# Rain Garden Design

## What have we learned so far

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# On the Agenda

1. What is a rain garden and why build one?
2. Design of Rain Gardens
   a. Siting & Sizing
   b. Location/Drainage Area
   c. Infiltration Rates
   d. Inlets
   e. Media
3. Maintenance of rain gardens
4. Completed Projects


*Image: Morton Salt Co.*

# What is a Rain Garden?

A rain garden is a vegetated, depressed landscape area designed to capture and infiltrate and/or filter stormwater runoff from impervious surfaces.

# Rain Garden Guidance

grow green

earth-wise guide to

## Rain Gardens

*Keeping Water on the Land*

### what is a rain garden?

A rain garden is a shallow, vegetated depression designed to absorb and filter runoff from hard (impervious) surfaces like roofs, sidewalks, and driveways. Rain gardens are usually planted with colorful native plants and grasses. They not only provide an attractive addition to the yard, but also help to conserve water and protect our water quality.

### how does a rain garden help?

As Austin becomes increasingly urbanized, native landscapes are replaced with impervious surfaces that prevent rainwater from soaking into the ground. Stormwater quickly runs off these hard surfaces, picking up pollutants from the land and carrying them to our creeks. This rapidly flowing water also increases the chances of flooding and erosion.

The goal of a rain garden is to keep water on the land. Rain gardens, with their shallow depressions, capture stormwater and provide for natural infiltration into the soil. This provides water for the plants and helps maintain a constant flow of water in our streams through groundwater. They also help filter out pollutants including fertilizers, pesticides, oil, heavy metals and other chemicals that would otherwise reach our creeks through storm drains or drainage ditches. By reducing the quantity of water that runs off your property, rain gardens help lower the risk of flooding and erosion.

growgreen.org

Austin Parks and Recreation - 919 West 28½ Street

### Create A Rain Garden in Six Steps

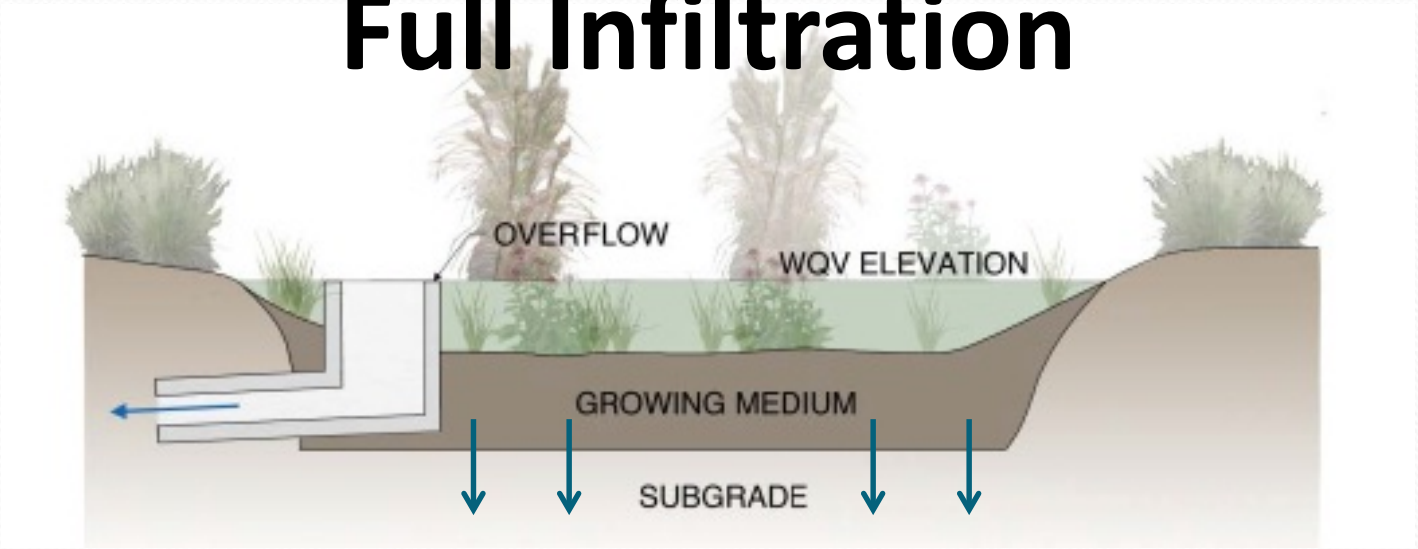
**1 Find the Right Location**

- Observe the flow of water from rooftops, driveways, or other hard surfaces and place the rain garden where this water collects
- Select an area on gently sloping or flat land
- Calculate the slope of your lawn (instructions on next page). The slope should be less than 10%
- If possible, pick a spot in full to partial sun. Shady locations will still work, but the options for flowering plants are more limited in the shade
- Make sure that any overflow will not cause unintended runoff to a neighbor's property or other structure
- If drainage-related problems are occurring (e.g. foundation problems, erosion or flooding), consider placing the rain garden at least 10' away from the structure
- Avoid areas with utility lines. Be sure to call 1-800-DIG-TESS (344-8377) to identify the location of underground utilities – the service is free

## Why Build a Rain Garden?

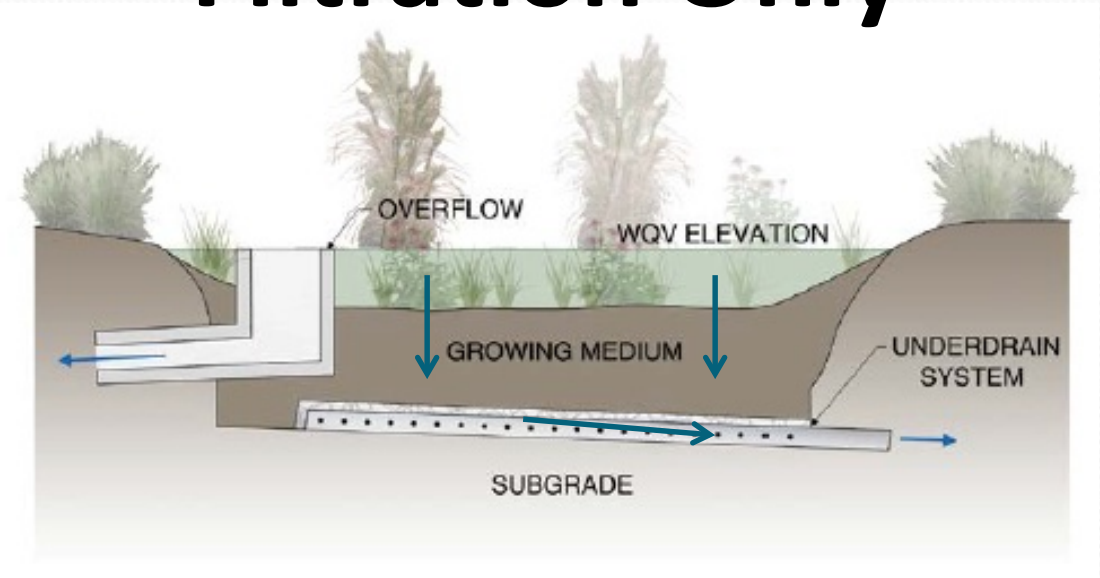
- Protect Watershed
- Conserve Water
- Clean water
- Minor peak runoff reduction
- Conserve Energy
- Wildlife Friendly
- Aesthetics

# Rain Garden Types
# Full Infiltration



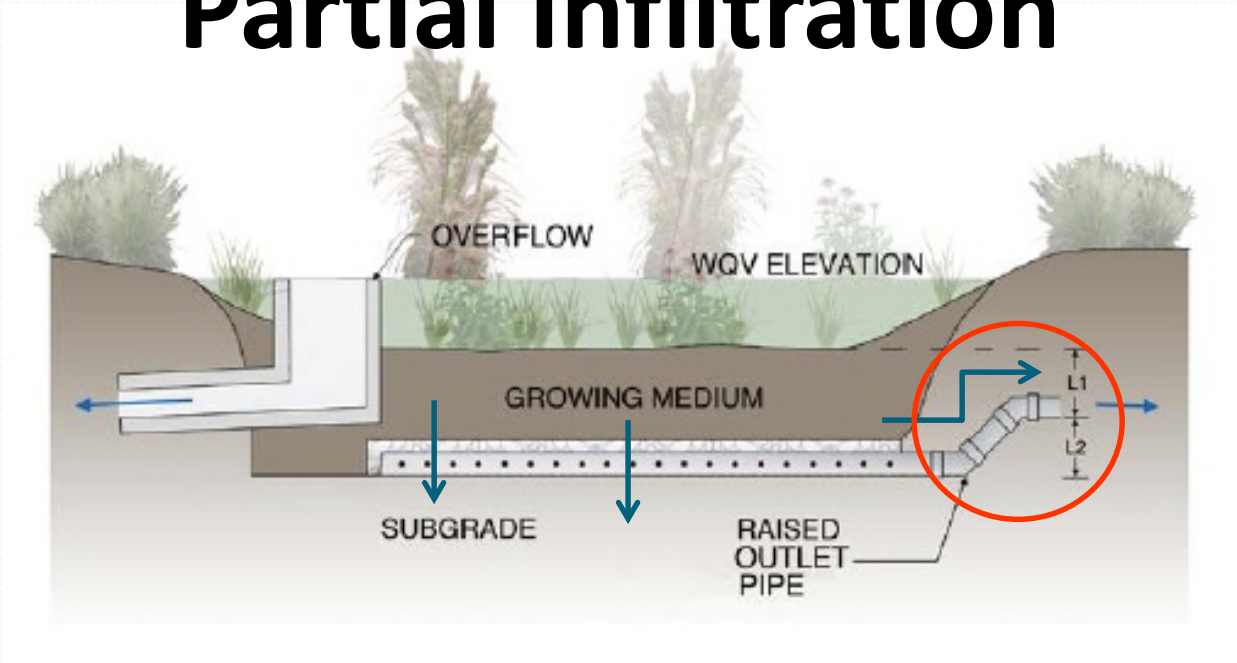

- Captures and fully infiltrates runoff
- The infiltration capacity of the site soils are used to reduce stormwater runoff volume and associated pollutants
- No underdrain

# Filtration Only



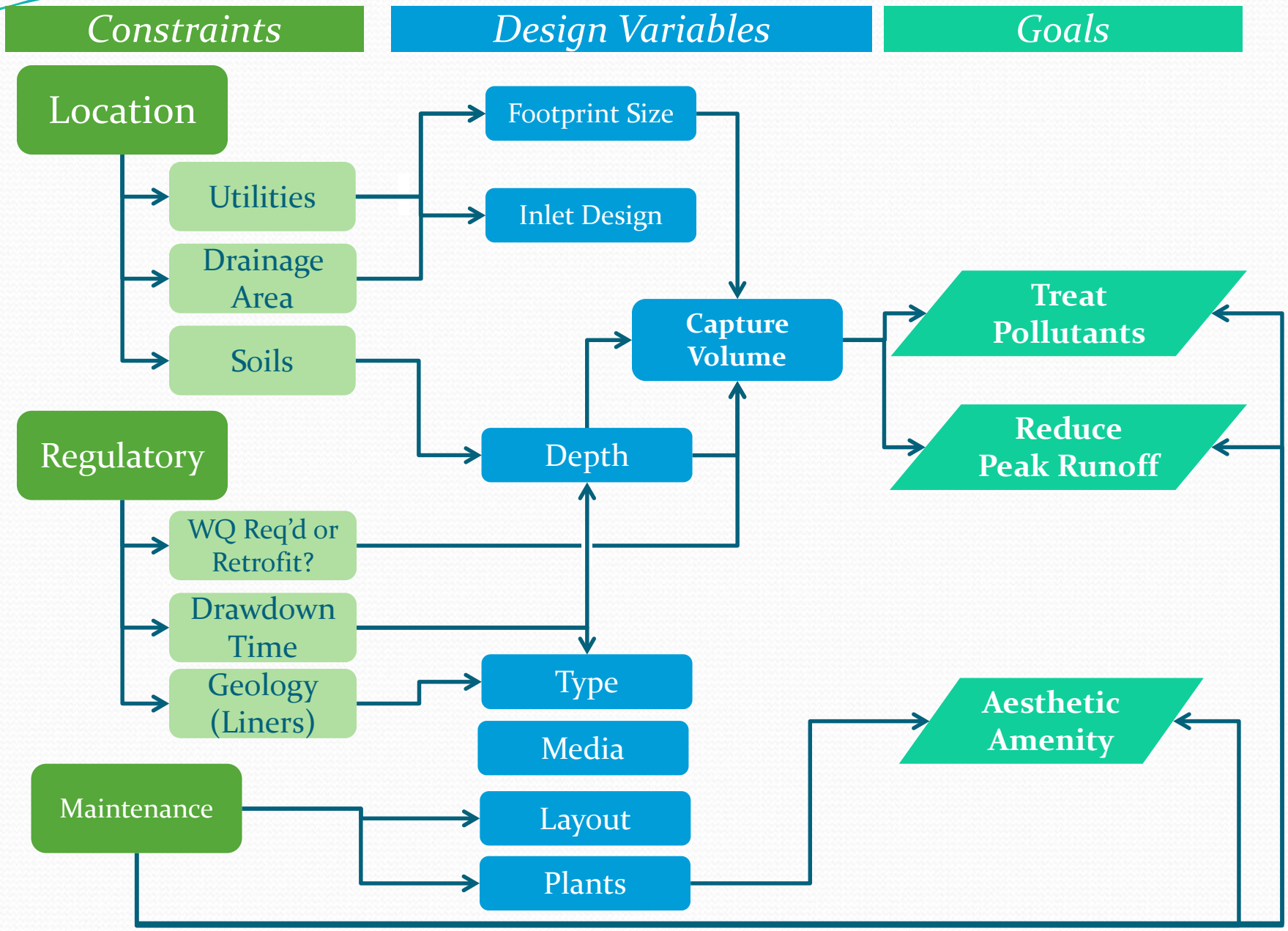

- Captures and conveys runoff through:
  - biofiltration bed
  - underdrain system
    - No infiltration into underlying soil.

# Partial Infiltration




- Captures and treats runoff through a biofiltration bed, a special soil mix
- Stormwater exits this rain garden in 2 ways:
  - via a raised outlet pipe
  - by infiltration into the underlying soil

# Rain Garden Design Considerations



# Siting

## COA Water Quality Requirements:

**Ponding Depth** – One foot maximum

**Land Use** -

- Commercial, Multi-Family, Civic, and Right of Way developments.
- Single Family water quality credit allowed under certain circumstances.
  - Minimum 4+ lots treated by a rain garden
  - Located in dedicated common area or drainage easement
  - Accessible by standard maintenance equipment from the ROW

# Stormwater Hotspots

Infiltration rain gardens are not allowed in areas where activities generate highly contaminated runoff due to the potential for ground water contamination.

Hot spots include, but are not limited to:

- commercial nurseries,
- auto salvage facilities,
- hazardous materials generators (where containers are exposed to rainfall),
- vehicle fueling and maintenance areas, and
- vehicle and equipment washing,
- dry or steam cleaning facilities,
- food production/distribution loading dock, and
- trash compactor areas

# Location

## Drainage Area

Contributing area not to exceed 2.0 acres.

## Setbacks

Prevent adverse impacts to building foundations, basements, wellheads, and roadways.

## Slopes

Should not be located on slopes exceeding 15 percent.

# Soil Conditions

Consider depth to water table, bedrock, and the soil infiltration rate.

- Infiltration rain gardens are not allowed in locations where the depth from the bottom of the growing medium to:
  - the highest known groundwater table is less than 12 inches.
  - bedrock is less than 12 inches.
- Infiltration rate of the soil subgrade below the growing medium of the rain garden must be determined using in-situ testing.

# Infiltration Rate of Soil

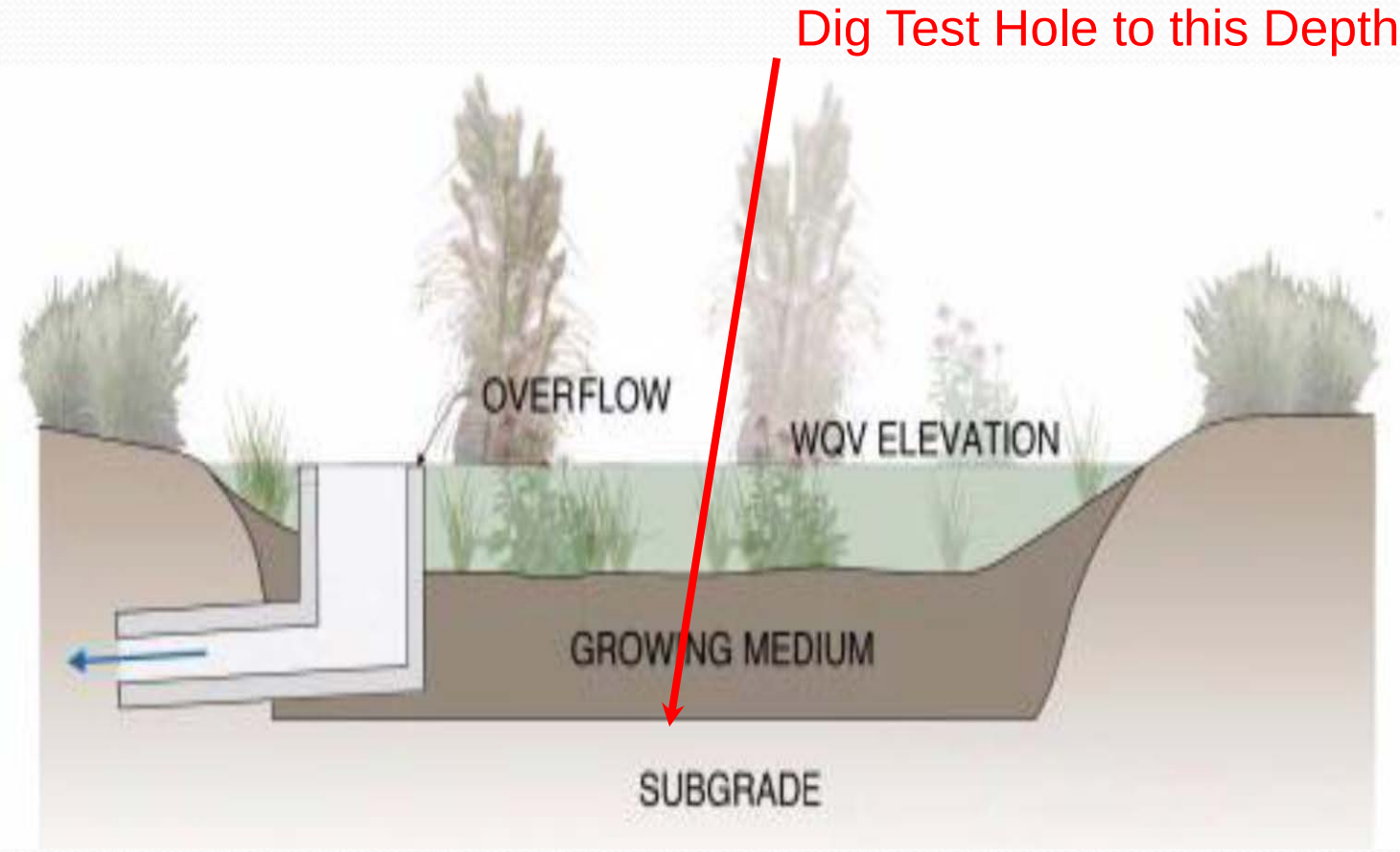
**(For infiltration only rain gardens )**

- Don’t rely of soil survey maps or desktop evaluation for soil infiltration rates
- Perform onsite infiltration test (percolation test)
- At least one test for every 2000 square feet of rain garden
- Dig test hole deep enough to measure infiltration at the bottom of the rain garden.
- Apply factor of safety

(COA recommends using FS = 2)



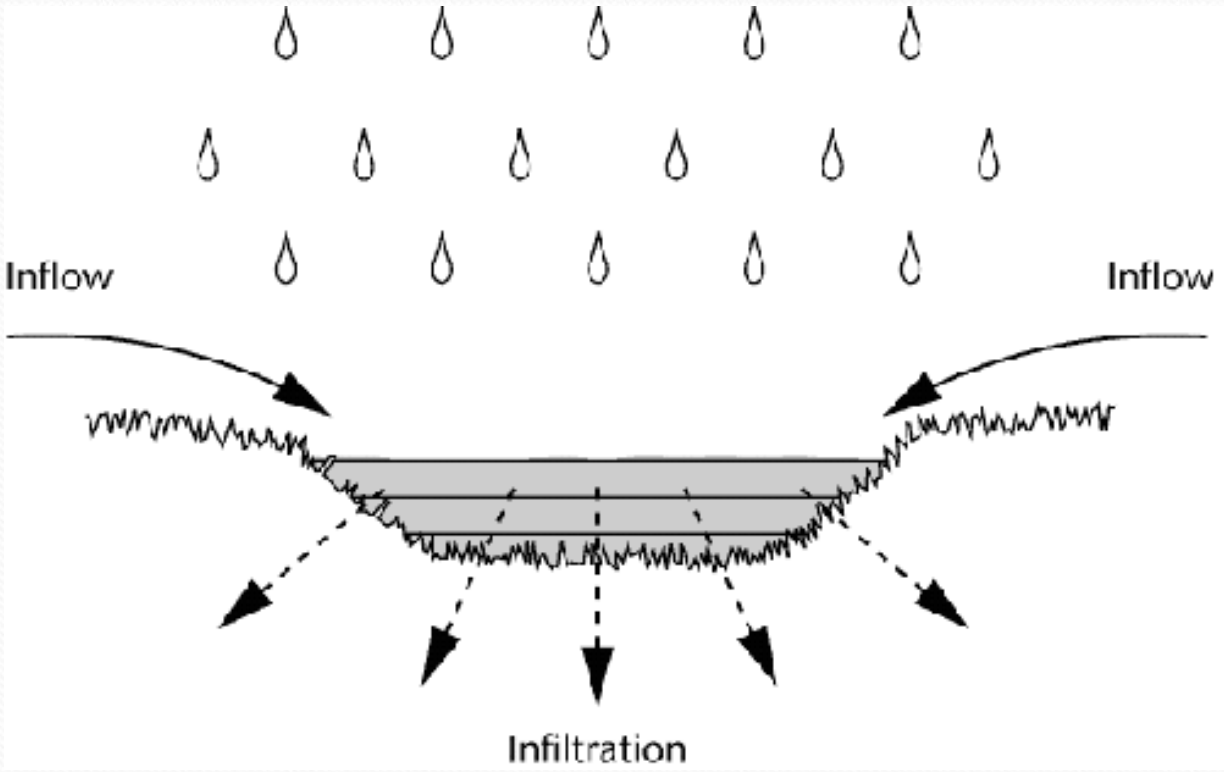

# Infiltration Test



# Infiltration vs. Ponding Depth

The underlying native soil must have a design infiltration rate that will draw down the full ponded depth in 48 to 72 hours.

| Infiltration Rate (inches/hour) | Recommended Ponding Depth (inches) |
|---|---|
| | |
| 0.23 | 12 |
| | |
| 0.13 | 6 |
| | |
| 0.06 | 3 |



# **Drawdown Time** - How fast should the rain garden empty after it rains?

The City of Austin recommends a drawdown time goal of no more than 2-3 days.

Why 3 days?

- Odors
- Mosquitos (typically take 4 to 5 days to hatch)
- Could affect health of plantings

# Drainage Area

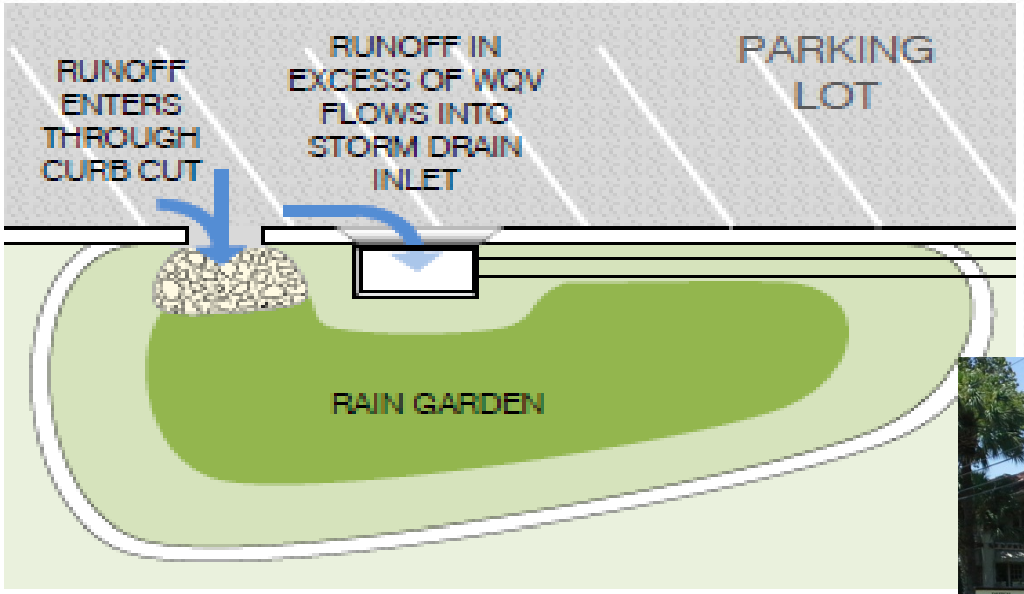

**Design inlet for certainty of capture**

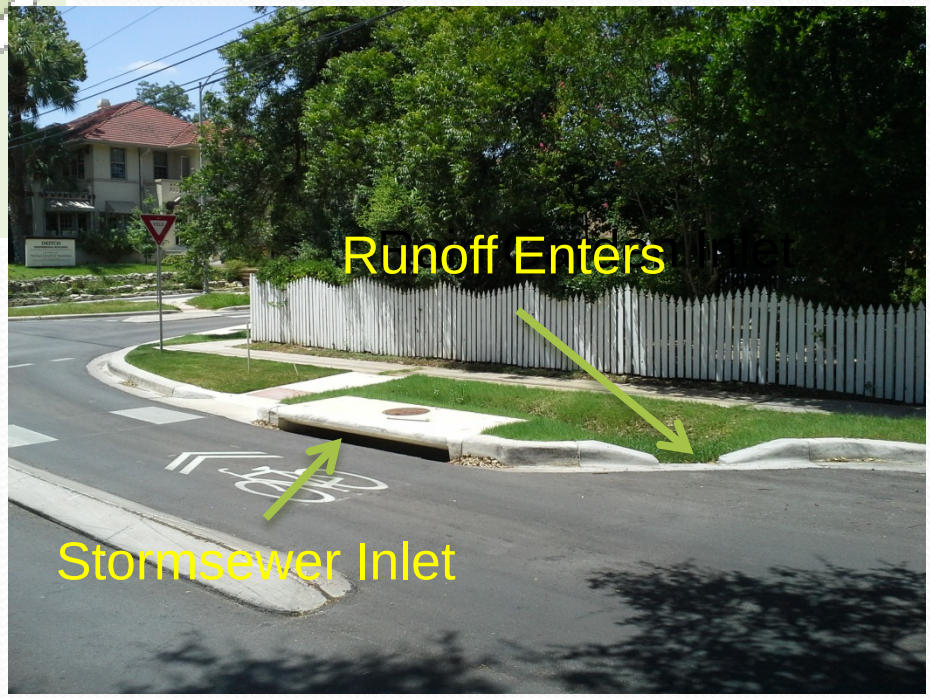
- Grading features or trench drains

FAIL

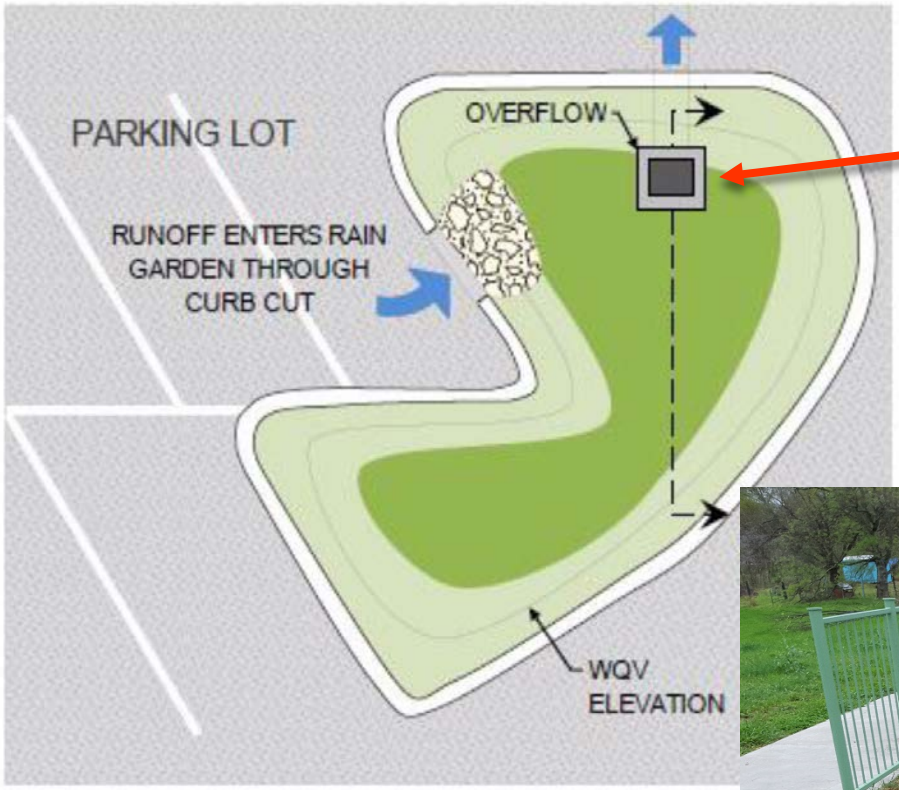
# Certainty of Capture

# Inlet Design



# Inlet Design




Overflow Grate

# Inlet Design: Items to Consider

Flow Control

- Flows into the rain garden should not exceed 2 feet per second. Higher velocities can cause scouring and erosion.

Scouring

# Inlet Design

Watch the Elevations during Construction

- Top of the area inlet sets the ponding depth.
- Location of curb cut and overflow weir

# Inlet Design

Don’t block flow path into RG

Often the addition of topsoil, sod, rock splash pad, etc. is not considered during design or construction and WQV is reduced or flows are hindered

# Splash Pad Design

Watch the length and width.

**Length**

- less than 6 inches from inside edge of inlet.

# Splash Pad Design

**Width**

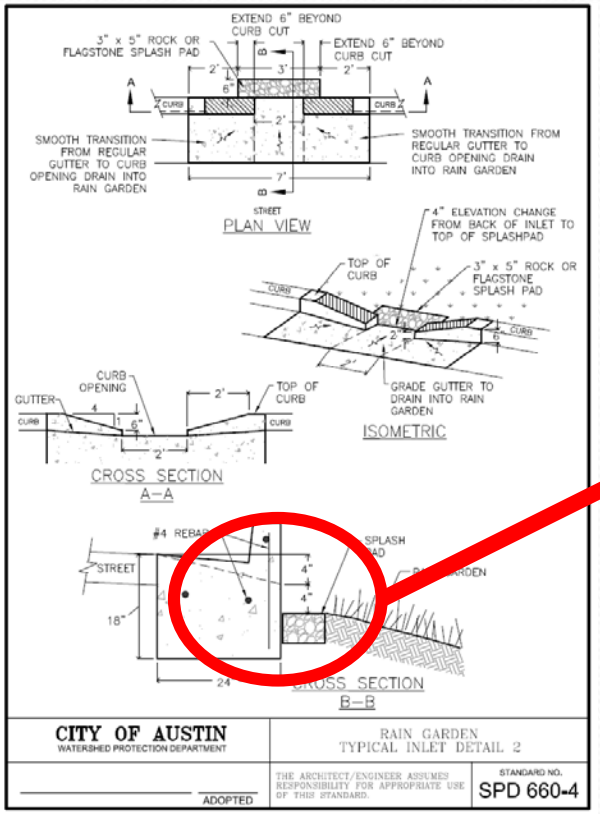
- extend 6 to 12 inches beyond the width of the inlet opening.

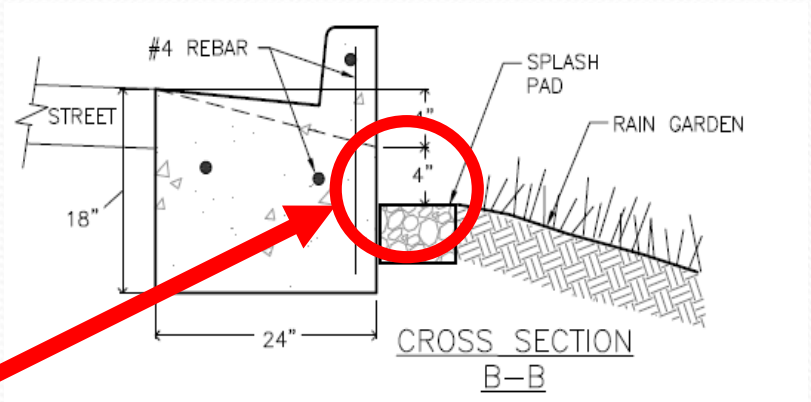
# Splash Pad Issues

Longer splash pads cause sediment and debris to drop out at the inlet entrance.  Over time the inlet becomes blocked and prevents stormwater from entering the rain garden.

# Splash Pad Issues

- Drop from edge of inlet opening onto splash pad should be at least 4 inches.



# Drop onto Splash Pad

4 inches

# Medium

## Biofiltration Medium

- Blend: 70% concrete sand and 30% chocolate loam
- Organic Matter
  - Aged mulch (partially decomposed) may be added (up to 5% by weight)
  - Increased Water Holding Capacity
  - No added nutrients
  - No manure or bio-solids based compost

Biofiltration Medium Specification (COA Spec. 660S):
https://library.municode.com/tx/austin/codes/standard_specifications_manual

Biofiltration Medium Suppliers:
http://www.austintexas.gov/department/stormwater-management

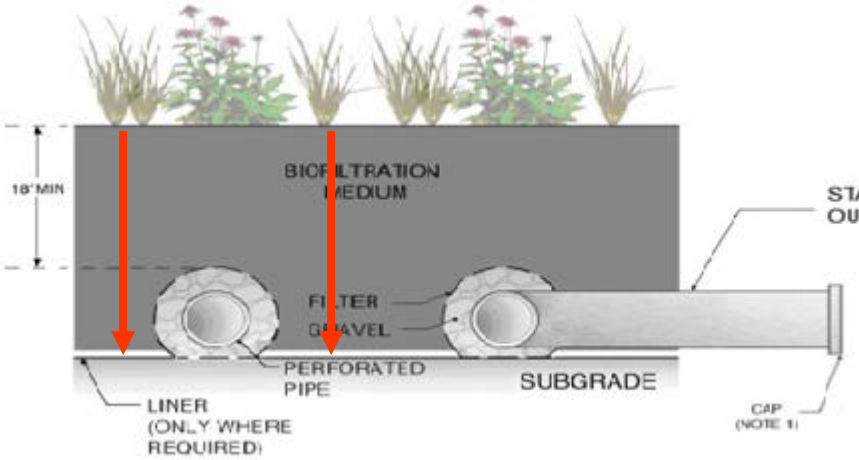
# Underdrains

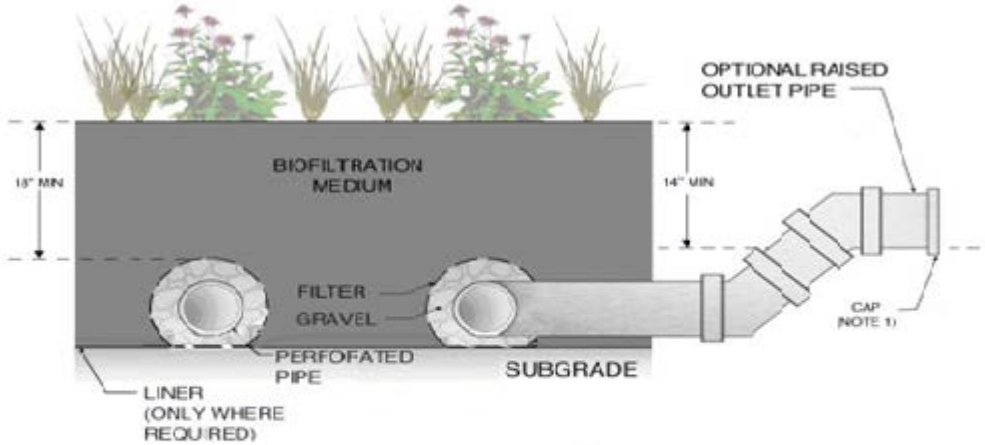
## Underdrain design

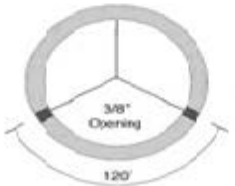
- Allows plant roots to access underlying soil
- Washed river gravel works best

## Saturated zone

- Promotes pollution removal
- Helps with plant viability




PERFORATED PIPE DETAIL

# Infiltration Only Rain Gardens

**During Construction:**

Foot and equipment traffic on the bottom of the rain garden area will compact the soils and will affect the infiltration rate.

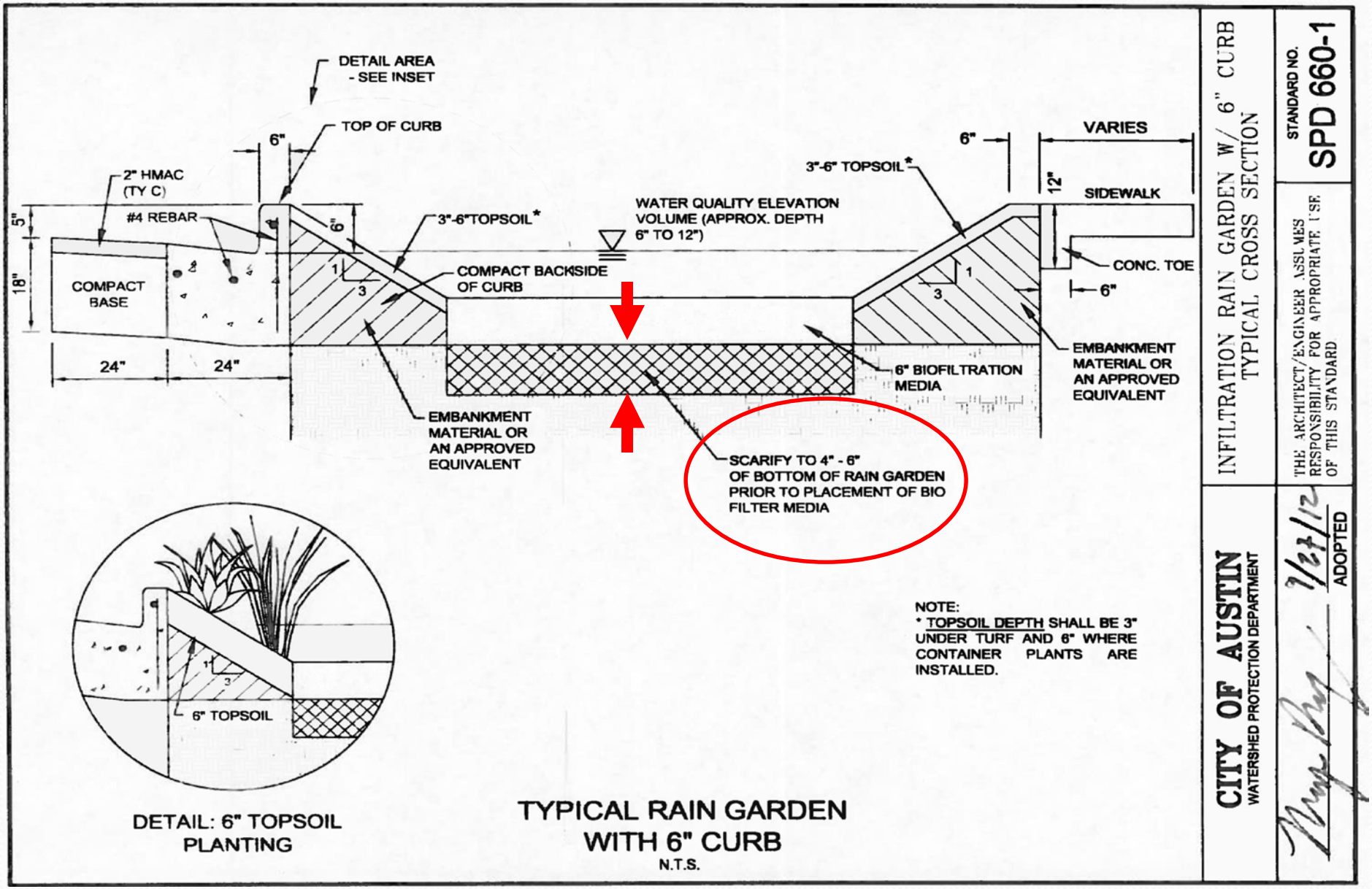

# Scarification/Decompaction

**Prior to installation of media/topsoil:**

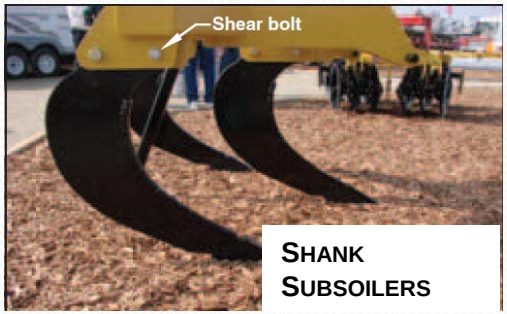
Scarify/decompact top four to six inches at the bottom of rain garden

- restores in-situ infiltration rate.
- promotes root penetration.
- minimizes nuisance ponding issues.

# Scarification/Decompaction



# Scarification/Decompaction



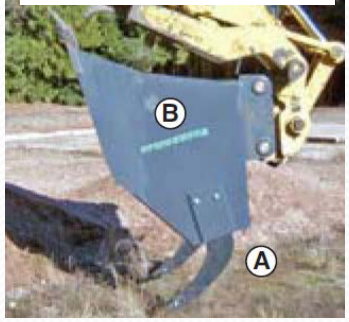

SHANK SUBSOILERS

ROTO-TILLER


BACKHOE

COULTER

SUBSOILING GRAPPLE RAKE




WINGED SUBSOILER

Sources: USFS, USDA, City of Austin, State of Minnesota

# Maintenance

"Another flaw in the human character is that everybody wants to build and nobody wants to do maintenance."
— Kurt Vonnegut, *Hocus Pocus*

Source: sbgardendesign.wordpress.com

# Maintenance Manual


Completed 2014

Includes:

- Recommended maintenance schedule
- Checklist of items to inspect/maintain for a variety of stormwater control measures

www.austintexas.gov/sites/default/files/files/Watershed/stormwater/

Fig. 1

**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

| ISSUE | SOLUTION |
|---|---|
| Erosion or scouring present; Mulch or topsoil is worn away by water flow<br>Fig. 2 | Redistribute/replace mulch to consistent 3 inch depth; Cover extensive scouring with appropriately sized rock (typically 3 inch river rock)<br>Fig. 3 |
| Sediment deposits or debris at the inlet<br>Fig. 4 | Remove sediment, leaves, debris, and trash from the inlet<br>Fig. 5 |
| Sediment deposits greater than 3 inches deep in bottom of basin<br>Fig. 6 | 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<br>Fig. 7 |





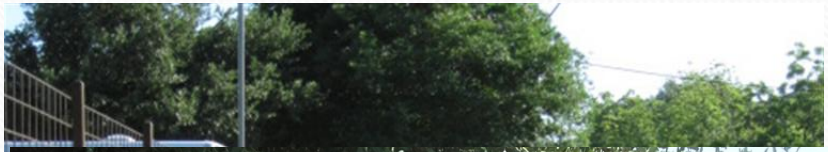
## Vegetative Coverage

| ISSUE | SOLUTION |
|---|---|
| Dead vegetation | Remove and replace with viable plants |
| Vegetation obstructing the street, sidewalk, or curb inlet<br>Fig. 8 | Prune overhanging vegetation/ dead branches with hand tools to prevent obstruction<br>Fig. 9 |
| Inflow/outflow structure is blocked | Remove blockage to allow unimpeded inflow/outflow |
| Bare areas more than 10 sf<br>Fig. 19 | Replace dead vegetation and/ or ground cover/mulch to 3 inch uniform coverage<br>Fig. 20 |
| Abundant weeds and invasive plants; Refer to www.texasinvasives.org for a database of invasive plants<br>Fig. 10 | 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.<br>*See note referring to the use of herbicides*<br>Fig. 11 |

# Grover & Reese

# Davis Lane & Leo

# One Texas Center



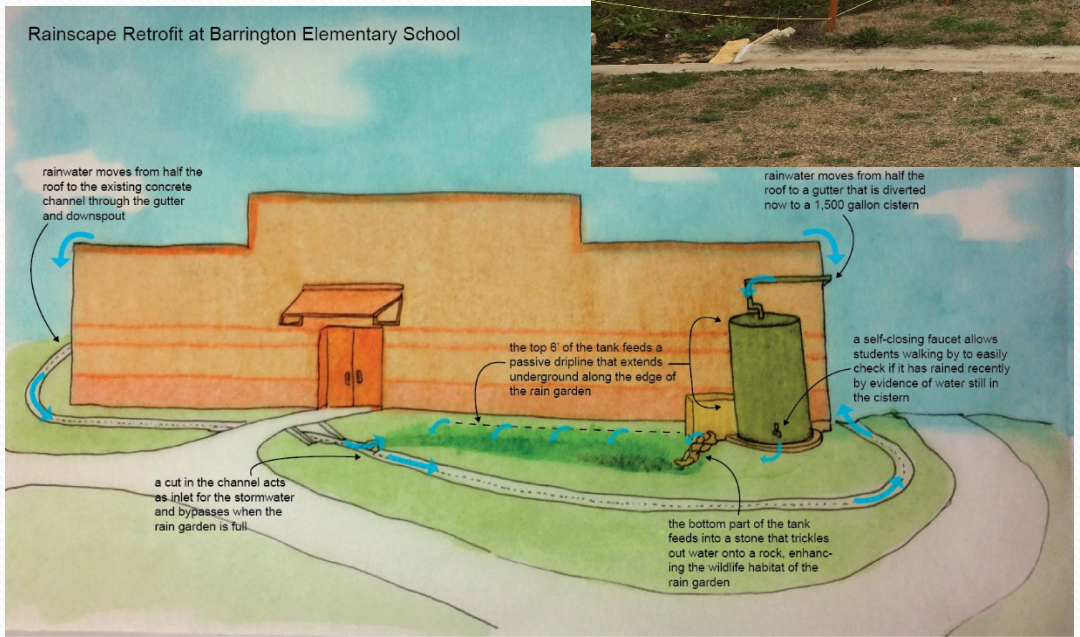
**Increased plant growth with the infiltration only design**

# JJ Seabrook – Denver at Pershing

# JJ Seabrook - Greenwood at Pershing

# EM Franklin Rain Gardens


# Barrington Elementary

# Questions ???

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Thank you for attending