



UNDERGROUND DETENTION FACILITIES

A. Design Considerations

1. Applicability

These specifications are appropriate for all underground pipe or vault detention, whether intended to detain channel protection flow attenuation volume, or temporarily store a portion of the water quality ESD treatment volume prior to releasing it to a quality BMP. Pipes or vaults may be located below vehicular or non-vehicular areas, and must be a minimum of 10-feet horizontally from other utilities.

2. Design Storm

The facility must be sized to provide storage for the required treatment volume, with safe conveyance of larger flows through the facility. The facility must be designed to safely pass a 10-year storm flow, at a minimum. Where the facility is located below a flow splitter, it must be sized to safely pass whatever portion of the 10-year event is delivered to it via the splitter.

3. Groundwater

In general, underground storage should not be located in areas of shallow groundwater. In situations where groundwater is encountered, additional design requirements may be necessary.

4. Geotechnical Analysis

Soil borings must be performed in the location of the proposed detention facility in order to determine presence and location of fill materials, rock, or groundwater. Borings must extend to a minimum of 2 feet below the facility.

B. Specifications and Details

1. Control Structure (for flow attenuation systems only)

The control structure shall be composed of cast in place concrete, and must be rectangular. The minimum inside dimensions of each internal cell must be 4-feet by 4-feet. Control structures for underground detention facilities may not be pre cast. Structures must be designed for H-20 loading at a minimum. Structural computations, signed and sealed by the designing structural engineer, must be submitted concurrent with detailed plan review. Direct access to both sides of the control structure is required.

2. Overflow Weir Sizing Criteria

The overflow weir in the control structure must be designed to safely pass larger flows through the facility.

3. Low Flow Control Orifice

The low flow orifice may be no smaller than 2-inches in diameter without specific approval from DPS, and must be protected by a trash rack. All trash racks must be removable. The trash rack dimensions overall must allow it to pass thru the access manhole opening. The open area of the trash rack must exceed the low flow orifice area by a ratio of at least 10 to 1. The trash rack must be made of expanded metal or perforated half round HDPE pipe. The perforations must be 1 inch in diameter and spaced 4 in on center. Trash racks must be attached to the walls of the concrete structure by use of stainless steel anchor bolts.



4. Storage Pipe

Except as noted below, all storage pipes must be circular, and must be a minimum of 48-inches in diameter. Metal, HDPE, or reinforced concrete may be used. Crossover connections must be provided between storage pipes, and these must be a minimum of 48-inches in diameter, also. Pipes may not be closer together than $\frac{1}{2}$ the inside pipe diameter, or 3-feet, whichever is greater. This dimension may be reduced when flowable fill is used as pipe bedding. Spacing for reinforced concrete pipes may be Outer Pipe Diameter / 6 or a minimum of 1-foot in order to get compaction. Minimum earth cover must be per the manufacturer's specifications, based on the design load and considering flotation where required. Ph and resistivity tests may be required on a case by case basis, wherever soil acidity is a concern.

a. Metal Pipe

Metal storage pipes must be circular, aluminized, Type 2, and must be designed for the appropriate loading (pipes may not be less than 14-gauge). Pipe ends must be re rolled, matched and numbered by the manufacturer. Connecting bands must be corrugated, and sleeve gaskets must be used. All connections must be per the latest DPS band detail. A 24-inch connecting band and 24-inch flat neoprene or rubber sleeve gasket, with four rods and lugs, must be used for all pipe connections.

b. Concrete Pipe

Gasketed concrete pipe must be used. Pipe shall meet ASTM C-76. ASTM C-361 is also acceptable. Gaskets must meet ASTM C-443. Pipe must be cast without lift holes. Pipe may be circular or elliptical. Elliptical pipes must have a minimum vertical inside dimension of 48-inches. All pipe joints must be soil tight when used for flow attenuation, and must be water tight when used to store the water quality volume.

c. HDPE Pipe

Circular High Density Polyethylene pipe is acceptable for use in underground storage facilities. Joints must be silt tight when used for flow attenuation, and must be water tight when used to store the water quality volume. Concrete manholes must be used at all HDPE pipe connections. Pipe installation must comply with ASTM D2321.

d. Concrete Vaults

Concrete vaults may be used for underground detention, with special design approved by the Department on a case by case basis. Proprietary structures must be specifically approved by DPS in advance of submission. Concrete design shall meet the requirements of ACI 350, Environmental Engineering Concrete Structures, with freezing and thawing exposures. Concrete shall be a Type II or IIA cement, with a 28 day compressive strength of 4500 psi for cast in place and 5000 psi for pre-cast structures. Type III cement is also acceptable so long as tricalcium aluminate is limited to 8%. Concrete shall also meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 420, Mix No. 6. All joints must be soil tight when used for flow attenuation, and must be water tight when used to store the water quality volume.

5. Pipe Bedding

Bedding must extend a minimum of 6-inches below the bottom of the pipe, and shall extend to the springline. Bedding stone shall be well graded granular material meeting AASHTO M-43. Flowable fill is also acceptable, with proper anchorage during installation. For flexible pipe (CMP, HDPE), flowable fill must extend to the top of the pipe.



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6. Access

All facility access manhole openings must be 28-inch diameter. There must be at least one manhole for every 100-feet of pipe. There must be a minimum of two manholes per pipe run. Where required, access ladders must be used, rather than manhole steps. Manhole covers must be bolted. Concrete manholes must be used for access to HDPE pipes. Manhole access is required at the terminal end of all pipe runs.

- a. At all access points to underground stormwater structures where more than nine inches of adjustment rings are required to match final grade, a concrete riser that is a minimum of forty eight inches in diameter must be used. Corrugated metal pipe (CMP) storage systems may have a CMP riser with a minimum of forty eight inches inside diameter.
- b. The top of underground stormwater management structures cannot be located more than four feet below proposed and/or final grade. If, in the as-built stage, it is revealed that the top of an underground structure is more than four feet below final grade, a plan revision will be required to provide safe and acceptable egress and ingress into the structure.
- c. All interior structure access openings must be a minimum of twenty-eight (28) inches in diameter or thirty-six inches square. Removal manhole covers, access doors, grates, etc. shall be magnetic and not weight more than 600 pounds. (Grates with openings at least two inches square need not be magnetic.) Access covers need not be magnetic and may weigh more than 600 pounds if they are hinged and counterbalanced so one person can easily open the cover; open and lock to a 90° angle; and, fitted with lift assistance mechanisms and safety bar(s) to secure cover(s) in an open position. All covers, hinges, lift assistance mechanisms and safety bars shall be manufactured as a single unit. Hinged covers shall have recessed hinges that do not protrude above the surface of the cover. The surface of all covers shall not be smooth. The surface of all covers shall be slip resistant. All castings in traffic bearing areas shall meet H-20 loading requirements. All castings shall meet AASHTO M105 and M306 specifications.
- d. The following will apply when a concrete riser is required for access. The manhole riser must be pre-cast concrete and may be square or round. It must be at least forty eight inches in diameter. If a round manhole riser is used it must be forty eight inches inside diameter for the entire height, it cannot be necked down to accommodate the manhole frame. A top slab must be used. The opening in the top of the underground structure must match the inside dimensions of the riser.
- e. Solid concrete adjustment rings may be used to raise the manhole a maximum of nine inches to match the final grade.
- f. Steps in the manhole risers and structures must comply with Standard Details No. MC-520.01 for spacing and No. MD-383.92 for the step material requirements.