Additional Recommended Design Criteria, Specifications and Methodologies

The following criteria, specifications, and methodologies are recommended for stormwater management systems that are not specified by applicable regulatory requirements of federal, state or local jurisdictions.

Wet Detention Systems: These systems collect and temporarily store stormwater in a permanently wet impoundment in such a manner as to provide for treatment through physical, chemical, and biological processes with subsequent gradual release of the stormwater. These systems should be designed to meet the following requirements:

1. Required volume: First 0.5 inch of runoff or 1.5 inches of runoff from impervious area.

2. Return time: Outfall structure must discharge one half (½) volume of stormwater within 48 to 72 hours. No more than one half (½) the volume will be discharged within 48 hours.

3. Permanent pool: Provide average residence time at least 14 days during wet season

4. Littoral zone design:

    a. Sloped (4:1 or flatter) to a depth of at least 2 feet below control elevation; approximately 30 percent of the wet detention system surface area should be littoral zone (ratio of vegetated littoral zone to surface area of the pond at the control elevation).
    b. The treatment volume should not cause pond level to rise more than 18 inches above the control elevation, unless the littoral zone vegetation can survive at greater depths.
    c. Eighty percent coverage of the littoral zone vegetation should be established within the first 24 months. Portions of the littoral zone may be established by placement of wetland topsoils (at least a four-inch depth) containing a seed source of desirable native plants. To utilize this alternative, the littoral zone must be stabilized by mulching or other means.

5. A forebay should be established at the pond inflow points to capture larger sediment particles and be 4 to 6 feet deep. The forebay volume should equal about 20% of the total basin volume. Multiple inlets may require additional volume. Direct maintenance access should be a minimum of 15 feet wide, with a maximum slope of 5:1.

6. Mean depth of the permanent pool should be between 2 and 8 feet. The maximum depth should not exceed 12 feet below the invert of the outlet device, unless the deeper depths will not inhibit physical, chemical, and biological treatment processes or cause re-suspension of pollutants into the water column due to anaerobic conditions in the water column.

7. Flow path through pond should have an average length-to-width ratio of at least 2:1. The alignment and location of inlets and outlets should maximize flow paths in the pond. If short flow paths are unavoidable, the effective flow path should be increased by adding diversion barriers such as islands, peninsulas, or baffles to the pond. Inlet structures should be designed to dissipate the energy of water entering the pond.

8. Outlet devices incorporating dimensions smaller than three inches minimum width or less than 20 degrees for “v” notches should include a device to eliminate clogging. Examples include baffles, grates, and pipe elbows.

9. Outlet structure invert elevations should be at or above the estimated post-development normal groundwater table elevation. If the proposed structure is set below this elevation, groundwater inflow must be considered in the drawdown calculations, calculation of average residence time, estimated normal water level in the pond, and pollution removal efficiency of the system.

10. Permanent maintenance easements or other acceptable legal instruments to allow for access to and maintenance of the system (including the pond, littoral zone, inlets, and outlet) should be established.

Dry Retention Systems: These systems are designed to collect and temporarily store stormwater in a normally dry basin with subsequent gradual release of the stormwater. Dry detention is recommended as an off-line system, but if the design calls for an in-line system, additional volume may be required. Additional volume may be required for on-line systems. These systems should be incorporated as a best management practice in a treatment train approach, which includes other best management practices including, but not limited to, grassed swales, level spreaders, filter strips, buffer zones, bioretention, and skip curbs—all with water flow lengths less than 300 feet. Dry retention systems are not recommended for use in areas that require piped water conveyance systems. These systems should be designed to meet the following requirements:

1. Required volume: first 1.0 inch of runoff or 2.5 inches from impervious areas, whichever is greater.

2. Return Time: Discharge one-half the appropriate treatment volume of stormwater specified above between 24-30 hours following a storm event.

3. Discharge structures should include a device to prevent the discharge of accumulated sediment, minimize exit velocities, and prevent clogging. A perforated riser enclosed in a gravel jacket and perforated pipes enclosed in sand or gravel is a good example.

4. Contain areas of standing water for no more than 3 days following a storm event.

5. Stabilize with permanent native vegetative cover.

6. Average flow path through the basin should have a length-to-width ratio of at least 3:1. The alignment and location of inlets and outlets should be designed to maximize flow paths in the basin. If short flow paths are unavoidable, the effective flow path should be increased by adding diversion barriers such as baffles.

7. Inlet structures should be designed to dissipate the energy of water entering the basin.

8. A maintenance schedule is recommended for removal of sediment and debris on at least a bi-monthly basis, as well as mowing and removal of grass clippings.

9. Basin floor should be level or uniformly sloped (1-2% maximum) toward the outfall structure.

10. Basin floor should be at least three feet above the seasonal high groundwater table elevation. Sumps may be placed up to one foot below the control elevation.

11. Permanent maintenance easements or other acceptable legal instruments should be in place to allow for access to and maintenance of the system. The easement or other acceptable instrument should cover the entire stormwater system.

Constructed Wetland Systems: Wetland systems collect and temporarily store stormwater in a permanently wet impoundment and provide treatment through physical, chemical, and biological processes. These systems should be designed to meet the following requirements.

1. Required volume: First 1.0 inch of runoff or 2.5 inches of runoff from impervious area.

2. Inflow of water must be greater than infiltration.

3. Designed for an extended detention time of 24 hours for the 1-year storm event.

4. Protection against blockage should be installed around outlets vulnerable to blockage from plant material or other debris that will enter the basin with stormwater runoff. Reverse slope pipes are recommended.

5. Surface area of the wetland should account for a minimum 3% of the area of the watershed draining into it.

6. The length-to-width ratio should be at least 3 to 1.

7. Deeper area of the wetland should include the outlet structure so that the outflow from the basin is not impeded by sediment buildup.

8. A forebay should be established at the pond inflow points to capture larger sediment particles and be 4 to 6 feet deep. The forebay volume should equal about 20% of the total basin volume. Multiple inlets may require additional forebay volume. Direct maintenance access should be a minimum of 15 feet wide, with a maximum slope of 5:1.

9. In cases where water velocities exceed 0.5 ft/s, energy dissipation devices should be installed.

10. Pre- and post-grading pondscaping design should be used to create both horizontal and vertical diversity and habitat.

11. Approximately 30 to 50 percent of the shoulder area (12 inches or less) of the basin should be planted with native wetland vegetation.

12. A 25-foot buffer, for all but pocket wetlands, should be established and planted with native riparian and upland vegetation.

13. Surrounding slopes should be stabilized by planting in order to minimize sediment and pollutants from entering the wetland.

14. A written maintenance plan should be provided and adequate provision made for ongoing inspection and maintenance. Maintenance should be scheduled more often during the first three years after construction.

15. Permanent maintenance easements or other acceptable legal instruments to allow for access to and maintenance of the system are recommended. The easement or other acceptable instrument should cover the entire stormwater system.

Swale Systems: These systems are man-made trenches that filter and treat stormwater runoff as part of a treatment train approach. Swale system criteria may vary depending on its place in the treatment train. However, at a minimum, these systems should be designed to meet the following requirements:

1. Required volume should be designed for a 6-month, 24-hour design storm event.

2. No contiguous areas of standing or flowing water within 72 hours following storm event.

3. Peak discharges should be 5 to 10 cfs.

4. Water velocity should be 1.0 to 1.5 ft/s.

5. Maximum design flow depth should be 1 foot.

6. Swale slopes:
   a. Graded as close to zero as possible and still permit drainage
   b. Should not exceed 2%

7. Must have a top width–to-depth ratio of greater than 6:1, or cross-section side slopes of 3:1 (horizontal:vertical) or flatter.

8. Swale length should be at least 100 feet per acre of drainage area.

9. Underlying soils should have high permeability.

10. Swales must be planted with or have stabilized native vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake.

11. Soil erodibility, soil percolation, slope, slope length, and drainage area must be taken into account, in order to prevent erosion and reduce pollutant concentration of any discharge.

12. Permanent maintenance easements or other acceptable legal instruments to allow for access to and maintenance of the system are recommended. The easement or other acceptable instrument must cover the entire stormwater system.

Manufactured Stormwater Treatment Systems: These systems are recommended for use in commercial and industrial developments. The manufactured systems should satisfy the following conditions:

1. Field test data from the southeastern United States should be available. The test data should be from an area with similar rainfall distribution as the project area.

2. Field test data should provide the following results:
   a. Removal of 70-80% of total suspended solids (TSS)
   b. Particle size distribution for TSS removal rates
   c. Conditions under which TSS removal is obtained (storm event, rainfall intensity, etc.)

3. Maintenance information should include how often the system should be serviced.

4. Manufactured systems should be structurally sound and designed for acceptable municipal and commercial traffic loadings.

5. Manufactured systems should not allow inflow or infiltration.

6. Weirs, openings, and pipes should be sized to pass, as a minimum, the storm drain system design storm.

7. Manholes should be provided to each chamber to provide access for cleaning.

8. Treatment train approach incorporating the use of other appropriate best management practices is recommended because efficiency will be increased and maintenance reduced.

9. Permanent maintenance easements or other acceptable legal instruments to allow for access to and maintenance of the system are recommended.

Detention Practice Criteria: These criteria are recommended when post-construction runoff volumes should be kept to pre-construction values in order to prevent downstream degradation and flooding. Detention basins and associated outflow structures should be designed to address the 2-year, 5-year, 10-year, 25-year, and 50-year, 24-hour storm events.

Runoff volumes and rates may be calculated using the SCS Runoff Curve Number Method (see Appendix Volume, Appendix A, A-16).

Detention storage may be determined using the Short Cut Floodrouting Method for determining drainage areas and runoffs that fall with the method's limits. If drainage areas and runoffs fall outside the method's limits, other detention sizing methodologies should be used.

Erosion and Sediment Control Calculations for Estimated Reductions: The effect of BMPs may be calculated using the USLE methodology (see Appendix Volume, Appendix A, A-2). During construction, the BMP plan should demonstrate the ability to keep sediment yield to 115% of the pre-disturbance sediment yield (15% increase in sediment above pre-disturbance conditions). This is known as performance-based planning. A performance-based plan can demonstrate that selected practices may meet the desired results.

Effectiveness of Erosion and Sediment Control BMPs: An estimate of the effectiveness of selecting the more common erosion and sediment control BMPs may be found on Page A-11 (in the Appendix Volume). These estimates can help in performance-based planning.