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Stormwater BMPs for Basins

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Module 1: Introduction to Basin BMP Types and Selection Guidance

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the three primary categories of basin-type BMPs and their fundamental operational differences.
- **Evaluate** site-specific factors—including watershed, terrain, and physical feasibility—to select the most appropriate stormwater pond type.
- **Compare** the pollutant removal efficiencies of dry detention, wet retention, and infiltration basins to meet water quality objectives.

Executive Summary: Modern stormwater management has shifted from simple flood control to comprehensive environmental protection. Effective basin design now requires integrating water quality treatment, stream channel protection, and groundwater recharge alongside traditional peak flow attenuation.

Introduction to Basin BMPs

Basin or pond BMPs remain the cornerstone of stormwater management (SWM). While engineering knowledge regarding the construction of farm and recreational ponds is extensive, applying these structures for **environmental protection** requires a reassessment of traditional design techniques.

This course facilitates the application of these techniques across three primary basin types:

1. **Dry Basins:** Including detention and extended detention basins.
2. **Wet Ponds:** Including wet detention and retention ponds.
3. **Infiltration Basins:** Basins designed to facilitate subsurface recharge.

Detention and Extended Detention Basins


Initially designed to control runoff peaks (e.g., 10-yr to 100-yr storms), detention basins have evolved. **Extended detention** refers to basins designed to hold runoff beyond the requirements of simple flood control to provide water quality benefits.

Performance Drivers for Extended Detention

- **Surface area** of the basin.
- **Peak outflow rate.**
- **Size distribution** and **specific gravity** of particles.
- **Fraction of sediment** that is active clay.
- **Concentration** of associated pollutants.
- **Fraction of influent solids** that are colloidal or dissolved.



Figure 1-1: Typical Dry Basin

 **Design Tip:** While flood-control detention basins have poorly documented pollutant removal on their own, they become highly effective when used as part of a **treatment train** involving upstream practices like swales or filter strips.

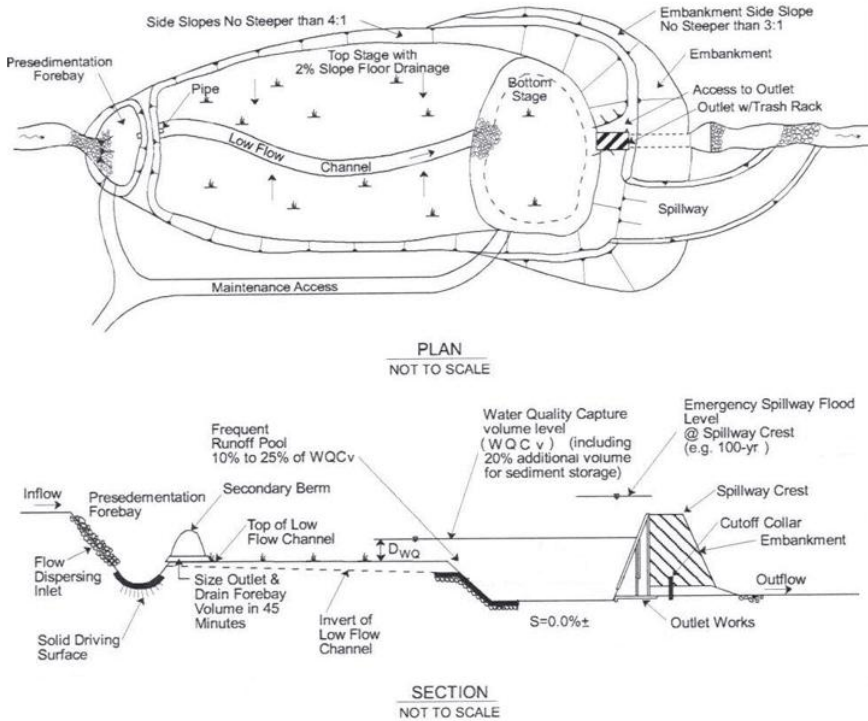


Figure 1-2: Extended Detention Basin, Typical Detail (modified from UDFCD, 1999)

Wet/Retention Ponds

Retention ponds maintain a **permanent pool** and often feature emergent wetland vegetation. Unlike dry basins, the permanent pool allows for treatment between storm events through physical, chemical, and biological processes.

- **Superior Nutrient Removal:** Effectively targets nitrogen and phosphorus.
- **Aesthetics:** Often viewed as a property amenity, as captured debris remains submerged and out of sight.

Infiltration Basins

Infiltration basins combine detention with simultaneous subsurface discharge. They provide a unique set of advantages:

- **Groundwater Recharge:** Meets specific groundwater recharge requirements (VR).
- **Thermal Mitigation:** Prevents the thermal impacts (stream warming) associated with open-water ponds.
- **Enhanced Settling:** Particle settling velocities increase by a value equal to the infiltration rate.

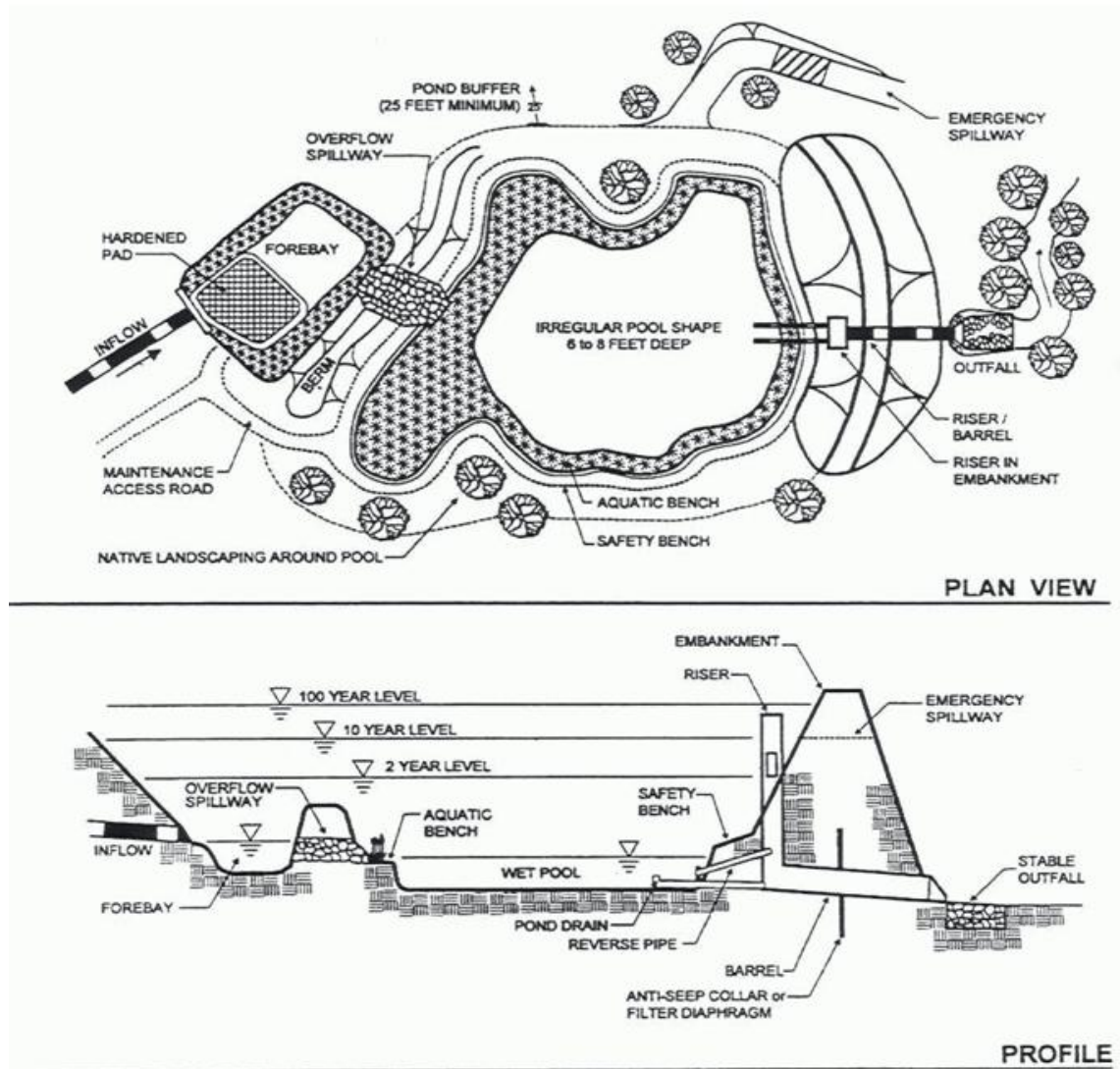


Figure 1-3: Wet Pond (modified from MDE, 2000)

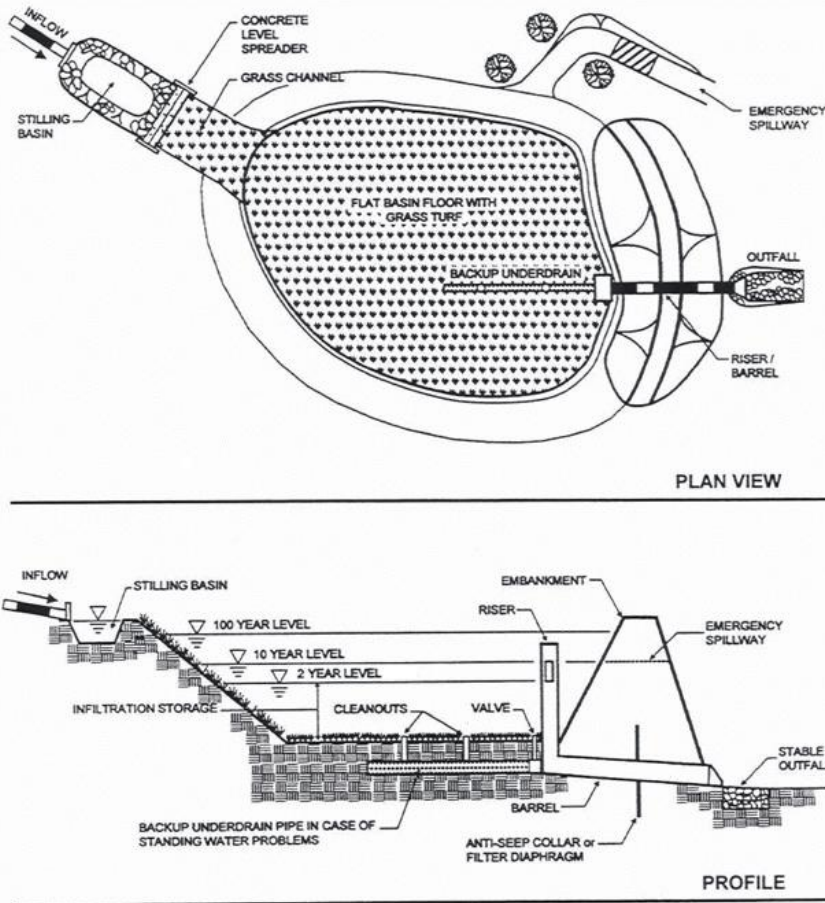


Figure 1-4: Infiltration Basin (MDE, 2000)

Selection Considerations for Pond BMPs

Selecting the correct BMP requires a matrix-based approach evaluating several key impact areas.

Table 1-1: Pond BMP Types vs. Ability to Control Impacts

Impact Area	Dry/Extended Detention Basins	Wet/Retention Pond	Infiltration Basin
Peak Discharge & Flooding	Yes (1)	Yes (1)	Yes (1)
Channel Erosion	Design Dependent (2)	Design Dependent (2)	Yes (3)
Groundwater Recharge	No	No	Yes
Thermal Impacts	No (4)	No (4)	Yes
Chemical Impacts	Yes (5)	Yes (6)	Yes (7)
Habitat & Biological	Design Dependent (2)	Design Dependent (2)	Yes (8)



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