

# Dwayne's View of Green Infrastructure for Panel Discussion

Views and opinions do not necessarily reflect the views or official position of the Minnesota Department of Transportation.

# Lots of Infrastructure, of different colors

- Vegetation, stormwater, natural resources, pavements, snow control, safety measures, buildings, ...



What is Green Infrastructure? | G x +

https://www.epa.gov/green-infrastructure/what-green-infrastructure

An official website of the United States government.

**EPA** United States Environmental Protection Agency

Environmental Topics Laws & Regulations About EPA Search EPA.gov

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## Green Infrastructure

- Green Infrastructure Home
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- Learn about Green Infrastructure
- Basics: What is Green Infrastructure?**
- Performance of Green Infrastructure
- Green Infrastructure for Climate Resiliency
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- Integrating Green Infrastructure into Federal Regulatory Programs
- Overcoming Barriers to Green Infrastructure
- Green Infrastructure Webcast Series
- Collaborate with Green Infrastructure Partners

## What is Green Infrastructure?

Section 502 of the Clean Water Act defines green infrastructure as "...the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters."

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls on our roofs, streets, and parking lots in cities and their suburbs, the water cannot soak into the ground as it should. Stormwater drains through gutters, storm sewers, and other engineered collection systems and is discharged into nearby water bodies. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

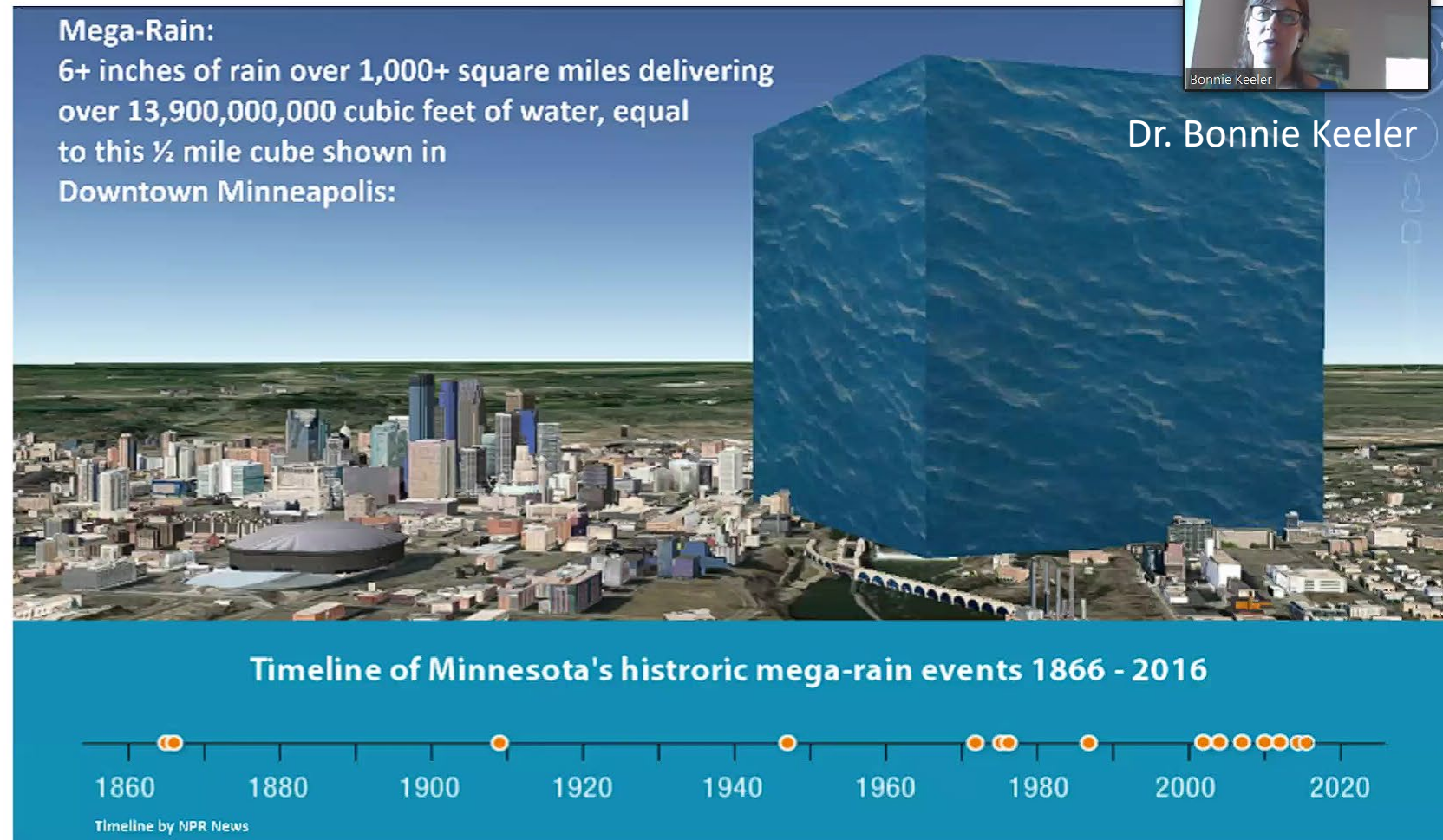
When rain falls in natural, undeveloped areas, the water is absorbed and filtered by soil and plants. Stormwater runoff is cleaner and less of a problem. Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water.

Learn more about green infrastructure elements that can be woven into a community, from small-

# Increased **frequency** and **intensity** of precipitation events

Resulting in:

- More frequent flooding and extreme rain events
- Damage to transportation, infrastructure, and property, especially water and sewer systems
- Increased burden on emergency management, and a growing financial toll on businesses, homeowners, and insurers



*Source: U.S. Global Change Research Program, Fourth National Climate Assessment*



# Unequal green infrastructure investment and maintenance

- Tree canopy
- Tree cover diversity
- Stormwater harvest, reuse, gardens





# Green Infrastructure With Many Names?

- Context sensitive solutions?
- Context sensitive design?
- Low Impact development?
- Complete streets?
- Climate resiliency program?
- Sustainable program?
- Vibrant Cities program?
- Visual design methods?



# Green Infrastructure starts with preservation of topsoil

- Salvage all topsoil
- Supplement with Engineered Topsoils
- Utilize topsoils for Stormwater management
- Keep vegetated for soil health



5.25







The Agenda  
AGENDA 2020

# Can American soil be brought back to life?

A new idea: If we revive the tiny creatures that make dirt healthy, we can bring back the great American topsoil. But farming culture — and government — aren't making it easy.

By JENNY HOPKINSON | 09/13/2017 05:00 AM EDT

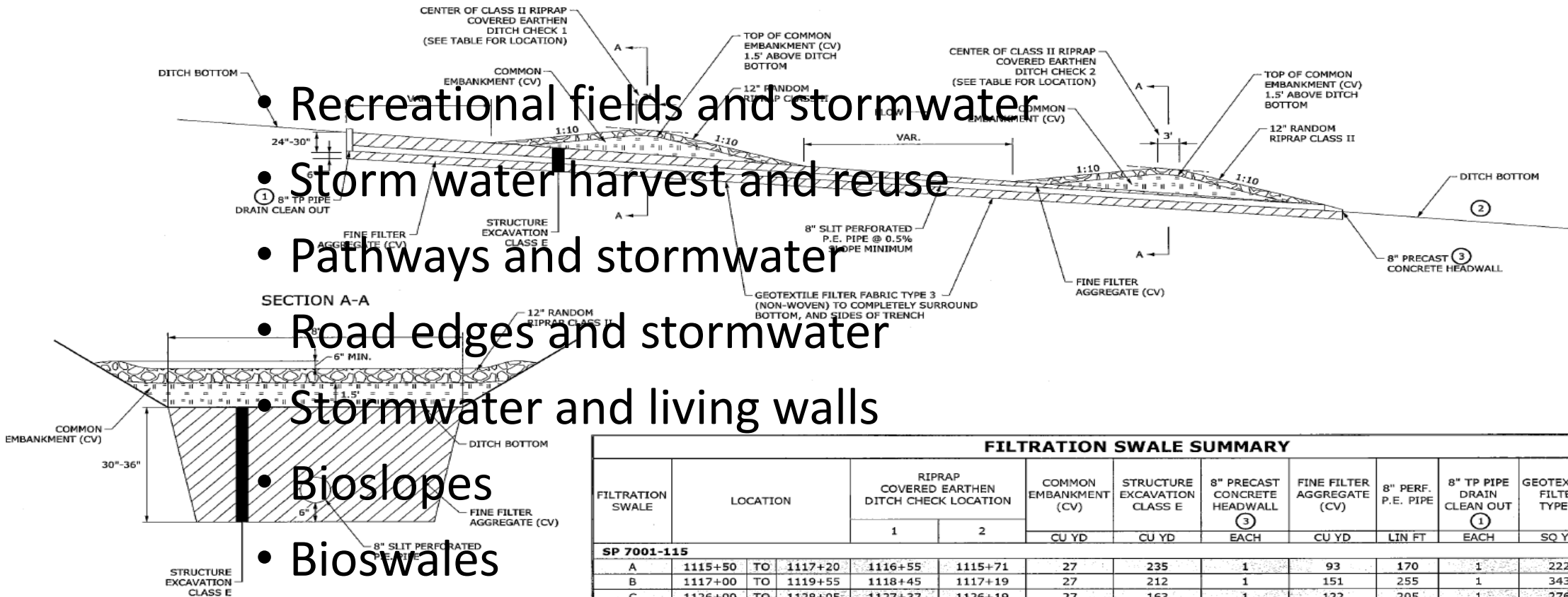


# Ideal: multiuse green infrastructure

## FILTRATION SWALE DETAIL

(NOT TO SCALE)

PROFILE VIEW



- Recreational fields and stormwater
- Storm water harvest and reuse
- Pathways and stormwater
- Road edges and stormwater
- Stormwater and living walls
- Bioslopes
- Bioswales

## FILTRATION SWALE SUMMARY

FILTRATION SWALE	LOCATION				RIPRAP COVERED EARTHEN DITCH CHECK LOCATION		COMMON EMBANKMENT (CV)	STRUCTURE EXCAVATION CLASS E	8" PRECAST CONCRETE HEADWALL ③	FINE FILTER AGGREGATE (CV)	8" PERF. P.E. PIPE	8" TP PIPE DRAIN CLEAN OUT ①	GEOTEXTILE FILTER TYPE 3	RANDOM RIPRAP CLASS II	NOTES
					1	2									
	SP 7001-115														
A	1115+50	TO	1117+20	1116+55	1115+71	27	235	1	93	170	1	222	55		
B	1117+00	TO	1119+55	1118+45	1117+19	27	212	1	151	255	1	343	55		
C	1126+00	TO	1128+05	1127+37	1126+19	27	163	1	122	205	1	276	55		
D	1138+00	TO	1140+05	1139+34	1138+20	27	96	1	123	205	1	278	55		
SP 7001-115 TOTAL (A)						108	706	4	489	835	4	1119	220		

### NOTES

SEE TURF ESTABLISHMENT & PERMANENT EROSION/SEDIMENT CONTROL PLAN FOR DITCH STABILIZATION INFORMATION.

① SEE SHEET 50 FOR CLEAN OUT DETAIL.

② PERFORM GRADING AS NEEDED TO ENSURE POSITIVE DRAINAGE DOWNSTREAM OF CONCRETE HEADWALL (INCIDENTAL).

③ SEE MNDOT STANDARD PLATE 3131 FOR CONCRETE HEADWALL DETAIL.

### FUNDING NOTES

(A) 80% FEDERAL / 20% STATE FUNDS.





Multi-purpose  
Green Infrastructure









Topdressing 1 inch over poor  
vegetative catch (135 cu yd/ac)



# Green Infrastructure Has Maintenance Requirements

- Need operator's manuals
- Need cleanout access
- Need to know what to do with collected sediments and trash
- Need to invest (set aside actual money) for future maintenance work







## GENERAL MAINTENANCE CARD

**BMP Site:** BH-1  
**Location:** Booth Avenue  
 (Blue Heron Watershed)  
**Facility:** Extended Detention Pond  
**Property:**  
**Ownership:** NYC Dept. of Parks & Recreation

### Major Areas of BMP:

- A) Forebay
- B) Micropool
- C) Outlet Structure (weir with notch)
- D) Concrete Pipe Collar
- E) Permanent Pool
- F) Extended Detention

### SHORT-TERM MEASURES (FREQUENCY: AT LEAST ONCE A MONTH)

#### Drainage Issues:

- 1) Inspect Permanent Pool wetland surface area.
  - Remove accumulated debris/floatables by hand or skimmer; use waders if required.
  - Note the existence of excessive algae, if present.
- 2) Visually inspect the 60"x 38" inlet pipe and concrete pipe collar (see Location D on Fig.1).
  - Remove accumulated debris by hand or skimmer; use waders if required.
  - Repair cracks in pipe/collar using a sealant, if required.
- 3) Inspect the 30-foot weir wall with 6-inch notch and steel plate (see Locations C on Fig.1).
  - Complete outlet structure Checklist (attached).
  - Repair cracks/damage on weir wall, if present.
  - Inspect steel plate (10"x 32"x 1/2") and lock for damage.
  - Manually remove debris in notch, as required; dispose of debris properly off-site.
  - Replace displaced/damaged outlet protection field stone.
- 4) Inspect adjacent catch basin grates and manhole covers.
  - Remove accumulated debris; dispose of properly off-site.
  - Secure manhole covers using a hook.

#### Landscaping Issues:

- 5) Inspect overall condition of installed vegetation.
  - Remove invasive plants manually if possible, ensuring root removal; dispose of properly off-site. Consult Field Manager for advice, if required.
  - Relocate muskrats and/or provide exclusion devices; consult Field Manager if required.
  - Cut grass located along street frontages, as required.
  - Trim shrubs along street frontages, as required.

#### Perimeter Treatment:

- 6) Inspect overall condition of the perimeter treatment items.
  - Remove accumulated litter/debris by hand; dispose of properly off-site.
  - Promptly notify DEC police regarding illegal dumping issue.
  - Lubricate locks and hinges, as required.
  - Inspect and repair damaged fencing, guiderails, and BMP signs, as required.
  - Refurbish concrete pavers/gravel on accessway and fieldstone, as required.

### MODERATE-TERM MEASURES (FREQUENCY: ONCE EVERY SIX MONTHS)

#### Drainage Issues:

- 1) Measure the sediment depth in forebay/micropool (see Locations A and B on Fig.1).
- 2) Inspect for unstable embankments.
  - Repair/reinforce unstable embankments using field stone, plantings, etc.

#### Landscaping Issues:

- 3) Inspect for septic inflow and nuisance odors.
  - If septic inflow exists, introduce plantings that promote nutrient uptake.
  - Remove dead animals causing foul odor, if present.
- 4) Inspect plant mortality.
  - Remove dead plants by hand; dispose of properly; replant as necessary.
  - Trim and remove specified trees, as required.



Blue Heron  
(NYCDPR Property)

FIGURE 1

- 5) Inspect for herbivore damage.
  - Repair burrows/damage created by muskrats, or other critters.
  - Introduce alternative plantings, if required. Consult Field Manager.

### LONG-TERM MEASURES (FREQUENCY: ONCE EVERY TWO YEARS)

#### Drainage Issues:

- 1) Vactoring Activity
  - Vactor sediment from forebay/micropool.
  - Vactor sediment from adjacent catch basins.

### LONG-TERM MEASURES (FREQUENCY: ONCE EVERY TEN YEARS)

#### Drainage Issues:

- 1) Vactor accumulated sediment from entire shallow marsh wetland.
- 2) Replant native wetland plants.

Note: Fill out the attached Short-term and Long-term General Inspection Checklists during inspection of the site.

#### Required Maintenance Permit Checklist:

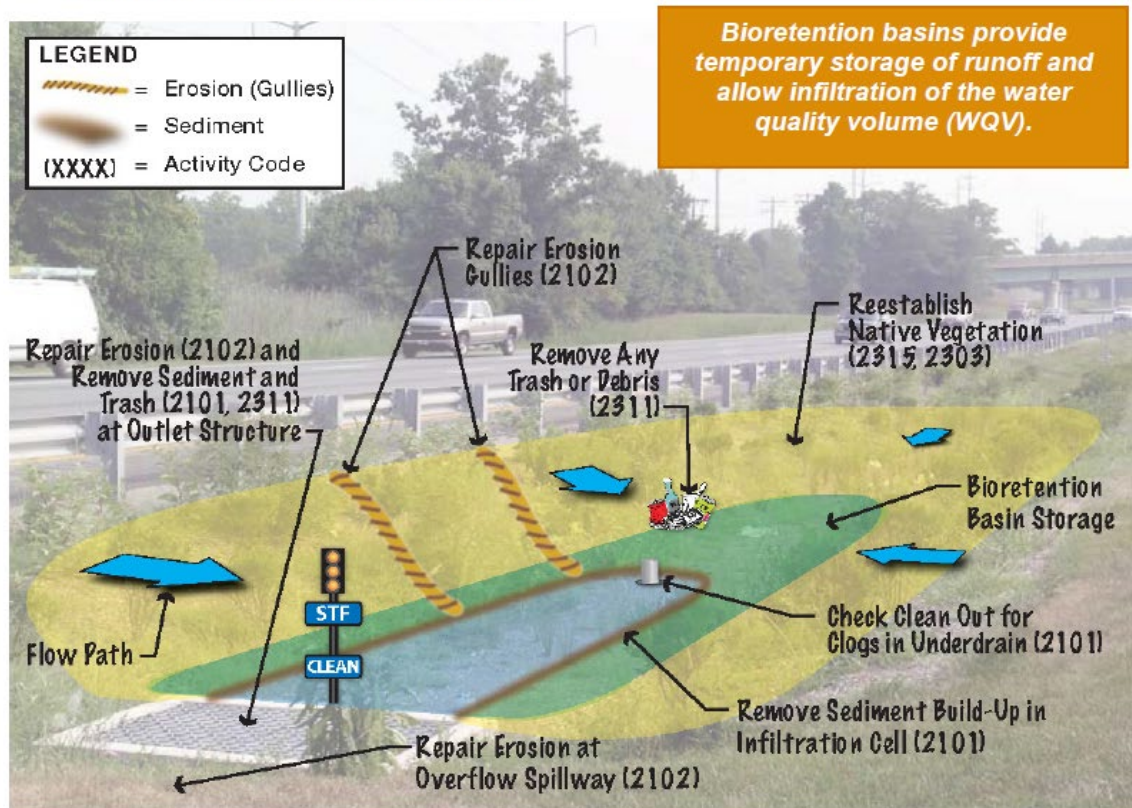
Issuing Agency	Regulated Parameters
U.S. Army Corps of Engineers	Placement of fill within wetland/stream; streambank stabilization; restoration
NYS DEC	Temporary dewatering of wetland; sediment removal; revegetation; herbicide application
NYC Parks Department	Tree removal



# MAINTENANCE GUIDE

## Bioretention

### MAINTENANCE OVERVIEW



### Maintenance Needs Example for Bioretention

Not to Scale

#### BIORETENTION BASIN QUICK FACTS

**Description** Bioretention basins are shallow basins in low lying areas that provides storage and treats stormwater through filtration by select plantings and infiltration within the basin and sand/compost infiltration cell (shown by light blue).

- Sediment build-up may occur due to the nature of this facility. This can clog the infiltration cell and decrease the effectiveness of the basin.
- Runoff from pipes, as well as overland sheet flow from adjacent slopes may cause erosion which will need to be filled in with amended soils and reestablished through seeding and erosion control blankets.
- If heavy equipment must be used within the basin, make sure it has tracks or low pressure tires; when replacing soils it should be lightly compacted to allow infiltration.

# MAINTENANCE GUIDE

## Bioretention

Maintenance Activity	Do	Don't
Remedy any standing water (2101).	Check the outlet structure and underdrain pipe for clog; look at compacted soils and sediment build-up preventing infiltration.	Excavate infiltration cell until cause of water back-up is determined.
Remove sediment build-up (2101).	Remove sediment from the basin bottom with machinery through use of mud mats; working from the middle of basin bottom and scarifying to the edges; or using a lighter machine like a skid steer for the foreslopes and Gradall stationed outside of the basin for the bottom.	Station machinery in the bottom of the basin or use machinery with overfilled tires.
Repair erosion and eliminate gullies (2102).	Fill in erosion with soil mix (contact RSU for details) and lightly compact. Cover with erosion control blanket or mulch.	Station machinery in the basin or use overfilled tires on machinery.
Maintain vegetation between 6" and 12" (2301, 2302)	Hand mow or machine mow	Use large machinery to mow, instead use a push or riding lawn mower.
Remove trash and debris (2311).	Use handwork to pick up the trash and debris.	Use equipment to remove debris.
Reestablish vegetation (2315) and occasionally maintain through pesticides and herbicides (2303).	Use hand application of pesticides and herbicides; reference the Roadside Vegetation Establishment and Management for lists of invasive species.	Use pesticides or herbicides unless explicitly stated in inspection report.
Repair tire ruts (2350).	Use a tiller to decompact the soil in and around the rut, fill voids with soil mix (contact RSU for details) and regrade, lightly compact, and cover with erosion blanket or mulch.	Fill the rut in with soil and recompact.

Any maintenance concerns regarding the activity codes listed in the inspection form shall be directed to the Roadside Stabilization Unit (RSU) (402) 479-4656.

#### Equipment/Crew/Materials

Activity Code	Description	Materials	Equipment	Crew Size
2101	Drainage Structure Maintenance	Pipes, outlet structures, fill soil	1 Skid Steer, 1 Tandem Truck, 1 Pickup, 1 Gradall or Backhoe	3
2102	Maintaining Miscellaneous Structures	Riprap, etc.	1 Skid Steer, 1 Pickup, 2 Tandem Trucks, 1 Gradall or Backhoe*, 1 Motor Grader*	4
2301	Machine Mowing	N/A	1 Tractor/Mower, 1 Pickup	1
2302	Hand Mowing	N/A	1 Pickup, 1 Mower	2
2303	Chemical Control of Insects and Roadside Trees and Shrubs	N/A	1 Tandem Truck, 1 Weed Sprayer, 1 Pickup, 1 Tractor	2
2311	Litter Pickup	N/A	1 Pickup	2
2315	Seeding and Sodding	Seed Mixtures, Erosion Control Mat	1 Pickup, 1 Tandem Truck, and as required: 1 Tractor, and 1 Seed Drill	3
2350	Other Roadside Maintenance	Fill soil, Erosion Control Mat	1 Garden Tiller, 1 Skid Steer, 1 Pickup, 1 Tandem Trucks, 1 Motor Grader*	2

\* **Caution:** Heavy Equipment can compact soils and reduce effectiveness of STF.



# Doing with Less: Engage Community & Business Practitioners

- Adopt a road.
- Adopt a landscape?
  - Michigan DOT
  - Virginia DOT
- Adopt a water treatment facility?

The State Transportation Commission formally adopted a Context Sensitive Solutions (CSS) process in 2005 as part of the Michigan Department of Transportation's (MDOT) mission to provide the highest quality integrated transportation services for economic benefit and improved quality of life. Under CSS, MDOT solicits dialogue early in the planning process with local governments, road commissions, industry groups, land use advocates, and state agencies. This dialogue helps to ensure these bridges, interchanges, bike paths and other transportation projects "fit" into their communities. The CSS approach results in projects that respect a community's scenic, aesthetic, historic, economic, and environmental character.

The Adopt-A-Landscape Program exists within MDOT's right-of-way trunkline jurisdiction and must also adhere to the CSS process. For more information, go to [www.michigan.gov/adoptalandscape](http://www.michigan.gov/adoptalandscape).







SMOKIE WATTS  
LEAF CHAIRMAN 1993 - FOREVER



# Competing Interests for the same physical space

- Where is green infrastructure valuable, needed most?
- Is environmental equity missing in green infrastructure?

