

# Bioretention and Permeable Pavement Maintenance in the Context of GAM

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# Bioretention in Parking Lot

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# Permeable Pavement

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# Bioretention is Low Maintenance... ...but not *NO* maintenance

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# I. Standing Water -- Clogging

Most common cause of bioretention failure....



Chapel Hill, NC

# Clogging Causes

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- ❑ Berm erosion into mulch and media
- ❑ Unstable catchment
- ❑ Unmaintained forebay
- ❑ Media mix is wrong!



# Asphalt Generates Sediment

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# Clogging

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- ❑ Media chosen for **specific porosity**
- ❑ Fines occupy pore space in media
- ❑ Reduces infiltration rate significantly (**goal = 1 in/hr rainfall event**)
- ❑ Useful lifespan of bioretention found to be limited by clogging (Li and Davis, 2008)



# Key Maintenance Test

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- Visit site within 24 hours of 1 inch rain event (avg 11-12 /yr)
- If water is still ponded site has clogged
- Action needed
- Do this once or twice per year



# Unclogging

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- ❑ Excavate top 5-20 cm
- ❑ Replace with clean media
- ❑ May need deeper if severe failure occurs
- ❑ Can be expensive \$\$\$



# Remove mulch, move plants, dig out clogged soil

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## II. Short Circuiting & Erosion Slow Distributed Inflow

# Internal Erosion from poor water delivery

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# Curb cut

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# Rip rap

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# Gravel verges and grass filter strips = Treatment train

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# Bioretention Forebays

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# III. Overflow Structure Maintenance

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- ❑ Urban areas, overflow structure *can* be matter of **public safety**
- ❑ Certain outlets more apt to clog than others
- ❑ Private firms specialize in outlet maintenance on SCMs



# Clogged outlet

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## IV. Debris Cleanup

# Trash Removal

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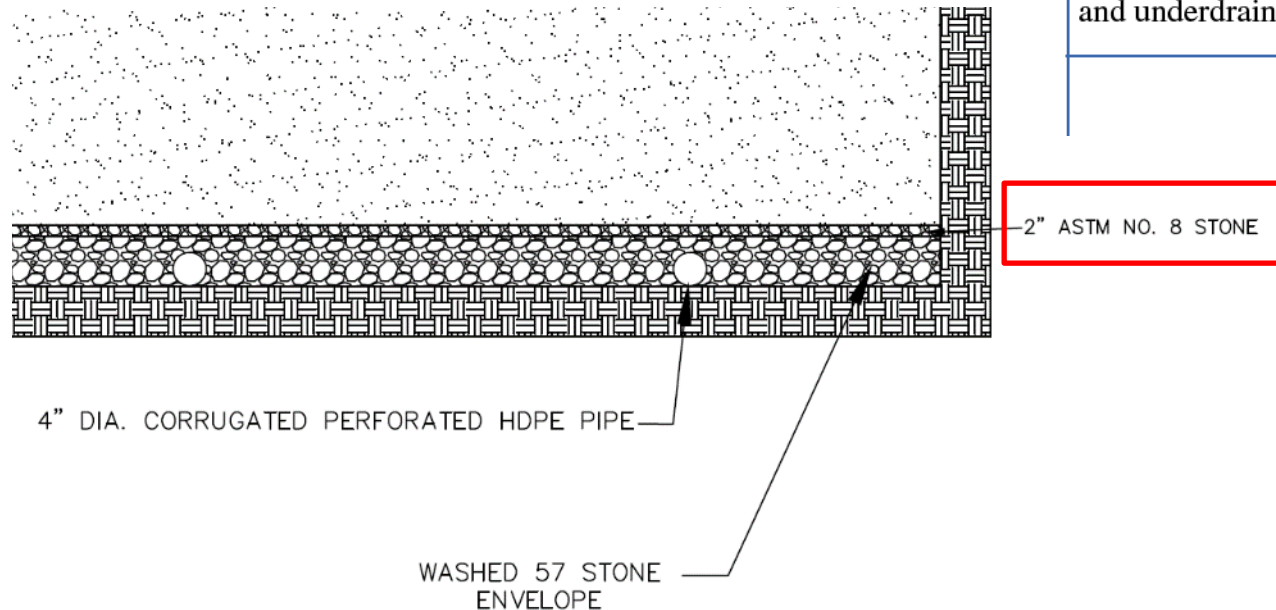
- ❑ Unsightly, poor aesthetics
- ❑ Safe harbor for mosquitos
- ❑ Can clog drawdown
- ❑ Takes up volume in forebay



# V. Underdrain Maintenance?

- ❑ Surprisingly uncommon
- ❑ Clogging potential: filter fabric vs choking stone
- ❑ Cleanouts make it easy

Fill Soil Media: 85 – 88% Washed Sand 8 – 12% Fines (Silt + Clay) 3 – 5% Organic Matter	
Washed Sand	2 to 4 inches
Choking Stone (typically #8 or #89 washed)	2 inches
Washed #57 stone or similar, and underdrain pipe.	6 to 8 inches
In-situ soil	



# Underdrain Cleanouts

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Bad



Better





# VI. Plant Selection

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- ❑ Plant palette has grown as BR soils have improved
- ❑ Natives are good
- ❑ Avoid invasives and 'spreaders'

# Plant Density

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Keep it open!

## Maintenance Trigger: Plant replacement

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- Replace dead plants ASAP with more tolerant plants or plant new plants on higher ground in the bioretention bed

# Vegetation Maintenance

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Fort Bragg, NC

# Vegetation Maintenance

- **Irrigate**
  - 2 to 3 days for first few months
- Once established, should sustain themselves
- Vegetation selection is key here
- Droughts

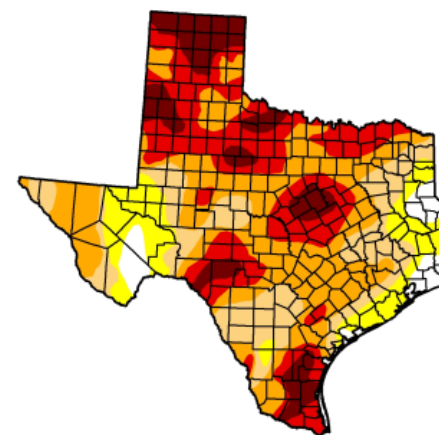
## U.S. Drought Monitor Texas

January 8, 2013  
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.29	95.71	83.78	65.85	34.79	11.41
Last Week (01/01/2013 map)	3.04	96.96	87.00	65.39	35.03	11.96
3 Months Ago (10/09/2012 map)	16.50	83.50	65.38	31.79	15.88	3.23
Start of Calendar Year (01/01/2013 map)	3.04	96.96	87.00	65.39	35.03	11.96
Start of Water Year (09/25/2012 map)	9.13	90.87	78.73	57.41	24.91	5.18
One Year Ago (01/03/2012 map)	0.01	99.99	97.83	84.81	67.32	32.40

Intensity:



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>



Released Thursday, January 10, 2013  
David Simeral, Western Regional Climate Center

Importantly...

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**Think *clean water*, not *lush***



# Vegetation Maintenance

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**1 to 2  
times/yr**

# VII. Mulching: Benefits

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- ❑ Prevents weeds from sprouting
- ❑ Adds organic matter, active zone for microorganisms
- ❑ Conserves moisture during dry periods
- ❑ Cools soil
- ❑ Attractive





# Mulching

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- ❑ Use double or triple-shredded hardwood
- ❑ Renew if needed due to oxidation or discoloration
- ❑ Do not over-mulch and fill water storage pool with mulch
- ❑ “Hot Spots”

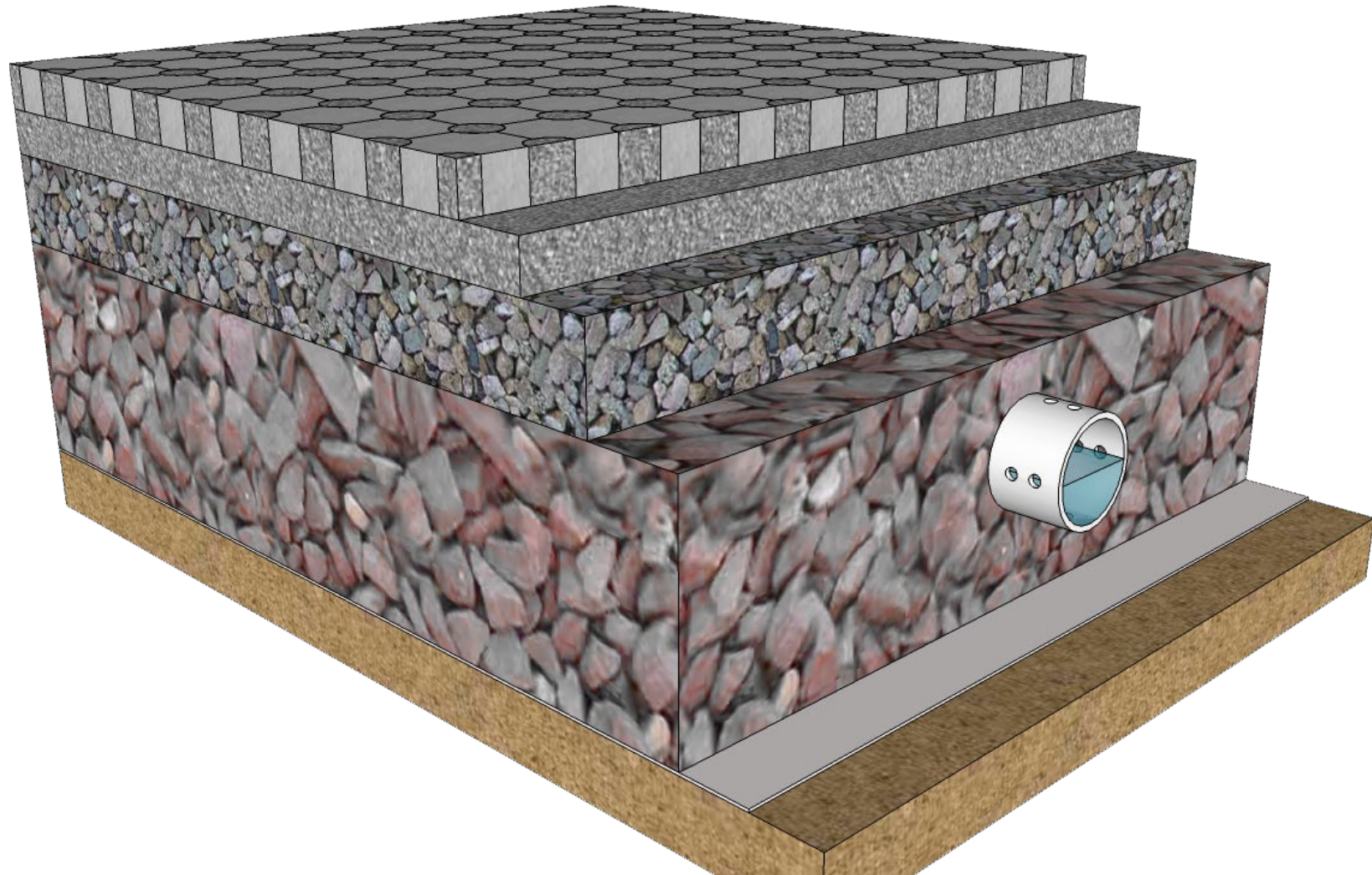


## Example Bioretention Maintenance Task Schedule

Task	Frequency	Maintenance Notes
<b>PRUNING</b>	1 – 2 times/yr	Nutrients in runoff often cause bioretention vegetation to flourish
<b>MOWING</b>	2 – 12 times/yr	Frequency depends upon location and desired aesthetic appeal
<b>MULCH REMOVAL</b>	Once every 2 – 3yrs	Mulch accumulation reduces available water storage volume. Removal of mulch also increases infil. rate
<b>WATERING</b>	Once every 2 -3 days for first few months. Seldom after establishment	During droughts, watering after initial year may be needed
<b>FERTILIZATION</b>	Once initially	
<b>REMOVE AND REPLACE DEAD PLANTS</b>	Once per year	>10% of plants may die, survival rates increase over time
<b>MISCELLANEOUS</b>	Monthly	Trash collection, spot weeding, removing mulch from overflow

# Permeable Pavement

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# If not maintained, “permeable” pavement can become Impervious

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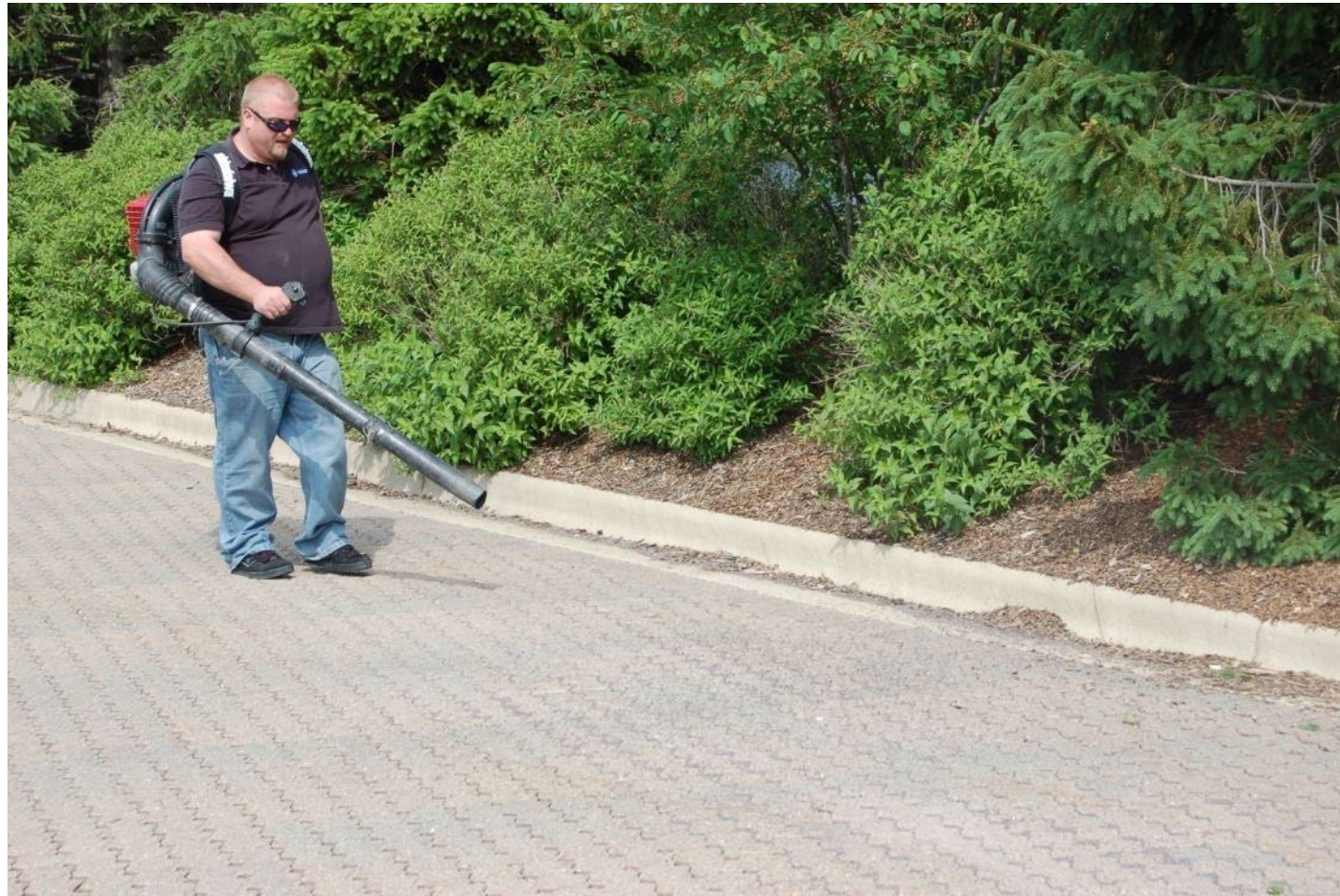
# Permeable Pavement Maintenance: Clean the Catchment - Street Sweeper

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# Permeable Pavement - Clean the Catchment: Blowing

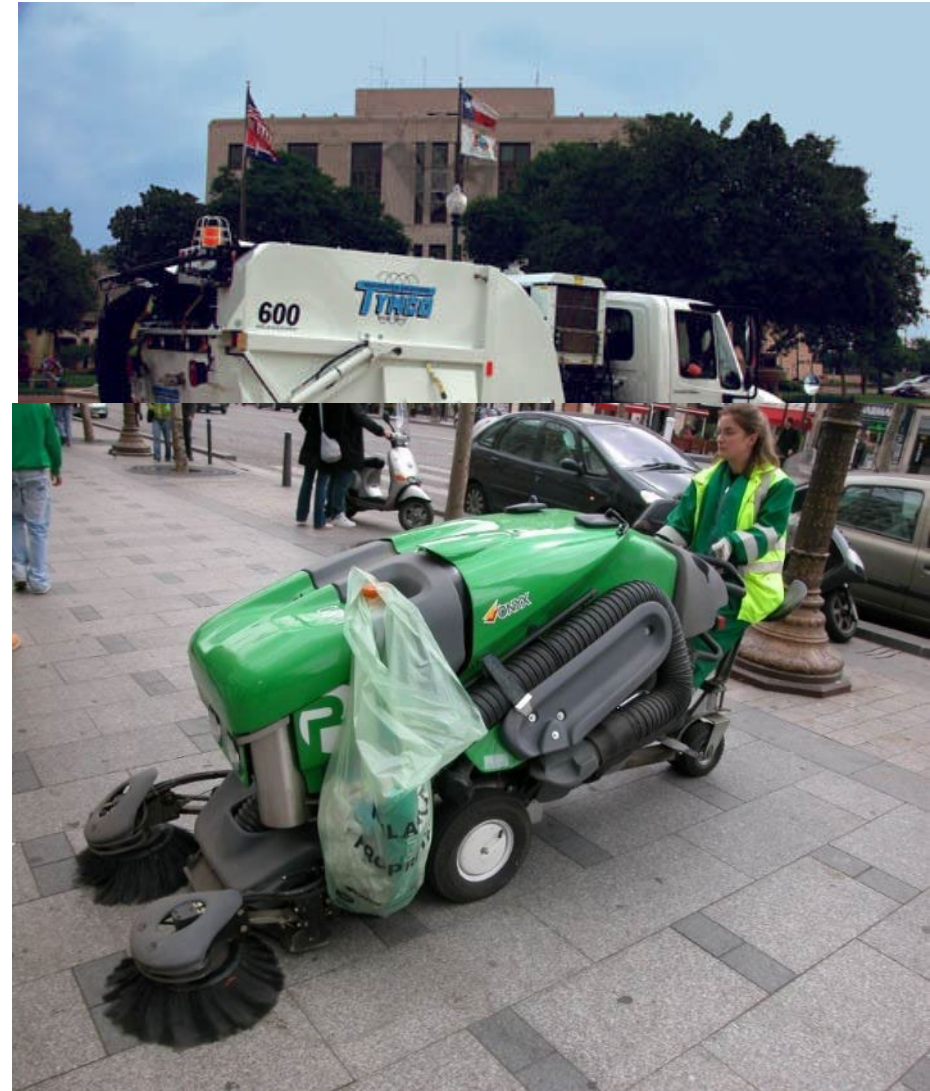
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# Permeable Pavement Maintenance: Sweeper/Vacuum Truck

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- ❑ Different Types of Sweepers for Different Types of Permeable Pavements:
- ❑ Mechanical Sweeper vs. Regenerative Air Sweeper vs. Vacuum Sweeper



# Permeable pavement weed control

- ❑ Systemic herbicides like Roundup - Preferred
- ❑ Flame weed killers – LP gas fueled – Be careful. Could ignite Concrete!





# Grassed Permeable Pavement

## You might have to mow it!

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# Permeable Pavement Maintenance Tasks and Schedule

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<u>TASK</u>	<u>SCHEDULE</u>
Inspect Lot for Clogging	Semi-annual to Quarterly
Street sweeping and vacuuming	Per inspection results
Gravel replacement	Post-Vacuuming
Oil and grease cleaning	As needed per clientele
Avoidance of landscape debris (grass clippings, leaves)	Each landscape maintenance
Spray/ <sub>Flame</sub> Weeds and Moss with Herbicides	Monthly during growing season
Adjoining land and watershed stabilization	Keep watch

Questions?

