

APPENDIX I

STORMWATER BMP OPERATION AND MAINTENANCE GUIDELINES

STORMWATER BEST MANAGEMENT PRACTICES (BMPs) OPERATION AND MAINTENANCE GUIDELINES

Stormwater treatment controls should be routinely inspected and maintained to ensure that the controls are in proper working condition and operating as designed. Operation and maintenance (O&M) guidelines for common stormwater Best Management Practices (BMPs) are summarized below. Detailed maintenance requirements for specific stormwater treatment BMPs can be found in the publication "Urban Runoff Quality Management" (Water Environment Federation and American Society of Civil Engineers, 1998) and the references listed therein.

General O&M requirements for stormwater treatment controls include:

- Inspections: Inspections should be performed at regular intervals to ensure proper operation of stormwater BMPs. Inspections should be conducted at least annually, with additional inspections following large storm events. Inspections should include a comprehensive visual check for evidence of the following:
 - Accumulation of sediment or debris at inlet and outlet structures
 - Erosion, settlement, or slope failure
 - Clogging or buildup of fines on infiltration surfaces
 - Vegetative stress and appropriate water levels for emergent vegetation
- Routine Maintenance: Routine maintenance should be performed on a regular basis to ensure proper BMP operation and aesthetics. Routine maintenance should include:
 - Debris and litter removal
 - Silt and sediment removal
 - Clearing of vegetation around flow control devices
 - Maintenance and mowing of healthy vegetative cover for infiltration/filtration BMPs
- Nonroutine Maintenance: Nonroutine maintenance refers to corrective measures taken to repair or rehabilitate stormwater controls to proper working condition. Nonroutine maintenance is performed as needed, typically in response to problems detected during routine maintenance and inspections, and can include:
 - Erosion and structural repair
 - Sediment removal and disposal
 - Nuisance control (odors, mosquitoes, weeds, excessive litter)

Recommended O&M practices for specific classes of stormwater BMPs are summarized below:

1) Vegetated Swales and Filter Strips

- Inspect biofilters monthly, if possible, and after heavy rainfall.
- Inspect annually for the following:
 - Damage to vegetation by foot or vehicular traffic
 - Gully erosion and evidence of concentrated bypass flows around swale/strip
 - Reduction in vegetation density
- Keep biofilters free of lawn debris and pet waste.
- Keep inlet flow spreaders even and free of debris.
- Maintain dense grass cover through periodic mowing, spot reseeding, and weed control.
- Do not mow grass too close to the ground or over-apply fertilizers and pesticides.
- Mow vegetation to a height above the maximum flow depth.
- At end of growing season, vegetation should be at least 2 inches above the design water depth.
- Remove and properly dispose of grass cuttings.
- Remove sediment with a flat-bottomed shovel.
- Re-seed damaged areas and cover with erosion control fabric.

2) Infiltration Trenches

- Inspect trenches several times in the first few months of operation, and then annually thereafter.
- If possible, conduct inspections after large storms.
- Check for surface water ponding or clogging.
- Periodically check pretreatment inlets of underground trenches and clean out when sediment depletes more than 10% of available capacity.
- Prune or trim adjacent trees to prevent leaves from clogging the trench.
- Rehabilitate trench after it becomes clogged, typically after 10 to 15 years.

3) Infiltration Basins

- Inspect after major storm events in the first few months after construction. Check for:
 - Standing water after 48 to 72 hours following a storm
 - Upland sediment erosion
 - Low spots
- Inspect basin annually thereafter. Check for:
 - Differential settlement, cracking, erosion, or leakage through the embankment
 - Condition of the riprap in the inlet and outlet channels
 - Sediment accumulation in the basin

- Mow the buffer, side-slopes, and basin floor at least twice a year to discourage woody growth and control weeds.
- Mow dry ponds more frequently in residential areas adjacent to residences.
- Remove all litter and debris during each mowing operation.
- Immediately replace/revegetate eroding or barren areas.
- Annual or semi-annual tilling may be required for basins located on marginally permeable soils.
- Deep tilling, regrading, and leveling typically required every 5 to 10 years.
- Carefully remove the top layer of accumulated sediment after the basin has thoroughly dried out, as necessary.

4) Media Filters

- Inspect semiannually and after major storm events.
- Remove sediment and floatables from the :
 - settling basin when 4 inches accumulates
 - filter when 0.1 inches accumulates or when there is standing water over the filter 40 hours after a storm
- Clean the filter surfaces twice per year by raking off dried sediment

5) Extended Detention (Dry) Basins

- Mow the upper stage, side-slopes, embankment and emergency spillway at least twice a year to discourage woody growth and control weeds.
- Mow dry ponds more frequently in residential areas adjacent to residences.
- Inspect dry ponds annually. If possible inspections should be conducted during wet weather.
- Regular inspections of the following components should be conducted:
 - Check extended detention control device for clogging
 - Check upper stage pilot channel for signs of erosion
 - Check the pond's bed and banks for signs of erosion
 - Check the condition of the emergency spillway
 - Check for accumulation of sediment around the riser
- Remove accumulated debris and litter from around the extended detention control device.
- Regrade and replant vegetation to correct problems with pond side-slopes, emergency spillway, and embankment.
- Reduce potential nuisance conditions (i.e., odors, mosquitoes, weeds, and litter).
- Remove accumulated sediment from the lower stage of the pond every 5 to 10 years, on average.

6) Retention (Wet) Ponds

- Mow the side-slopes, embankment and emergency spillway at least twice a year to discourage woody growth and control weeds.
- Mow wet ponds more frequently in residential areas adjacent to residences.
- Inspect wet ponds annually. If possible inspections should be conducted during wet weather.
- Regular inspections of the following components should be conducted:
 - Check the embankment for subsidence, erosion, cracking, or tree growth
 - Check upstream and downstream channel erosion protection measures
 - Check the stability of the pond's side-slopes
 - Check the condition of the emergency spillway and drain
 - Check for accumulation of sediment and clogging of the barrel and outlet
- Remove debris and litter from the surface of the pond, with particular attention paid to floating debris around the riser.
- Regrade and replant vegetation to correct problems with pond side-slopes, emergency spillway, and embankment.
- Reduce potential nuisance conditions (i.e., odors, mosquitoes, weeds, algae, and litter).
- Remove accumulated sediment from the pond every 10 to 20 years, on average.

7) Constructed Wetlands

- Inspect quarterly in year 1, semiannually in years 2 and 3, and annually thereafter.
- Conduct inspections with the as-built pondscaping plans in hand for:
 - Wetland plant species distribution/survival
 - Sediment accumulation
 - Water elevations
 - Condition of the outlet
- Clean out accumulated sediments in the forebay every 3 to 5 years. Conduct cleanouts after draining the forebay.
- Mow the maintenance access, bench, and embankment twice a year to prevent woody growth.
- Replant or adjust plant types depending on water levels and operating conditions.
- Remove potential nuisance plant species.

8) Oil/Water Separators

- Inspect monthly during the wet season.
- Clean several times per year.
- Always clean before the start of the wet season.
- Properly dispose of removed oil.