Operations & Maintenance for Bioretention Stormwater Practices

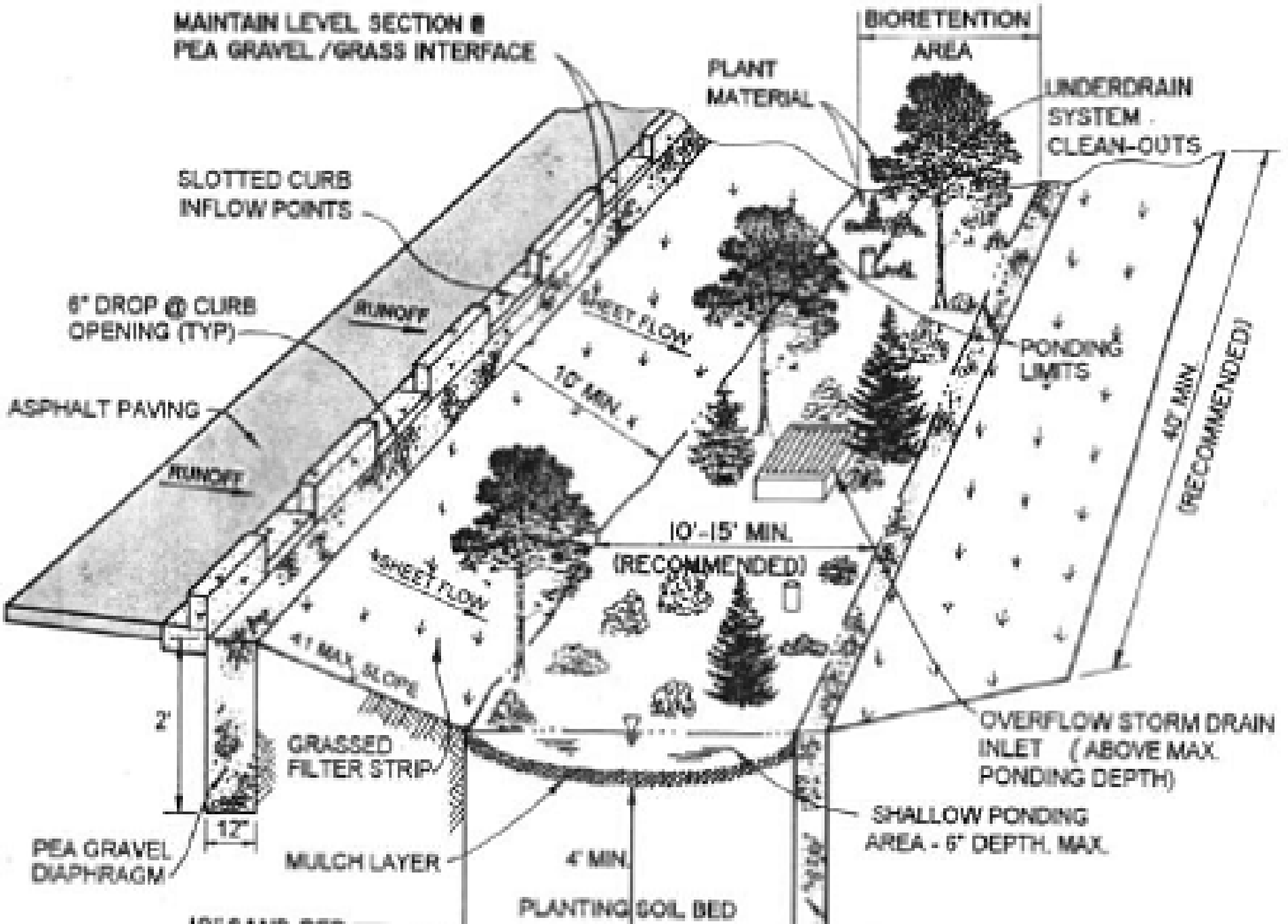
Brian Prunty CPSWQ, CPESC
Stormwater Specialist
Summit Soil & Water Conservation District

How Do We Know A Bioretention Facility Requires Maintenance?

Components of the Bioretention Facility

- **Pretreatment:** Grass filter strip, gravel verge, grass channel or forebay

- **Filter Bed Area (FBA):** ponding zone, mulch, soil mix, filter layer, gravel & under drain


MAINTAIN LEVEL SECTION @
PEA GRAVEL / GRASS INTERFACE
BIORETENTION
AREA
PLANT
MATERIAL
UNDERDRAIN
SYSTEM
CLEAN-OUTS
SLOTTED CURB
INFLOW POINTS
6" DROP @ CURB
OPENING (TYP)
RUNOFF
SHEET FLOW
10' MIN.
PONDING
LIMITS
ASPHALT PAVING
RUNOFF
40' MIN.
(RECOMMENDED)
10'-15' MIN.
(RECOMMENDED)
SHEET FLOW
4:1 MAX. SLOPE
2'
GRASSED
FILTER STRIP
OVERFLOW STORM DRAIN
INLET (ABOVE MAX.
PONDING DEPTH)
SHALLOW PONDING
AREA - 6" DEPTH, MAX.
12"
PEA GRAVEL
DIAPHRAGM
MULCH LAYER
4' MIN.
PLANTING SOIL BED

Maintenance for Pretreatment Area:

- **Gravel Verge** – remove debris accumulation or repair wash out.
- **Turf Filter Strip**:
  - Overseeding (slice seeder) or patch repair and maintain thick stem density. (tall fescue & 5-10% micro-clover mix by weight)
  - Remove weeds (corn gluten meal, non chemical spray
  - Mow high (no lower than 4”)
  - Apply compost tea or compost blanket
  - Snow storage & salt damage

What Types of Maintenance are There?

Functional (Safety & Drainage Function):

- Remove sediment deposit
- Replace clogged material
- Scouring or erosion
- Blocked grate or under drain
- Debris & litter removal

Aesthetical (Enhance the Appearance):

- Pruning
- Weeding
- Young tree training
- Replacing dead plants
- Mow turf BR Facilities
- Debris & litter removal

* Some items will fall under both categories.

Aesthetical Maintenance for Filter Bed Area (FBA):

- Plant care: (consult with your urban forester or parks)

pruning & young tree training– cut at branch collar

Bare root trees – Prevent soil contamination & expose root flare.

Watering – greater that 4 weeks w/o rain or first year. (5 gallon + 1” rule)

Compost tea - fogger, foliar sprayer or drench

Pest management – Id pest, spray with neem oils, soaps and other organic non-chemical methods.

Staking trees - until root development.

Aesthetical Maintenance for Filter Bed Area (FBA):

- **Mulching**:

  Depth of 3-4”

  Keep mulch 3” minimum from stems (rot)

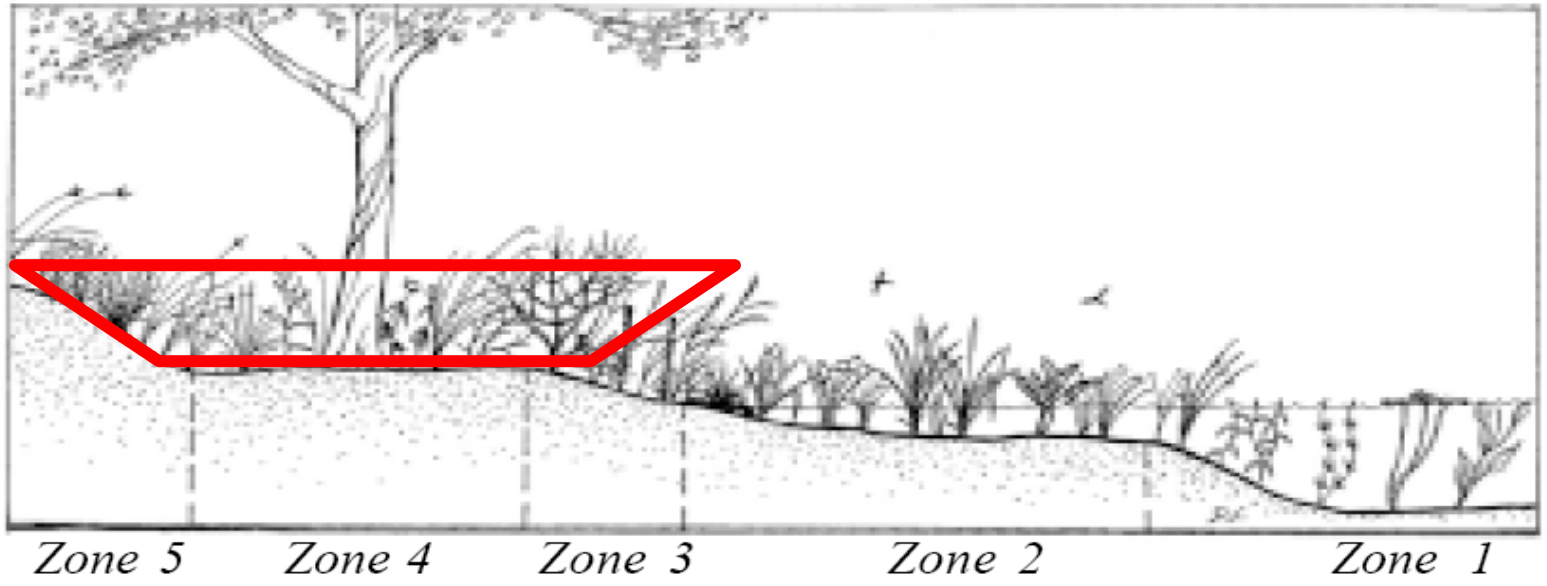
  Replace or add every 1-2 years

  Mulch types – compost, 2x-3x shredded & aged

  No Alternative Mulches - Wood mulch provides weed control, regulates soil temps, retains moisture, reduces soil compaction and provide a better environment for the microbial community.

Aesthetical Maintenance for Filter Bed Area (FBA):

- **Removal of weeds** – manually with pincher, flame, hot water or organic sprays.
- **Young tree training** – promotes tree integrity and decreases damage from weather.
- Clean up debris and litter.
- Replacing diseased or dead plants (remember the growing environment)



ZONE	PLANT COMMUNITY	HYDROLOGY
1	Submergent zone	1.5-6 feet of water
2	Emergent zone	0-18 inches of water
3	Wet meadow zone	Permanent moisture
4	Floodplain zone	Flooded during snowmelt and large storms
5	Upland zone	Seldom or never inundated (the upland zone includes prairie and forest plant communities)

Functional Maintenance for Filter Bed Area:

- Repair erosion & scouring
- Remove sediment & debris accumulation
- Clogged soil media, filter fabric or under drain
- Compaction of media
- Blockage of overflow grate or catch basin
- Excessive Ponding duration or loss of volume
- Snow and plow damage

Overflow Grate

Scouring or Erosion

- Eroded areas can clog the BR and reduce its ability to function as a drainage system.
- Deep channels shall be filled with proper soil mix and compacted lightly with hand tamper.
- Shallow channels shall be graded out and remulched.

Excessive and Repeated Erosion

- Install cobbles at top of erosion channel should be 3 times the width of the erosion channel and at least 12 inches minimum length.
- Look up stream for the issue, install velocity & energy controls.

Sediment & Debris Accumulation

- Buildup will clog the BR and reduce its ability to function as a drainage system.
- Where sediment accumulation is visible remove it with a shovel when dry.
- Remulch
- Repeated buildup? Look up stream for source, repair issues up stream & replace soil mix, if needed.

Compaction

- Dig test hole to identify compaction layer and depth.
- Rip, drill, trench or air knife below compacted layer to loosen up the soil and provide air space.

Winter and Snow Removal

- Design and designate a snow storage area.
- Do not pile snow in filter bed area – This can compact the FBA, damage plants or clog media.
- Install signs to prevent snow piling and storage.
- Require an annual a meeting with snow removal contractor or staff.

Maintenance Schedule :

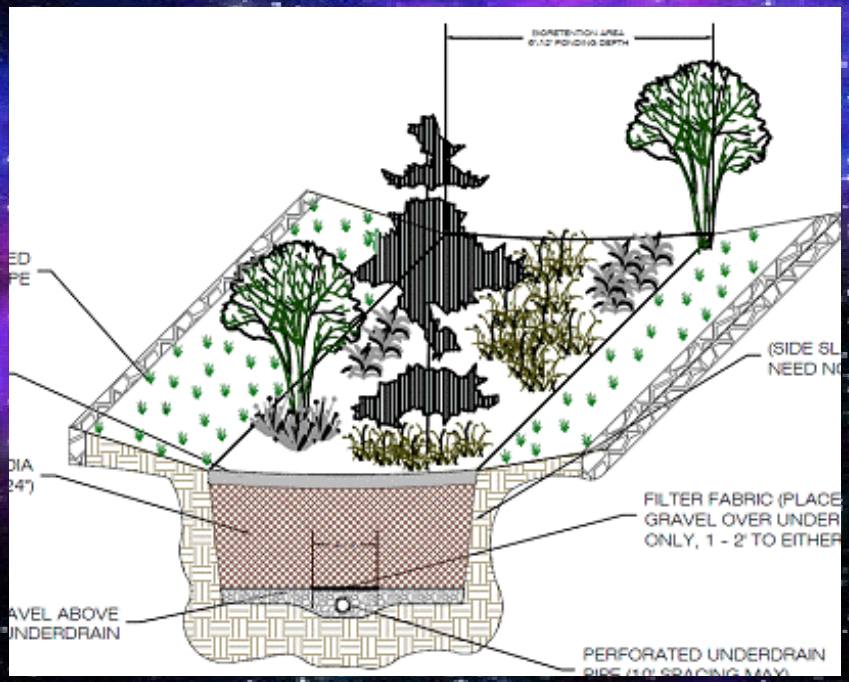
Activity	Schedule
Water Plants	As necessary during first growing season
Prune and weed plants for appearance	As needed
Inspect & replace poorly suited or diseased plants	As needed
Check for erosion or deposition in pretreatment and bioretention areas; Clean out and repair damaged areas	Semi-annually
Inspect facility for salt damages	Monthly
Remove litter and debris	Monthly
Add and/or replace mulch	Annually
Test soil and adjust as necessary to maintain in 5.2- 8.0 pH range	Biannually
Check planting soil and filter layer for clogging, replacing nec. portions	2 –10 years/ As needed

Table 2.0.2 These maintenance activities are suggested as a minimum.

Bioretention Maintenance:

- Low tech equipment most companies or garages have the required tools (shovels, rakes, wheelbarrow, pruning and snake)
- Requires a basic landscape knowledge base

Bioretention in the Future



Turf Bioretention

- Turf Management – Mow high no less than 4”
- Turf type (Cool Season) – Tall Fescue (best), Kentucky Bluegrass (good) & do not use Rye
- Maintain a thick “Stem Density” – Slice seed (Aug 15th- Sept 15th)
- Microclover (Trifolium repens L. var. Pirouette)
- No mow grasses?
- Equipment compaction of FBA & don’t mow after a rain

Actively Aerated Compost Tea (AACT)

- Inoculating the soil with microbial community without nutrient inputs.
- Increases plant growth, health, disease & drought resistance.
- Increases nutrient retention, nutrient uptake & water retention.
- Fungi and bacteria can breakdown heavy metals, PAHs, organic chemicals and e. coli.

Evapotranspiration (ET)

- ET has shown to reduce outflow volume by 19%
- What influences ET:
  - Crop factor - Root density & root depth
  - Media Volume to Drainage area
  - Media Depth
  - IWS
  - Soil amendments


S130
Bobcat
A TO Z
RENTALS
210-659-6601

References:

Houng Li, Sharkly, L.J., Hunt W.F. (2009). Mitigation of Impervious Surface Hydrology Using Bioretention in North Carolina and Maryland. JOURNAL OF HYDROLOGIC ENGINEERING. ASCE/APRIL 2009. DOI: 10.1061/(ASCE)1084-0699(2009)14:4(407)

Pitt,R., Clark, S., and Voorhees.,J. Water Removal in Bioretention Devices by Evapotranspiration Processes and Related Issues Affecting Performance. Arcata Engineering International Conference, July 2007

Manuals:

Ohio Department of Natural Resources. 2006. Rainwater and Land Development: Ohio's Standards for Stormwater Management Land Development and Urban Stream Protection.

Center for Watershed Protection. 2012. Trees in Bioretention.

United States Department of Agriculture. 2005. Urban watershed Forestry Manual.

SVR Design Company. 2006. High Point Community: Right of Way and Open Space Landscape Maintenance Guidelines

QUESTIONS?

Brian Prunty
Stormwater Specialist
Summit SWCD
330-929-2871
bprunty@summitswcd.org