwater through microbial, plant and algal biological uptake. Additional stormwater pond storage provided above the $\mathbf{V_{wq}}$ allocation is used to control flows of particular frequencies at pre-development or other specified levels to prevent downstream channel degradation and flood damage.

Storage in a stormwater pond can be either permanent pool or extended detention storage. As the name implies, water in the permanent pool is meant to remain in the basin, allowing settling and biological uptake to occur between storms and protecting against sediment resuspension. To maintain a permanent pool over a period of time, the pond must be designed with a sufficiently large drainage area. Extended detention storage refers to the volume above the permanent pool which is controlled by an outlet structure, sized so that runoff from larger storms can be captured and released over a period of time, allowing some settling to occur and keeping flow rates in check.

Ponding requirements for new impervious area treatment are mandated in the state Construction General Permit (CGP). It is possible to design a pond with no permanent pool (dry pond, ponded only for a maximum of several days following a storm event), but stormwater ponds used for water quality treatment should be

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MANAGEMENT SUITABILITY

Med	Water Quality (V_{wq})
High	Channel Protection (V_{cp})
High	Overbank Flood Protection (V_{p10})
High	Extreme Flood Protection (V_{p100})
Low	Recharge Volume (V_{re})

MECHANISMS

	Infiltration
	Screening/ Filtration
	Temperature Control
X	Settling
X	Evaporation
	Transpiration
	Soil Adsorption (limited)
X	Biological/ Micro. Uptake

POLLUTION REMOVAL

85%	Total Suspended Solids
50%/30%	Nutrients - Total Phosphorus/ Total Nitrogen
60%	Metals - Cadmium, Copper, Lead, and Zinc
70%	Pathogens - Coliform, Streptococci, E. Coli
80%	Toxins - Hydrocarbon

SITE FACTORS

25 AC Min*	Drainage Area *10 AC possible if hydrology capable of supporting water levels
25%	Max. Site Slope
0*	Min. Depth to Bedrock *2 ft in PSH areas
0*	Min. Depth to Seasonally High Water Table *pond bottom must be above bedrock
C,D Preferred	NRCS Soil Type *A and B soils require liners
Poor*	Freeze/ Thaw Suitability *unless adapted with additional storage for snowmelt
Yes	Potential Hotspot Runoff *requires impermeable liner

designed with a permanent pool. Dry ponds are highly susceptible to sediment resuspension and generally do not meet water quality performance criteria. However, dry ponds can be employed in some circumstances, such as for supplemental storage when the $\mathbf{V_{wq}}$ has already been treated with upstream BMPs.

Sediment and pollutant removal in stormwater ponds can be enhanced through the use of multiple cells in succession. In particular, a sediment forebay (pre-treatment basin) sized at 10% of the pond area should be considered upstream of the pond. This allows for settling of heavier materials in a designated area, enhancing the main pond performance and reducing the maintenance burden by concentrating the majority of sediments in one location.

It is also possible to design a pond with no extended detention storage (wet pond), in which the only outlet is the spillway and where 100% of the treated volume is within the permanent pool. When a storm occurs, the treated runoff in the pond is displaced by new (untreated) runoff. Wet ponds are able to fulfill water quality treatment requirements, but do not mitigate the channel degradation or flooding effects of increased flow from larger storms. Also, wet ponds are not generally recommended for cold climates because during frozen conditions, runoff can flow over the ice of the permanent pool, effectively negating the benefits of the intended treatment volume. Generally the most desirable pond configuration for Minnesota is a large enough permanent pool to meet water quality needs, and sufficient extended detention to ensure adequate treatment during frozen conditions.