GREEN STORMWATER INFRASTRUCTURE MAINTENANCE MANUAL

RAIN GARDENS

BIOFILTRATION

VEGETATIVE FILTER STRIPS

One Texas Center Raingarden
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RAIN GARDENS

IDEAL CONDITIONS

- No erosion or scouring of soil in garden
- No sediment or debris at inlet or within garden
- Uniform coverage with desired vegetation; no weeds
- Uniform mulch coverage
- No visible compaction, water drains within 48 hours
## Sediment

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion or scouring present; Mulch or topsoil is worn away by water flow</td>
<td>Redistribute/replace mulch to consistent 3 inch depth; Cover extensive scouring with appropriately sized rock (typically 3 inch river rock)</td>
</tr>
<tr>
<td>Sediment deposits or debris at the inlet</td>
<td>Remove sediment, leaves, debris, and trash from the inlet</td>
</tr>
<tr>
<td>Sediment deposits greater than 3 inches deep in bottom of basin</td>
<td>If sediment deposits in discrete piles, remove with hand tools. If sediment uniformly covers bottom of basin and has reduced storage depth of garden over design depth, entire basin may need to be dredged to attain design conditions. If vegetation is disturbed, replace with in-kind vegetation. Refer to ECM (Section 1.6.7.C) for information on appropriate vegetation</td>
</tr>
</tbody>
</table>
Scouring filled with 3-inch river rock

Clogged inlet

A cleaned inlet with probes

Sediment deposits that need to be removed

Bottom of the basin is clear of sediment buildup
### Vegetative Coverage

<table>
<thead>
<tr>
<th>ISSUE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dead vegetation</td>
<td>Remove and replace with viable plants</td>
</tr>
<tr>
<td>Vegetation obstructing the street, sidewalk, or curb inlet</td>
<td>Prune overhanging vegetation/dead branches with hand tools to prevent obstruction</td>
</tr>
<tr>
<td>Inflow/outflow structure is blocked</td>
<td>Remove blockage to allow unimpeded inflow/outflow</td>
</tr>
<tr>
<td>Bare areas more than 10 sf</td>
<td>Replace dead vegetation and/or ground cover/mulch to 3 inch uniform coverage</td>
</tr>
<tr>
<td>Abundant weeds and invasive plants; Refer to <a href="http://www.texasinvasives.org">www.texasinvasives.org</a> for a database of invasive plants</td>
<td>Remove weeds by hand tools or other approved IPM measures. Prevent the introduction of weeds by removing weeds before seed dispersal (before seed head forms) and properly maintaining desired vegetation. See note referring to the use of herbicides</td>
</tr>
</tbody>
</table>
Vegetation obstructing sidewalk

Sidewalk and curb free from vegetation

Abundant weeds

Appropriate/planned vegetation
### Infiltration

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Standing water, &gt;48 hours &lt;72 hours</td>
<td>Monitor drawdown time; soil may be lightly scarified with hand cultivator</td>
</tr>
<tr>
<td>Standing water, &gt;96 hours</td>
<td>Remove top layer of sediment and mulch and potentially vegetation. De-compact soil by scarifying with tiller, garden weasel, or other appropriate hand tools. Replace mulch and disturbed vegetation</td>
</tr>
</tbody>
</table>
Holding water after a storm event

Receding water after a storm event
IDEAL CONDITIONS

- No visible bare spots
- Appropriate viable vegetation
- Refer to ECM (Section 1.6.7.C) for information on appropriate vegetation
- Little or no weeds or woody vegetation
- Appropriate infiltration rates
## BIO FILTRATION

### Sediment

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<td>Remove sediment, leaves, debris, and trash from the inlet</td>
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<tr>
<td>Sediment deposits greater than 3 inches deep in the bottom of basin</td>
<td>If sediment deposits are in discrete piles, remove with hand tools. If sediment uniformly covers bottom of basin and has reduced storage depth of the garden over design depth, entire basin may need to be dredged to attain design conditions. If vegetation is disturbed, replace with in-kind vegetation or mulch. Refer to ECM (Section 1.6.7.C) for information on appropriate vegetation</td>
</tr>
</tbody>
</table>

Fig. 15

Fig. 16
Inflow into the basin clear of all blockage

Curb inlet severely blocked by sediment and vegetation
### Vegetative Coverage

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<td>Prune overhanging vegetation/dead branches with hand tools to prevent obstruction</td>
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<td>Replace dead vegetation and/or ground cover/mulch to 3 inch uniform coverage</td>
</tr>
<tr>
<td>Inflow/outflow structure is blocked</td>
<td>Remove blockage to allow unimpeded inflow/outflow</td>
</tr>
<tr>
<td>Abundant weeds. Refer to <a href="http://www.texasinvasives.org">www.texasinvasives.org</a> for a database of invasive plants and weeds</td>
<td>Remove weeds by hand tools or other approved IPM measures. Prevent the introduction of weeds by removing weeds before seed dispersal (before seed head forms) and properly maintaining desired vegetation (See note referring to the use of herbicides)</td>
</tr>
<tr>
<td>Dead/diseased trees or dead vegetation</td>
<td>Remove dead trees including root balls, fill void areas with mulch by hand; Treat diseased trees mechanically or by hand depending on IPM guidelines. Cut back and replace with viable vegetation</td>
</tr>
</tbody>
</table>
Appropriate coverage with no bare spots

Proper vegetation

Little or no vegetative cover

Appropriate coverage with no bare spots
### Infiltration

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<td>Standing water, &gt;96 hours</td>
<td>Remove top layer of sediment and mulch and potentially vegetation. De-compact soil by scarifying with tiller, Garden Weasel, or other appropriate hand tools. Replace mulch and disturbed vegetation</td>
</tr>
</tbody>
</table>
Holding water with no infiltration

Debris line left by receding storm water
IDEAL CONDITIONS

- Dense vegetation cover with no bare spots exceeding 10 sf
- No sediment accumulation greater than 3 inches, especially at level spreader
- No trash or debris
- Level spreaders are intact
## Sediment - Inspect twice annually

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Level spreader is disrupted and clogged with weeds</td>
<td>Remove weeds and sediment buildup from level spreader</td>
</tr>
<tr>
<td>![Fig. 24](Fig. 24)</td>
<td>![Fig. 25](Fig. 25)</td>
</tr>
<tr>
<td>Level spreader structure is compromised; rills or gullies are visible from concentrated flow</td>
<td>Repair spreader such that water flows in unconcentrated sheetflow; re-grade rills/gullies to match adjacent flat topography and either re-sod or reseed and cover with soil retention blanket</td>
</tr>
<tr>
<td>![Fig. 26](Fig. 26)</td>
<td>![Fig. 27](Fig. 27)</td>
</tr>
</tbody>
</table>
Level spreader clogged with sediment and debris

Unobstructed level spreader

Vegetative Filter Strip showing rills caused by concentrated flow

Vegetative Filter Strip with no rills or gullies
# Vegetative Coverage

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Bare spots exceeding 10 sf</td>
<td>Reseed bare spots with appropriate seed mixture or sod</td>
</tr>
<tr>
<td>Overgrown vegetation or trash present</td>
<td>If vegetation impedes sidewalks, ROW or level spreader, trim with appropriate hand tools. Pick up trash by hand and dispose of properly</td>
</tr>
<tr>
<td>Appearance of woody vegetation</td>
<td>Remove, re-grade disturbed areas, and re-seed or re-sod</td>
</tr>
<tr>
<td>Vegetation height</td>
<td>For turfgrass VFS, mowed height should be =&gt; 3 inches. For native bunch grass VFS, mowed height should be =&gt; 18 inches</td>
</tr>
</tbody>
</table>

Fig. 28

Fig. 29
Appropriate cover and vegetative height for turf grass applications

Appropriate height for native bunch grasses
Mulch is a layer of organic or inorganic material applied to the surface of an area of soil. Its purpose is any or all of the following:

- To conserve moisture
- To improve the fertility and health of the soil
- To reduce weed growth
- To enhance the visual appeal of the area

Examples of mulch are, but not limited to: bark mulch, wood chips, river rock, appropriately sized gravel and properly rounded or milled glass chips.
25-inch river rock mulch

Woody mulch

Crushed glass mulch

Woody mulch
Integrated Pest Management

- Weeding by hand tools only.
- Prevent the introduction of weeds by removing weeds before seed dispersal (before seed head forms) and properly maintaining desired vegetation. Refer to www.texasinvasives.org for a database of invasive plants and weeds. Fertilizers are unnecessary and limited use of organic herbicides is allowed.
- Treat all diseased trees and shrubs mechanically or by hand for insect or disease infestation.
- Remove and replace all dead and diseased vegetation considered beyond treatment.

www.austintexas.gov/IPM

Inspections

It is recommended that inspections be performed at least twice annually once the vegetation is established. Inspections will be necessary more frequently during the growing season, March through November. Maintenance is to be performed as needed.
Additional Tips

Tips on Vegetation Maintenance

- Tall Herbaceous and Medium Herbaceous Plants: Trimming activities must not impinge on the growing tips (basal crown) of the bunch grasses. Cutting these grasses below the basal crown will severely stress and possibly kill them. These plants shall be cut no lower than 18” from the ground. The annual physical removal of all woody weeds from the filtration basin is required.

- Short Herbaceous Plants: Sod-forming grasses may be mown or trimmed to an appropriate height. These plants shall not be scalped, cut no lower than 3” from the ground.

- Late winter harvesting should include trimming of bunchgrasses (minimum 18” or higher), and mowing of turf grasses (minimum 3” high). For other types of vegetation, see recommendations in the planting specifications located in the ECM (Section 1.6.7.C).

- Inspect during periods of drought for plant stress. If plants are wilting from heat, apply periodic temporary irrigation to keep plants alive. Consult design landscape architect if unsure about plant stress or irrigation options.
For detailed information:
The Environmental Criteria Manual (ECM) can be found at:

www.austintexas.gov/department/regulations-and-criteria-manuals