Sediment Basin – SB

DEFINITION

A temporary basin consists of an embankment constructed across a drainage way, or of an excavation that creates a basin, or by a combination of both. A sediment basin typically consists of an impoundment, a dam, a riser pipe outlet, and an emergency spillway. The size of the structure will depend upon the location, size of the drainage area, soil type, land cover/use, rainfall amount, and any unique site conditions favorable to producing high runoff volume, velocity, or sediment.

PURPOSE

A sediment basin is used to retain runoff waters and trap sediment from disturbed areas to protect properties and waters below the installation from damage by excessive sedimentation and debris. The water is temporarily stored and the bulk of the sediment carried by the water falls out of suspension and is retained in the basin, while the water is slowly released over a period of time.

CONDITIONS

This practice is required by permit at locations within construction sites where the total disturbed drainage area at any given time is at least ten (10) acres. Sediment basins may also be used for drainages smaller than ten acres, however they are not mandatory. There must be sufficient space and appropriate topography for the construction of a temporary impoundment. Specifications described in this standard apply to temporary installations that are to be removed within 18 to 30 months and where the total drainage area does not exceed 50 acres. By virtue of their potential to impound and release large volumes of water, the design of sediment basins is required to be completed by professionals trained in the design of impoundment structures, and in accordance with good engineering practices.

DESIGN CRITERIA

Compliance with Laws and Regulations: Sediment basin design and construction shall comply with all applicable state and local laws, ordinances, permit requirements, rules, and regulations. Basins shall be constructed according to the approved SWPPP unless modified by the engineering design professional. Additional regulations apply if vertical height of dam from downstream toe to crest of embankment exceeds 20 feet. Refer to “Embankment Cross-Section” later in this section.

Location: To improve the effectiveness of the basin, it should be located so as to intercept the largest possible amount of runoff from the disturbed area. **Runoff from undisturbed areas should be diverted away from or around the disturbed areas and the basin.** The best locations are generally low areas and natural swales or drainageways below disturbed areas. It is recommended that the basin be located at least 50 feet outside the designated floodway or 25 feet from the top of bank of small streams or as otherwise required by local ordinance, whichever is greater. Basin efficiency can be improved by the use of diversions (refer to **Diversion - DI**) and by introducing chemical coagulants and coagulant aids (refer to **Polyacrylamide - PAM**). **Under no circumstance shall a basin be located in a stream or in any waters of the state.** Instead, the basin should be located to trap sediment-laden runoff before it enters a stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service to public utilities or roads.

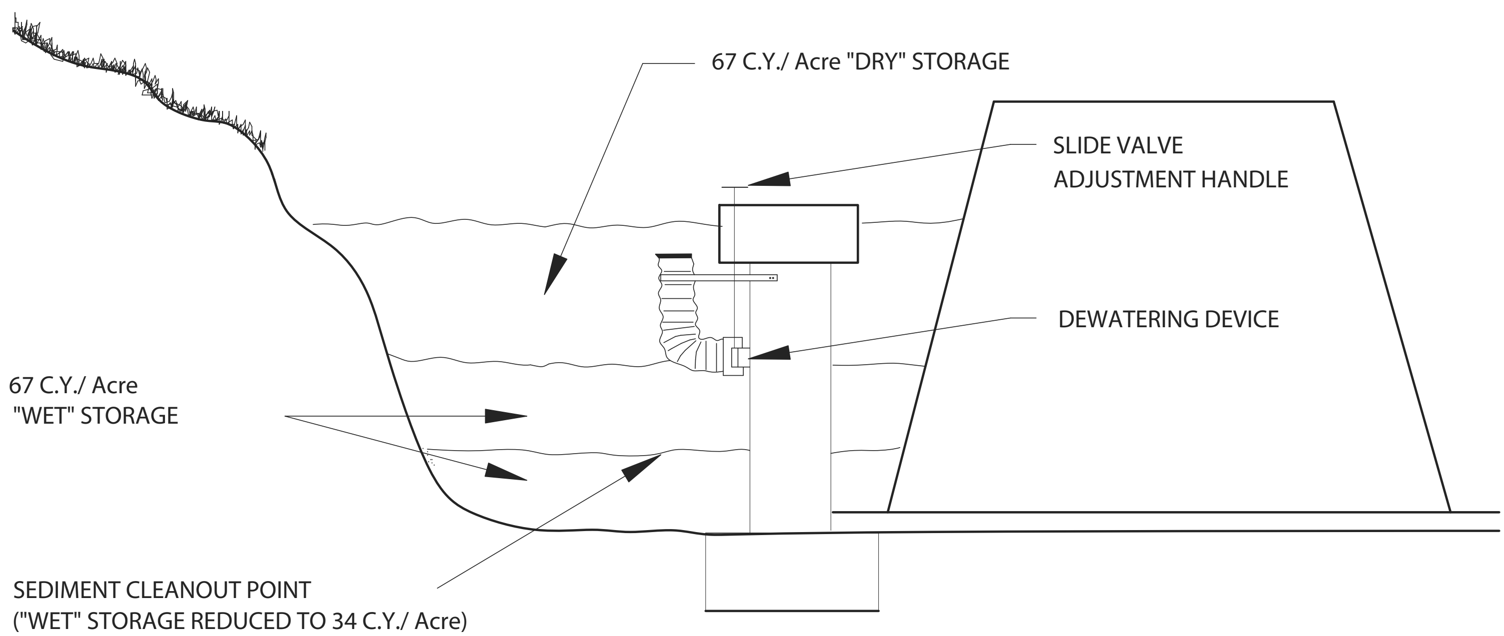
Maximum Drainage Area: The maximum allowable total drainage area (disturbed and undisturbed) feeding into a temporary sediment basin is 50 acres. It is recommended that when the drainage area to any one temporary basin exceeds 25 acres, an alternative design procedure that more accurately defines the specific hydrology, sediment loading, hydraulics of the site, and the control measures in use be utilized to perform design calculations. The design criteria in this manual do not generate hydrographs, estimate sediment erosion and delivery rates, provide hydraulic routing, or predict sediment capture efficiency. More rigorous and accurate design considerations, which are more site-specific than those in this manual, are acceptable and encouraged with any size basin.

Effectiveness and Volume: Sediment basins constructed according to these standards are, at best, 50 to 70 percent effective in trapping sediment that flows into them during large storm events, or during periods of minimal vegetative cover at a construction site. The performance of any sediment pond depends on several factors: (1) size and shape of the basin, (2) soil properties, (3) runoff volume and flow, (4) water chemistry, (5) permanent vs. dry pond design, and other factors. It should be understood that a sediment basin is a temporary, but defensive measure, and should be made functional before any upslope land disturbance takes place in order to keep sediment from escaping the site and washing into storm sewers, and filling streams and waterways. Basins should always be used in conjunction with primary erosion control and stabilizing practices (as found throughout this manual) such as temporary seeding, mulching, diversion dikes, etc. designed to prevent or reduce the possibility of soil from being eroded in the first place.

In order to maximize trapping and retaining the incoming sediment, the basin should have a permanent pool, or wet storage component and a dry storage component that dewaters over time. The volume of the permanent pool (needed to protect against re-suspension of sediment and to promote better settling conditions between runoff events) must be at least 67 cubic yards (1809 cubic feet) per acre of drainage area and the volume of dry storage above the permanent pool (needed to prevent "short-circuiting" of the basin during larger storm events) must be at least an additional 67 cubic yards (1809 cubic feet) per acre of drainage area. The total storage volume of the basin at the principal (service) spillway riser crest would, therefore, be a minimum of 134 cubic yards (3,618 cubic feet) per acre of drainage area (see Figure 1).

When computing the number of acres draining into a common location, it is not necessary to include flows from offsite areas and runoff from undisturbed or permanently stabilized areas where such flows are diverted around both the disturbed area and the sediment basin. Otherwise, the calculations for determining basin size should include the entire drainage area, disturbed and undisturbed.

Minimum Storage Volume and Sediment Cleanout Point



Source: VA DSWC

Figure 1

The volume of the permanent pool shall be measured from the lowest point of the basin to the bottom of the dewatering device. This device should be installed at the elevation corresponding to one half the total storage volume. The volume of the active or drawdown zone shall be measured from the elevation of the permanent pool to the crest of the principal (service) spillway riser pipe. Sediment should be removed from the basin when the volume of the permanent pool has been reduced by one half. In no case shall the sediment cleanout level be higher than one foot below the bottom of the dewatering device for the drawdown zone. The elevation of the sediment cleanout level should be calculated and clearly marked on the plans and the riser. Since this part of the riser normally will be under water, a mark should appear above the permanent pool a measured distance above the cleanout elevation to provide a reference from which to measure the sediment depth.

The above volume requirements should be regarded to be minimum criteria and may be modified at the discretion of the engineering design professional to protect critical aquatic resources and safety/health of the public. It is noted that undisturbed areas can contribute significant amounts of runoff that can reduce the efficiency of a sediment basin. The following conditions and circumstances need to be considered in determining whether or not the basin volume would need to be increased:

- Highly erodible soils
- Steep upslope topography
- Space-limiting basin geometry (depth and/or shape)
- Degree to which off- and/or on-site runoff is diverted from contributing undisturbed areas
- Sediment cleanout schedule
- Degree to which chemical flocculent agents are added to inflowing runoff
- Extent to which other erosion and sediment control practices are used
- Critical downstream conditions

For drainage locations which serve 10 or more disturbed acres at one time and where a temporary sediment basin is not feasible, multiple, smaller basins and/or sediment traps must be used. The total trapping capacity of these must have an equivalent storage of 134 cubic yards (3618 cubic feet) of runoff per acre.

<u>Note</u>: There are 27 cubic feet per cubic yard. Conversion between cubic feet and cubic yards is as follows:

number of cubic feet x 0.037 = number of cubic yards

or

number of cubic feet / 27= number of cubic yards

While attempting to attain the desired storage capacities, efforts should be made to keep embankment heights to a minimum. When site topography permits, the designer should give strong consideration to the use of excavation to obtain the required capacity and to possibly reduce the height of the embankment. This excavation can be designed in a manner which creates a wet storage forebay area or which increases the storage capacity over the entire length of the basin.

Basin Shape: It is important that the designer of a sediment basin incorporate features to maximize detention time within the basin in order to improve its trapping efficiency. Suggested methods of accomplishing this objective are:

- Recommended design effective length to width ratio is 4:1, but not less than 2:1, where length is the distance between the inlet and outlet.
- A wedge shape with the inlet located at the narrow end - ideally, the shape would be symmetrical about the pond's central axis formed by the inlet - riser - center of the dam.
- Installation of baffles or diversions.

The purpose of having a length to width ratio of at least 2:1 is to minimize the "short-circuiting" effect of the sediment-laden inflow to the riser and thereby increasing the effectiveness and efficiency of the sediment basin. Having a symmetrical basin about the central axis from the inlet to the riser tends to reduce dead or ineffective space.

The length of the flow path (L) is the distance from the point of inflow to the riser outflow point. The point of inflow is the point that the waste stream enters the active (sometimes called "normal") pool, created by the elevation of the riser crest. The pool area (A) is the area of the active pool. The effective width (We) is equal to the area (A) divided by the length (L). The length to width ratio (L:W) is found by the equation:

$$L:W = L/We = L/(A/L) = L^2/A$$

The designer is encouraged to locate all inflows at or near the point of the wedge. However, where there is more than one inflow point and where circumstances preclude this ideal arrangement, any inflow point which conveys more than 30 percent of the total peak inflow rate shall meet the above length-width ratio criteria. Ponds whose L:W ratios are less than 1, even if enhanced with baffling, are not permitted.

For ponds having L:W ratios less than 4:1, construction should consist of two wetpool cells using a separation berm, as shown in Figure 2. The first (upper) wetpool cell volume should hold between 25% to 35% of the total wetpool volume. Ponds with L:W ratios equal to or greater than 4:1 are suggested to follow this design, but may be single cell construction.

Baffles: The required basin shape should be obtained by proper site selection and by excavation to reduce dead storage and to maximize sediment removal efficiency. Where less than ideal conditions exist, a baffle may be constructed in the basin. The purpose of the baffle is to increase the effective flow length from the inflow point(s) to the riser. Baffles shall be placed mid-way between the inflow point and the riser. The baffle length shall be as required to achieve the minimum 2:1 length-width ratio at less than ideal site conditions. The effective length (Le) shall be the shortest distance the water must flow from the inflow point around the end of the baffle to the outflow point.

Then:

$$L:W = Le/We = Le^2/A$$

Three baffle examples are shown in Figure 3. Note that that for the third baffle case:

$$L = L_1 + L_2$$

The baffle material should be outdoor grade and weather resistant. The baffles should be placed in such manner to minimize interference with basin cleaning. Construction should be modular for easy maintenance and convenient replacement in event of damage from cleaning or from deterioration. The baffles should be inspected frequently for tears or breaks from weathering, high flows, and from cleaning damage. Damaged baffling should be replaced or repaired immediately.

The dimensions necessary to obtain the required basin volume and surface area shall be clearly shown on the plans to facilitate plan review and inspection.

Multiple Use: Sediment basins may remain in place after final site stabilization is completed to serve as permanent storm water management structures. Because the most practical location for a sediment basin is often the most practical location for a storm water management basin, it is often desirable to utilize these structures for permanent storm water management purposes. It should be noted, however, that in most cases, a typical structure's outlet control system would vary during construction and post-construction periods. Care must be taken to avoid constructing an outlet control system, which will achieve the desired post-construction quantity or quality control but will not provide the necessary facility for the containment and settling of sediment-laden construction runoff. Notably, the design for such permanent flow control ponds is beyond the scope of these standards and specifications.

Access Requirements: Maintenance access road(s) shall be provided to the sediment pond facility for convenient inspection and for access by maintenance and emergency vehicles. An access track around the pond is recommended for convenient removal of sediment from the

Sediment Basin Showing 2 Cells

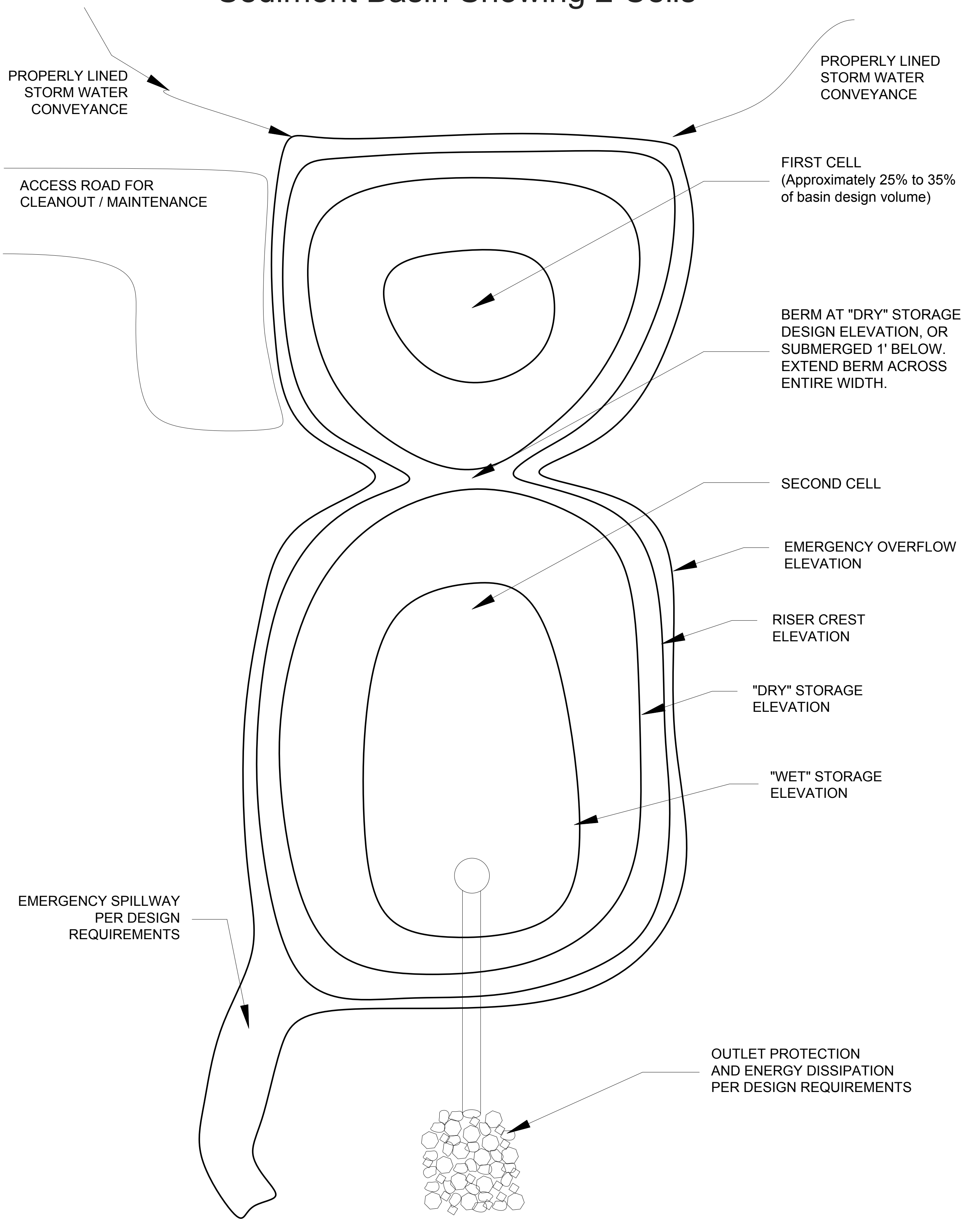
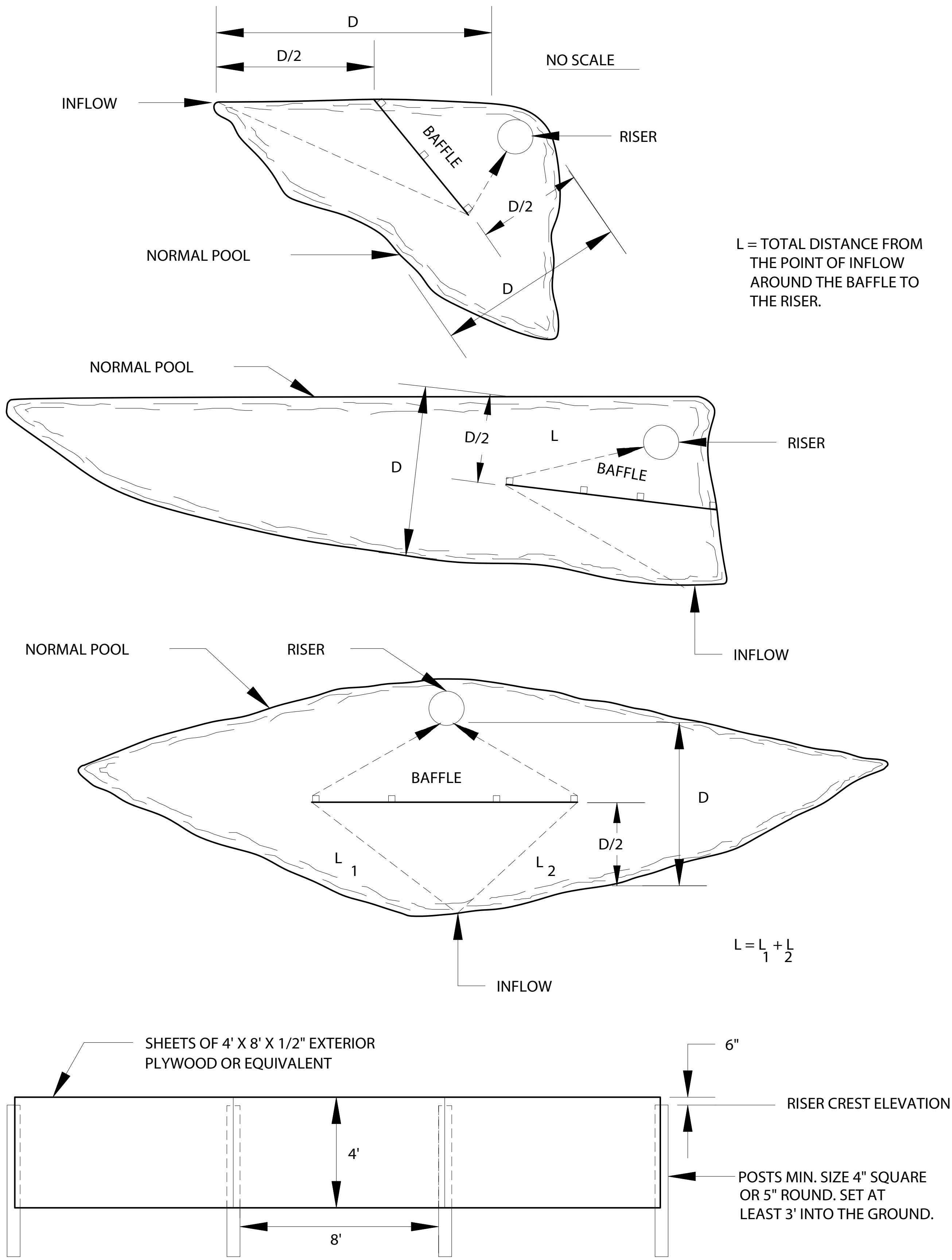


Figure 2

Baffle Locations in Sediment Basins



Source: US NRCS

Figure 3

pond or pond cells with appropriate equipment. An access ramp into the pond itself is discouraged because of the potential for creating equipment-generated rutting and stabilization problems.

Embankment Cross-Section: The height of the embankment dam is measured from its crest down to the lowest point of natural grade (at the downstream toe of the embankment). For dam heights less than 10-feet, the embankment must have a minimum top width of 6 feet, and the side slopes must be 2:1 or flatter to permit access and maintenance. In the case of an embankment 10 to 14 feet in height, the minimum top width shall be 8 feet and the side slopes 2.5:1 or flatter. For 15 to 19 high embankments, the top width must be 10 feet with maximum side slopes of 2.5:1. Embankments must comply with the Tennessee Safe Dams Act of 1973, as amended if either of the following two conditions exist: (a) the embankment is twenty feet or more in height, or (b) the impoundment will have a capacity, at maximum water storage elevation, of thirty (30) acre-feet (48,400 cy/yds) or more. Any such dam which is equal to or less than six feet in height, regardless of storage capacity, or which has a maximum storage capacity not in excess of fifteen (15) acre-feet (24,200 cy/yds), regardless of height, would not be regulated under the Safe Dams Act. If ponds and dams meet or exceed the criteria mentioned above, permit certificates of construction and operation are required by the Tennessee Dam Safety Office in the Division of Water Supply of the Tennessee Department of Environment and Conservation. Further information on safe dam design standards, regulations, and permit applications is available at the website: http://www.state.tn.us/environment/permits/safedam.htm.

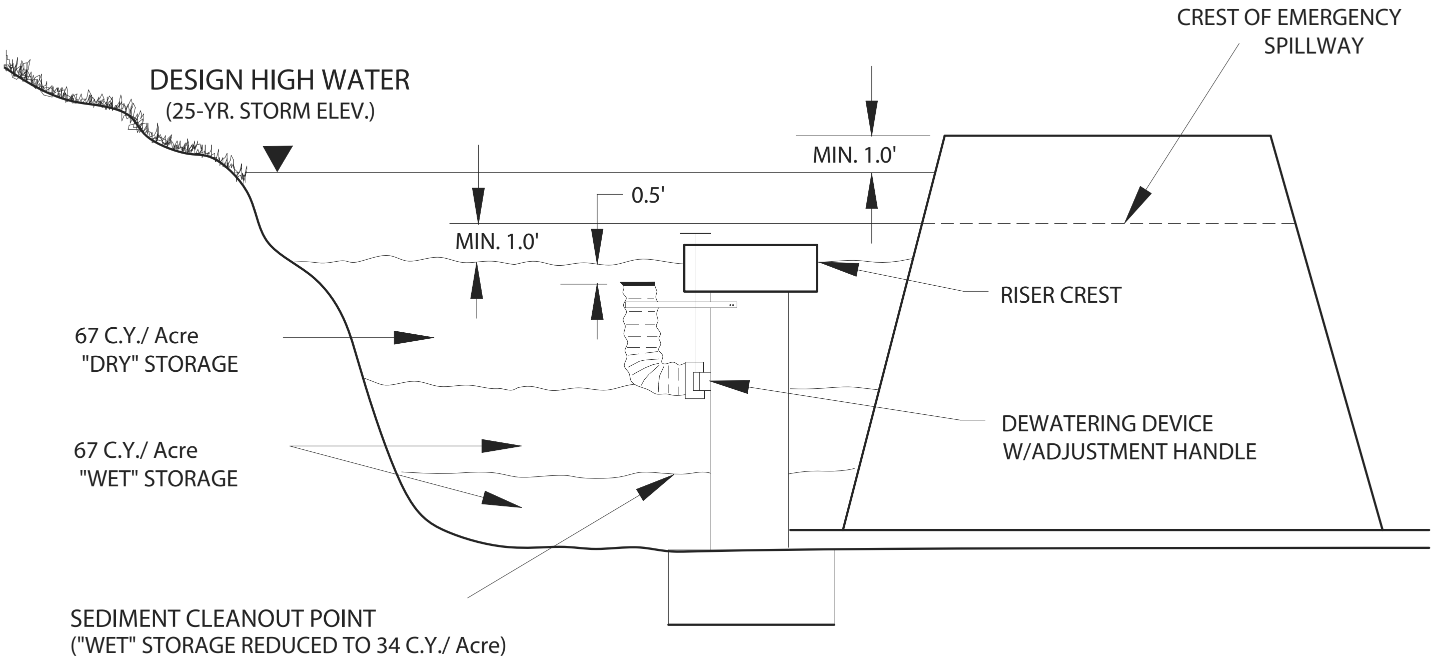
The site foundation for the embankment should be prepared by removing all vegetation, debris, topsoil, and large rocks down to competent material. Embankments should be keyed into the foundation soil with at least a 2-ft x 2-ft. trench. The embankment height should include a 10 percent settlement allowance across the longitudinal axis of the dam. A minimum 1-foot freeboard is required between the maximum design flow water level and top of the dam. (See Figure 4)

Spillways Design: The outlets for the basin should consist of a combination of principal and emergency spillways. These outlets must pass the peak runoff expected from the contributing drainage area for a 25-year 24-hour storm. If, due to site conditions and basin geometry, a separate emergency spillway is not feasible, the principal spillway must pass the entire peak runoff expected from the 25-year 24-hour storm. However, an attempt to provide a separate emergency spillway should always be made (refer to "Emergency Spillway" later on in this section) because the principal spillway riser is vulnerable to clogging by debris during high runoff events. Runoff computations shall be based upon the soil cover conditions that are expected to prevail during the life of the basin. In determining total outflow capacity, the flow through the dewatering device cannot be credited when calculating the 25-year 24-hour storm elevation because of its potential to become clogged. However, principal spillway capacity can be credited with the emergency spillway capacity when determining the peak flow and maximum pond elevation from the 25-year 24-hour storm. Incoming flood flow and storage calculations must begin at the elevation of the principal spillway riser crest.

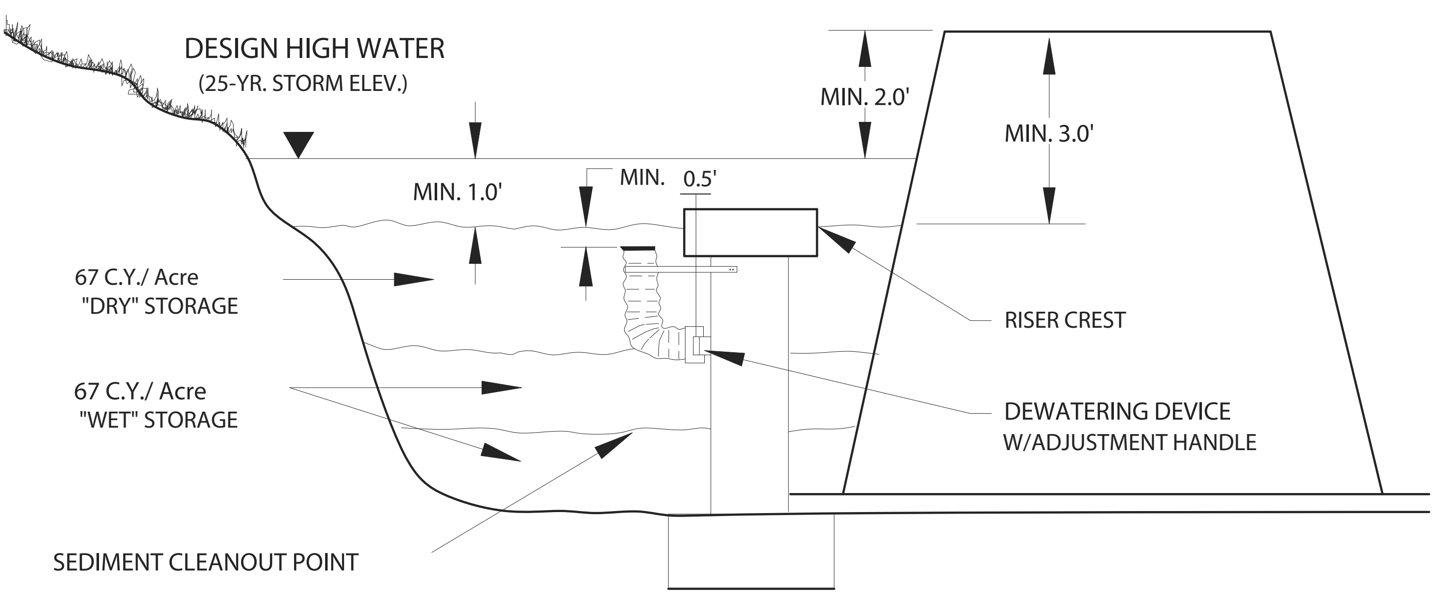
Temporary sediment pond storage and outflow controls are not normally designed to reduce incoming peak flows. Consequently, the spillways designed by the procedures contained in the standard and specification will not necessarily result in any reduction in the peak rate of runoff. If a reduction in peak runoff is desired, the appropriate hydrographs/storm routings should be generated to choose the basin and outlet sizes.

Dewatering: Provisions shall be made to dewater the basin down to the permanent (wet) pool elevation. It is well known that particle characteristics, flow-through velocity, surface loading rate, turbulence levels, sediment concentration and other lesser factors can have a significant effect on the sediment trapping efficiency in a pond. Studies have generally shown that the slower the flow-through velocity and, hence, the

Sedimen Basin Schematic Elevations



Design Elevations With Emergency Spillway



Design Elevations Without Emergency Spillway
(Riser Passes 25-YR Event)

Source: VA DSWC

Figure 4

longer the detention storage time in a pond, the greater the sediment removal efficiency. TDEC recommends a 72-hour drawdown time.

Dewatering of the dry storage should be done in a manner that removes the "cleaner" water without removing the potentially sediment-laden water found in the wet storage area or any appreciable quantities of floating debris. An economical and efficient device for performing the drawdown is a "skimmer" type section of perforated vertical tubing, which is connected to and braced to the principal spillway at two locations. A slide gate type of valve is required at the bottom of this tubing for achieving the desired drawdown time and seasonal control. Figure 5 provides a schematic orientation of such a device. Because of the potential for the dewatering device or orifice becoming clogged, no credit should be given for drawdown by the device in the calculation of the principal or emergency spillway locations.

A dewatering operation procedure might be to keep the slide gate valve closed during dry periods, or close it before anticipated precipitation events. Then, during and after the precipitation event, the slide gate valve is manually adjusted to allow the draw down to begin. The amount of adjustment should be determined so that the draw down to the wet pool elevation occurs over a period of 72 hours, as stated above.

Principal (or Service) Spillway: For maximum effectiveness, the principal spillway should consist of a vertical riser pipe or box of corrugated metal or reinforced concrete, with a minimum diameter of 18 inches, joined by a watertight connection to a horizontal drain pipe (barrel) extending through the embankment and discharging beyond the downstream toe of the fill. The riser and all pipe connections shall be completely water tight except for the inlet opening at the top or dewatering openings, and shall not have any other holes, leaks, rips, or perforations. If the principal spillway is used in conjunction with a separate emergency spillway, the principal spillway must be designed to pass at least the peak flow expected from of 2-year 24-hour storm. If no emergency spillway is used, the principal spillway must be designed to pass the entire peak flow expected from a 25-year 24-hour storm. See Figure 6 for details.

Design Elevations: The crest of the principal spillway riser shall be set at the elevation corresponding to the total storage volume required (67 cubic yards/acre wet storage plus 67 cubic yards/acre dry storage = 134 cubic yards/acre). If the principal spillway is used in conjunction with an emergency spillway, this elevation shall be a minimum of 1.0 foot below the crest of the emergency spillway. In addition, a minimum freeboard of 1.0 foot shall be provided between the maximum 25-year pool level and the top of the embankment. If no emergency spillway is used, the crest of the principal spillway shall be a minimum of 3 feet below the top of the embankment; also, a minimum freeboard of 2.0 feet shall be provided between the 25-year pool level and the top of the embankment.

Anti-Vortex Device and Trash Rack: An anti-vortex device and trash rack shall be attached to the top of the principal spillway to improve the flow characteristics of water into the spillway and to reduce the possibility of floating debris from blocking the principal spillway. The anti-vortex device shall be of the concentric type as shown in Figure 7, and designed using the information provided in Table 1.

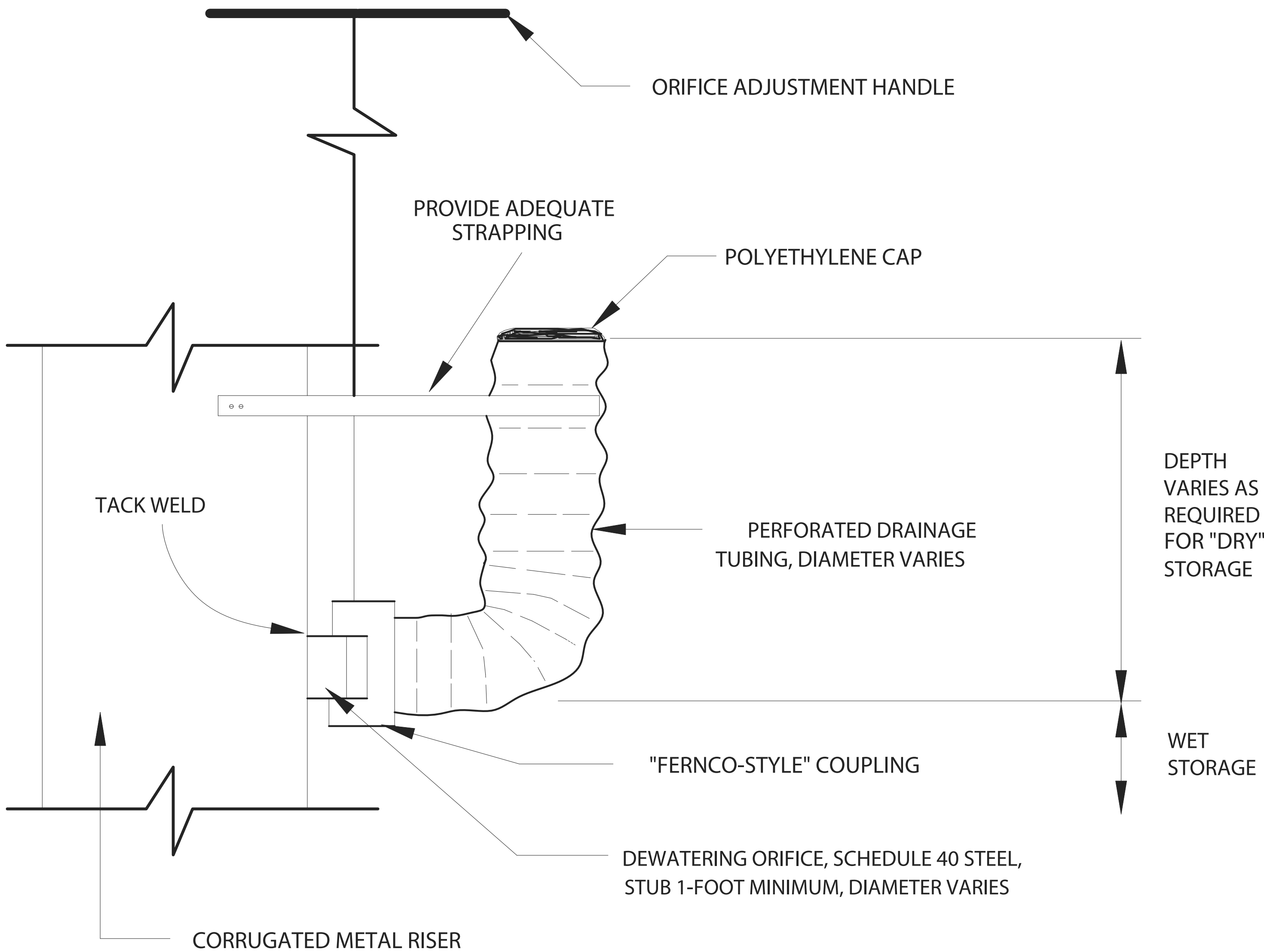
Spillway Foundation: The foundation base of the principal spillway must be firmly anchored to prevent its floating due to buoyancy. If the riser of the spillway is greater than 10 feet in height, computations must be made to determine the anchoring requirements to prevent flotation. A minimum factor of safety of 1.25 shall be used (downward forces = 1.25 x upward forces).

For risers 10 feet or less in height, the anchoring may be done in one of the two following ways:

1. A concrete base 18 inches thick and twice the width of riser diameter shall be used and the riser embedded at least 6 inches into the concrete. See Figure 8 for details.

2. A square steel plate, a minimum of 1/4-inch thick and having a width equal to

Recommended Dewatering System for Sediment Basins

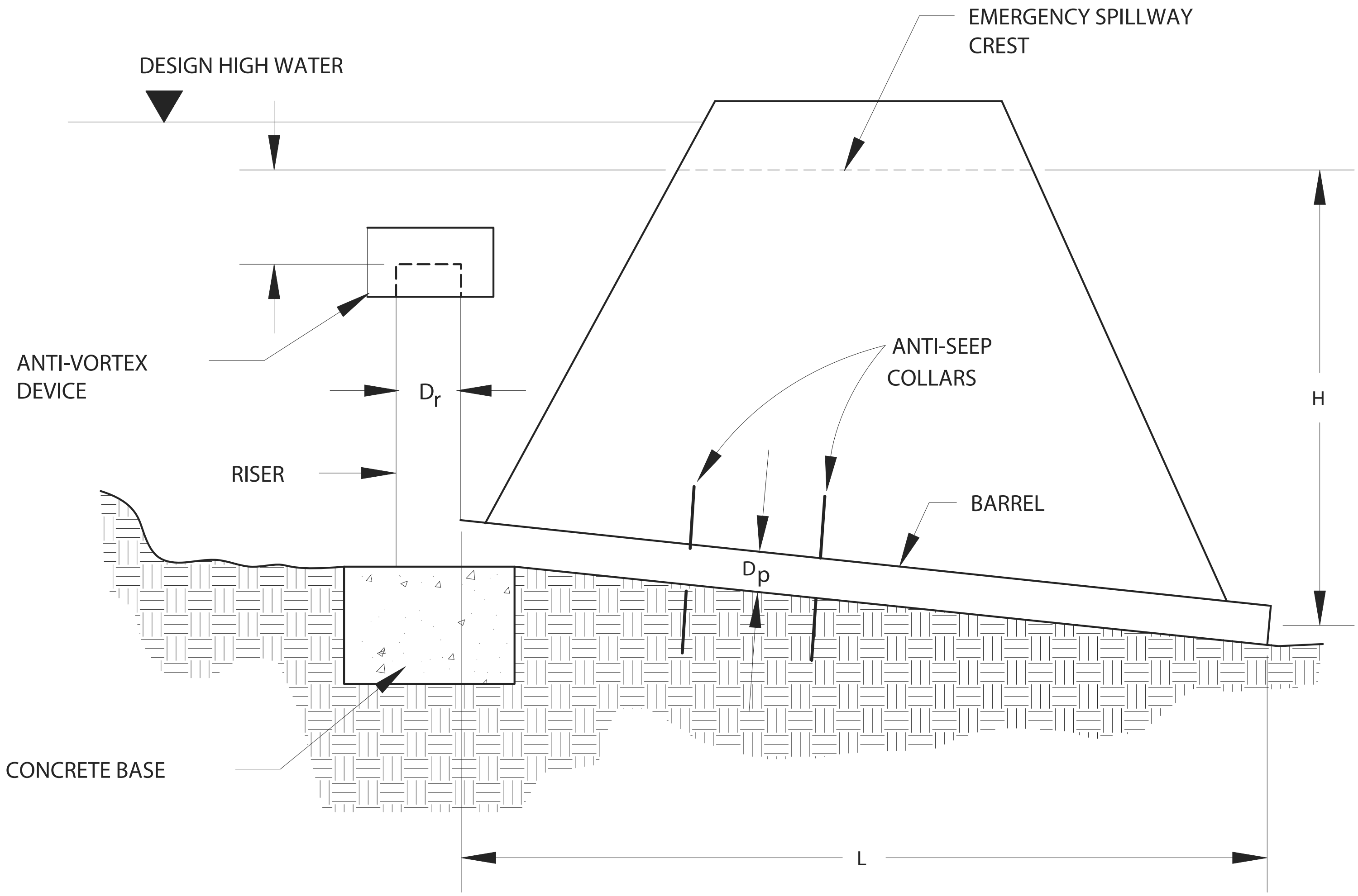


NOTE: WITH CONCRETE RISER, USE PVC SCHEDULE 40 STUB FOR DEWATERING ORIFICE

Source: VA DSWC

Figure 5

Principal Spillway Design



H = HEAD ON PIPE THROUGH EMBANKMENT

h = HEAD OVER RISER CREST

L = LENGTH OF PIPE THROUGH EMBANKMENT

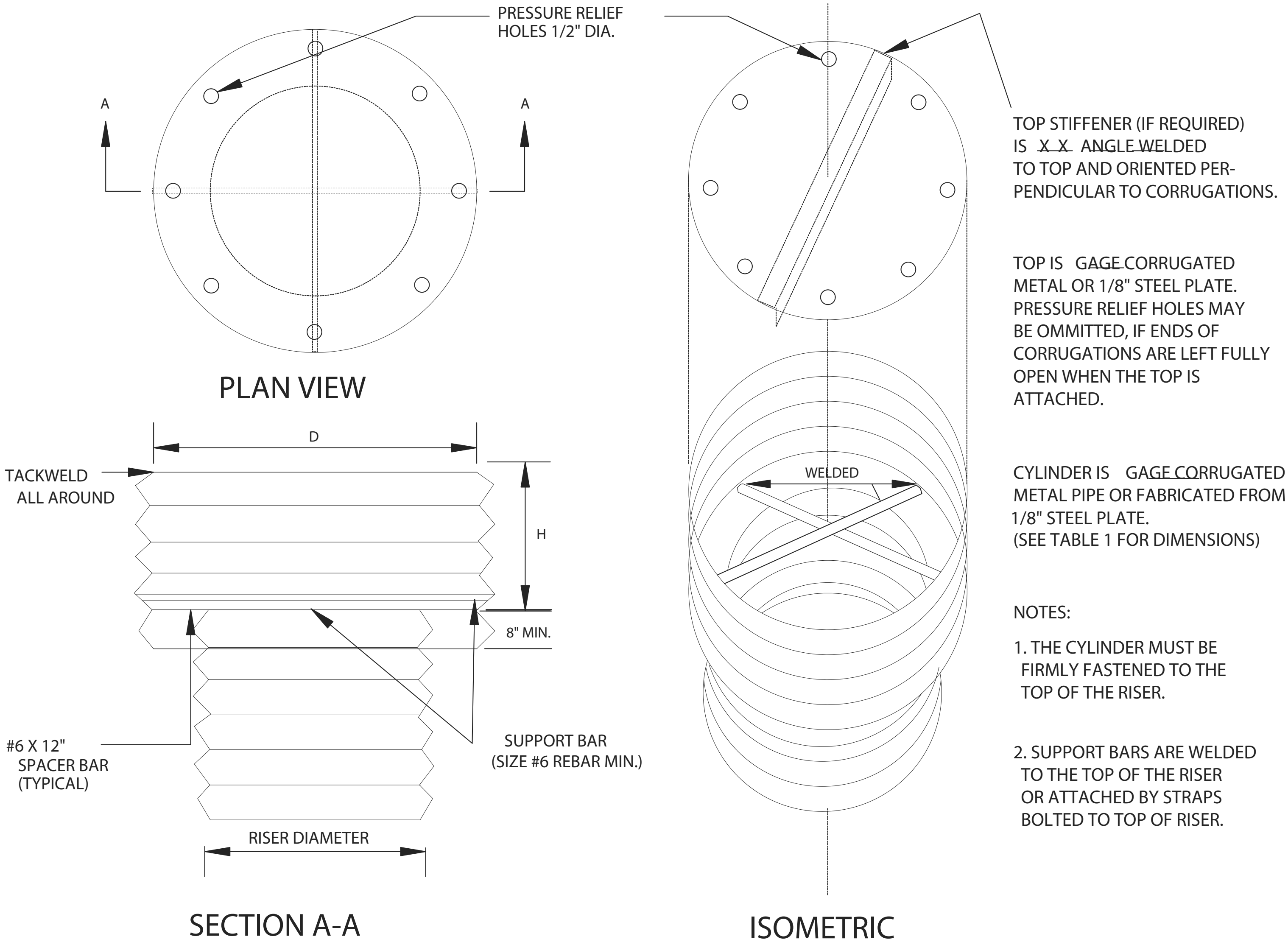
D_p = DIAMETER OF PIPE THROUGH EMBANKMENT

D_r = DIAMETER OF RISER

Source: VA DSWC

Figure 6

Anti - Vortex Device Design



Source: US - NRCS

Figure 7

Concentric Trash Rack and Anti-Vortex Device Design Table

Riser Diam., inches	Cylinder			Minimum Size Support Bar	Minimum Top	
	Diameter, inches	Thickness, gage	Height, inches		Thickness	Stiffener
12	18	16	6	#6 Rebar or 1 1/2" x 1 1/2" x 3/16" angle	16 ga. (F&C)	-
15	21	16	7	" "	" "	-
18	27	16	8	" "	" "	-
21	30	16	11	" "	16 ga.(C), 14 ga.(F)	-
24	36	16	13	" "	" "	-
27	42	16	15	" "	" "	-
36	54	14	17	#8 Rebar	14 ga.(C), 12 ga.(F)	-
42	60	14	19	" "	" "	-
48	72	14	21	1 1/4" pipe or 1 1/4" x 1 1/4" x 1/4" angle	14 ga.(C), 10 ga.(F)	-
54	78	14	25	" "	" "	-
60	90	14	29	1 1/2" pipe or 1 1/2" x 1 1/2" x 1/4" angle	12 ga.(C), 8 ga.(F)	-
66	96	14	33	2" pipe or 2" x 2" x 3/16" angle	12 ga.(C), 8 ga.(F) w/stiffener	2" x 2 1/4" angle
72	102	14	36	" "	" "	2 1/2" x 2 1/2" x 1/4" angle
78	114	14	39	2 1/2" pipe or 2" x 2" x 1/4" angle	" "	" "
84	120	12	42	2 1/2" pipe or 2 1/2" x 2 1/2" x 1/4" angle	" "	2 1/2" x 2 1/2" x 5/16" angle

Note: The table above is useful only for corrugated metal pipe. Concrete trash rack and anti-vortex devices are also available. Manufacturer's recommendations should be followed for concrete applications.

Note: Corrugation for 12"-36" pipe measures 2 2/3" x ½"; for 42"-84" the corrugation measures 5" x 1" or 8" x 1".

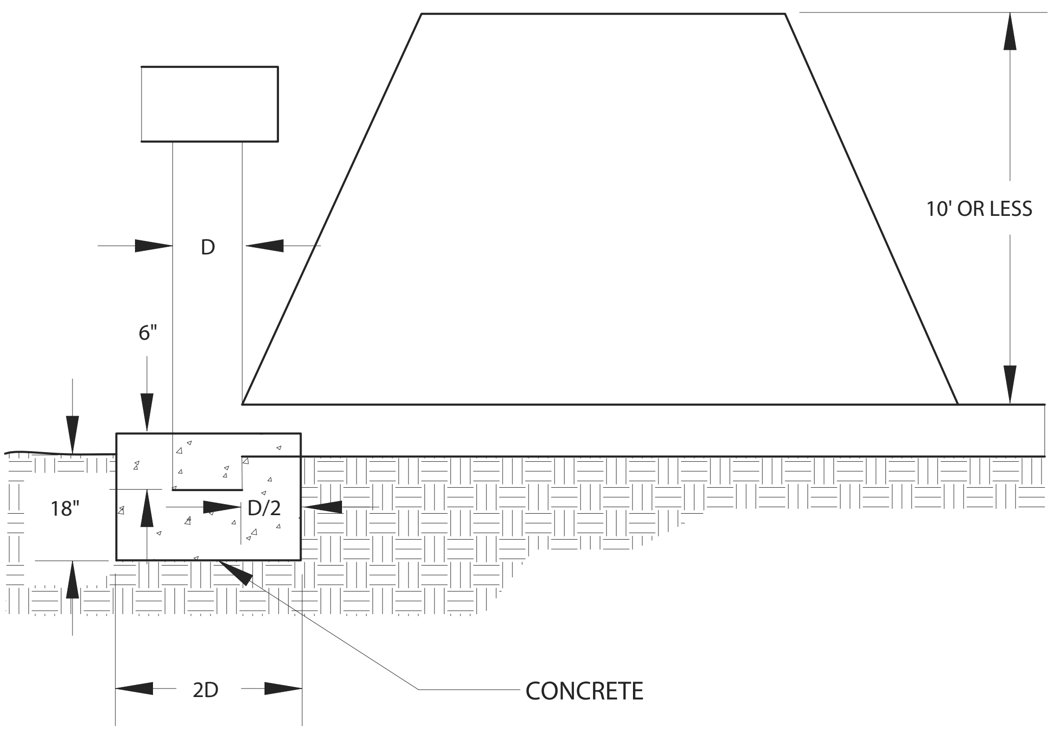
Note: C = corrugated; F = flat.

Source: VA DSWC

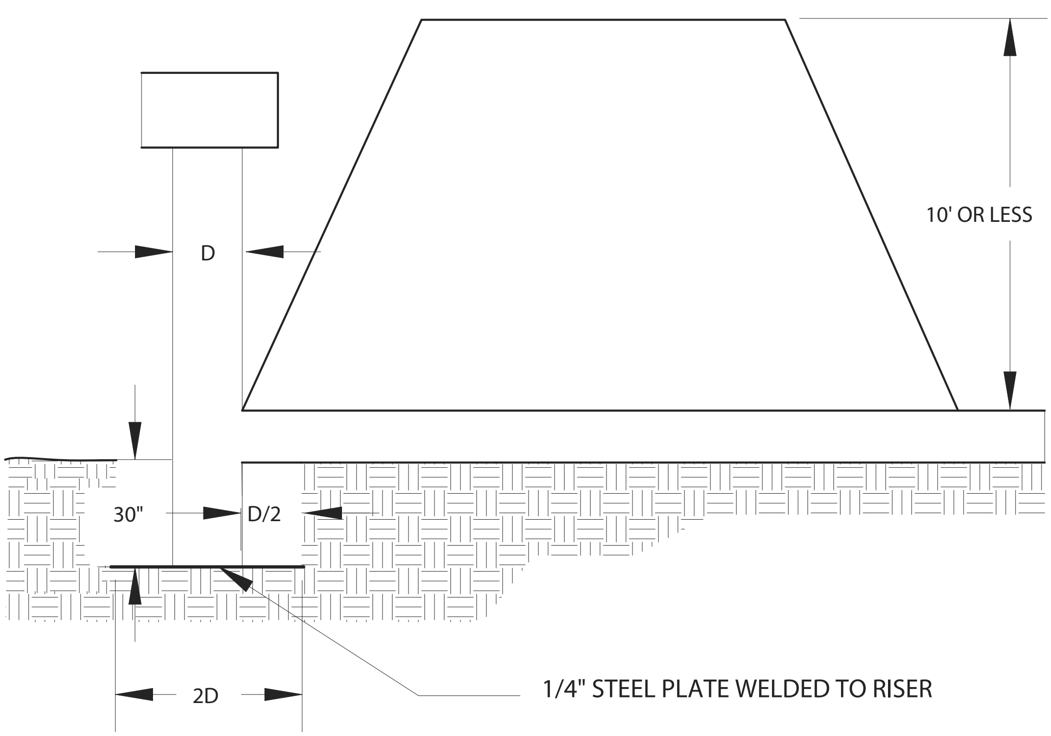
Table 1

Riser Pipe Base Conditions For Embankments Less Than 10' High

CONCRETE BASE FOR EMBANKMENT 10' OR LESS IN HEIGHT



STEEL BASE FOR EMBANKMENT 10' OR LESS IN HEIGHT



Source: VA DSWC

Figure 8

twice the diameter of the riser shall be welded to the riser pipe. It shall be covered with 2.5 feet of stone, gravel, or compacted soil to prevent flotation. See Figure 8 for details.

Note: If the steel base is used, special attention should be given to compaction so that 95% compaction is achieved over the plate. Also, added precautions should be taken to ensure that material over the plate is not removed accidentally during removal of sediment from basin. One method would be to use simple marker posts at the four corners.

Outlet Barrel: The drainpipe barrel of the principal spillway, which extends through the embankment, shall be designed to carry the flow provided by the riser of the principal spillway with the water level at the crest of the emergency spillway. The riser and all pipe connections shall be completely watertight and not have any other holes, leaks, gashes, or perforations other than designed openings. The minimum size of the pipe shall be 10 inches in diameter. The connection between the riser and the barrel must be watertight to prevent local scouring. The outlet of the barrel must be protected to prevent erosion or scour of downstream areas. Where discharge occurs at the property line, drainage easements will be obtained in accordance with local ordinances. Adequate notes and references regarding such easements will be shown on the erosion and sediment control plan. Measures may include excavated plunge pools, riprap, impact basins, revetments, or other effective methods. Refer to specification **Storm Drain Outlet Protection - OP**.

Caution should be given in directing all outlet water from the impoundment to a receiving watercourse so that natural flow paths are preserved above off-site property owners.

Anti-Seep Collars: Anti-seep collars are used to reduce uncontrolled seepage and prevent internal erosion or "piping" inside the dam along the drainpipe barrel. Anti-seep collars shall be used on the drainpipe barrel of the principal spillway within the normal saturation zone of the embankment to increase the seepage length by at least 10%, if either of the following two conditions is met:

1. The settled height of the embankment exceeds 10 feet.

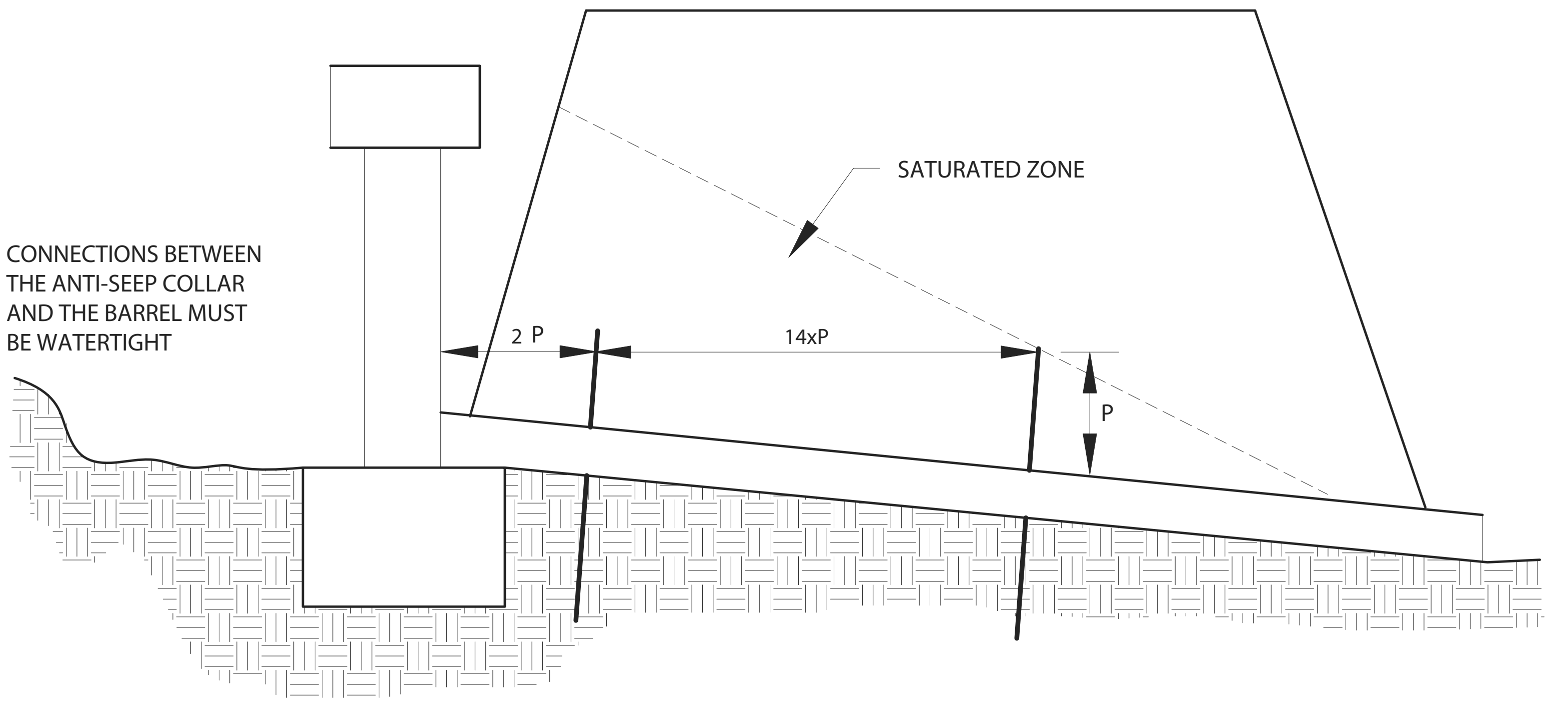
2. The embankment has a low silt-clay content (Unified Soil Classes SM or GM) and the barrel is greater than 10 inches in diameter.

The anti-seep collars shall be installed within the saturated zone. The maximum spacing between collars shall be 14 times the projection of the collars above the barrel. Collars shall not be closer than 2 feet to a pipe joint. Collars should be placed sufficiently far apart to allow space for hauling and compacting equipment. Precautions should be taken to ensure that 95% compaction is achieved around the collars. Connections between the collars and the barrel shall be watertight. See Figure 9 for details.

Emergency Spillway: The emergency spillway acts as a safety release for a sediment basin, or any impoundment type structure, by conveying the larger, less frequent storms through the basin without overtopping or damaging the embankment. The emergency spillway also acts as its name implies - an emergency outlet - in case emergency circumstances arise from excessive sedimentation or damage to the riser, which prevents flow through the principal spillway. The emergency spillway shall consist of an open channel constructed adjacent to the embankment over undisturbed material (not fill, such as the dam embankment). The emergency spillway shall be lined with a non-erodible material such as dumped and compacted riprap or engineered vegetation. Design of an emergency spillway requires the special expertise of a qualified, engineering design professional. The control section is a level portion of the spillway channel at the highest elevation in the channel. See Figure 10 for location of emergency spillway and Figure 11 for an example excavated earth spillway.

The designer must ensure that the spillway lining (either grassed or riprapped) would withstand the high velocities expected in the

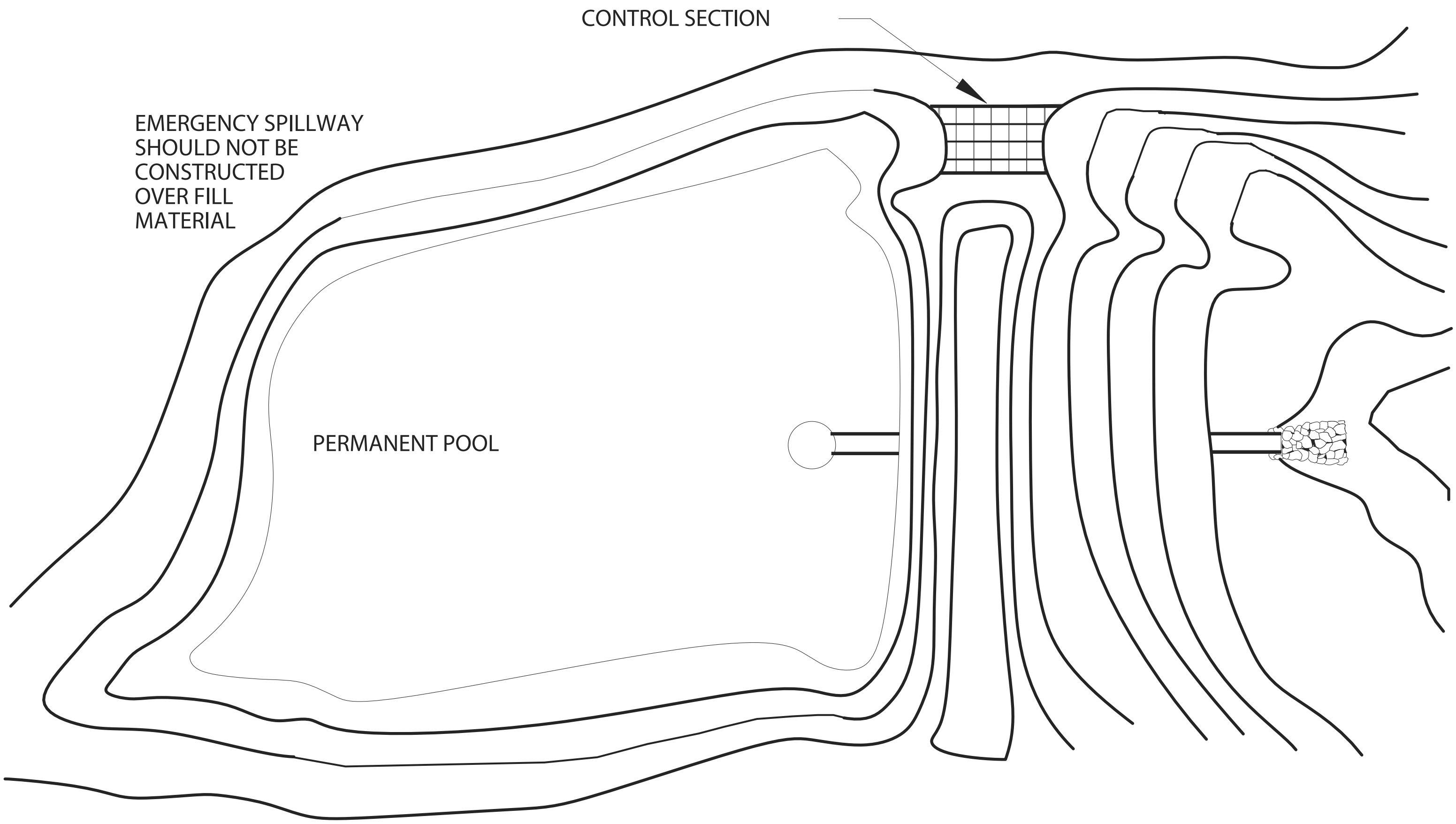
Anti-Seep Collar



Source: VA DSWC

Figure 9

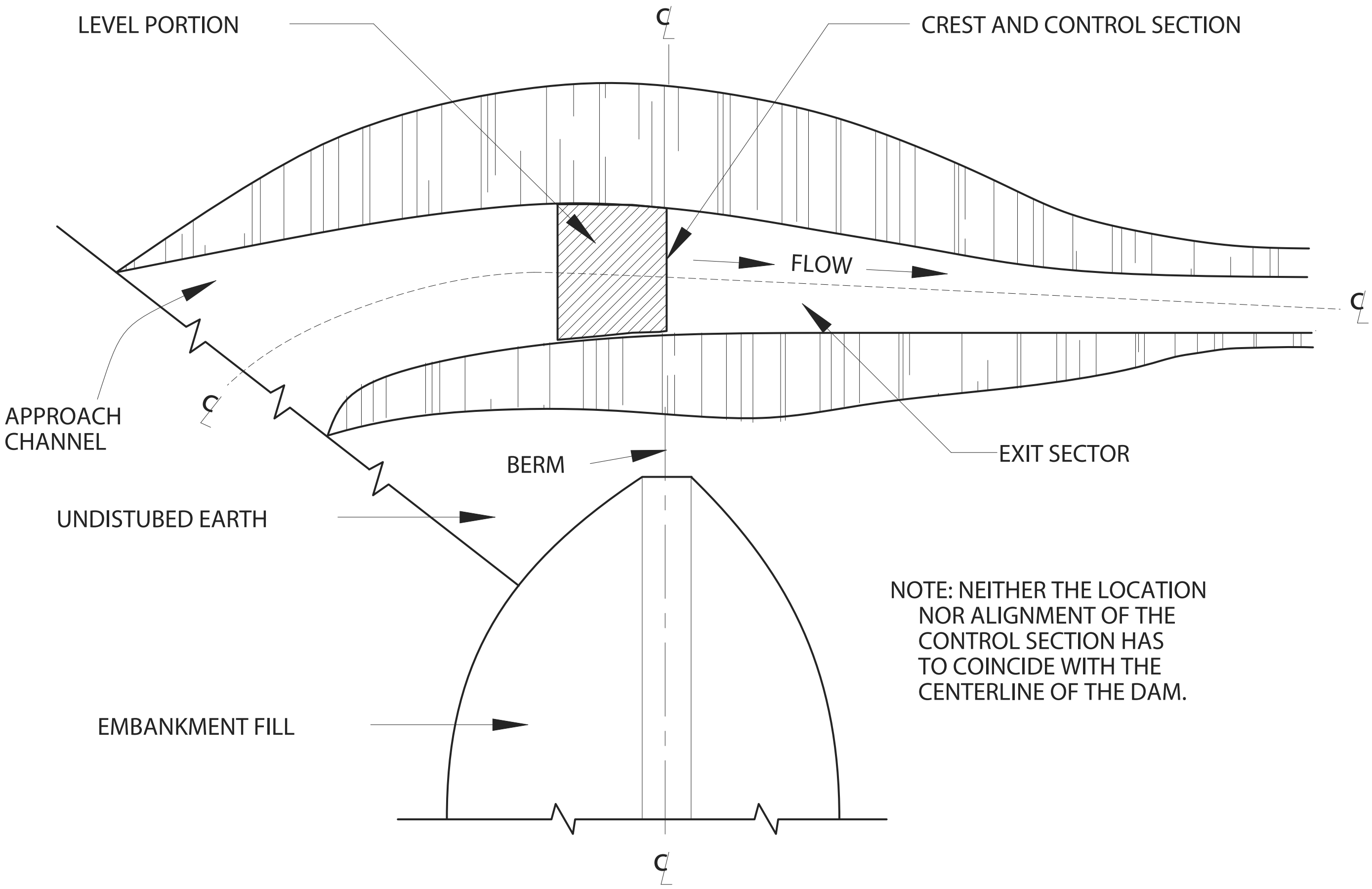
Emergency Spillway



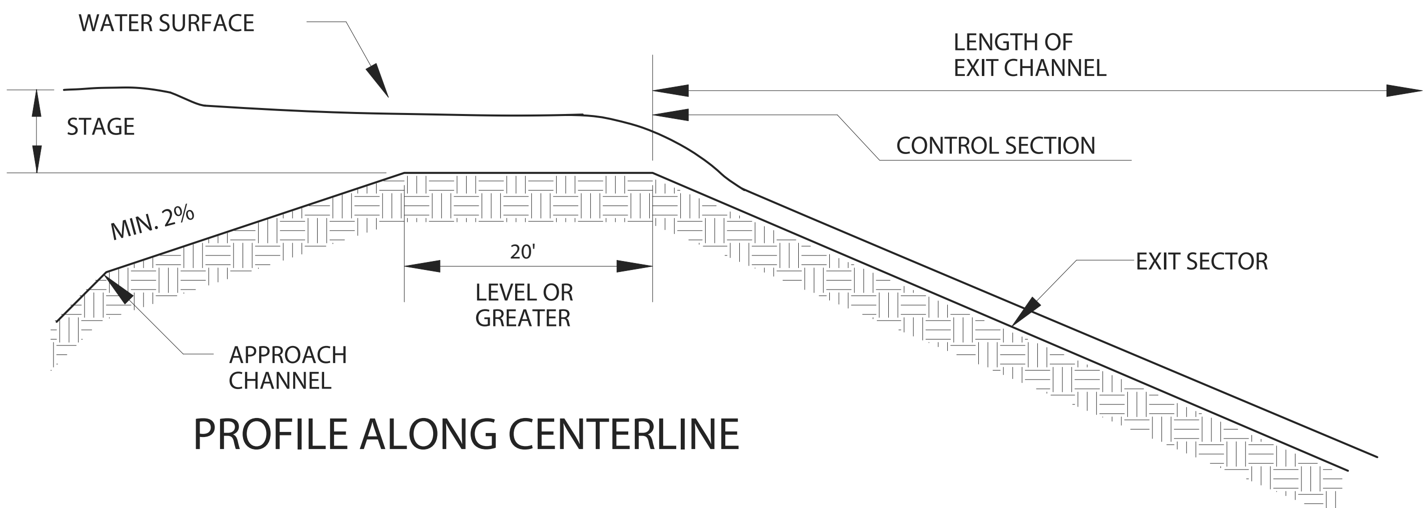
Source: VA DSWC

Figure 10

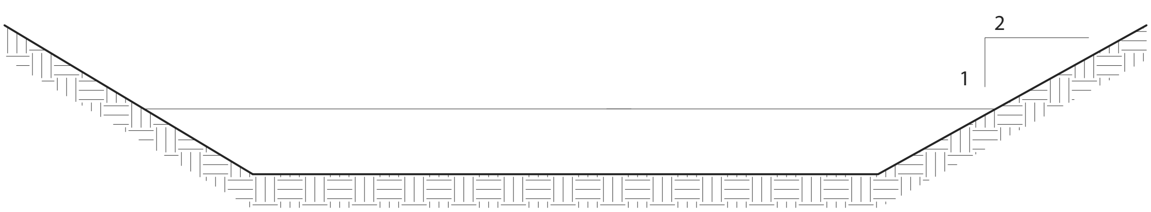
Excavated Earth Spillway



PLAN VIEW



PROFILE ALONG CENTERLINE



CROSS-SECTION AT CONTROL SECTION

Source: US - NRCS

Figure 11

spillway approach, crest and channel sections without causing erosion.

An evaluation of site and downstream conditions must be made to determine the feasibility and justification for the incorporation of an emergency spillway. In some cases, the site topography does not allow a spillway to be constructed in undisturbed material, and the temporary nature of the facility may not warrant the cost of disturbing more acreage to construct and armor a spillway. The principal spillway should then be sized to convey all the design storms. If the basin is designed as a permanent facility with downstream restrictions, the added expense of constructing and armoring an emergency spillway may be justified.

Capacity: The emergency spillway shall be designed to carry the portion of the peak runoff discharge expected from a 25-year 24-hour storm event that is not credited to the principal spillway.

Design Elevations: The maximum 25-year storm pool elevation shall have a freeboard of at least 1.0 foot below the top of the embankment. The control crest of the emergency spillway channel shall be at least 1.0 foot above the crest of the principal spillway.

Location: The emergency spillway channel should be located so that it is not constructed over erosion-susceptible fill material. The channel should be located so as to avoid sharp turns or bends. The channel should return the flow of water to a defined channel downstream from the embankment. Caution should be given in directing all outlet water from the impoundment to an established watercourse so that natural flow paths are preserved above off-site property owners.

Maximum Velocities: The maximum allowable velocity in the emergency spillway channel will depend upon the type of lining used. Vegetated linings should only be used for low velocity and non-scouring applications. Otherwise, non-erodible linings such as concrete or riprap should be used. For non-erodible linings, design velocities may be increased. However, the emergency spillway channel shall return the flow to the downstream receiving channel at a non-eroding velocity.

Stabilization: The embankment of the sediment basin shall receive vegetative cover immediately after installation. Refer to **Disturbed Area Stabilization (With Permanent Vegetation) - PS** for recommended vegetation details. If excavation is required in constructing the basin, side slopes should not be steeper than 1.5:1.

Disposal: Sediment should be removed from the basin before the sediment level reaches higher than 1 foot below the bottom of the dewatering orifice, or before one-half of the permanent pool volume has been filled in, whichever occurs first. Plans for the sediment basin should indicate the methods for disposing of sediment removed from the basin. Possible alternatives are to use the material in fill areas on-site, or removal to an approved off-site location.

Sediment basin plans should indicate the final disposition of the sediment basin after the upstream drainage area is stabilized. The plans should include methods for the removal of excess water lying over the sediment, stabilization of the basin site, and the disposal of any excess material. Where the sediment basin has been designed as a permanent storm water management basin, plans should also address the steps necessary for the conversion of the sediment basin into a permanent detention or retention structure.

Health and Safety: The designer and developer should be aware of the potential hazards that a temporary wet pond represents to the health and safety of a neighborhood. Sediment basins can be attractive to children and can be dangerous to those who may accidentally slip into the water and soft mud or who may become entrapped at flowing inlets. The basin area should, therefore, be fenced or otherwise made inaccessible to persons or animals, unless this is deemed unnecessary due to the remoteness of the site or other circumstances. Strategically placed signs around the impoundment reading “DANGER-QUICKSAND” should also be installed. In addition to signs and fences, consideration should be given to frequent inspection, regular maintenance and provision for security at such facilities. In any case, local ordinances and regulations regarding health and safety must be adhered to.

Flocculant and Coagulant Aids: In situations with particularly fine-grained and erodible soil (i.e. loess or clays), the design professional may consider the use of flocculants added to the sediment-laden runoff prior to its entrance into the sediment basin. These flocculants encourage the fine sediment particles to "stick together" which allows them to settle more quickly and effectively. Coagulant aids such as polymers may be used. A common polymer for this purpose is synthetic polyacrylamide (PAM), which may be added to the sediment-laden runoff as it enters the basin, or sprayed on bare slopes to reduce erosion and the transport of sediment. Refer to specification **Polyacrylamide - PAM**. The means of delivery for these chemicals and their application rates will be provided by the engineer in the form of appropriate standard detail drawings and specifications. An example of such an application is shown in Figure 12.

CONSTRUCTION SPECIFICATIONS

Site Preparation: Areas under the proposed embankment (or any structural works related to the sediment basin) shall first be cleared, grubbed, and stripped of topsoil. All trees, vegetation, roots, and/or other objectionable or inappropriate materials should be removed and disposed of by appropriate methods. In order to facilitate clean out and restoration, the pool area, as measured from the top of the principal spillway, should be cleared of all brush and trees.

Cut-Off Trench: For earth-fill embankments, a cutoff trench shall be excavated along the centerline of the earth fill embankment (dam). The trench must extend at least 1 foot into a stable, impervious layer of soil and have a minimum depth of 2 feet. The cutoff trench shall extend up both abutments to the riser crest elevation. The minimum width shall be 4 feet, but also must be wide enough to permit operation of compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for the embankment. The trench shall be drained during the backfilling/compacting operations.

Embankment: The fill material shall be taken from approved borrow areas (shown on the plans). It shall be clean mineral soil, free of roots, woody vegetation, stumps, sod, oversized stones, rocks, or other perishable or objectionable material. The fill material selected must have enough strength for the dam to remain stable and be tight enough, when properly compacted, to prevent excessive percolation of water through the dam. Fill containing particles ranging from small gravel or coarse sand to fine sand and clay in desired proportion is appropriate. Any embankment material should contain approximately 20% clay particles by weight. Using the Unified Soil Classification System, SC (Clayey sand), GC (clayey gravel) and CL ("low liquid limit" clay) are among the preferred types of embankment soils. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material should contain the proper amount of moisture to ensure that at least 95% compaction will be achieved. Fill material will be placed in 6-inch continuous layers over the entire length of the fill. Compaction shall be obtained by routing the hauling equipment over the fill so that the entire surface of the fill is traversed by at least one wheel or tread track of the equipment, or by using a compactor. Special care shall be taken in compacting around the anti-seep collars (compact by hand, if necessary) to avoid damage and achieve desired compaction. The embankment shall be constructed to an elevation 10% higher than the design height to allow for settlement if compaction is obtained with hauling equipment. If compactors are used for compaction, the overbuild may be reduced to not less than 5%.

Addition of Chemical Flocculent at Sediment Basin Entrance

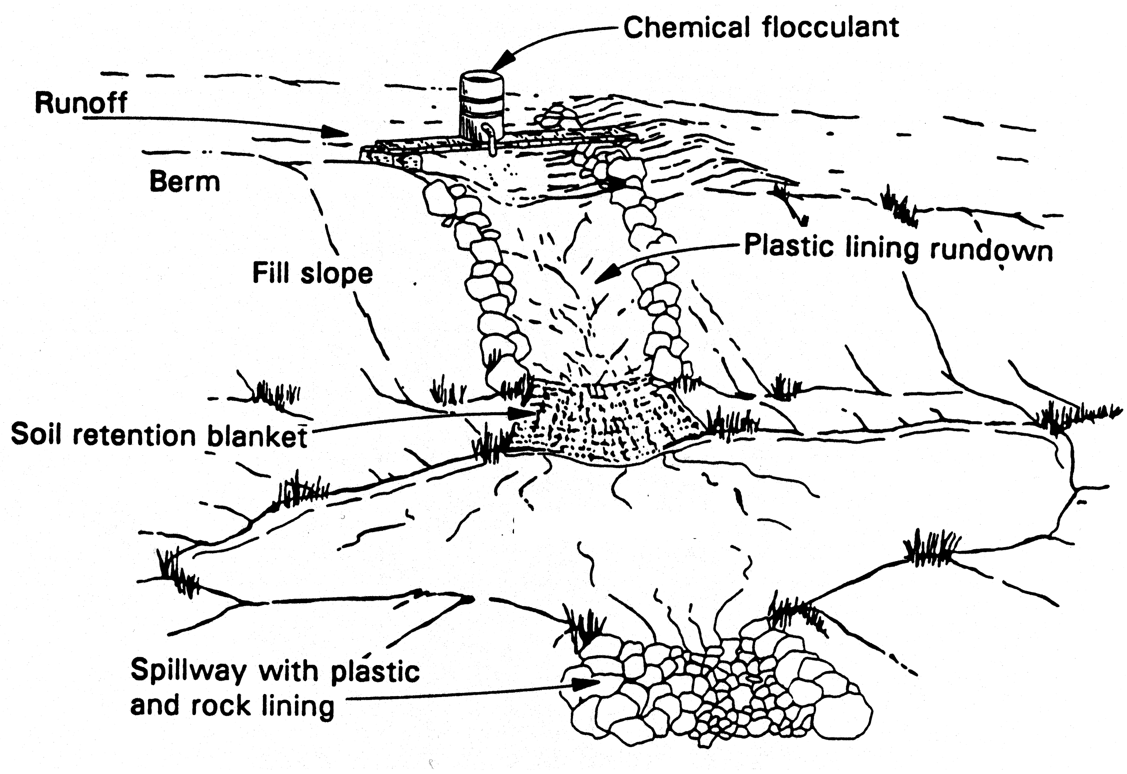


Figure 12

Note: Illustration shows exaggerated foreshortening. Sediment Basin length to width proportions are incorrect and not according to specifications within this standard.

Principal Spillway: The riser of the principal spillway shall be securely attached to the barrel pipe by welding the full circumference making a watertight connection. The barrel and riser shall be placed on a firmly compacted soil foundation. The base of the riser shall be firmly anchored according to design criteria to prevent its floating. Pervious materials such as sand, gravel, or crushed stone shall not be used as backfill around the barrel or anti-seep collars. Fill material shall be placed around the pipe in 4-inch layers and compacted until 95% compaction is achieved (compact by hand, if necessary). A minimum of two feet of fill shall be hand-compacted over the barrel before crossing it with construction equipment.

Emergency Spillway: The emergency spillway shall be installed in undisturbed ground. The implementation of planned elevations, grades, design width, entrance and exit channel slopes are critical to the successful operation of the emergency spillway and must be constructed within a tolerance of 0.2 feet. If the emergency spillway requires erosion protection other than vegetation, the lining shall not compromise the capacity of the emergency spillway, e.g. the emergency spillway shall be over-excavated so that the lining will be flush with the designed slope surface.

Vegetative Stabilization: The embankment and emergency spillway of the sediment basin shall be stabilized with the appropriate temporary or permanent vegetation immediately after construction of the basin. Trees and/or shrubs should not be allowed to grow upon the embankment due to the ability for the roots of such vegetation to destabilize the embankment and/or encourage piping.

Erosion and Sediment Control: The construction of the sediment basin shall be carried out in a manner such that it does not result in sediment problems downstream.

Safety: All state and local requirements shall be met concerning fencing and signs warning the public of the hazards of soft, saturated sediment and flood water.

Final Disposal: When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with the SWPPP. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. If the site is scheduled for future construction, then the embankment and trapped sediment must be removed, safely disposed of, and backfilled with a structural fill. When the basin area is to remain open space, the pond may be pumped dry, graded and backfilled.

INSPECTION

Inspections of sediment basins should be made before anticipated storm events (or series of storm events such as intermittent showers over one or more days) and within 24 hours after the end of a storm event of 0.5 inches or greater, and at least once every fourteen calendar days. The basin embankment should be checked according to permit requirements to ensure that it is structurally sound and has not been damaged by erosion or construction equipment. The emergency spillway should be checked to ensure that its lining is well established and erosion-resistant.

MAINTENANCE

Maintenance needs identified in inspections or by other means should be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified. Accumulated sediment shall be removed from the basin when it reaches the specified distance below the top of the riser. Sediment shall not enter adjacent streams or drainage ways during sediment removal or disposal. The sediment shall not be deposited downstream from the embankment, adjacent to a stream or floodplain.

A recommended inspection and maintenance checklist is shown on the following page.

Sample Field Inspection and Maintenance Checklist

Name/location of site: ___________________________
Date: _____________
Inspector(s): ____________________________
____

- Inspect embankment slopes and crest for :
    - erosion ____
    - structural stability (slumping, bulging, sliding) __________________________
    - cracking (both longitudinal and lateral) ________________________________
    - wet or soft spots or on lower downstream slope and toe area _____________
    - discolored or muddy water seepage _________________________________
    - uneven crest settlement (check if adequate freeboard above
    - emergency crest) ____
- Inspect basin slopes for:
    - erosion____
    - sliding or slumping ____
- Check amount of sediment in pond for cleaning ____________________________________
- Check baffles for structural soundness and holes or breaks ___________________________
- Inspect trash rack and anti-vortex device for debris and blockage ______________________
- Inspect emergency spillway for obstructions ____
- Check emergency spillway entrance, channelway, and exit for significant erosion and scouring ____
- Check principal spillway outlet for excessive scouring and erosion _____________________
- Check all safety- and health-related facilities (warning signs, fences, etc.)________________
- Check for vandalism, especially around and inside principal spillway riser _______________
- Inspect dewatering device for debris/silt clogging and structural integrity _________________
    - Inspect outside edge of outlet pipe for excessive seepage (i.e., flowing water) -- look for discolored or muddy water along the sides as a sign of serious piping or pipe joint separation.

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Other comments and observations:
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