

## Infiltration Basin

### *Inspection and Maintenance Guidance Requirements*

- All routine inspections and maintenance are required to be performed before September of each year.
- Conduct regular inspections and routine maintenance on pretreatment devices such as vegetated swales, sediment forebays, detention basins, etc. A pretreatment device, such as an oil and water separator, may be required in areas where petroleum hydrocarbons in stormwater are anticipated.
- Inspect following major rainfall events during the first year after installation.
- Inspect annually for settling, cracking, erosion, leakage, condition of the riprap, state of the turf vegetation, and amount of sedimentation. If necessary, repair immediately.
- If the drawdown time is more than 72 hours, maintenance and replacement of the filter media is required.
- Debris and litter shall be removed from the infiltration basin as needed, but at least prior to the beginning of the wet season.
- Eliminate standing water to prevent vector breeding. No pyrethroid pesticides may be used.
- If bare and eroded areas are present in the drainage area directly adjacent to the infiltration basin, vegetation and/or additional stabilization methods may be required to minimize premature clogging.
- Vegetation installed within the infiltration basin tends to decrease the rate of clogging.
- Vegetation shall be mowed when growth exceeds 6 inches in height. Remove grass clippings, litter, and debris.
- Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- Do not use herbicides or other chemicals to control vegetation.
- Every 5 to 10 years the area shall be tilled, fine materials removed, and the base of the basin regraded.
- If a spill occurs and hazardous materials contaminate soils, sands or gravels in an infiltration basin, the affected areas shall be removed immediately, and the appropriate soils and materials replaced as soon as possible.
- Inspect overflow devices for obstructions or damaged pipes. Remove debris or replace damaged pipes upon discovery.
- Maintain access to the basin for regular maintenance activities.



**Figure 1: Infiltration Basin**  
(Source: CASQA Stormwater BMP Handbook)

## Infiltration Trench

### *Inspection and Maintenance Guidance Requirements*

- Conduct regular inspections and routine maintenance on pretreatment devices such as vegetated swales, detention basins, etc. A pretreatment device, such as an oil and water separator, may be required in areas where petroleum hydrocarbons in stormwater are anticipated.
- Inspect infiltration trench and observation well following major rainfall events.
- If the drawdown time is more than 72 hours, maintenance and replacement of the filter media is required.
- Check for debris/sedimentation accumulation, rake surface and remove debris/sediment.
- Assess the condition of the top aggregate layer for sediment buildup and crusting. Remove the top layer of pea gravel and replace. If slow draining conditions persist, the entire trench may need to be excavated and removed.
- Eliminate standing water to prevent vector breeding. Do not use pyrethroid pesticides.
- Debris and litter shall be removed from the infiltration basin prior to the beginning of the wet season, and as needed.
- If a spill occurs and hazardous materials contaminate infiltration media, the affected areas shall be removed immediately, and the appropriate materials replaced as soon as possible.
- Inspect overflow devices for obstructions or damaged pipes. Remove debris or replace damaged pipes upon discovery.
- The City may require the inclusion of a 4 to 6-inch diameter perforated pipe anchored vertically to serve as a monitoring well. A monitoring plan for this well shall be included into the O&M Plan.



**Figure 2: Infiltration Trench (Source: LA LID Manual)**

## Pervious Pavers

### *Inspection and Maintenance Guidance Requirements*

- All facility components, vegetation, and source controls should be inspected for proper operations and structural stability, at least quarterly for the first two years from the date of installation, twice per year thereafter, and within 48 hours after each major storm event.
- Blocks shall not be washed to remove debris and sediment in the openings between pavers. Sweep pervious pavers as needed to clean them of leaves, debris, and sediment. Sweeping with suction shall be utilized at least annually. Replace lost ASTM No. 8 aggregate infill.
- Joints between pavers may require occasional weed suppression. No pesticide or herbicide use.
- Pavers can be removed individually and replaced when utility work is needed.
- Replace surface filter layer by vacuuming out aggregate media from blocks to reduce potential pollutant runoff if it becomes evident that runoff does not rapidly infiltrate into the surface.
- If vacuuming does not adequately remove fill, blocks can be lifted and reset with new joint fill material.
- If soils swell or subside, blocks can be removed individually, the base leveled, and blocks reset.
- For pavers planted with turf, regular turf maintenance will be necessary. Provide irrigation as needed. Limit and control.
- Insects and rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.
- If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if necessary, and only by a licensed individual or contractor. No pyrethroid pesticides may be used.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.
- Exercise spill prevention measures when handling substances that can contaminate stormwater runoff. Implement a spill prevention plan at all nonresidential sites and in areas where there is likelihood of spills.
- Eliminate standing water to prevent vector breeding.
- Provide safe and efficient access to permeable pavement. Egress and ingress routes must be maintained to design standards. Roadways must be maintained to accommodate size and weight of vehicles if applicable.



**Figure 3: Open Jointed Block Pavers**

## Porous Concrete and Porous Asphalt

### *Inspection and Maintenance Guidance Requirements*

- Accumulated debris and litter shall be routinely removed as a source control measure.
- Inspect porous asphalt and concrete to determine if stormwater runoff is infiltrating properly at least twice during the wet season and after significant storms.
- Permeable pavements and materials shall be cleaned with a vacuum-type street cleaner a minimum of twice a year (before and after the rainy season). If infiltration is significantly reduced, remove surface aggregate with vacuum. Dispose and replace old aggregate with fresh aggregate as needed.
- Handheld pressure washers can be effective for cleaning the void spaces of small areas and shall follow vacuum cleaning.
- Sweep permeable pavement as needed to clean it of leaves, debris, and sediment.
- Prune vegetation and large shrubs/trees that limit access or interfere with permeable pavement operation. Rake and remove fallen leaves and debris from deciduous plant foliage. Remove poisonous, nuisance, dead, or odor-producing vegetation immediately. Mow grass to less than four inches and bag and remove grass clippings.
- Maintenance personnel must be instructed not to seal or pave with non-porous materials.
- Exercise spill prevention measures when handling substances that can contaminate stormwater runoff. Implement a spill prevention plan at all nonresidential sites and in areas where there is likelihood of spills.
- Eliminate standing water to prevent vector breeding.
- Provide safe and efficient access to permeable pavement. Egress and ingress routes must be maintained to design standards. Roadways must be maintained to accommodate size and weight of vehicles if applicable.
- Minimize the use of fertilizers and herbicides as they can have adverse effects on concrete products and to reduce potential pollutant runoff.
- Insects and rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.
- If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if necessary, and only by a licensed individual or contractor.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.
- Identify and control sources of erosion damage when native soil is exposed near the overflow device.
- Add gravel or ground cover if erosion occurs due to vehicular or pedestrian traffic.



**Figure 4: Example of Porous Concrete (Source: LA LID Manual)**

## Biofiltration Basin

### Inspection and Maintenance Guidance Requirements

Primary maintenance activities include vegetation management and sediment removal. Mosquito control is also a concern in extended detention basins that are designed to include pools of standing water. All inspections and maintenance activities shall be performed prior to September of each year.



Figure 6: Biofiltration Basin (Source: Austin WPD)

- Conduct annual inspections as follows:
  - Evaluate the health of the vegetation and remove and replace any dead or dying plants.
  - Remove any trash and debris
  - Inspect the outlet, embankments, dikes, berms, and side slopes for structural integrity and signs of erosion or rodent burrows. Fill any holes detected in the side slopes.
  - Examine outlets and overflow structures and remove any debris plugging the outlets.
  - Identify and minimize the sources of sediment and debris. Check rocks or other erosion control and replace, if necessary.
  - Check inlets to make sure piping is intact and not plugged. Remove accumulated sediment and debris near the inlet. Ensure that engineered energy dissipation is functioning adequately by checking for evidence of local scour near the inlet.
  - Inspect for standing water and correct any problems that prevent the extended detention basin from draining as designed.
  - Confirm that any fences around the facility are secure.
- Maintenance activities at the bottom of the basin shall NOT be performed with heavy equipment, which would compact the soil and limit infiltration.
- Debris and litter shall be removed from the infiltration basin as needed, but at least prior to the beginning of the wet season.
- If bare and eroded areas are present in the drainage area directly adjacent to the infiltration basin, vegetation and/or additional stabilization methods may be required to minimize premature clogging.
- Vegetation shall be mowed when growth exceeds 6 inches in height to prevent establishment of woody vegetation and for aesthetic and mosquito control reasons. Remove grass clippings, litter, and debris.
- Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- Do not use herbicides or other chemicals to control vegetation. No pyrethroid pesticides may be used. Follow the principles of integrated pest management (IPM).
- Remove sediment from the forebay when the sediment level reaches the level shown on the fixed vertical sediment marker (if present).
- Remove accumulated sediment and regrade every 10 years or when the accumulated sediment volume exceeds 10% of basin volume.

## Stormwater Planters

### *Inspection and Maintenance Guidance Requirements*

- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the stormwater planter and flow dissipation and erosion protection strategies in the flow entrance should be reassessed. If sediment is deposited in the stormwater planter, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
- A health evaluation of trees and shrubs shall be conducted biannually.
- Pruning, weeding and trash removal shall be conducted as necessary.
- Debris should be removed routinely (no less than every 6 months) and upon discovery.
- Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter strip function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, stormwater planters are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters. No pyrethroid pesticides may be used.
- Sediment accumulation shall be hand removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick
- Mulch replacement is generally required every 2 to 3 years.
- If a spill occurs and hazardous materials contaminate soils in landscape detention areas, the affected materials shall be removed immediately, and the appropriate soils and materials replaced as soon as possible.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.
- Key inspection/maintenance areas include inlet and overflow areas for potential erosion, the ponding area in basin for trash and debris, and the monitoring well/clean out port for potential early signs of stagnant water in the system if an underdrain system is included.
- If ponding is observed to exceed 72 hours, particularly during the primary mosquito breeding season (June through October), the cause may be clogged filter fabric (if used, which is not recommend), compacted soils from construction activities, improper placement and compaction of the engineered soil mix, or surface clogging with fines from a heavy loading source in the drainage area (e.g., an upgradient dirt lot or a construction site without BMPs). The reason for the extended ponding shall be determined and mitigated (e.g., removal of filter fabric, cleaning of the underdrain



**Figure 7: Stormwater Planter (Source: Portland BES)**

system, replacement of engineered soils, and/or ripping of underlying native soils to re-establish permeability).

- Structural deficiencies in the planter including rot, cracks and failure shall be repaired.
- Insects and rodents shall not be harbored at in stormwater planters. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.
- If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.
- Provide training and/or written guidance to all property owners and tenants. Provide a copy of the Maintenance Plan to all property owners and tenants.

## Cistern/Rainwater Capture

### *Inspection and Maintenance Guidance Requirements*

- ❑ Clean out gutters, inflow and outflow pipes of leaves and debris as needed.
- ❑ Make sure gutters and downspouts are free of debris prior to the rainy season. The “first flush”, or the runoff created by the first rainfall event after a long dry spell, will need to be carefully monitored to ensure that the system is working properly.
- ❑ Inspect water tanks periodically and any remove debris and sediment that may interfere with the proper function of the system.
- ❑ Screen inlet and outlet pipes to keep the system closed to mosquitoes. No opening shall be greater than 1/16” on systems where water will be retained for more than 72 hours.
- ❑ Cap and lock tanks for safety. Caps should have access ports for interior inspection and maintenance.
- ❑ Eliminate standing water to prevent vector breeding.



**Figure 8: A rainwater capture and reuse system on a residential home. (Photo: Kennedy/Jenks Consultants)**



## Green Roofs

### *Inspection and Maintenance Guidance Requirements*

- Upon installation, the green roof system should be inspected monthly for the first year and after each large rainfall event for erosion, plant survival, proper drainage and water proofing.
- Inspections can be reduced to a quarterly schedule once the green roof system has proven to work properly and vegetation is established.
- Inspect soil for evidence of erosion from wind or water. If erosion channels are evident, stabilize them with additional soil substrate/growth medium and cover with additional plants.
- If necessary, irrigate in short bursts only (3-5 minutes) to minimize runoff. Irrigation frequencies shall be established by the designer using an automated system.
- Irrigate green roof either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, follow manufacturer's instructions for operations and maintenance. During the establishment period (one to three years), provide sufficient irrigation to assure plant establishment. Following the establishment period (after three years), provide sufficient irrigation to maintain plant cover.
- Vegetation shall be maintained to provide 90% plant cover. During the establishment period, replace plants once per month as needed. After the establishment period, replace dead plants as needed. Remove plant litter and nuisance and prohibited vegetation regularly. Remove weeds manually without herbicides or pesticides.
- Clean out drain inlets as needed.
- Remove debris and litter to prevent clogging of drain inlets and interference with plant growth
- Weeding and mulching may be necessary during the establishment period, depending on the planting design.
- During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss.
- Replace or fill in vegetation as needed.
- Fertilization is not necessary, and fertilizers shall not be applied.
- Inspect soil levels semi-annually to improve plant survival and rainfall absorption.
- If the vegetation used is flammable during the dry season, it shall be mowed or watered as needed to minimize fire potential.
- If soil compacts over time and more is added, it will increase the seismic load of the supporting structure.
- Insects shall not be harbored on the green roof. Standing water shall be eliminated by manual means. No pyrethroid pesticides may be used.



**Figure 9: Green roof on Carmel Valley, CA Residence (Photo: Jonathan Feldman Architecture)**

- Spill prevention measures from mechanical systems located on the roofs shall be exercised when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.
- Provide training and/or written guidance information for operating and maintaining green roofs to all property owners and tenants. Provide a copy of the Maintenance Plan to all property owners and tenants.
- Provide safe and efficient access to the green roof. Maintain egress and ingress routes to design specifications. Clear walkways of obstructions and maintain them to design specifications.
- Eliminate standing water to prevent vector breeding.

## Vegetated Swales

### *Inspection and Maintenance Guidance Requirements*

- ❑ Proper maintenance includes mowing, weed control, removal of trash and debris, watering during the dry season, and reseeded of non-vegetated areas.
- ❑ When mowing grass, never cut shorter than the design flow (WQF) depth and remove grass cuttings.
- ❑ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- ❑ Prune vegetation, large shrubs, or trees that interfere with swale operation.
- ❑ Fallen leaves and debris from deciduous plant foliage shall be removed.
- ❑ Inspect swales at least twice annually and after every storm greater than 0.75 inches for damage to vegetation, erosion, sediment accumulation and ponding water standing longer than 72 hours.
- ❑ If the swale is does not drain in 72 hours, till the swale if compaction or clogging occurs and revegetate.
- ❑ Eliminate standing water to prevent vector breeding.
- ❑ Debris in quantities that inhibit operation shall be removed routinely (no less than quarterly), or upon discovery.
- ❑ Periodic litter collection and removal will be necessary if the swale is located adjacent to a main road.
- ❑ Sediments shall be removed when depths exceed 3 inches, if vegetation growth is inhibited in more than ten percent of the swale, or if sediment is blocking even distribution and entry of water. Re-plant and/or re-seed vegetation, as needed, following sediment removal activities to reestablish vegetation.
- ❑ Stabilize slopes with appropriate erosion control measures when native soil is exposed, or erosion channels are forming.
- ❑ Swale outlet shall maintain sheet flow of water exiting the swale unless a collection drain is used.
- ❑ If a spill occurs and hazardous materials contaminate soils in vegetated swales, the affected areas shall be removed immediately and the appropriate soils and materials replaced as soon as possible.
- ❑ Insects and rodents shall not be harbored in the vegetated swales. Pest control measures shall be taken when insects/rodents are found to be present. Pyrethroid pesticides may not be used.
- ❑ If sprays are considered, then a mosquito larvicide, such as Bacillus thurensensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor. No pyrethroid pesticides may be used.
- ❑ Holes in the ground located in and around the pervious pavement shall be filled and compacted.



**Figure 10: Grassy Swale**

## Vegetated Filter Strips

### Inspection and Maintenance Guidance Requirements

- The owner/operator of the property must be responsible for maintaining vegetated filter strips.
- Inspect vegetated filter strip for erosion or damage to vegetation at least two times a year (preferably before and after the winter/wet season), and after every storm greater than 0.75 inches. Vegetated filter strips should be checked for debris and litter and areas of sediment accumulation.
- Remove sediment, as needed, if vegetation growth is inhibited in more than ten percent of the swale, or if sediment is blocking even distribution and entry of water. Re-plant and/or re-seed vegetation, as needed, following sediment removal activities to reestablish vegetation.
- Grasses or turf shall be maintained at a desired height of 4 - 6 inches and remove grass clippings.
- If turf is used, filter strips shall be irrigated during the dry season.
- Prune vegetation, large shrubs, or trees that interfere with filter strip swale operation.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter strip function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- Trash, litter, rocks, and branches shall be frequently collected from filter strips, especially those located along highways.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Debris in quantities more than 2" deep or sufficient to inhibit operation shall be removed routinely (no less than quarterly) or upon discovery.
- Eliminate standing water to prevent vector breeding.
- Sediments that accumulate along the upstream edge of filter strips and/or in level spreaders shall be collected and removed at least once a year.
- If a spill occurs and hazardous materials contaminate soils in vegetated filter strips, the affected areas shall be removed immediately and the appropriate soils and materials replaced as soon as possible.
- Insects and rodents shall not be harbored in the vegetated filter strips. Pest control measures shall be taken when insects/rodents are found to be present.
- If sprays are considered, then a mosquito larvicide, such as Bacillus thurensensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.



**Figure 11: Vegetated Filter Strip (Source: 3 Rivers Wet Weather)**