Fact Sheet 2.2: Basins

The mitigation objective of this Fact Sheet is to reduce flooding and contamination below stormwater management facilities due to flood conditions.

Basins are generally used to collect stormwater and release it at a controlled rate to prevent flooding and erosion. Some basins can also filter some pollutants out of the water before it enters the storm drain system. Table 2.2.1 summarizes some common mitigation solutions that can improve the performance of these basins.

Table 2.2.1. Basin Mitigation Solutions

Solutions and Options	***Stormwater Basins***	***Bioretention Areas***	***Dry Swales***	***Wet Ponds***	***Extended Detention Ponds***
Option 1: Install Riprap	✓		✓	✓	✓
Option 2: Install Screens	✓	✓	✓	✓	✓
Option 3: Add Vegetation	✓	✓	✓	✓	✓
Option 4: Strengthen Riser	✓	✓		✓	✓
Option 5: Increase Capacity				✓	✓

Stormwater Basins

Stormwater basins must remain stable and intact during severe flooding events such as hurricanes and severe storms. These structures typically fail during severe storm events when overwhelmed by flood volumes that exceed the facility's design capacity or by defects or lack of maintenance that result in reduced storage capacity. For these reasons, mitigation for stormwater basins can be a beneficial capital investment.

- Impoundments or excavated areas are usually installed on developed sites for the short-term detention of stormwater runoff from a small watershed.
- Many on-site stormwater storage facilities were built to meet a community's development regulations.

- Determined by design, water is retained for a short period to allow pollutants to settle from the water column to the pond's bottom and then slowly release downstream at or below pre-development flow rates.
- Typical basin structure components are shown in Figure 2.2.1.

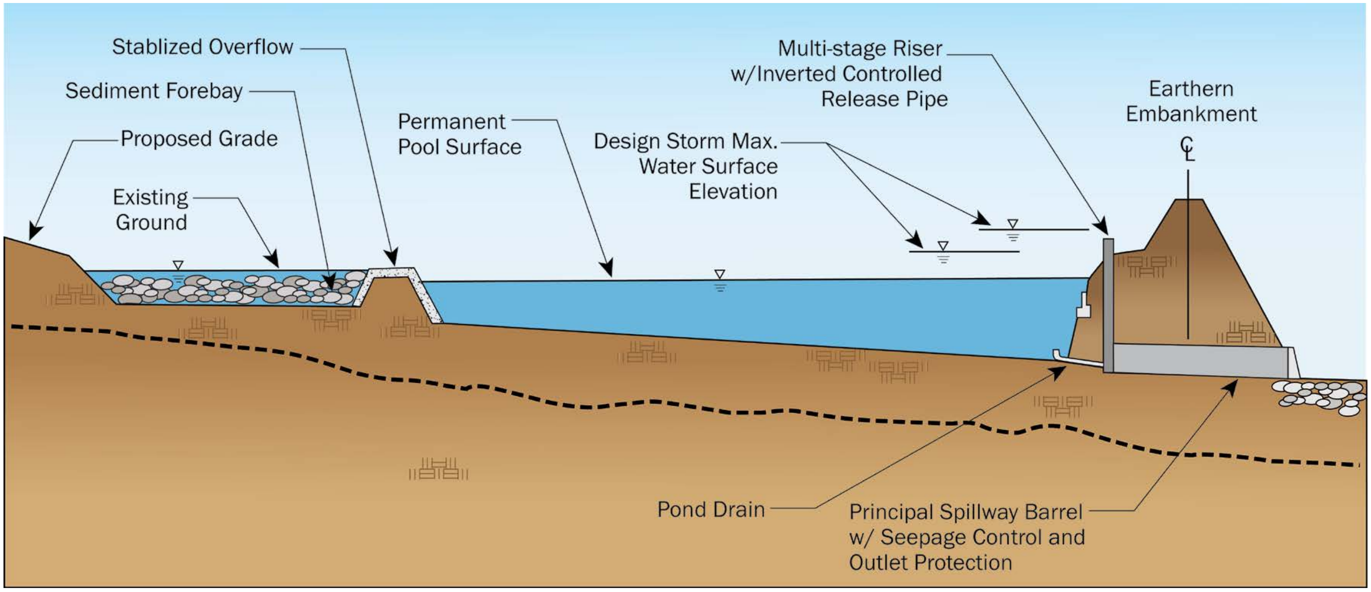


Figure 2.2.1. Typical stormwater basin cut.
(Source: Virginia Department of Conservation and Recreation, 1999)

Rural Stormwater Basins

- Many rural stormwater basins were built during the mid-late twentieth century for rural watershed flood protection and have been poorly maintained due to funding backlog. These stormwater basins are vulnerable to failure during extreme flood volumes due to reduced capacity or failure of equipment or embankment structures.

Bioretention Areas

Bioretention areas are shallow depressions lined with filter materials and topped with mulch and plantings. When functioning properly, water pools above the mulched planting area and quickly drains. Damage can occur when the filter media and underdrains become clogged and cannot properly treat and drain floodwater. Figure 2.2.2 shows a typical bioretention facility.

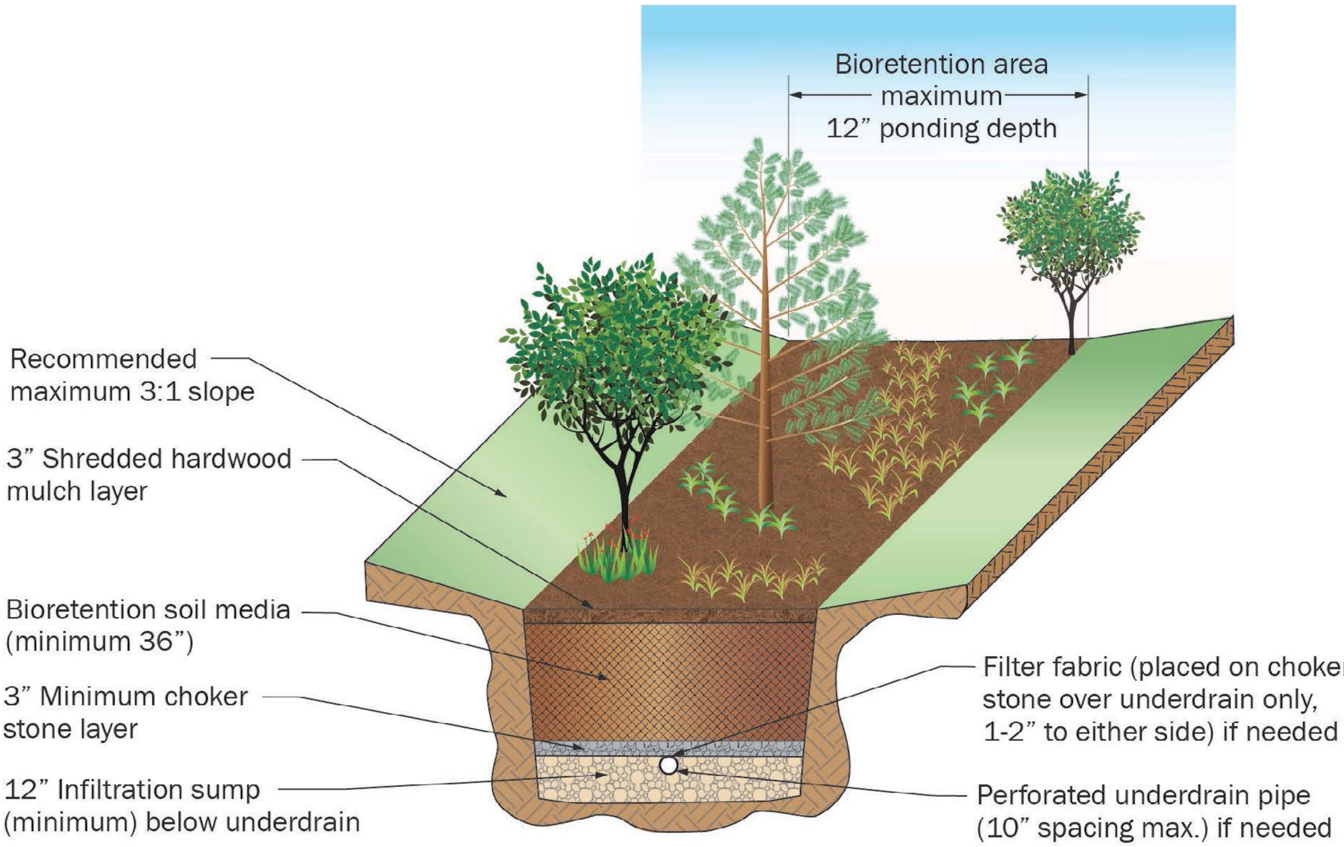


Figure 2.2.2. Typical bioretention facility.
(Source: Virginia Department of Conservation and Recreation, 2013(a))

Dry Swales

Dry swales are very similar to bioretention facilities but are shallow, linear channels that filter water and convey runoff to specific outfalls. They also feature a soil media filter layer below the channel that directs the water into an underdrain or the underlying soils. Dry swales may include energy dissipating check dams throughout the channel. Dry swale facilities usually treat runoff from areas that are less than five acres. Figure 2.2.3 shows a typical dry swale with check dam profile.

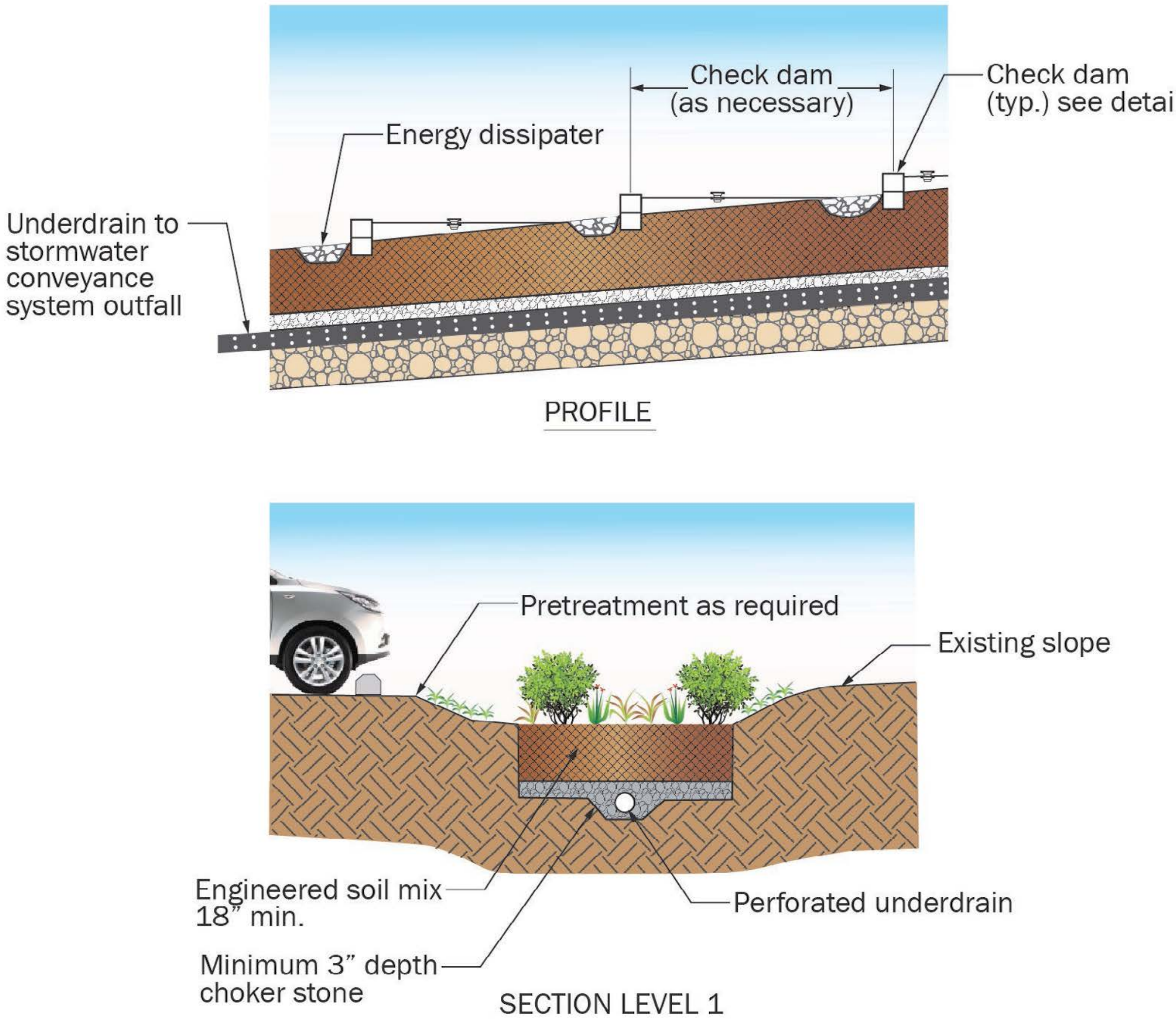


Figure 2.2.3. Typical dry swale with check dams.

Wet Ponds

Wet ponds collect and store stormwater in a permanent, on-site pond or basin which slowly releases that stormwater. Basins treat stormwater by retaining, or "holding", runoff for a designated period (usually 24 or 48 hours) to allow pollutants like sediments, heavy metals, and nutrients to settle to the pond bottom and petroleum chemicals to be removed by biological action. Wet ponds are designed to have appropriate detention capacity for a stated storm frequency to control storm runoff long enough to mitigate water pollution and reduce the discharge out of the basin. The pond area usually is 1% to 3% of its drainage area and has between 10 to 25 acres draining to it. Figure 2.2.4 shows a typical plan view of a wet pond, and Figure 2.2.5 shows a typical section view.

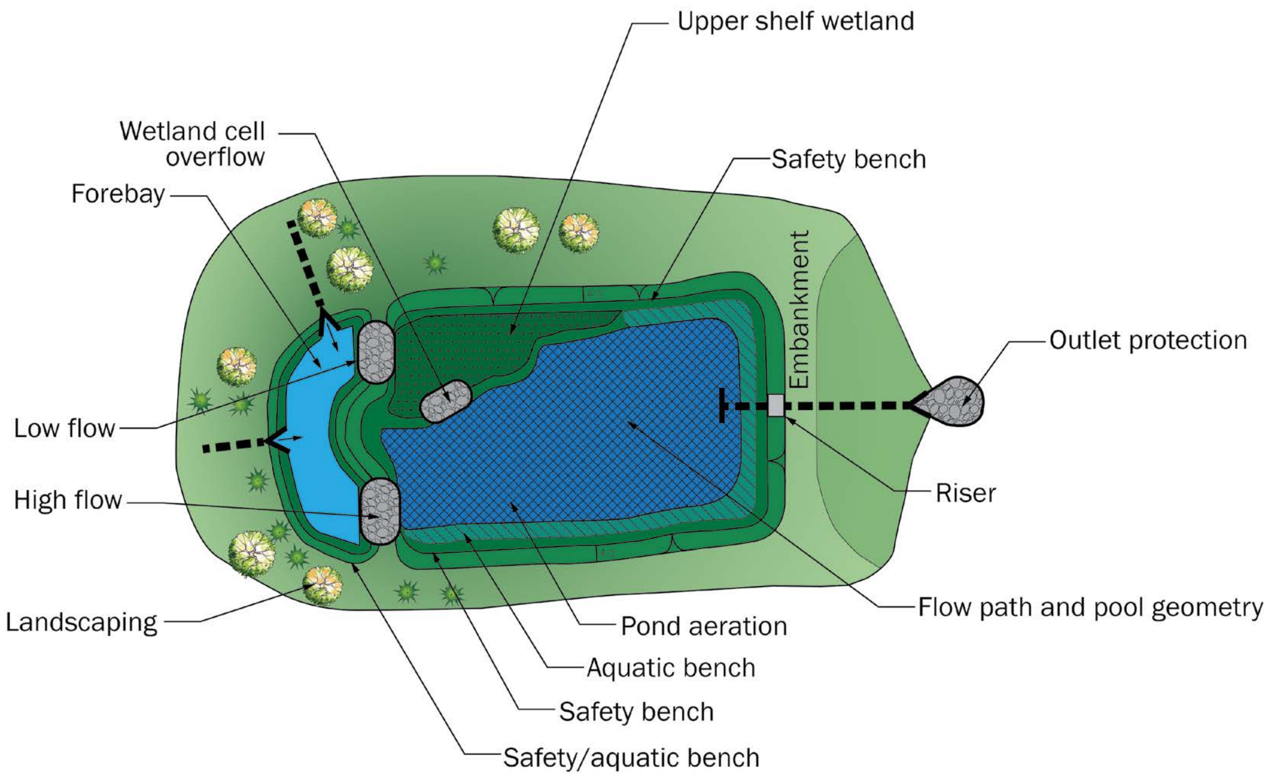


Figure 2.2.4. Wet pond plan view.

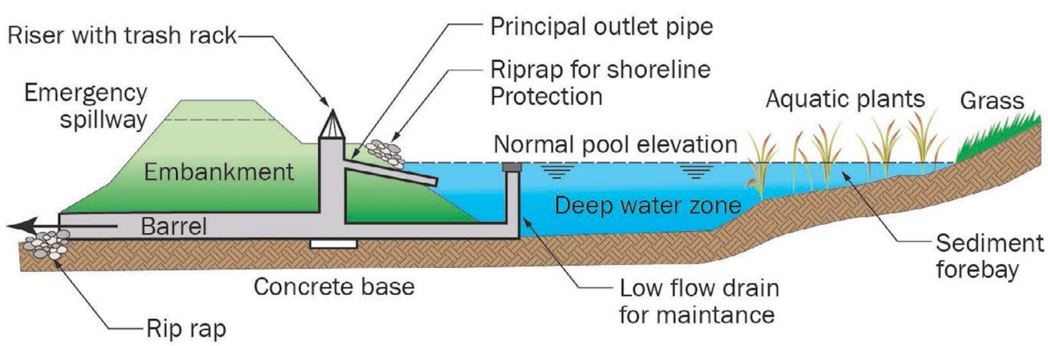


Figure 2.2.5. Wet pond section view.

Extended Detention Ponds

Extended detention ponds are a mix of wet ponds and dry ponds that store water and release it over a 24 to 48-hour period to treat pollutants and minimize downstream flood impacts. Figure 2.2.6 shows a typical plan view of an extended detention pond. These facilities have many of the same potential problems as wet ponds: erosion, sediment control, and damage to the riser. Mitigation measures are similar to Wet Ponds.

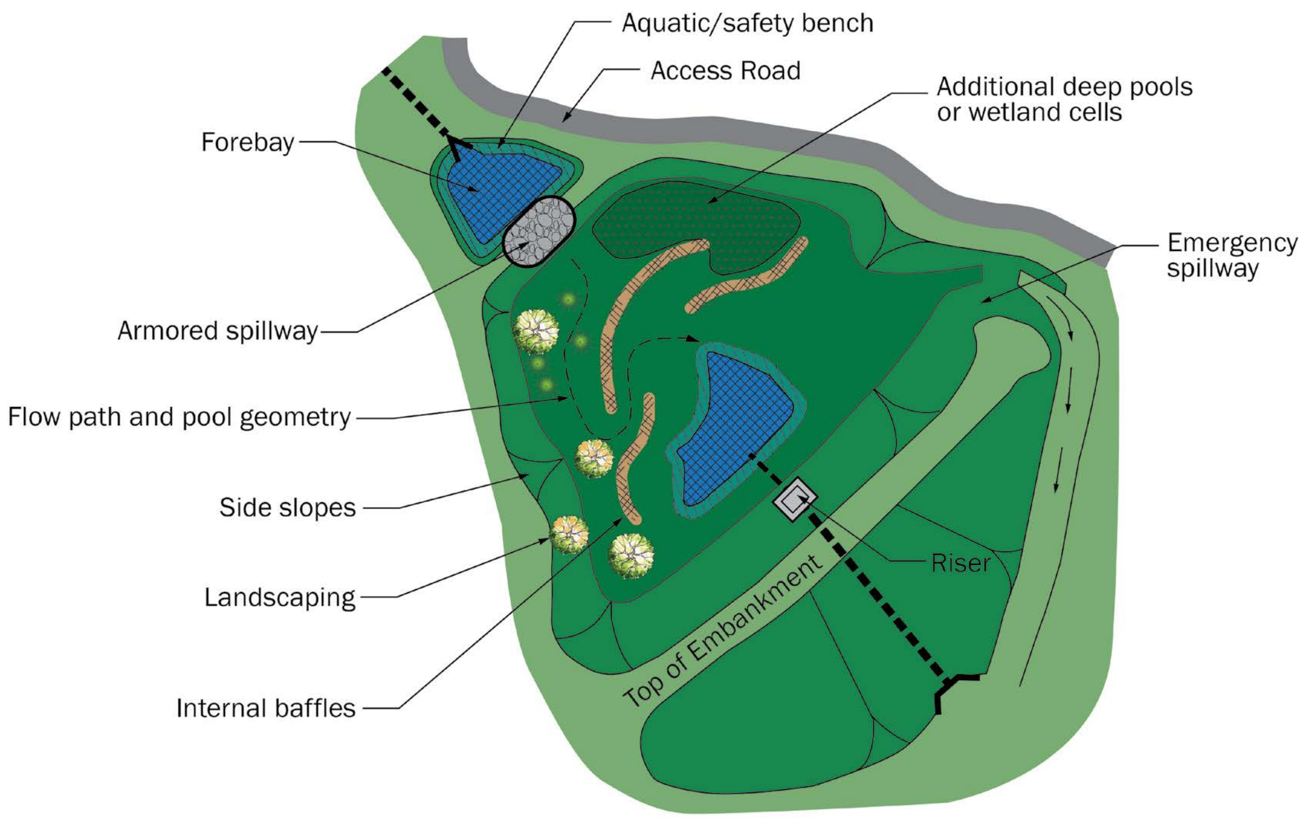


Figure 2.2.6. Extended Detention Pond.

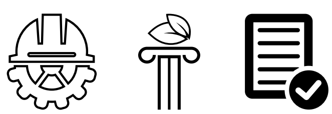
Mitigation Solutions

Option 1: Install Riprap

Basins can be vulnerable to erosion, undercutting and scour which can lead to damage to embankments, side slopes or other components of the basin design. Riprap can be used to reinforce embankments and side slopes, inlets, outlets, overflow spillways and risers. Considerations for riprap installation include:

- Riprap is generally easy to install but may require heavy equipment; determine if site conditions will accommodate the size of equipment needed for installation.
- Riprap should be sized appropriately for the flow conditions. If riprap was present before but did not perform adequately, evaluate the size of the riprap to determine if it should be increased.
- Riprap should be placed to prevent movement of the rock resulting from the velocity and force of water.
- Protection against erosion can be enhanced by installing the riprap over a layer of geotextile fabric.
- Riprap placed immediately upstream of an inlet can help protect against small debris plugging.
- The use of riprap may preclude regrowth of riparian areas. Live stakes and fascines can be placed between riprap to improve effectiveness and foster growth of riparian areas.

CONSIDERATIONS:

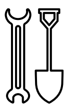


Option 2: Install Screens

All basins are vulnerable to the accumulation of sediment, trash, or other debris which can lead to reduced storage or conveyance capacity. To address this issue, removing the accumulated sediment and debris is recommended in combination with installing screens to prevent future accumulation of debris. The following techniques may complement this mitigation strategy:

- Clear the underdrain pipe of clogs and the observation cleanout (if there is one).
- Install debris screens to avoid future clogging.
- These are generally inexpensive and easy to install.
- Screens require regular removal of debris to prevent clogging.
- This option can also keep inlets, outlets, and risers functioning as intended.

CONSIDERATIONS:

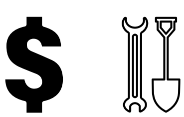


Option 3: Add Vegetation

Basins can be vulnerable to erosion which can lead to damage to embankments, side slopes or other components of the basin design. Adding vegetation can stabilize and reinforce erosion areas. Considerations for adding vegetation include:

- This option can be used alone or together with other stabilization measures.
- Minimize erosion and maintain storage capacity through the addition of vegetation to bench basin embankment areas.
- Carefully selected grasses, shrubs, and other ground cover can be effective in reducing soil erosion. Native species should be used.
- The selection and design of bioengineered embankment protection should consider the steepness of embankment, expected flow rates, and the growing season of the vegetation selected.
- Where flow velocities are of concern, anchor vegetation using stakes to hold it in place while it takes root.

CONSIDERATIONS:

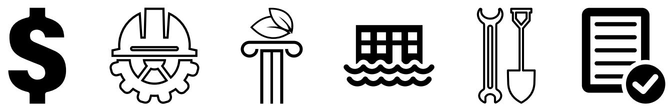


Option 4: Strengthen Riser

Many basins have risers to control water flow, prevent ponding, and release water at a reduced rate. Risers can be vulnerable to spalling, joint failure, corrosion, cracks in the structure, pipe failure or other structural damage which could negatively impact their performance. Considerations when strengthening risers include:

- Repair riser damage immediately after the storm to reduce or prevent leakage.
- Repair spalling and joint damage.
- Apply an interior coating to strengthen the riser structure unless risers are perforated or slotted CMP.

CONSIDERATIONS:

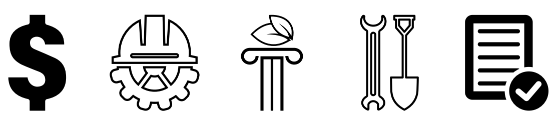


Option 5: Increase Capacity

Over time, sediment can build up in basins, limiting flood storage capacity. Increase capacity by dredging, removing sediment, expanding the footprint of the basin and removing obstructions. Considerations for increasing capacity include:

- This option is appropriate for wet ponds and extended detention ponds.
- After large rainstorms, if the storage capacity of the wet pond has been hindered because of sediment build-up, it may be appropriate to dredge the wet pond to an increased capacity.
- Dredge permanent pool every five to seven years to maintain facility storage capacity.

CONSIDERATIONS:



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