4.3.3 Dry Extended Detention Ponds

General Application
Stormwater BMP

Description: A surface storage basin or facility designed to provide water quantity control through detention of stormwater runoff. A dry extended detention pond can be used for water quality treatment purposes as well as for flood control.

KEY CONSIDERATIONS

DESIGN GUIDELINES:

- A sediment forebay or equivalent upstream pretreatment must be provided.
- Minimum flow length to width ratio for the pond is 1.5:1. The pond shall be sized to detain the volume of runoff to be treated for a minimum of 24 hours.
- Side slopes to the pond shall not exceed 3:1 (h:v) on one side of the pond to facilitate access. Slopes as steep as 2:1 will be allowed for other areas, with proper stabilization.

ADVANTAGES / BENEFITS:

- Moderate removal rate of urban pollutants.
- High community acceptance.
- Useful for water quality treatment and flood control.

DISADVANTAGES / LIMITATIONS:

- Potential for thermal impacts/downstream warming.
- Dam height restrictions for high relief areas.
- Pond drainage can be problematic for low relief terrain.

MAINTENANCE REQUIREMENTS:

- Remove debris from inlet and outlet structures.
- Maintain side slopes and outlet structure.
- Remove invasive vegetation.
- Monitor sediment accumulation and remove periodically.

OTHER CONSIDERATIONS:

- Outlet clogging
- Safety bench
- Landscaping

STORMWATER MANAGEMENT SUITABILITY

- ☑ **Water Quality**
- ☑ **Channel/Flood Protection**
- ☑ **Overbank Flood Protection**
- ☑ **Extreme Flood Protection**

Accepts runoff from SPAP land uses: *Yes*

FEASIBILITY CONSIDERATIONS

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

Residential/Subdivision Use: *Yes*

High Density/Ultra-Urban: *No*

Drainage Area: *unlimited.*

POLLUTANT REMOVAL

- **M** **Total Suspended Solids**
- **L** **Nutrients**: Total Phosphorus / Total Nitrogen
- **L** **Metals**: Cadmium, Copper, Lead, and Zinc
- **No Data** **Pathogens**: Coliform, Streptococci, E.Coli

L=Low **M**=Moderate **H**=High

4.3.3.1 General Description

Dry extended detention (ED) ponds are surface facilities that provide for the temporary storage of stormwater runoff for some minimum time (e.g., 24 to 72 hours) to allow suspended sediments and other associated pollutants to settle to the pond bottom, and therefore, not discharge to downstream channels. Dry ED ponds provide moderate treatment of the water quality volume (WQv), are useful for control of the channel protection volume (CPv), and can provide overbank flood protection (Qp_2, Qp_{10}, and Qp_{25}) and extreme flood protection (Qp_{100}) as well.

4.3.3.2 Pollutant Removal Capabilities

Dry ED ponds are presumed capable of removing at least 60% of the total suspended solids load in typical urban post-development runoff when sized, designed, constructed and maintained in accordance with the specifications provided in this manual. The TSS removal performance can be reduced by poor design, construction or maintenance.

Additionally, research has shown that use of dry ED ponds will have moderate benefits beyond the removal of TSS, such as the removal of other pollutants (i.e. phosphorous, nitrogen, fecal coliform and heavy metals), as well, which is useful information should the pollutant removal criteria change in the future. The following design pollutant removal rates are conservative average pollutant reduction percentages for design purposes derived from sampling data, modeling and professional judgment. In a situation where a removal rate is not deemed sufficient, additional controls may be put in place at the given site in a series or "treatment train" approach.

- Total Suspended Solids – 60%
- Total Phosphorus – 35%
- Total Nitrogen – 25%
- Pathogens – Insufficient data to provide a pollutant removal value
- Heavy Metals – 25%

For additional information and data on dry ED ponds, see the National Pollutant Removal Performance Database (2nd Edition) available at www.stormwatercenter.net and the International Stormwater Best Management Practices Database at www.bmpdatabase.org.

Because dry ED ponds cannot alone provide adequate treatment of the water quality volume, they must be utilized in a treatment train approach with other structural controls to achieve the goal of 80% removal of total suspended solids (TSS). Volume 2, Chapter 2 provides more information on treatment trains.

4.3.3.3 Planning and Design Standards

The following criteria shall be considered **minimum** design standards for the design of a dry ED pond. Dry ED ponds that are not designed to these standards will not be approved. The Director of Engineering and Public Works (the Director) shall have the authority to require additional design conditions if deemed necessary.

A. LOCATION AND SITING

- It is strongly recommended that dry ED ponds be located where the topography allows for maximum runoff storage at minimum excavation or embankment construction costs. When locating a detention basin, the site designers should also consider the location and use of other land use features, such as planned open spaces and recreational areas, and should attempt to achieve a multi-use objective with the pond where this can be safely achieved.
- Detention ponds shall not be located on unstable slopes or slopes greater than 15%.
- Flood protection controls for control of the Qp_2, Qp_{10}, Qp_{25} and Qp_{100} peak discharges should be designed as final controls for on-site stormwater. Because most dry ED ponds will be used for flood protection and are not capable of achieving Knox County's required 80% TSS removal standard, they

will typically be located downstream of structural stormwater BMPs that are used in conjunction with the dry ED pond to provide 80% treatment of the WQv.

- Dry ED ponds shall not be located in a stream or any other navigable waters of the United States, including natural (i.e., not constructed) wetlands. Where an appeal or variance of this policy is desired, the property owner must obtain coverage under a Section 404 permit under the Clean Water Act and/or an Aquatic Resource Alteration Permit (ARAP) and provide proof of such coverage with the Stormwater Management Plan.
- Each dry ED pond shall be placed in a water quality easement. The water quality easement shall be defined at the outer edge of the safety bench, or a minimum of 15 feet from the normal water pool elevation (measured perpendicular from the pool elevation boundary) if a safety bench is not included in the pond design. The easement limit should be located no closer than as follows unless otherwise specified by the Director:
  - From a public water system well – TDEC specified distance per designated category
  - From a private well – 50 feet; if the well is downgradient from a land use that must obtain a Special Pollution Abatement Permit, then the minimum is 250 feet
  - From a septic system tank/leach field – 50 feet
- The minimum setback for habitable structures from the water quality easement shall be 15 feet. The first floor elevation (FFE) for any structure adjacent to the pond shall have an elevation no lower than 1 foot above the top of the berm.
- All utilities shall be located outside of the dry ED pond.

B. GENERAL DESIGN

- A dry ED pond shall consist of the following elements, designed in accordance with the specifications provided in this section:
  (1) An outlet structure;
  (2) An emergency spillway;
  (3) A sediment forebay;
  (4) Maintenance access;
  (5) Appropriate landscaping.

C. PHYSICAL SPECIFICATIONS / GEOMETRY

- Vegetated embankments shall be less than 20 feet in height. Side slopes shall not exceed 3:1 (horizontal to vertical) on one side of the pond to facilitate access for maintenance and repair. The remainder of the pond shall have side slopes no steeper than 2:1 although 3:1 is preferred. Benching of the slope is required for embankments greater than 10 feet in height and having greater than a 3:1 side slope. Riprap-protected embankments shall be no steeper than 2:1. Geotechnical slope stability analysis is recommended for embankments greater than 10 feet in height and is mandatory for embankment slopes steeper than those given above. All embankments must be designed to State of Tennessee guidelines for dam safety.
- The maximum depth of the basin shall not exceed 10 feet.
- Areas above the normal high water elevations of the detention pond shall 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 pond bottom shall be graded toward the outlet to prevent standing water. 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.

Inlet and Outlet Structures

- Inflow channels shall be stabilized with flared riprap aprons, or the equivalent.

- The outlet structure shall be sized for Qp_2, Qp_{10}, Qp_{25} and Qp_{100} control (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 shall not be permitted. Routing calculations must be used to demonstrate that the storage volume is adequate. See Volume 2, Chapter 7 for more information on the design of outlet works.
- Seepage control or anti-seep collars shall be provided for all outlet pipes.
- Water shall not be discharged from a dry ED pond in an erosive manner. Riprap, plunge pads or pools, or other energy dissipators shall be placed at the outlet of the barrel to prevent scouring and erosion. If a pond outlet discharges immediately to a channel that carries dry weather flow, care should be taken to minimize disturbance along the downstream channel and streambanks, and to reestablish a forested riparian zone in the shortest possible distance (if the downstream area is located in a water quality buffer).
- The outlet barrel shall be of reinforced concrete.

D. PRETREATMENT / INLETS

- A sediment forebay shall be provided for dry ED ponds that are located in a treatment train with other water quality treatment structural controls. The sediment forebay is utilized to remove incoming sediment from the stormwater flow prior to dispersal into the larger pond area. The forebay shall consist of a separate cell, formed by an acceptable barrier. A forebay must be provided at each inlet to the dry ED pond, unless the inlet provides less than 10% of the total design storm inflow to the pond.
- The sediment forebay shall be sized to contain 0.1 inch per impervious acre (363 ft^3) of contributing drainage and shall be no more than 4 to 6 feet deep.
- A fixed vertical sediment depth marker shall be installed in the forebay to measure sediment deposition over time. The bottom of the forebay may be hardened (e.g., using concrete, paver blocks, etc.) to make sediment removal easier.
- Inflow channels to the forebay shall be stabilized with flared riprap aprons, or the equivalent. Exit velocities of discharges from the forebay to the pond must be non-erosive.

E. OUTLET STRUCTURES

- Flow control from a dry ED pond that is used for control of the WQv, CPv and Qp_2, Qp_{10}, Qp_{25} and Qp_{100} is typically accomplished with the use of a riser and barrel. The riser is a vertical pipe or inlet structure that is located at the base of the pond. The outlet barrel is a horizontal pipe attached to the riser that conveys flow under the embankment. The riser shall be located within the pond embankment for maintenance access, safety and aesthetics.
- A number of outlets at varying depths in the riser provide internal flow control for routing of the WQv, CPv, Qp_2, Qp_{10}, Qp_{25} and the Qp_{100}. The number of orifices can vary and is usually a function of the pond design. A dry ED pond riser configuration is typically comprised of an outlet that provides water quality (WQv) and channel protection (CPv) outlet (usually an orifice), an overbank flood protection (Qp_2, Qp_{10}, Qp_{25}) outlet (often a slot or weir), and the extreme flood protection (Qp_{100}) outlet. The channel protection orifice is sized to release the channel protection storage volume for a minimum 24-hour period.
- Extended detention ponds can have a bottom drain pipe with an adjustable slide gate that can completely or partially drain the pond within 24 hours.
- Ponds shall not be drained until at least 24 hours after the completion of a rain event, so that water quality and channel protection objectives can be met.
- Higher flows (Qp_2, Qp_{10}, Qp_{25}, Qp_{100}) pass through openings or slots protected by trash racks further up on the riser.
- After entering the riser, flow is conveyed through the barrel and is discharged downstream. Anti-seep collars shall be installed on the outlet barrel to reduce the potential for pipe or embankment failure.

- Water shall not be discharged from a detention pond in an erosive manner. Riprap, plunge pads or pools, or other energy dissipators shall be placed at the outlet of the barrel to prevent scouring and erosion. If a pond outlet discharges immediately to a channel that carries dry weather flow, care should be taken to minimize disturbance along the downstream channel and streambanks, and to reestablish a forested riparian zone in the shortest possible distance (if the downstream area is located in a water quality buffer).

F. EMERGENCY SPILLWAY

- An emergency spillway shall be included in the stormwater pond design to safely pass Qp_{100}. The spillway prevents pond water levels from overtopping the embankment and causing structural damage. The emergency spillway shall be located so that downstream structures will not be impacted by spillway discharges.
- The emergency spillway shall be located a minimum 0.1 foot above the 100-year water surface elevation.
- A minimum of 1 foot of freeboard shall 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.

G. MAINTENANCE ACCESS

- A maintenance right-of-way or easement having a minimum width of 20 feet shall be provided to the pond from a driveway, public or private road. The maintenance access easement shall have a maximum slope of no more than 15% and shall have a minimum unobstructed drive path having a width of 12 feet, appropriately stabilized to withstand maintenance equipment and vehicles.
- The maintenance access shall extend to the forebay (if included) and outlet structure, and, to the extent feasible, be designed to allow vehicles to turn around.

H. SAFETY FEATURES

- A safety bench shall be provided for embankments greater than 10 feet in height and having greater than a 3:1 side slope. For large ponds, the safety bench shall extend no less than 15 feet outward from the normal water edge to the toe of the pond side slope. The slope of the safety bench shall not exceed 6%.
- All embankments and spillways shall be designed to TDEC rules and regulations as applied to the Safe Dams Act of 1973, where applicable.
- The property owner may consider fencing the pond for the purpose of safety management.
- All outlet structures shall be designed so as not to permit access by children. Knox County encourages the posting of warning signs near the pond to prohibit swimming and fishing in the facility.

I. LANDSCAPING

- All areas of the pond shall be stabilized with appropriate vegetation to prevent the occurrence of erosion.
- Woody vegetation shall not be planted on the embankment or allowed to grow within 15 feet of the toe of the embankment and 25 feet from the principal spillway structure.
- Water quality buffers, as defined and described in Volume 2, Chapter 6 of this manual, are not required for dry ED ponds. However, it should be noted that vegetated buffers can be utilized for water quality treatment and can result in a volume credit that reduces the WQv. The criteria for the vegetated buffer credit are presented in Volume 2, Chapter 5 of this manual.

4.3.3.4 Design Procedures

In general, site designers should perform the following design procedures when designing a dry ED pond.

Step 1. Compute runoff control volumes

Calculate WQv, CPv, Qp_2, Qp_{10}, Qp_{25}, and Qp_{100}, in accordance with the guidance presented in Volume 2.

Step 2. Confirm design criteria and applicability

Consider any special site-specific design conditions/criteria from subsection 4.3.3.3. Check with Knox County Engineering, TDEC or other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply to the site.

Step 3. Determine pretreatment volume

A sediment forebay is provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond. The forebay should be sized to contain 0.1 inch per impervious acre (363 ft^3) of contributing drainage and should be 4 to 6 feet deep.

Step 4. Determine pond location and preliminary geometry

This step involves initially designing the grading of the pond (establishing contours) and determining the elevation-storage relationship for the pond. Include safety bench, if required or used. See subsection 4.3.3.3 for more details.

Step 5. Compute extended detention orifice release rate(s) and size(s), and establish CPv elevation

The water quality orifice is sized to release the calculated WQv over a minimum of 24 hours. Orifice diameters less than three inches must employ internal orifice protection (i.e., an over-perforated vertical stand pipe with ½-inch orifices or slots that are protected by wirecloth and a stone filtering jacket). The CPv elevation is then determined from the stage-storage relationship. The invert of the channel protection orifice is located at the water quality extended detention elevation, and the orifice is sized to detain the channel protection storage volume for a 24-hour period, measured from centroid to centroid.

Step 6. Calculate Qp_2, Qp_{10}, Qp_{25} and Qp_{100} release rates and water surface elevations

Set up a stage-storage-discharge relationship for the control structure for the extended detention, the 2, 10, 25 and 100-year storm orifices.

Step 7. Design embankment(s) and spillway(s)

Size emergency spillway, calculate the 100-year water surface elevation, set the top of the embankment elevation, and analyze safe passage of the Qp_{100}. Set the invert elevation of the emergency spillway 0.1 foot above the 100-year water surface elevation.

Step 8. Investigate potential pond hazard classification

The design and construction of stormwater management ponds are required to follow the latest version of the "TDEC Rules and Regulations Applied to the Safe Dams Act of 1973" (Chapter 1200-5-7).

Step 9. Design inlets, sediment forebay(s), outlet structures, maintenance access, and safety features

See subsection 4.3.3.3 for more details.

Step 10. Design vegetation

A vegetation scheme for the dry ED pond shall be prepared to indicate how the pond bottom, side slopes and embankment will be stabilized and established with vegetation.

4.3.3.5 Maintenance Requirements and Inspection Checklist

Note: Section 4.3.3.5 must be included in the Operations and Maintenance Plan that is recorded with the deed.

Regular inspection and maintenance is critical to the effective operation of the dry extended detention (ED) pond as designed. It is the responsibility of the property owner to maintain all stormwater BMPs in accordance with the minimum design standards and other guidance provided in this manual. The Director has the authority to impose additional maintenance requirements where deemed necessary.

This page provides guidance on maintenance activities that are typically required for dry ED ponds, along with a suggested frequency for each activity. Individual ponds may have more, or less, frequent maintenance needs, depending upon a variety of factors including the occurrence of large storm events, overly wet or dry (i.e.., drought) regional hydrologic conditions, and any changes or redevelopment in the upstream land use. Each property owner shall perform the activities identified below at the frequency needed to maintain the pond in proper operating condition at all times.

Inspection Activities	**Suggested Schedule**
• After several storm events or an extreme storm event, inspect for: bank stability; signs of erosion; and damage to, or clogging of, the outlet structures and pilot channels.	As needed
• Inspect for: trash and debris; clogging of the outlet structures and any pilot channels; excessive erosion; sediment accumulation in the basin, forbay and inlet/outlet structures; tree growth on dam or embankment; the presence of burrowing animals; standing water where there should be none; vigor and density of the grass turf on the basin side slopes and floor; differential settlement; cracking; leakage; and slope stability.	Semi-annually
• Inspect that the outlet structures, pipes, and downstream and pilot channels are free of debris and are operational. • Note signs of pollution, such as oil sheens, discolored water, or unpleasant odors. • Check for sediment accumulation in the facility. • Check for proper operation of control gates, valves or other mechanical devices.	Annually
Maintenance Activities	**Suggested Schedule**
• Clean and remove debris from inlet and outlet structures. • Mow side slopes (embankment) and maintenance access. Periodic mowing is only required along maintenance rights-of-way and the embankment.	Monthly or as needed
• Repair and revegetate eroded areas. • Remove vegetation that may hinder the operation of the pond. • Repair damage to pond, outlet structures, embankments, control gates, valves, or other mechanical devices; repair undercut or eroded areas.	As Needed
• Monitor sediment accumulations, and remove sediment when the pond volume has become reduced significantly.	As Needed (typically every 15 to 50 years)

Knox County encourages the use of the inspection checklist that is presented on the next page to guide the property owner in the inspection and maintenance of dry extended detention ponds. The Director can require the use of this checklist or other form(s) of maintenance documentation when and where deemed necessary in order to ensure the long-term proper operation of the dry detention pond. Questions regarding stormwater facility inspection and maintenance should be referred to the Knox County Department of Engineering and Public Works, Stormwater Management Division.

INSPECTION CHECKLIST AND MAINTENANCE GUIDANCE (continued)
DRY EXTENDED DETENTION POND INSPECTION CHECKLIST

Location: _____ Owner Change since last inspection? Y N

Owner Name, Address, Phone: _____

Date: _____ Time: _____ Site conditions:_____

Inspection Items	Satisfactory (S) or Unsatisfactory (U)	Comments/Corrective Action
Embankment and Emergency Spillway		
Vegetation coverage adequate?		
Erosion on embankment?		
Animal burrows in embankment?		
Cracking, sliding, bulging of dam?		
Blocked or malfunctioning drains?		
Leaks or seeps on embankment?		
Obstructions of spillway(s)?		
Erosion in/around emergency spillway?		
Other (describe)?		
Inlet/Outlet Structures and Channels		
Clear of debris and functional?		
Trash rack clear of debris and functional?		
Sediment accumulation?		
Condition of concrete/masonry?		
Pipes in good condition?		
Slide gate operational?		
Pond drain valve operational?		
Outfall channels function, not eroding?		
Other (describe)?		
Pond Bottom		
Vegetation adequate?		
Undesirable vegetation growth?		
Excessive sedimentation?		
Hazards		
Have there been complaints from residents?		
Public hazards noted?		

If any of the above inspection items are **UNSATISFACTORY**, list corrective actions and the corresponding completion dates below:

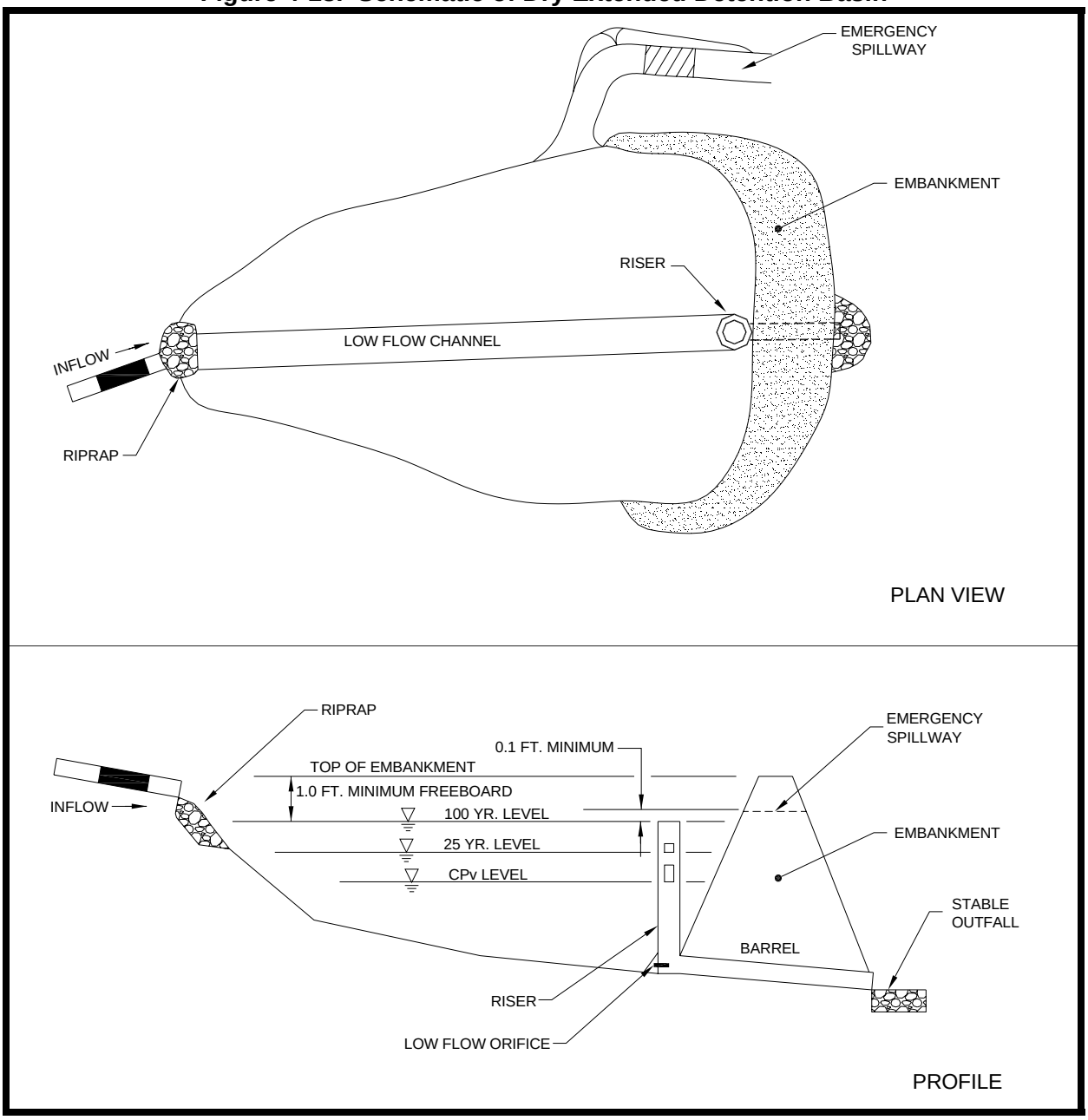
Corrective Action Needed	Due Date

Inspector Signature:_____ Inspector Name (printed)_____

4.3.3.6 Example Schematics

The example schematic for a dry extended detention basin presented in Figure 4-18 can be used to assist in the design of such BMPs.

Figure 4-18. Schematic of Dry Extended Detention Basin



4.3.3.7 Design Procedures Form

PRELIMINARY HYDROLOGIC CALCULATIONS

1a. Compute WQv volume requirements
Compute Runoff Coefficient, Rv — Rv = _____
Compute WQv — WQv = _____ acre-ft

1b. Estimate CPv — CPv = _____ acre-ft

1c. Estimate storage volumes
Estimate storage volume required for 2-year storm — 2-year storage = _____ acre-ft
Estimate storage volume required for 10-year storm — 10-year storage = _____ acre-ft
Estimate storage volume required for 25-year storm — 25-year storage = _____ acre-ft
Estimate storage volume required for 100-year storm — 100-year storage = _____ acre-ft

DRY EXTENDED DETENTION PONDS DESIGN

2. Is the use of a dry extended detention pond appropriate? — ***See subsections 4.3.3.1***

3. Confirm design criteria and applicability. — ***See subsection 4.3.3.3***

4. Pretreatment Volume (Forebay)
V_{pre} =(I)(.1")(1'/12") — V_{pre} = _____ acre-ft

5. Conduct grading design and determine storage available — Prepare an elevation-storage table and curve using the average area method for computing volumes.

Elevation MSL	Area ft^2	Ave. Area ft^2	Depth ft	Volume ft^3	Cumulative Volume ft^3

6. WQv and CPv Orifice Computations
   Average ED release rate (if applicable) — release rate= _____ cfs
   Average head, h= (ED elev.- Permanent Pool elev.) /2 — head= _____ ft
   Area of orifice from orifice equation — Area= _____ ft^2
   $Q=CA(2gh)^{0.5}$ — diameter _____ inches
   (C varies with orifice condition. Refer to Chapter 3, Section 3.3.2.3 for guidance)

   Establish CPv top elevation using stage-storage curve — CPv WSEL= _____ ft-NGVD
   Estimate orifice size — CPv orifice diameter = _____ inches
   Perform hydrograph routing to check detention time — centroid-centroid det. = _____ hours
   Iterate to final orifice size — Final CPv orifice diameter = _____ inches

7. Calculate Qp_2, Qp_{10}, Qp_{25} and Qp_{100} release rates and WSEL — Set up a stage-storage-discharge relationship

Elevation	Storage	Low Flow	Riser			Barrel		Emergency	Total
		WQv-ED	CPv.ED	High Storage		Inlet	Pipe	Spillway	Storage
				Orif.	Weir				
MSL	acre-ft	H(ft) Q(cfs)	H(ft) Q(cfs)	H Q	H Q	H(ft) Q(cfs)	H(ft) Q(cfs)	H(ft) Q(cfs)	acre-ft

   Qp_2=pre-dev. Peak discharge - (WQv-ED release + CPv-ED release) — Qp_2= _____ cfs
   Qp_{10}=pre-dev. Peak discharge - (WQv-ED release + CPv-ED release) — Qp_{10}= _____ cfs
   Qp_{25}=pre-dev. Peak discharge - (WQv-ED release + CPv-ED release) — Qp_{25}= _____ cfs
   Qp_{100}=pre-dev. Peak discharge - (WQv-ED release + CPv-ED release) — Qp_{100}= _____ cfs

   Maximum head = — H= _____ ft
   Use weir equation for slot length ($Q=CLH^{3/2}$) — L= _____ ft

   Check inlet condition
   Check outlet conditions — **Use culvert design guidance in Chapter 7**

8. Size emergency spillway using the Qp_{100} and set top of embankment elevation and emergency spillway elevation based on $WSEL_{100}$
   $Q_{ES}=Qp_{100}$ _____ cfs
   $WSEL_{100}$= _____ ft
   $El_{embank}=WSEL_{100}+1.0$ _____ ft
   $El_{ES}=WSEL_{100}+.01$ feet _____ ft

9. Investigate potential pond hazard classification — **See TN Safe Dams Act of 1973**

10. Design inlets, sediment forebays, outlet structures, maintenance access, and safety features — **See Section 4.3.3.3**

11. Design vegetation according to guidance in Chapter 6

12. Verify peak flow control, water quality drawdown time and channel protection detention time

4.3.3.8 References

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Atlanta Regional Council (ARC). *Georgia Stormwater Management Manual Volume 2 Technical Handbook.* 2001.

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4.3.3.9 Suggested Reading

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City of Austin, TX. *Water Quality Management.* Environmental Criteria Manual, Environmental and Conservation Services, 1988.

City of Sacramento, CA. *Guidance Manual for On-Site Stormwater Quality Control Measures.* Department of Utilities, 2000.

Maryland Department of the Environment. *Maryland Stormwater Design Manual, Volumes I and II.* Prepared by Center for Watershed Protection (CWP), 2000.

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Urban Drainage and Flood Control District. *Urban Storm Drainage Criteria Manual – Volume 3 – Best Management Practices – Stormwater Quality.* Denver, Colorado, September 1992.

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