




# Practical Tools for Managing Stormwater Runoff

March 9, 2019  
Land and Water Summit



# Today's Highlighted Resources



**Rhode Island Stormwater Solutions**


ABOUT US | STORMWATER BASICS | TAKE ACTION | STORMWATER MANAGERS | LID AND GI

**Stormwater Managers**

Educational Materials  
Workshops  
List Of Managers

**Educational Materials**


Education, Outreach, & Involvement: Introduction  
Educational Materials By Topic  
Educational Materials By Type  
Educational Materials By Pollutant



## Soil Erosion and Sediment Control Online Training


Thanks to a partnership between URI Cooperative Extension and StormwaterONE, with funding from RIDOT and support from RIDEM, we are pleased to offer an online soil erosion and sediment control (SESC) training program tailored to construction in RI. The overall program and each of the four course options are detailed in factsheets below.

**Program Overview & Level 1: Awareness**




[Level 1 Enrollment Link](#)

**Level 2: Introduction**




[Level 2 Enrollment Link](#)

**Level 3: SESC Inspections**



[Level 3 Enrollment Link](#)

**Level 4: SESC Plan Preparation**



[Level 4 Enrollment Link](#)



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**Quick Links**

Workshops (NEMO site)  
Rhode Island NEMO  
Educational Materials





## Spot Stormwater Violations around a Construction Area

Construction sites are required to install and maintain control measures that prevent soil erosion. Soil erosion happens when water, wind, or gravity move soil from one location to another. The control measures ensure public safety, help keep local waters clean, and prevent flooding, soil loss, and other long-term consequences of erosion.

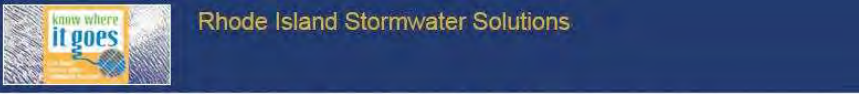
Look familiar? Contact your [Stormwater Manager](#) if you see a violation illustrated in the "Please Report" column. Use the "All Good" column to learn about the Best Management Practices that contain and control soil erosion.

*For immediate assistance contact the RI DEM Office of Compliance and Inspection at (401) 222-1360 or [DEM.Compliance2@dem.ri.gov](mailto:DEM.Compliance2@dem.ri.gov).*

Click on images below to enlarge.

 <b>Please Report</b>	 <b>All Good!</b>
 <p>Muddy water is an illicit discharge and a violation of the Soil Erosion and Sediment Control plan.</p>	 <p>Filter fabrics on storm drains are a last line of defense against erosion entering waterways. Photo credit: US EPA.</p>
 <p>Compost filter socks are highly effective. However sediment must be cleared away regularly or it will pile up and eventually be carried over the compost filter sock.</p>	 <p>Filter sock appropriately placed between construction and a wetland. Area is free of accumulated sediment.</p>
 <p>Concrete washout, which is highly toxic to aquatic life, has been carried by runoff to the storm drain at left.</p>	 <p>Designated concrete wash out areas allow for management of polluted water from washing out ready-mix trucks, drums, and pumps.</p>

# Highlighted Resources... Continued



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## Maintenance of Rain Gardens and Wetland Buffers

Maintenance of Rain Gardens and Wetland Buffers  
Regulatory Rain Gardens  
Example Rain Garden Management Plan  
Example Wetland Buffer Management Plan  
Rain Garden / GI Sign Templates



### Maintenance of Rain Gardens and Wetland Buffers



**[In the Weeds: A Guide for Maintaining Vegetation in Stormwater Treatment Systems in Rhode Island](#)**

- An illustrated guide of weedy and invasive plants known to invade and compromise the function of vegetated stormwater systems such as rain gardens, bioretention, bioswales, and tree filters. Designed to help maintenance staff and supervisors identify problem plants in the field.

**[Rain Garden Factsheets, Maintenance Checklists, and Maintenance Guidance](#)**

- A detailed rain garden maintenance factsheet, and editable checklist and guidance templates intended for use by municipalities, designers, and others to customize for their own projects.

**[Example Rain Garden Management Plan](#)**

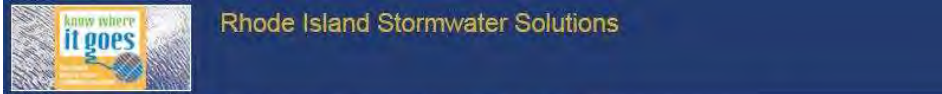
- A maintenance plan developed by the City of Pawtucket and designer Tim Gerrish, Gardner&Gerrish Landscape Architects LLC, with assistance from URI Cooperative Extension, for a series of rain gardens that will receive runoff from a new spray park in the City of Pawtucket.

**[Example Wetland Buffer Management Plan](#)**

- A maintenance plan developed by the City of Pawtucket and designer Kyle Alfred of Fusa & O'Neill, with assistance from URI Cooperative Extension, for a vegetated buffer to discourage waterfowl access to Slater Pond.

**[Rain Garden / GI Sign Templates](#)**

- Permanent signs accompanying vegetated stormwater systems can educate the public and assist landscape maintenance workers.




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## Low Impact Development

LID/GI Overview & Regulations  
RI Map Inventory  
GI Maintenance




### In the Weeds: A Guide for Maintaining Vegetation in Stormwater Treatment Systems in Rhode Island

Online for your mobile device



Download as a PDF



**Purpose**

*In the Weeds: A Guide for Maintaining Vegetation in Stormwater Treatment Systems in Rhode Island* is an illustrated guide of weedy and invasive plants known to invade and compromise the function of vegetated stormwater systems such as rain gardens, bioretention, bioswales, and tree filters. It is designed to help maintenance staff and supervisors identify problem plants in the field, and it targets the aggressive plants most likely to take over a stormwater treatment system in Rhode Island.



**How To Use It**

This guide is split into four categories: Trees, Shrubs, Herbaceous/Grasses, and Vines. Under each category, the plants are alphabetized by common name. When multiple plants have a shared name, they are listed by that name. For example, to find "Common Barbary" and "Japanese Barbary" look for the alphabetic placement of "Barbary."

The photos illustrating each species were chosen to show different stages of the plant throughout the growing season. Because it is much easier to control invasive species through frequent inspection and weeding before they get firmly established, many photos show seedlings and young plants. Photos also emphasize distinctive plant features, such as large flowers, fruits, seedpods, and different bark textures.


# So Why Are We Here Today?

Rhode Island General Construction Stormwater Awareness Training



Rhode Island  
Department of  
Environmental  
Management

*Rhode Island General  
Construction Stormwater  
Awareness Training*

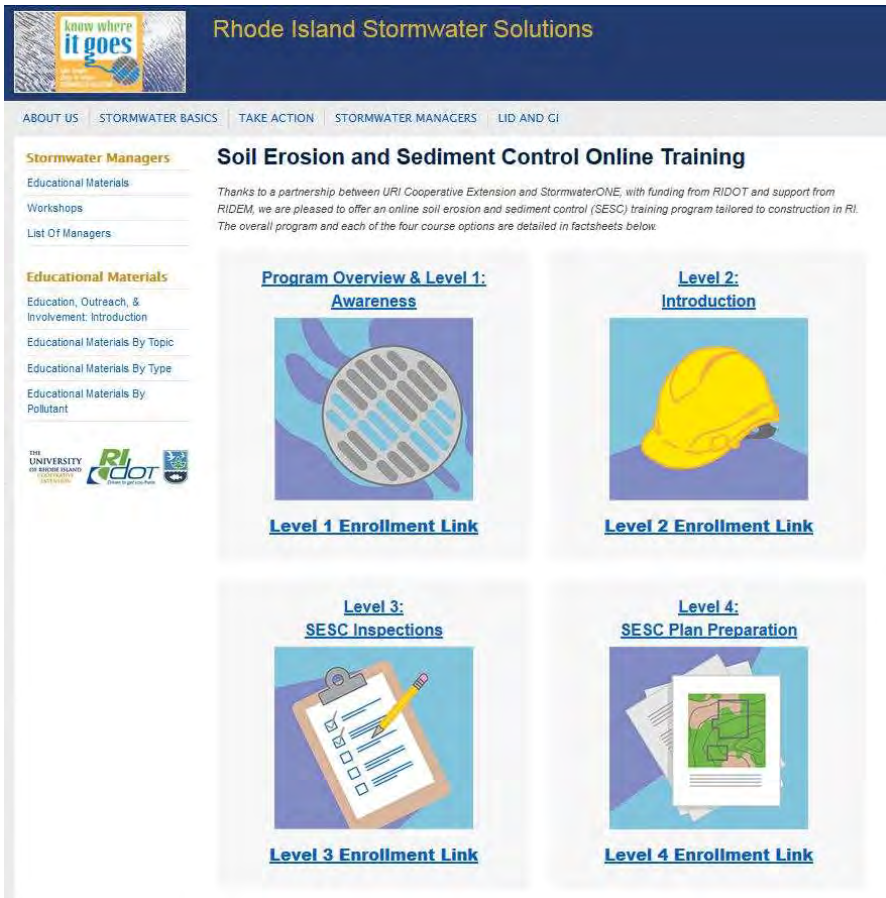


**StormwaterONE**  
Online Training & Credentials

1-1

StormwaterONE, LLC

# Soil Erosion and Sediment Control Training







**know where it goes**  
Rhode Island Stormwater Solutions

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**Soil Erosion and Sediment Control Online Training**  
*Thanks to a partnership between URI Cooperative Extension and StormwaterONE, with funding from RIDOT and support from RIDEM, we are pleased to offer an online soil erosion and sediment control (SESC) training program tailored to construction in RI. The overall program and each of the four course options are detailed in factsheets below.*

<p><b>Program Overview &amp; Level 1:</b> <b>Awareness</b></p>  <p><a href="#">Level 1 Enrollment Link</a></p>	<p><b>Level 2:</b> <b>Introduction</b></p>  <p><a href="#">Level 2 Enrollment Link</a></p>
<p><b>Level 3:</b> <b>SESC Inspections</b></p>  <p><a href="#">Level 3 Enrollment Link</a></p>	<p><b>Level 4:</b> <b>SESC Plan Preparation</b></p>  <p><a href="#">Level 4 Enrollment Link</a></p>

THE UNIVERSITY OF RHODE ISLAND  
RI dot  
Rhode Island Department of Transportation





Rhode Island General  
Construction Stormwater  
Awareness Training

# Soil Erosion and Sediment Control Training

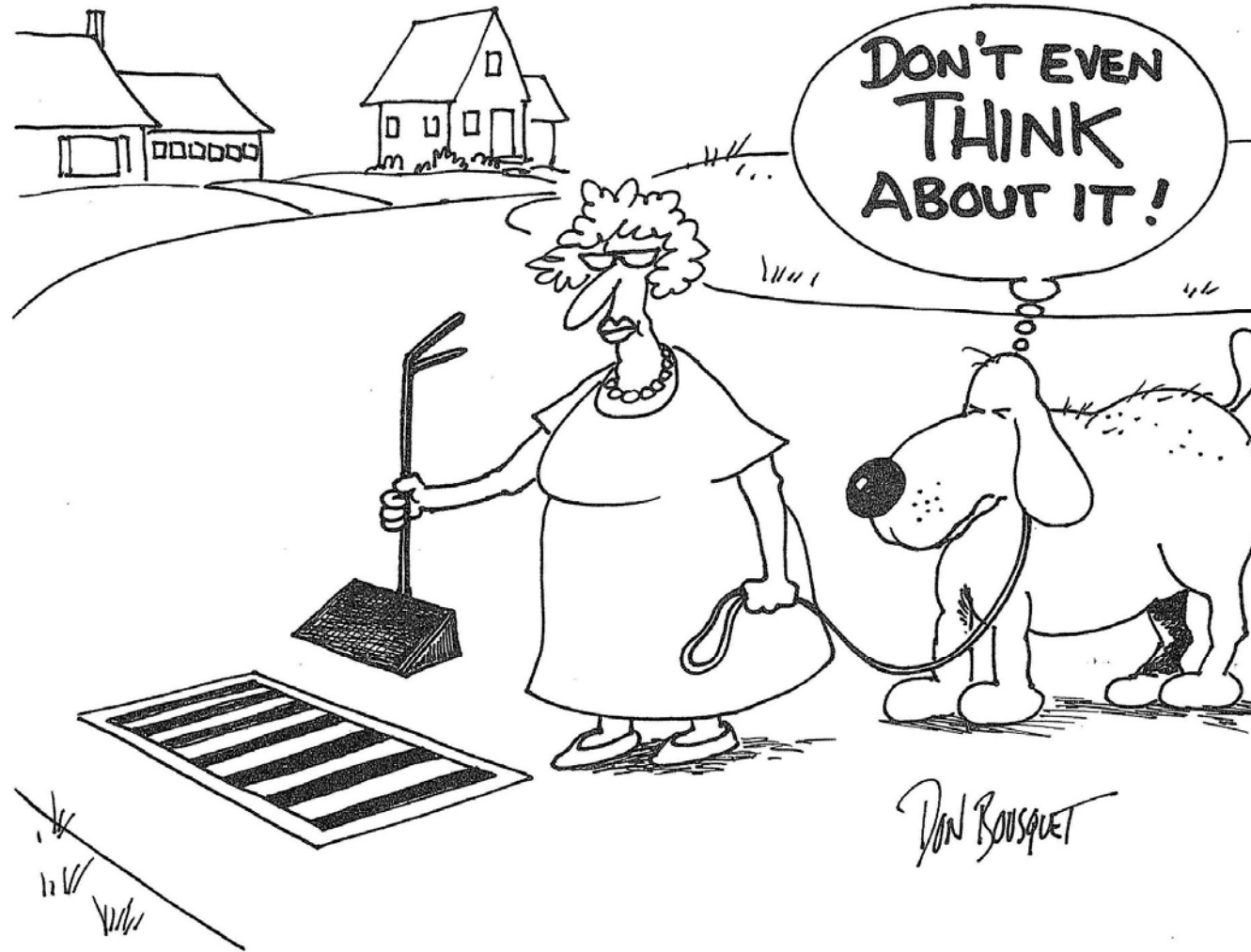


## *Action Items:*

- ✓ Advocate for this training.
- ✓ Suggest it be required for certain building permit applicants.
- ✓ Share with Land Trust members.
- ✓ Share with construction community.



# Spotting Stormwater Violations





# What's Wrong With This Picture?

www.ristormwatersolutions.org

**Know where it goes** **Notice: Erosion Control Stormwater Violations**

Construction sites are required to install and maintain control measures that prevent soil erosion (when water, wind, or gravity move soil from one location to another). This ensures public safety, helps keep local waters clean, and prevents flooding, soil loss, and other long-term consequences of erosion.

**Look familiar?** Contact your Stormwater Manager if you see anything from the "Please Report" column, as these are illicit discharges. Use the "All Good!" column to learn about the Best Management Practices that control soil erosion. For immediate assistance with illicit discharging call the RI DEM Office of Compliance and Inspection at (401) 222-1360.

**⊘ Please Report**



Muddy water flowing from construction sites is an illicit discharge.



Concrete washout, which is highly toxic to aquatic life, was being carried by runoff to a storm drain.



Sediment trapped on the construction side of compost filter socks must be collected and removed regularly.



The sediment in this roadway is a public safety hazard.



A small construction site with no visible erosion control measures. Photo credit: iowastormwater.org.

**✔ All Good!**



Filter fabrics on storm drains are a last line of defense against sediment entering waterways. Photo credit: US EPA.



The use of a concrete wash out area allows for containment of water that is generated from washing out ready-mix equipment.



This filter sock is appropriately placed between construction and a wetland. The area is free of accumulated sediment.



Crushed stone has been placed at the construction site access, which reduces sediment being tracked into roadways. Photo credit: iowastormwater.org.



Straw mulching is a good way to prevent soil erosion. Photo credit: Barry Tinning at Tetra Tech.

Images not otherwise credited are courtesy of RI DEM.


Produced by URI Cooperative Extension with funding from the RI Department of Transportation and support from the Rhode Island Department of Environmental Management.

**RI DOT** **THE UNIVERSITY OF RHODE ISLAND** **RI DEM**


## Stormwater Matching

The correct use of soil erosion and sediment control BMPs ensures public safety, keeps local waters clean, and prevents flooding, soil loss, and other long-term consequences of erosion. Try to match the violation in the "Bad" column to the best practice in the "Good" column... and match the description to each photo. The first one is done for you.


**⊘ Bad**




Sediment trapped on the construction side of compost filter socks must be collected and removed regularly.




Muddy water is an illicit discharge and a violation of the SESC plan.



The dried concrete here is evidence that concrete washout, which is highly toxic to aquatic life, was being carried by runoff to the storm drain.




There are no visible erosion control measures on this small construction site. Photo: iowastormwater.org.




The sediment in this roadway is tracked from a construction site entrance and is a public safety hazard.


**✔ Good**




A well-maintained pad of crushed stone has been placed where construction vehicles pull into and out of site, reducing the tracking of sediment into roadways. Photo credit: iowastormwater.org.




The use of a designated concrete wash out area allows for management of water generated from washing out ready-mix trucks, drums, and pumps.



Filter fabrics on storm drains are a last line of defense against sediment entering waterways. They must be cleaned regularly. Photo: US EPA.



This filter sock is appropriately placed between construction and a wetland. The area is free of accumulated sediment.



Straw mulching is an effective and low-cost way to prevent soil erosion. Photo credit: Barry Tinning at Tetra Tech.

Images not otherwise credited are courtesy of RI DEM.

# Spotting Stormwater Violations



## Action Items:

- ✓ Think about sediment. Think about storm drains. Know what to report!
- ✓ Report violations.
- ✓ Share this information!
- ✓ Continue to report!
- ✓ Help organize an event.



# Rain Garden Maintenance





# Maintenance and Care of a Rain Garden

Updated 2022

## What is a Rain Garden?

Rain gardens are designed to capture stormwater runoff from nearby impervious areas like rooftops and driveways so that rainwater can soak into the ground below, where pollutants are gradually filtered out instead of entering waterways. Simple inlet and outlet structures made from pipe, stone, or both help water enter and leave the garden. Rain gardens can be planted with a variety of native plants and maintained to appear anywhere from manicured to naturalistic.



Native, drought-tolerant rain garden consisting of Listeria of New Hampshire.

## Healthy & Functional

Any landscaped area requires maintenance—rain gardens are no different. Along with basic steps for maintaining plant health such as watering and weeding, rain gardens also require some attention to how water moves in and out and keeping edges and berms intact to prevent erosion from taking place. Regular inspections and maintenance will keep your rain garden healthy and allow it to soak up and clean plenty of stormwater.



Volunteers maintain the rain garden at Southside Cultural Center in Providence by weeding.

## Maintenance Checklist

### WEEKLY

- Water** 1 inch per week including rainfall for the first 3 years. Water new trees and shrubs weekly until soil at depth of roots is moist. Water established rain gardens during summer droughts and unseasonably hot and dry periods.
- Weed** regularly, before seeds can spread.\*
- Mow** lawn around rain garden and direct clippings away from the rain garden as they can cause clogging. **Do not mow** rain garden plants (unless garden is designed to be mowed).
- Clean up** trash, organic debris, and pet waste from within and around garden.
- Inspect** the rain garden bed for standing water lasting over 48 hours after a heavy rain. This indicates a clogged surface layer.\*

### MONTHLY, following heavy rain, or as needed.

- Replace plants** that are not thriving with approved native plants to maintain ground cover. Annuals may also be used to maintain ground cover.
- Remove sediment buildup** from inflow structure and any flow channels (including gutters if they are directed toward garden) and from bed of rain garden when it accumulates 1 inch of sediment.
- Cut back perennials** and mow tall grasses (removing clippings) in the fall, or leave task until early spring for winter interest and to provide habitat for birds and other wildlife.
- Prune** trees and shrubs to encourage growth in the spring or fall.
- Repair gutties** and any other problems caused by soil erosion in or near the rain garden.\*
- Stabilize soil** if there is erosion on areas draining to the rain garden. Cover bare soil with mulch or reseed.
- Fill animal burrows** and gently pack if there are any in or around rain gardens.
- Replenish mulch** once per year to a depth of 2-3", using shredded non-dyed hardwood mulch.
- Never fertilize** rain garden, apply pesticides, or add compost. Fertilizer and compost add nutrients that are not needed.

\*See the Troubleshooting page for more information and guidance.



**Problem** Deep gullies are forming within a rain garden.

*Above images courtesy of Rutgers University.*



**Solution** Add river rock and more plants to better dissipate the flow of water.



**Problem** There is sediment build-ups in the inlet, covering the river rock, allowing plants to take root, and blocking flow into the garden.



**Solution** Weed as needed and remove sediment and other debris. Look for bare soil in the area draining to rain garden and correct the problem at the source. Above is a typical rain garden inlet. The stone and pipe will need cleaning out from time to time.



**Problem** The lowest points in the rain garden have begun to gather dark sediment build-up over the brighter mulch layer.



**Solution** Carefully remove top layer of sediment with a flat shovel to prevent or stop clogging. Add fresh mulch if needed.

## Troubleshooting

At some point a rain garden may begin to exhibit signs of trouble. This is normal: in order to function optimally, rain gardens almost always require some adjustment over time, especially when newly installed. Make a habit of inspecting the rain garden regularly, especially during and after heavy rains.

**Plants are not thriving/are dying...** When plants die and leave voids in the garden they must be replaced. The cause of poor plant health should be diagnosed before the plants are replaced. For assistance, contact URI Master Gardeners March – October, Monday – Thursday, 9:00 AM – 2:00 PM by phone (401) 874-4836 or by email [gardeners@uri.edu](mailto:gardeners@uri.edu).

**The original rain garden plants are being joined or outcompeted by invading plants...** For help identifying weeds refer to *In the Weeds*, a stormwater system weed identification guide available to print or use from your mobile device at [web.uri.edu/riss/in-the-weeds-a-guide/](http://web.uri.edu/riss/in-the-weeds-a-guide/).

**It looks like soil is moving within, into, or out of the rain garden...** Erosion within the system signals different problems depending upon location.

- Erosion **throughout the garden** in the form of rills and gullies means energy dissipators like stones must be adjusted or added in order to spread the flow of water more evenly over the garden.
- Erosion **at the edge of the garden** indicates that runoff is entering at other points in addition to the inlet area—check that edges are intact or construct a berm to correct this.
- Erosion **near or past the overflow** means the rain garden is too small to handle the amount of runoff that it is receiving. Enlarge the footprint of the garden.

**Sediment is building up in the rain garden...** When sediment is building up at the inflow structure or on top of the mulch in the bed of the rain garden, then erosion is likely taking place outside of the rain garden. Remove the sediment build-up in the garden and check the contributing area, stabilizing the soil there if needed. If gutters are connected to the rain garden, they should be cleaned out regularly.

**The rain garden has standing water over 48 hours after a rain storm...** Stormwater is meant to pool in the rain garden for some time before infiltrating, but water standing over 48 hours after a rainfall indicates that the rain garden is clogged. Sediment entering the garden can form a visible crust that will prevent drainage. If this happens, remove about 2" of surface crust and mulch with a flat shovel and replace with fresh soil mixture and shredded non-dyed hardwood mulch. If the standing water problem persists, amend the rain garden soil with coarse sand or adjust the overflow structure to let more water out during a rain storm.

**The rain garden looks different than when it was first installed...** Rain gardens will change over time. Plants that are most adapted to the site may multiply while others die out, shrubs and trees may begin to dominate, and new plants may settle in (and attract native pollinators). This naturalized look does not affect the functioning of the rain garden. If a more manicured look is preferred it can be achieved with weeding and pruning.



# SLATER PARK WATERFOWL BUFFER PLANTS PHOTO GUIDE

## BUFFER A

SWEET FLAG  
*Acorus americanus*



ARROW ARUM  
*Peltandra virginica*



## BUFFER B

TUSSOCK SEDGE  
*Carex stricta*

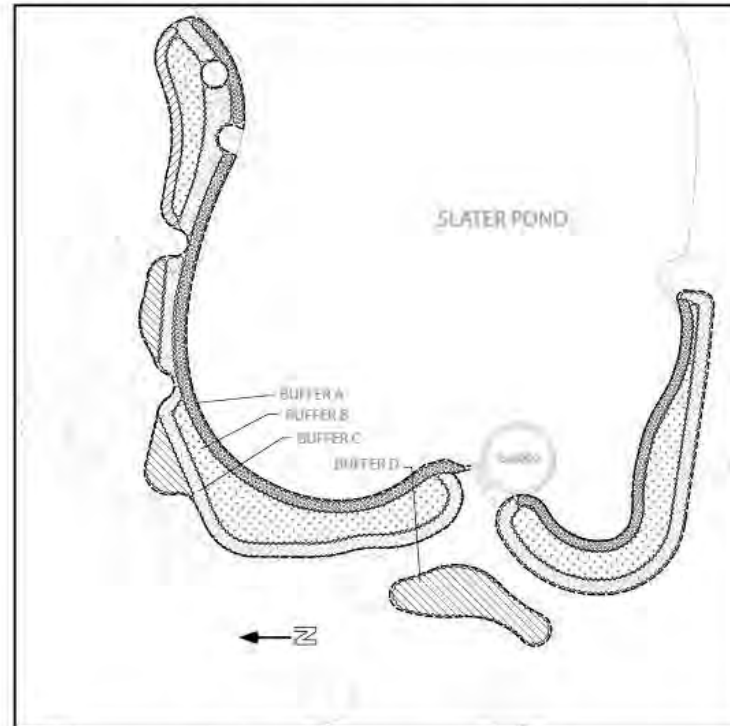


FOX SEDGE  
*Carex vulpinoidea*



All photos by E. A. Howell, University of Connecticut, Storrs, CT. Sweet flag photos by Thomas G. Rasmussen, University of Kentucky Department of Environmental Botany, Lexington, KY. Arrow arum photo by Michael Anderson, University of Maryland System, P.O. Box 380134, College Park, MD 20742. Tussock sedge photo by John L. Howell, University of Connecticut, Storrs, CT. Fox sedge photo by John L. Howell, University of Connecticut, Storrs, CT. All photos are for educational purposes only. No part of this publication may be reproduced without the prior written permission of the University of Connecticut. © 2018

# SLATER PARK WATERFOWL BUFFER PLANTING PLAN

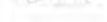


## KEY

PLANTED BEDS



EXISTING TREE



### BUFFER A

**Botanical name**  
*Acorus americanus*  
*Peltandra virginica*

**Common name**  
Sweet Flag  
Arrow Arum

### BUFFER C

**Botanical name**  
*Iris versicolor*  
*Lobelia cardinalis*  
*Lobelia spicata*

**Common name**  
Blue Flag Iris  
Cardinal Flower  
Pale-spike Lobelia

### BUFFER B

**Botanical name**  
*Carex stricta*  
*Carex vulpinoidea*

**Common name**  
Tussock Sedge  
Fox Sedge

### BUFFER D

**Botanical name**  
*Schizachyrium scoparium* 'The Blues'

**Common name**  
The Blues  
Little Bluestem

Prepared by City of Pawtucket, designer Kyle Alfred de Fusi & O'Neill, and, with funding from Rhode Island Department of Transportation, US Cooperative Extension.

# Rain Garden Maintenance



Action Items:

- ✓ Consider a rain garden... and a sign!
- ✓ Share with friends.
- ✓ Share with town staff and boards.
- ✓ Explore “adopting” a town BMP.

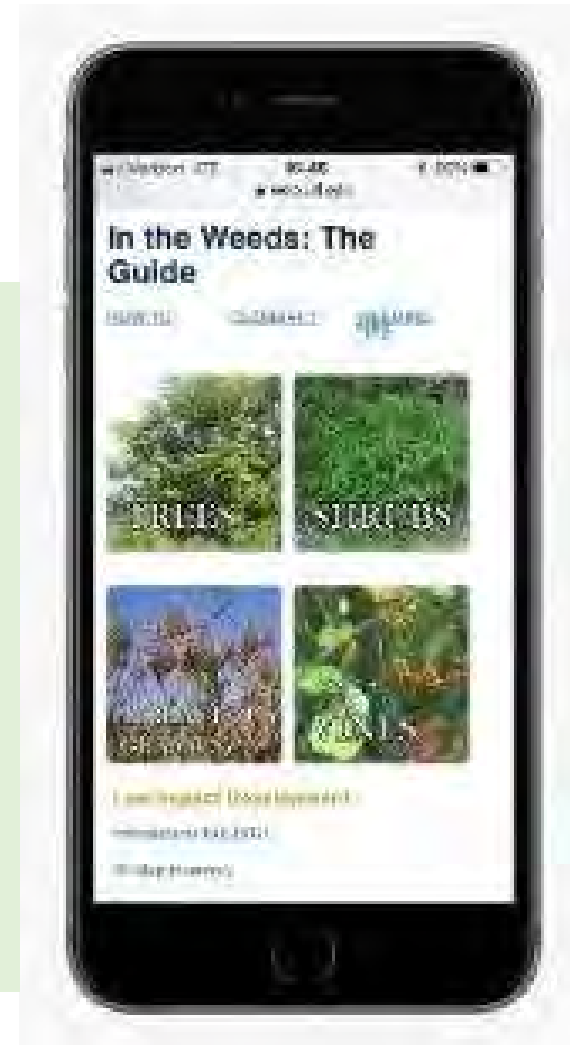


# In The Weeds

Use your phone (or work with your neighbor) to search:

“In the Weeds RI”

Using that mobile guide, try to determine what your picture is.















# In The Weeds



## Action Items:

- ✓ Learn to spot species that can easily overtake vegetated stormwater systems.
- ✓ If you see town BMPs that are being overtaken, bring it to their attention!
- ✓ But share this resource.... so that only the invasives are removed.





# Rhode Island General Construction Stormwater Awareness Training

# Putting It All Together

Please fill out the following form. If you are a form author, choose Distribute Form in the Forms menu to send it to your recipients. Highlight Fields

## LID Site Planning and Design Techniques: Municipality Self-Assessment

**GOAL #1: Avoid the impacts of development to natural features and pre-development hydrology.**

**UNDISTURBED OPEN SPACE** MORE INFO...  
*Objective 1: Protect as much undisturbed open space as possible to maintain predevelopment hydrology and allow precipitation to naturally infiltrate into the ground.* TOPIC A

**1. Has Conservation Development, or other types of compact development that require the preservation of natural resources, been adopted to protect open space and predevelopment hydrology?** TOPIC A

Yes, it is required unless proven infeasible  Yes, it is allowed  No  N/A to highly urban Action:  Leave as is  To be revised

Ordinance:  ZO  LDSR  SESC  SW  Other: \_\_\_\_\_ Section name & number: \_\_\_\_\_

Notes: \_\_\_\_\_

**2. Is it required to mark limits of disturbance on all construction plans with details?** TOPIC B

Yes  No Action:  Leave as is  To be revised

Ordinance:  ZO  LDSR  SESC  SW  Other: \_\_\_\_\_ Section name & number: \_\_\_\_\_

Notes: \_\_\_\_\_

**3. Is it required to have limits of disturbance installed prior to site work?** TOPIC B

Yes  No Action:  Leave as is  To be revised

Ordinance:  ZO  LDSR  SESC  SW  Other: \_\_\_\_\_ Section name & number: \_\_\_\_\_

Notes: \_\_\_\_\_

**4. Are there limits on lawn area for residential lots in order to protect undisturbed open space?** TOPIC C

Yes  No  N/A to highly urban Action:  Leave as is  To be revised

DON'T FORGET TO SAVE YOUR WORK!

1

Please fill out the following form. If you are a form author, choose Distribute Form in the Forms menu to send it to your recipients. Highlight Fields

## LID Site Planning and Design Techniques: Municipality Self-Assessment

### PRIMER ON LID DESIGN TECHNIQUES AND PRINCIPLES

**TOPIC C**


#### LIMITS ON LAWN AREA

Too often entire lots are cleared of native trees and shrubs and replaced by extensive high-maintenance lawns. Limiting lawn area allows for smaller building envelopes and larger areas of natural vegetation that can intercept and infiltrate stormwater much more effectively than mowed lawns. Smaller lawns have many other LID benefits:

- » maximize protection of wetland buffers;
- » reduce fertilizers and pesticides washing off as runoff or seeping into groundwater supplies;
- » direct stormwater to naturalized areas as "Qualified Pervious Areas" for treatment instead of constructed BMPs;
- » conserve water and minimize summer water shortages\*;
- » reduce development costs by avoiding the need restore areas compacted by construction activities before seeding, as specified in the *RI SESC Handbook* and Topic K.

Recommendations: the RI LID Guidance Manual recommends limiting lawn to the lesser of 20% of the overall lot size or 5,000 square feet.

\* The Town of North Kingstown has found that in neighborhoods with large lawns, summer water use triples due to lawn watering, leading to seasonal water bans that affect all residents.



LEFT: CRMC consider a 25 feet setback to be sufficient for building construction and maintenance, and RIDEM Wetland BMP Manual notes that as little as 10-15 feet can be an adequate distance from a structure to a wetland buffer. CENTER: Low-maintenance gardens with native plants will better infiltrate and treat stormwater. RIGHT: Compare the lawn area of nine 1/2 acre lots of the conservation development in white with that of the nine 1 acre lots in the conventional development in yellow (RIDEM Environmental Resource Map & South Kingstown Web GIS).

RI LID Planning and Design Guidance Manual See Chapter 4 and Chapter 8 – <http://www.dem.ni.gov/programs/benviron/water/permits/ripdes/stwater/4guide/lidplan.pdf>  
Return to question 4.

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# Where Can I Find All This Information?

THE UNIVERSITY OF RHODE ISLAND

Know where it goes

Rhode Island Stormwater Solutions

ABOUT US | STORMWATER BASICS | TAKE ACTION | STORMWATER MANAGERS | LID AND GI

Know where it goes

Rhode Island Stormwater Solutions

Build a rain garden

**Taking Simple Steps Toward Cleaner Rhode Island Waters**  
Dog poop, lawn chemicals, and oil spills. With every rain, storm drains carry all this pollution directly to local streams, ponds, and Narragansett Bay without treatment. Stormwater pollution is a major problem for RI waters – closing beaches and shellfish beds, destroying wildlife habitat, and threatening drinking water supplies. The good news is that you can be part of the solution!

**Take Action With Simple Steps**

- Don't Dump Into Storm Drains**  
Everything that enters a storm drain goes directly to local waters. Don't dump, wash, or rake anything into the path of a storm drain.
- Fertilize Sparingly**  
Unfortunately, lawn care chemicals often wind up washing right into local waters.
- Water Wisely**  
Conserving water when you're working outdoors can reduce the potential for contaminants to wind up in local waters.
- Recycle Rainwater**  
Keep runoff off paved surfaces with rain barrels, cisterns, and rain gardens: even downspout extenders.
- Scoop The Poop, Then Treat It**  
Scoop the Poop: Keep pet waste from entering local water bodies. When you're out on a walk, pick up after your pet and throw it in the trash.

**RI Stormwater Rules**

**Online Training: Soil Erosion and Sediment Control**

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