

Community and Commercial Stormwater Ponds

Design and Function

Stormwater ponds provide areas for impervious surface runoff to prevent adverse downstream effects on watersheds and local tributaries. In natural areas, rainfall seeps into the soil, allowing for nutrients and pollutants to be filtered in a process called soil infiltration. The volume of water running off paved surfaces (i.e., roads, parking lots) and commercial/residential buildings is greatly increased in urban areas. Many impervious surfaces channel runoff water to the nearest drainage area, which prevents natural infiltration treatment processes from occurring and causes various compounds to accumulate in downstream ecosystems. These large pulses of water can also lead to potential flooding of surrounding areas whenever an adequate flow pathway is not present. To mitigate issues with water quality and flooding, stormwater regulations require new developments, construction projects and various urban areas to capture and manage runoff and prevent downstream impacts. The two main types of stormwater ponds are wet ponds and dry ponds.

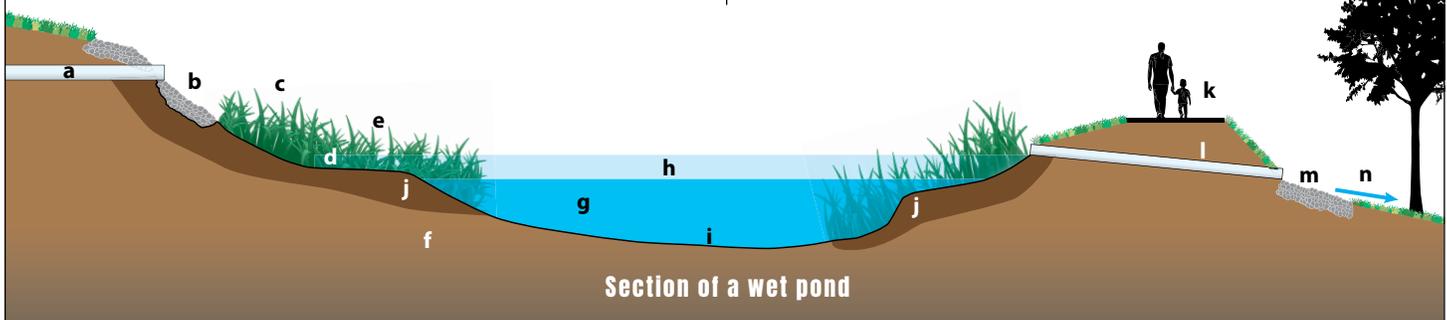
► Wet Ponds

Wet ponds, also known as retention or stormwater ponds, are designed to be permanent bodies of water. A permanent water level is maintained, while the pond is designed to accommodate water level fluctuations with freeboard. Both the permanent water level and freeboard normally inundate aquatic and semi-aquatic plants around the edge of the pond. These plants provide a natural filter for water quality parameters and can help maintain healthy ecosystems. The permanent water depth also allows for the settling of sediments and particulates from incoming water.

The wet pond design incorporates many elements to maintain water for permanent storage. Water starts from the inflow piping location (a), which diverts runoff water from impervious surfaces or construction areas. To reduce the velocity and energy transfer from water as it runs off, a rock bed (b) is placed where the inflow pipe discharges. This is a critical area for regular cleaning to ensure debris does not clog the water flow. The water then flows across the next stage, which is the shallow introduction into the pond, or forebay (c). This area will allow for initial settling and energy absorption before water is spread across the 10 to 15-foot aquatic bench (d). The aquatic bench stretches the inside perimeter of the pond and is home to many of the native wetland plants (e), including shoreline and emergent plants that help absorb nutrients. This area of the pond maintains shallow inundation and supports plants that thrive in saturated conditions. It also serves as a flood barrier in case the pond has unusually high water.

The freeboard (h) is the vertical distance maintained above the natural water level that prevents the topping or flooding

of water outside the designated pond. Permanent water (g) is maintained at an adequate depth of approximately four to six feet. Pond bottoms may be clay soil, or they may incorporate pond liners (i). In some cases, with high sedimentation or abundant algae, dredging may be needed from time to time to maintain proper water depth. Amended soil (j) is used to build the aquatic bench around the perimeter of the pond to ensure growth for plants and a natural ecosystem. In some community stormwater ponds, foot and biking paths (k) will surround the pond for enhanced recreational value and serve as a levee system to ensure water is permanently maintained. An outflow pipe (l) is staged above the freeboard to provide emergency flood control. In the case of major flooding, the water would pass through the outflow pipe and be run through a gravel bed (m) before entering a connected waterway or management area (n). In most cases, this is a local tributary or nearby canal. The outflow pipe is also an important area to maintain since plant and debris build-up can cause and reduce water flow in the case of a storm event.



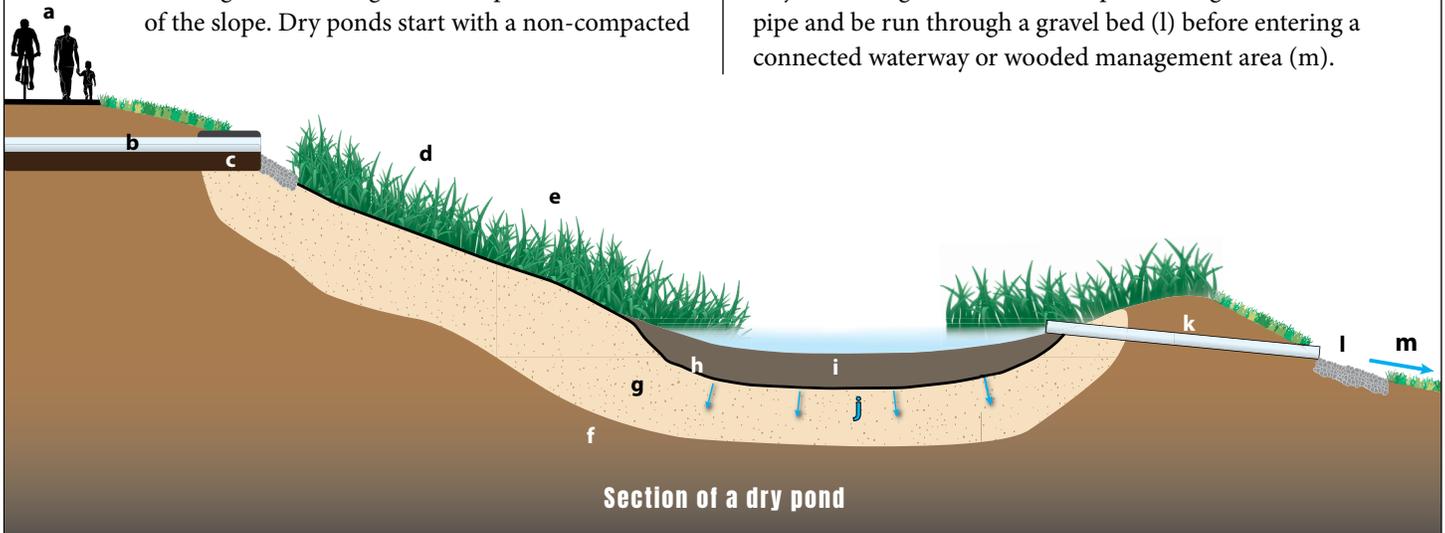
► Dry Ponds

Dry ponds, also known as detention ponds, are designed to drain completely after holding water for a minimum amount of time. Water is slowly released following flooding events. In this setting, water moves through vegetation and grasses along the pond bottom and edges to promote filtration of pollutants. The naturally shallow design allows for additional soil infiltration as water slowly moves into the receiving waterway (canal, ditch or stream).

The dry pond design has many components found in wet ponds but is causes water to spread across sediment and grass for infiltration. Dry ponds are typically built downhill from walking and biking paths (a). Water moves through an inflow piping location (b), which sits on a rock headwall for stability and erosion prevention (c). Water is then allowed to funnel down a steep sloped forebay (d) and across wetland plants and grasses (e) to start the plant uptake and soil infiltration processes. Topography across Louisiana varies, and this may require modifying the slope and grade of the embankment. For instance, the southern parishes may have a flatter landscape, meaning runoff will slowly release across the grasses compared to steep sloped ponds.

Light runoff events will spread a low volume of water across plants and soil for quick removal, while larger rain events will generate enough water to pool at the base of the slope. Dry ponds start with a non-compacted

base (f) with fill sand (g) built on top. A landscape fabric (h) separates the sand layer from the soil media (i), where the water settles during a large flow event. Due to the nature of the soil media and sand, water is quickly passed through the substrates by means of infiltration (j), while the shallow water allows for further evaporation to occur, minimizing the time that the water inundates the pond. In some cases, especially in the dry season, plants can grow where the water is designed to pool, which further increases the uptake of water and nutrients. To maintain an efficient system, regular maintenance is needed for the turf grass. In some cases, wetland plants can be utilized to reduce maintenance and remove nutrients. If left unmanaged, the grasses can overgrow and cause issues with sorption and the soil/sand base. An outflow pipe (k) is positioned to provide emergency flood control. In the case of major flooding, the water would pass through the outflow pipe and be run through a gravel bed (l) before entering a connected waterway or wooded management area (m).



Resources:

Storm Water Permit Resources | Louisiana Department of Environmental Quality (<https://deq.louisiana.gov/page/storm-water-protection>)
Stormwater Wet Pond and Wetland Management Guidebook, February 2009 (www.epa.gov/sites/default/files/2015-11/documents/pondmgmtguide.pdf)

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