

2.2.9 Dry Detention / Extended Detention Dry Basins



Description: A surface storage basin or facility designed to provide water quantity control through detention and/or extended detention of stormwater runoff.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- Location – extended detention dry basins may be part of larger treatment train
- Sized to temporarily store and provide flood control protection for the Q_f storm event (up to 100-yr event)
- Side-slope and earthen embankment must be considered
- Inlet and inflow channels are to be stabilized.
- Outlet structures are sized to discharge the SP_v and Q_f flows.

ADVANTAGES / BENEFITS:

- Typically less costly than stormwater (wet) ponds for equivalent flood storage, as less excavation is required.
- Used in conjunction with water quality structural control
- Recreational and other open space opportunities between storm runoff events.

DISADVANTAGES / LIMITATIONS:

- Controls for stormwater quantity primarily – extended detention may provide limited water quality treatment and streambank protection

MAINTENANCE REQUIREMENTS:

- Maintenance access must be provided

POLLUTANT REMOVAL

65% Total Suspended Solids

50/30% Nutrients – Total Phosphorous / Total Nitrogen Removal

No Data Metals – Cadmium, Copper, Lead, and Zinc Removal

70% Pathogens – Coliform, Streptococci, E. Coli Removal

STORMWATER MANAGEMENT SUITABILITY

- S** Water Quality Protection
- P** Streambank Protection
- P** On-Site Flood Control
- P** Downstream Flood Control

IMPLEMENTATION CONSIDERATIONS

- L** Land Requirement
- L** Capital Cost
- M** Maintenance Burden

Residential Subdivision Use: Yes
 Hi Density/Ultra-Urban: No
 Drainage Area: No restrictions
 Soils: Hydrologic group 'A' and 'B' soils may require pond liner
 Other Considerations:

- Recreational and open space uses for dry detention

L = Low M = Moderate H = High

2.2.9.1 General Description

Dry detention and dry extended detention (ED) basins are surface facilities intended to provide for the temporary storage of stormwater runoff to reduce downstream water quantity impacts. These facilities temporarily detain stormwater runoff, releasing the flow over a period of time. They are designed to completely drain following a storm event and are normally dry between rain events.

Dry detention basins are intended to provide on-site flood control (peak flow reduction) and can be designed to control the extreme flood (100-year) storm event. Extended detention dry basins provide downstream streambank protection through extended detention of the streambank protection volume (SP_v), flood control.

Both dry detention and extended detention dry basins provide limited pollutant removal benefits and are not intended for water quality treatment. Detention-only facilities must be used in a treatment train approach with other structural controls that provide full treatment of the WQ_v (see Section 2.1).

Compatible multi-objective use of dry detention facilities is strongly encouraged.

2.2.9.2 Design Criteria and Specifications

Location

- Dry detention and extended detention dry basins are to be located downstream of other structural stormwater controls providing treatment of the water quality volume (WQ_v). Extended detention dry basins may be part of a treatment train which treats the WQ_v. See Section 2.1 for more information on the use of multiple structural controls in a treatment train.

General Design

- Dry detention basins are sized to temporarily store the volume of runoff required to provide flood protection above the Q_f storm event up to the 100-year storm, if required.

Extended detention dry basins are sized to provide extended detention of the streambank protection volume over 24 hours and can also provide additional storage volume for normal detention (peak flow reduction) of the 100-year storm event.

Routing calculations must be used to demonstrate that the storage volume and outlet structure configuration are adequate. See Section 4.5 (*Storage Design*) for procedures on the design of detention storage.

- Storage may be subject to the requirements of the Texas Dam Safety Program (see Appendix H) based on the volume, dam height, and level of hazard.
- Earthen embankments less than 6 feet in height that are exposed to flood waters shall have side slopes no greater than the natural angle of repose of the fill material as determined by a geotechnical study. In lieu of a geotechnical study side slopes shall be 4:1 (horizontal to vertical) maximum.
- Earthen embankments 6 feet in height or greater shall be designed per Texas Commission on Environmental Quality guidelines for dam safety (see Appendix H).
- Vegetated slopes shall be less than 20 feet in height and shall have side slopes no steeper than 2:1 (horizontal to vertical) although 3:1 is preferred. Riprap-protected slopes shall be no steeper than 2:1. Geotechnical slope stability analysis is recommended for slopes greater than 10 feet in height.
- Areas above the normal high water elevations of the detention facility should be sloped toward the basin to allow drainage and to prevent standing water. Careful finish grading is required to avoid creation of upland surface depressions that may retain runoff. The bottom area of storage facilities should be graded toward the outlet to prevent standing water conditions. A low flow or pilot channel
- across the facility bottom from the inlet to the outlet (often constructed with riprap) is recommended to convey low flows and prevent standing water conditions.
- Adequate maintenance access must be provided for all dry detention and extended detention dry basins.

Inlet and Outlet Structures

- Inflow channels are to be stabilized with flared riprap aprons, or the equivalent. A sediment forebay sized to 0.1 inches per impervious acre of contributing drainage should be provided for dry detention

and extended detention dry basins that are in a treatment train with off-line water quality treatment structural controls.

- For a dry detention basin, the outlet structure is sized to its SPv and Qf functions (based upon hydrologic routing calculations) and can consist of a weir, orifice, outlet pipe, combination outlet, or other acceptable control structure. Small outlets that will be subject to clogging or are difficult to maintain are not acceptable.

For an extended detention dry basin, a low flow orifice capable of releasing WQv and SPv over 24 hours must be provided. The streambank protection orifice should have a minimum diameter of 3 inches and should be adequately protected from clogging by an acceptable external trash rack. The orifice diameter may be reduced to 1 inch if internal orifice protection is used (e.g., an overperforated vertical stand pipe with 0.5-inch orifices or slots that are protected by wirecloth and a stone filtering jacket). Adjustable gate valves can also be used to achieve this equivalent diameter.

See Section 4.6 (*Outlet Structures*) for more information on the design of outlet works.

- Seepage control or anti-seep collars should be provided for all outlet pipes.
- Riprap, plunge pools or pads, or other energy dissipators are to be placed at the end of the outlet to prevent scouring and erosion. If the basin discharges to a channel with dry weather flow, care should be taken to minimize tree clearing along the downstream channel, and to reestablish a forested riparian zone in the shortest possible distance. See Section 4.7, *Energy Dissipation Design*, for more guidance.
- An emergency spillway is to be included in the stormwater pond design to safely pass the extreme flood flow. The spillway prevents pond water levels from overtopping the embankment and causing structural damage. The emergency spillway must be designed to State of Texas guidelines for dam safety (see Appendix H) and must be located so that downstream structures will not be impacted by spillway discharges.
- A minimum of 1 foot of freeboard must be provided, measured from the top of the water surface elevation for the extreme flood, to the lowest point of the dam embankment not counting the emergency spillway.

2.2.9.3 Inspection and Maintenance Requirements

Table 2.2.9-1 Typical Maintenance Activities for Dry Detention / Extended Detention Dry Basins (Source: Denver Urban Storm Drainage Manual, 1999)	
Activity	Schedule
• Remove debris from basin surface to minimize outlet clogging and improve aesthetics.	Annually and following significant storm events
• Remove sediment buildup. • Repair and revegetate eroded areas. • Perform structural repairs to inlet and outlets.	As needed based on inspection
• Mow to limit unwanted vegetation.	Routine

2.2.9.4 Example Schematics

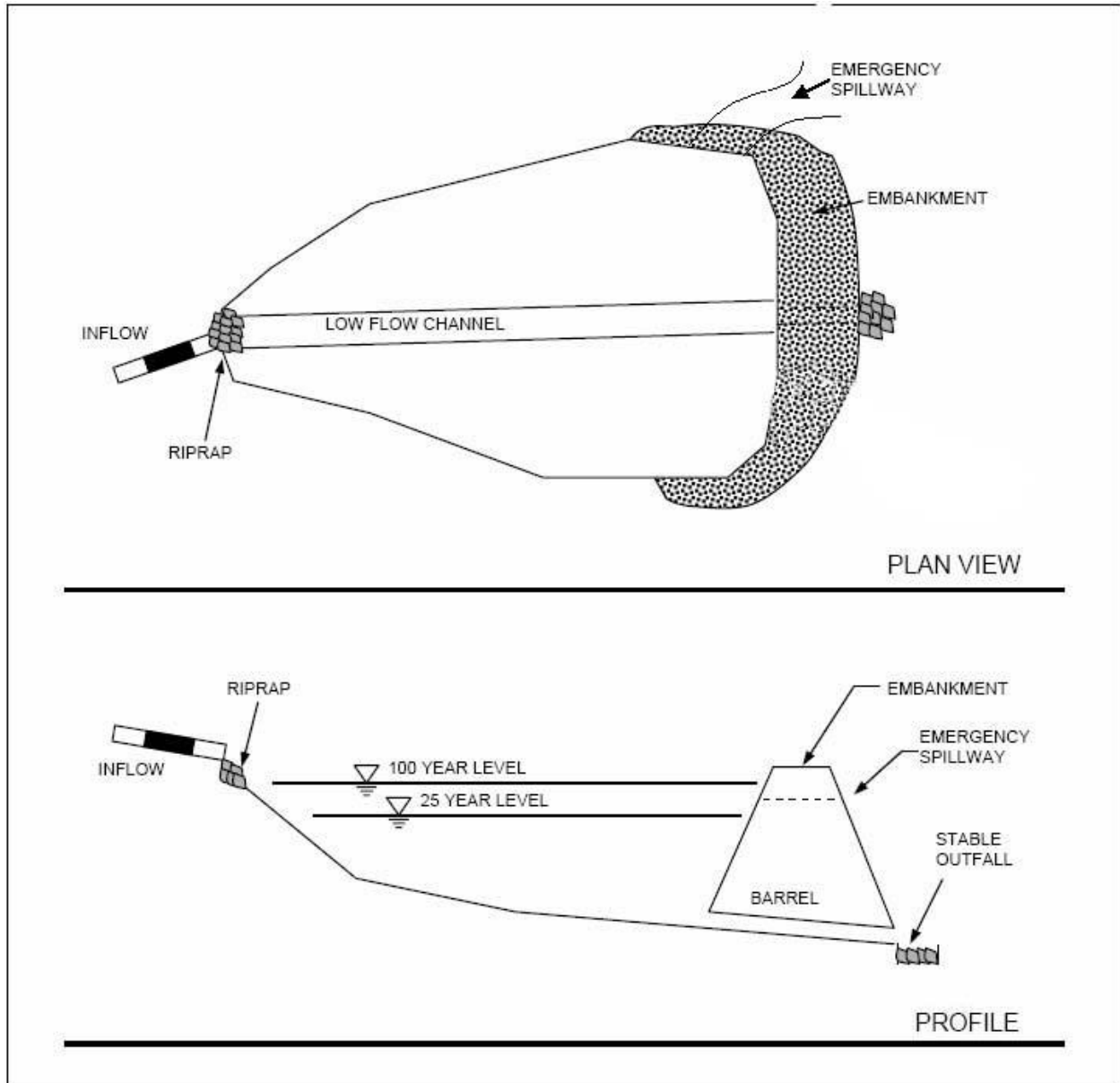


Figure 2.2.9-1 Schematic of Dry Detention Basin
SP_v

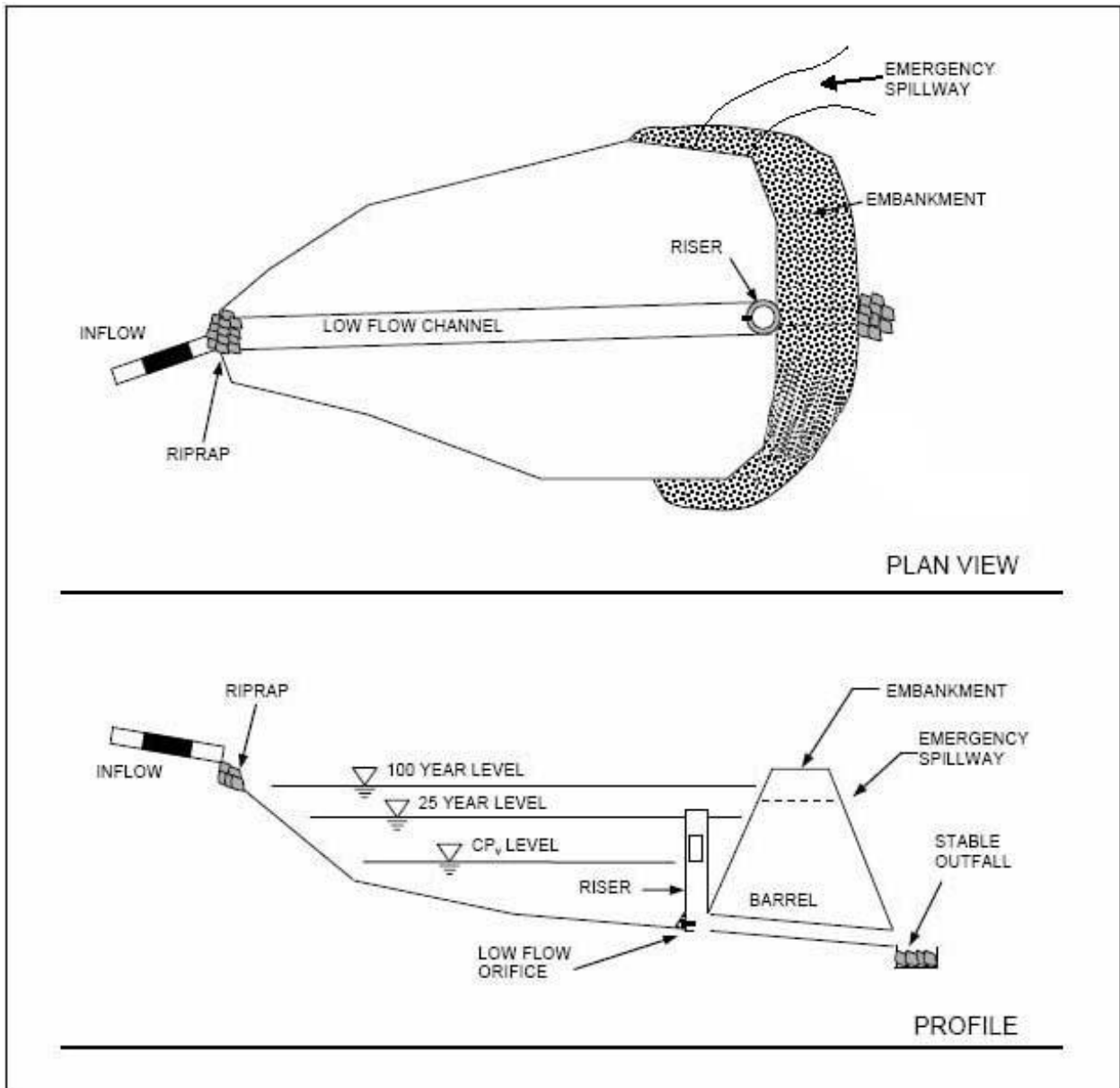


Figure 2.2.9-2 Schematic of Dry Extended Detention Basin

Dry and Extended Detention – end