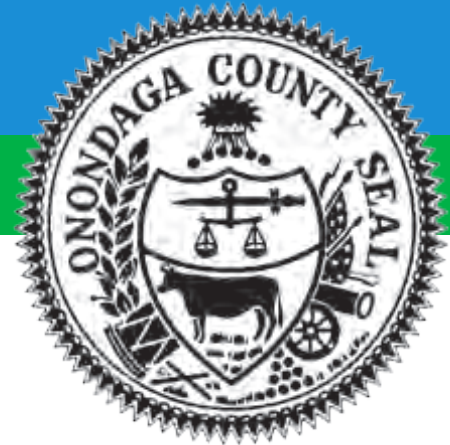


Onondaga County, New York Save the Rain Program Green Infrastructure Maintenance Training



Prepared for
Onondaga County, New York



March 9, 2012



Save the Rain



Save the Rain

Green Infrastructure Maintenance Training

Friday, March 9, 2012

Table of Contents

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4. Table of Green Infrastructure Standard Maintenance Procedures
5. Green Infrastructure Seasonal Maintenance Schedule
6. Detailed Green Infrastructure Standard Maintenance Procedures
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8. Common Plants Used in Rain Gardens/Bioretenion: Plant List and ID Manual
(Draft Version)
9. Appendix: 11" x 17" Site Plans/Asset Tables
 - a. City Lot 21
 - b. City Lot 3
 - c. Townsend Lot B

Agenda of March 9th Maintenance Training

AGENDA



Save the Rain

Green Infrastructure Maintenance Training

Friday, March 9, 2012

2 sessions: 9:30-12 PM or 1:30-4 PM

Rosamond Gifford Zoo Conference Room

9:30 – 10:00 / 1:30 – 2:00

Introductions

Save the Rain (STR) Program Overview, CH2M HILL

Green Infrastructure Technology Overview, CH2M HILL

Discussion of Porous Pavements, Infiltration Bed, Cistern/Rain Barrel, Green Roof, Rain Garden/Bioretention, Green Streets, Inlet Filter Inserts

10:00-10:15 / 2:00 – 2:15

Group Activity “How to Read a Site Plan”: Review how to read a site plan in order to determine the location of the Green Infrastructure features needing Maintenance. Using the 11x17 handouts, participants are to “find and highlight” the Green Infrastructure elements located on each site plan. CH2M HILL will have the “answer” key.

10:15 – 11:45 / 2:15 – 3:45

Overview of Maintenance Requirements for Green Infrastructure

Overview of Maintenance Efforts to Date

Review of Specific Green Infrastructure (GI) Maintenance Tasks

Porous Pavements, Gregg Novick, Stormwater Compliance, LLC

SMP-01	Porous Pavement Vacuuming
SMP-02	Porous Pavement Power Washing
SMP-03	Porous Paver Maintenance
SMP-08	Winter Maintenance for Porous Pavements

Stormwater Structures, CH2M HILL

SMP-04	Stormwater Structure Cleaning
SMP-05	Inlet Filter Insert Cleaning/Filter Insert Pouch Replacement
SMP-07	Riverstone Edge Maintenance

Landscape Features

Part One: Tree Maintenance, Fran Lawlor, Cornell Cooperative Extension of Onondaga County

SMP-09a	Tree General Maintenance/Weeding/Mulching/Soil Amendment
SMP-10a	Tree Watering
SMP-11a	Tree Pruning

Part Two: Landscape Maintenance, Amy Samuels, Onondaga Environmental Institute

SMP-09b, c	Landscape/Meadow General Maintenance/Weeding/Mulching
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SMP-10b	Landscape Watering
SMP-11b	Landscape Pruning
SMP-12	Meadow Mowing
SMP-13	Landscape Replacement (excludes Trees)
Part Three: Green Roofs	
SMP-06	Green Roof Maintenance

11:45 - 12:00 / 3:45 - 4:00

**Final Question & Answers
Evaluation Forms**

Guest Speakers

Gregg Novick, Stormwater Compliance, LLC

Gregg Novick has been working directly in the Stormwater industry for over 15 years. He received a Bachelors of Science degree from the University of Massachusetts in Resource Economics and a Civil Engineering degree from the University of Vermont. After years of working for a variety of BMP manufactures, in 2006 he founded StormWater Compliance, LLC – a company specializing in stormwater Inspection and Maintenance and “good housekeeping” services. He works closely with developers, designers and regulators to help implement, design and maintain practical solutions for Stormwater management.

Fran Lawlor, Cornell Cooperative Extension of Onondaga County

Fran Lawlor, M.S., Forest Biology, SUNY College of Environmental Science and Forestry. Fran has extensive experience with invasive species management and with public education in the selection, establishment and care of young trees. She has been a Urban and Community Forestry Educator with Cornell Cooperative Extension since 2005 including coordinating and training volunteers for large scale street tree plantings and is a board member of the New York State Urban and Community Forestry Council.

Amy Samuels, Onondaga Environmental Institute

Amy Samuels has been engaging youth and adults in science based learning for over 15 years. She received a B.S. from Cornell University in General Agriculture in 1987, a M.S. from Syracuse University in Science Education in 1996 and a M.S. in Forest Biology from SUNY ESF in 2002. Ms. Samuels became the Coordinator of Education and Outreach for the Onondaga Environmental Institute in 2010. Her main focus is on developing and implementing programs related to stormwater management, green infrastructure and community engagement. She is proud to be part of a team of educators chosen to design and deliver education and outreach for Onondaga County’s Save the Rain Campaign. Ms. Samuels has also been an instructor for SUNY ESF’s Green Train green landscaping and urban ecology job training program for refugees and residents of the Near Westside. Prior to joining the Onondaga Environmental Institute, Ms. Samuels worked for Cornell Cooperative Extension for twelve years, the last five as the Team Coordinator for the Natural Resource Department. Ms. Samuels is currently on the board of the Onondaga Earth Corps.

Power Point Presentation



Green Infrastructure Maintenance Training

Joanne M. Mahoney, County Executive
 Onondaga Lake Amended Consent Judgment (ACJ) Combined Sewer Overflow (CSO) Compliance Program

March 9, 2012

Tom Rhoads, Commissioner, OCDWEP

Matthew Marko, Rita Fordiani, Courtney Finneran, Leah Rominger
 CH2M HILL


Introductions

- **CH2M HILL**
 - Matt Marko; Rita Fordiani
 - Courtney Finneran; Leah Rominger
- **Guest Speakers**
 - Gregg Novick, StormWater Compliance, LLC
 - Fran Lawlor, Urban Forestry Educator at Cornell Cooperative Extension of Onondaga County
 - Amy Samuels, Education and Outreach Coordinator, Onondaga Environmental Institute

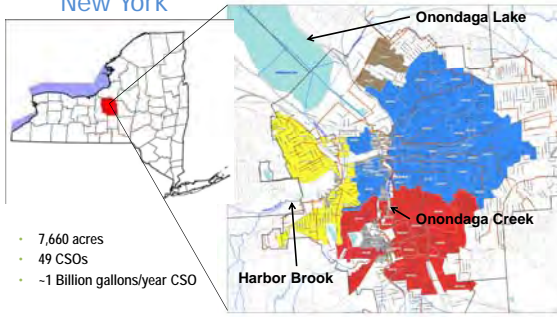


Logistics


- Restrooms
- Exit in case of emergency
- Please turn off your cell phones
- Parking Lot for extraneous issues
- Feel free to ask questions



Onondaga County, New York



- 7,660 acres
- 49 CSOs
- -1 Billion gallons/year CSO




History

- 1988 – Atlantic States Legal Foundation files lawsuit against County
- 1989 – Litigation settled through METRO consent judgment
- 1998 – METRO consent judgment replaced with Amended Consent Judgment (ACJ)
- 1st ACJ amendment May 1998
- 2006 ACJ Amended to include consolidation of ammonia and phosphorus treatment and Harbor Brook conveyances and RTF
- 3rd Amendment April 2008 (Extension)
- 2009 ACJ amended to authorize use of Gray and Green infrastructure

Onondaga Lake Facts

- Watershed: 285 Square Miles
- 1 Mile Wide – 4.6 Miles Long
 - Average Depth: 35 feet
 - Max Depth: 63 feet
- 1940 – Swimming Banned
- 1970 – Fishing Banned



4th ACJ Amendment Authorized a Balanced Approach to CSO Abatement

Regulatory Goals


- Capture and Treat 95% of the Annual CSO Volume via Gray & Green Infrastructure
- Achieve water quality standards in tributaries and lake

Community Impacts/Goals

- Improve quality of life through environmental responsibility
- Promote sustainability
- Ensure cost effectiveness in compliance with ACJ milestones
- Community revitalization

Major Milestones

- 89.5% capture/elimination by 12/31/2013
- 95% capture/elimination by 12/31/2018




Pervious surface



Save the Rain 13

Storage Bed: NYSDOT No. 3A Stone



Save the Rain 14

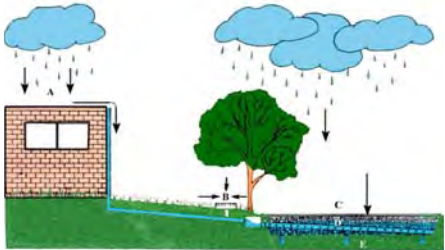
Storage Bed: Pre-manufactured Units



RainStore StormTank
image courtesy of ACO Technologies


Save the Rain 15

How does stormwater get into the bed?



Save the Rain 16


"Entrance" to bed needs Maintenance



Water Street "Green" street Sunnycrest Arena Parking Lot

Save the Rain 17

Perforated distribution pipes distribute runoff throughout the bed

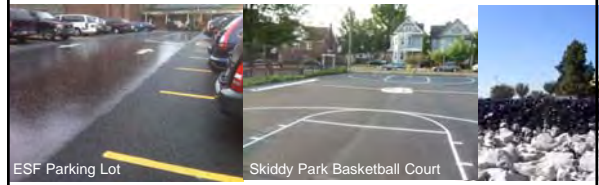


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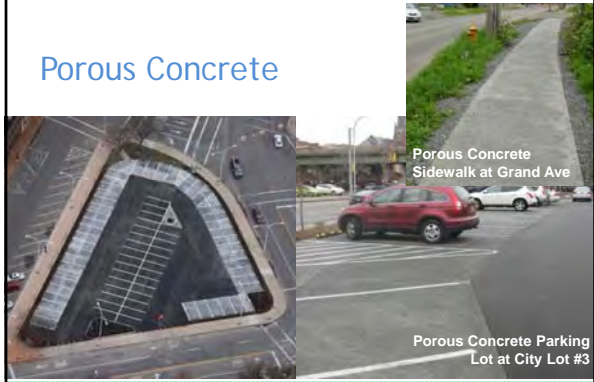
Clean-outs allow access to pipes



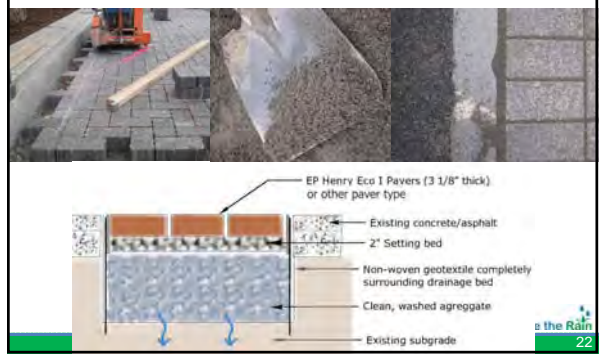
Porous Asphalt



Porous Concrete



Permeable Pavers



Permeable Pavers



Flexipave



Porosity Pavements: General Maintenance

- Clean inlets; clean-outs twice per year
- Vacuum annually; Power-wash
- Maintain adjacent landscaping/planting beds
- Winter maintenance considerations
- Detailed maintenance discussion to be held later on in the workshop

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Green Infrastructure Technology Overview

- Porosity Pavements
 - Porous Asphalt; Porous Concrete; Permeable Pavers
- **Infiltration Bed**
 - Dry Well; Infiltration Bed; Infiltration Trench/Tree Trench
- Cistern/Rain Barrel
- Green Roof
- Rain Garden/Bioretenion
- Green Streets
 - Vegetated Curb Extensions; Sidewalk Planters
- Inlet Filter Insert

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Infiltration Practices

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Infiltration Practice: Dry Well

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Infiltration Practice: Infiltration Bed

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Infiltration Practice: Infiltration Bed

Save the Rain 30

Infiltration Practice: Infiltration Trench



Infiltration Practices: General Maintenance

- Inspect and clean catch basins/inlets at least twice per year
- Maintain overlying vegetation; re-vegetate bare spots ASAP
- Prohibit vehicular access on subsurface infiltration areas unless designed to allow vehicles
- Avoid excessive compaction by mowers
- Detailed maintenance discussion to be held later on in the workshop

Infiltration Tree Trench

FACT SHEET: Tree Trenches and Commercial Street Trees

The benefits include the same benefits that other infiltration practices provide. Infiltration trenches provide an additional means of increasing the volume of rain water absorbed by the ground.

For more detailed design guidance, refer to Section 5.2.2, "Infiltration Trenches," in the *Portland Street Design Manual*, 2.2, "Commercial Streets," 5.1.1, "Stormwater Management," and 5.2, "Open Channels." Contact the Urban Tree Station, Stormwater Management Center, Manual Update 2010, 400 NE 1st St., City of Portland, Planning Department and Sustainability Dept 2010, "Tree Site Design - Growing the Tree List at the End," and "Tree Street" by James Olcott.

POTENTIAL APPLICATIONS	ESTIMATED QUANTITY	ADDITIONAL CONSIDERATIONS
Residential	Low	Medium
Commercial	High	Medium
City Street	Low	High
Highway	Low	High
Public Street	Low	High

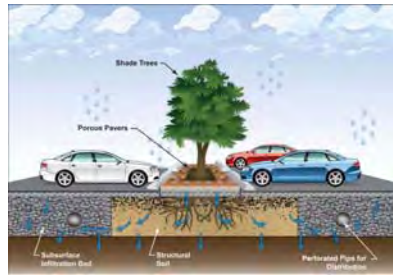
CONSIDERATIONS FOR TREE TRENCHES

- Tree trenches should be designed to accommodate the root zone of the tree.
- Tree trenches should be designed to accommodate the root zone of the tree.
- Tree trenches should be designed to accommodate the root zone of the tree.

Tree Trench



Tree Trench with Permeable Pavers



City Lot #21



Infiltration Trench (vegetation)



Infiltration Trench/Tree Trench: General Maintenance

- Water, mulch, treat diseased trees, and remove litter as needed
- Annual inspection for erosion, sediment buildup, vegetative conditions
- Inspection and clean inlets, outlets, cleanouts, etc. twice per year
- Detailed maintenance discussion to be held later on in the workshop

Green Infrastructure Technology Overview

- Porous Pavements
 - Porous Asphalt; Porous Concrete; Permeable Pavers
- Infiltration Bed
 - Dry Well; Infiltration Bed; Infiltration Trench/Tree Trench
- **Cistern/Rain Barrel**
- Green Roof
- Rain Garden/Bioretention
- Green Streets
 - Vegetated Curb Extensions; Sidewalk Planters
- Inlet Filter Insert

Cistern/Rain Barrel

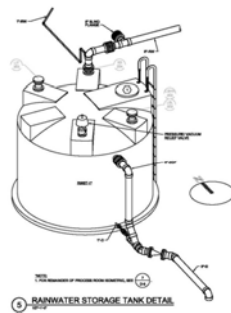
1.1.1 Rain Barrel

Storm and roof runoff collection devices are designed to collect and store runoff from buildings to allow for its reuse. Rainwater runoff devices are used to capture, store, and filter rainwater. Rainwater can be used for a variety of purposes, including irrigation, car washing, and flushing toilets. Rainwater collection systems are designed to capture rainwater from roofs and other surfaces. Rainwater collection systems are designed to capture rainwater from roofs and other surfaces. Rainwater collection systems are designed to capture rainwater from roofs and other surfaces.

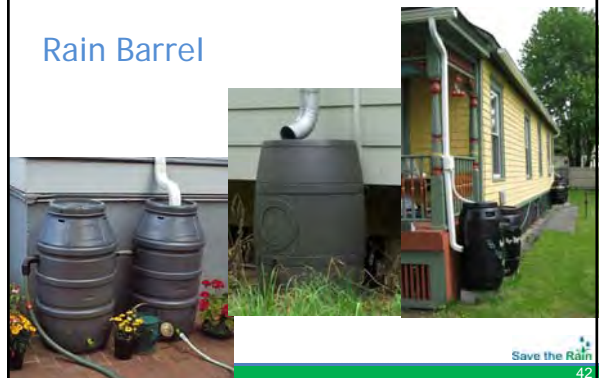
PROPERTIES, OPERATIONS	Advantages & Benefits	Limitations & Considerations
• Low cost	• Reduces water bills	• Limited capacity
• Easy to install	• Reduces water bills	• Limited capacity
• Reduces water bills	• Reduces water bills	• Limited capacity
• Reduces water bills	• Reduces water bills	• Limited capacity
• Reduces water bills	• Reduces water bills	• Limited capacity

Cistern

- War Memorial cistern



Rain Barrel



Cistern/Rain Barrel: General Maintenance

- Discharge water before next storm event
- Cisterns, rain barrels, and downspouts leading to them should be inspected regularly and cleaned
- The seals should be inspected periodically to prevent mosquito infestation
- May require flow bypass valves during the winter
- Detailed maintenance discussion to be held later on in the workshop

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Green Infrastructure Technology Overview

- Porous Pavements
 - Porous Asphalt; Porous Concrete; Permeable Pavers
- Infiltration Bed
 - Dry Well; Infiltration Bed; Infiltration Trench/Tree Trench
- Cistern/Rain Barrel
- **Green Roof**
- Rain Garden/Bioretention
- Green Streets
 - Vegetated Curb Extensions; Sidewalk Planters
- Inlet Filter Insert

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Green Roof

FAST FACT: Improved Roof

Expanded coverage of a variety of vegetation types, species, and colors of plants combined to provide a more diverse and resilient green roof. The use of native plants with high drought tolerance and low water requirements is encouraged. The use of native plants is encouraged. The use of native plants is encouraged. The use of native plants is encouraged.

FAST FACT: Improved Roof

Expanded coverage of a variety of vegetation types, species, and colors of plants combined to provide a more diverse and resilient green roof. The use of native plants with high drought tolerance and low water requirements is encouraged. The use of native plants is encouraged. The use of native plants is encouraged. The use of native plants is encouraged.

POTENTIAL APPLICATIONS	CONSTRUCTION CONSIDERATIONS	MAINTENANCE CONSIDERATIONS
Residential	Low Slope	Low Maintenance
Commercial	Low Slope	Low Maintenance
Industrial	Low Slope	Low Maintenance
Public	Low Slope	Low Maintenance
Government	Low Slope	Low Maintenance
Healthcare	Low Slope	Low Maintenance
Education	Low Slope	Low Maintenance
Religious	Low Slope	Low Maintenance
Corporate	Low Slope	Low Maintenance
Government	Low Slope	Low Maintenance
Healthcare	Low Slope	Low Maintenance
Education	Low Slope	Low Maintenance
Religious	Low Slope	Low Maintenance
Corporate	Low Slope	Low Maintenance

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Green Roof

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Green Roof at the OnCenter

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Green Roof: General Maintenance

- Once vegetation is established, little to no maintenance needed for the extensive system
- Detailed maintenance discussion to be held later on in the workshop

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Green Infrastructure Technology Overview

- Porous Pavements
 - Porous Asphalt; Porous Concrete; Permeable Pavers
- Infiltration Bed
 - Dry Well; Infiltration Bed; Infiltration Trench/Tree Trench
- Cistern/Rain Barrel
- Green Roof
- Rain Garden/Bioretentation
- **Green Streets**
 - **Vegetated Curb Extensions; Sidewalk Planters**
- Inlet Filter Insert

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Green Street

FACT SHEET: Green Streets

Green Streets are designed to be a variety of Green Infrastructure (GI) elements including Street Trees, Porous Pavements, and Greenways. Water quality improvements, greater shade and beauty, improved air quality and temperature of streets, and a sense of place are some of the benefits of Green Streets. Green Streets are designed to be a variety of GI elements including Street Trees, Porous Pavements, and Greenways. Water quality improvements, greater shade and beauty, improved air quality and temperature of streets, and a sense of place are some of the benefits of Green Streets.

Key Design Features:

- Porous pavement (green street pavements)
- Infiltration beds
- Infiltration trenches
- Enhanced tree planting (street trees that are well and are planted with a green street friendly landscape of native plants and trees)
- Greenways (sidewalks, bike lanes, etc.)
- Use of native plants and trees
- Use of native plants and trees
- Use of native plants and trees
- Use of native plants and trees

Costs:

- Use of native plants and trees
- Use of native plants and trees
- Use of native plants and trees
- Use of native plants and trees

Benefits:

- Reduced stormwater runoff
- Improved air quality
- Improved aesthetics
- Improved safety
- Improved quality of life
- Improved quality of life
- Improved quality of life
- Improved quality of life

Applications:

- Residential streets
- Commercial streets
- Industrial streets
- Institutional streets
- Institutional streets
- Institutional streets
- Institutional streets

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Green Street

- **Multiple GI included:**
 - Street Trees
 - Porous Pavements
 - Rain Gardens
 - Vegetated Curb Extensions ("Bump Outs")
 - Water Quality Devices/Inserts
 - Planter Boxes
 - Swales

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Green Street along Water Street

Save the Rain 58

Vegetated Curb Extension

Save the Rain 59

Vegetated Curb Extension (Bump-outs)

Portland, OR

Sidewalk Planter

Harrison Street (under construction)

Save the Rain 61

Green Street: General Maintenance

- Water, mulch, trim, prune, weed, and remove litter
- Inspect for erosion, sediment buildup, and vegetation health
- Porous pavement maintenance as discussed
- Inspect and clean inlets, outlets, cleanouts, etc.
- Detailed maintenance discussion to be held later on in the workshop

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Green Infrastructure Technology Overview

- Porous Pavements
 - Porous Asphalt; Porous Concrete; Permeable Pavers
- Infiltration Bed
 - Dry Well; Infiltration Bed; Infiltration Trench/Tree Trench
- Cistern/Rain Barrel
- Green Roof
- Rain Garden/Bioretention
- Green Streets
 - Vegetated Curb Extensions; Sidewalk Planters
- **Inlet Filter Insert**

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Inlet Filter Insert

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Inlet Filter Insert

- Device that reduces pollutants from stormwater runoff
- Attached to the entrance of an inlet or catch basin and filters the water prior to entering the sewer system
- Removes coarse sediment, oil and grease, litter, and debris
- Regular maintenance is critical for continued proper functioning

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Inlet Filter Insert

FioGuard Plus by KriStar

Ultra Urban Drop-In Filter by AbTech

Inlet Filter Insert at Water Street Green Street

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Inlet Filter Insert: General Maintenance

- Follow manufacturer's guidelines
- Inspect at least twice per year and after all major storm events (if possible)
- For areas with high leaf volume, inserts should be inspected once every 2 weeks during the fall, as leaf litter can affect the operation of the insert
- Detailed maintenance discussion to be held later on in the workshop


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Green Infrastructure at the Rosamond Gifford Zoo

- Site intentionally chosen for today's workshop
- Multiple GI technologies constructed and in design

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Rosamond Gifford Zoo Primate Exhibit and Courtyard



- Rain Barrels and Cisterns to harvest runoff from rooftops
- Porous Pavement in Courtyard
- Rain Garden along Primate Exhibit

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Rosamond Gifford Zoo Elephant Exhibit, 2011




6,000 sq.ft. Green Roof

Porous pavement and rain barrels for stormwater reuse

GI Technology:	Green roof
Project Owner:	County
Capture Area:	6,000 square feet
Runoff Reduction:	114,000 gallons/year
Construction Cost:	\$183,900
	\$/gallon: \$2.27

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Rosamond Gifford Zoo Entrance Enhancement

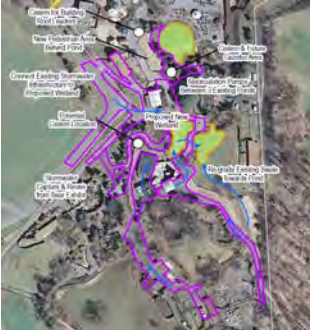


Green Infrastructure Concept for the Zoo Entrance

•GI Technology:	Rain gardens
•Project Owner:	County/City
•Capture Area:	39,000 square feet
•Run-off Reduction:	680,000 gallons/year
•Construction Cost:	\$300,000 (bid)
•\$/gallon:	\$0.62

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H-31: Zoo Stormwater Wetland (2012/2013)



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Maintenance Requirements for GI

- Overview of Maintenance
- Maintenance Efforts To Date
- Specific Green Infrastructure Maintenance Tasks
 - Porous Pavements
 - Stormwater Structures
 - Landscape Features
 - Trees
 - Vegetation
 - Green Roof
 - Meadows


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Overview of Maintenance: Why do we need to maintain GI?

- Required for proper and continued functioning of projects
- Important for aesthetics (landscaping, trees)
- Long-term investment that needs maintenance just like anything else!
- This region is one of the very few that have undertaken implementation of GI at this scale. There are not many examples to learn from
 - Portland, Oregon
 - Philadelphia, Pennsylvania
 - Seattle, Washington

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GI as part of the Facilities Network



- Many GI features are buried
- Dig-Safely New York (811) program in place to prevent unexpected exposure of buried utilities
 - GI to be part of the system by 2013
- Unplanned repairs / maintenance can be managed
- Utilities (water lines, gas lines) can coexist along with green infrastructure

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Communication and Signage

- Signage and education are critical to long term success of the STR program




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Maintenance Efforts to Date

- OCDWEP
- Onondaga Earth Corps

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OCDWEP Maintenance Activities To Date

- Nine sites visited
- Mostly porous pavements & tree infiltration trenches
- Approx. 70 bags of debris collected x ~4 pounds/bag = ~280-290 pounds of debris that did not go into/did not clog sewers or waterways
- Debris included
 - mostly trash (floatables – fast food containers, cans, etc.), & dirt, dust, stones, leaves
- Pre-cleaning (trash pickup, sweeping) often critical prior to vacuuming

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Onondaga Earth Corps Landscape Maintenance Oct-Nov 2011

- Visited 4 parking lots
- Evidence of excessive debris in inlets/storm drains
- Excessive amounts of litter; dog-waste
- Lack of care with mowing (i.e. clear-cutting establishing species)
- Pedestrian traffic impacts vegetated areas
- Snowplow-operator issues

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Plant Identification

- Preparation of a Plant Identification Manual is underway
- Seasonal photographs of perennials that may vary in appearance
- Draft provided in handouts
- Will be available on the STR website this spring!
- Includes common plant species as well as Common Weeds to be removed!




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ONONDAGA COUNTY GREEN INFRASTRUCTURE PLANT IDENTIFICATION

Common Weed Species to Look For and REMOVE!

Weed species vary from site to site, depending on surrounding conditions, existing weed seeds, and other factors. Below are some of the common weeds that may be encountered.



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Overview of Maintenance: Standard Maintenance Procedures

- Table 1 in your packet provides a listing of all the Standard Maintenance Procedures (SMPs) prepared for OCDWEP
- Every GI design component (or GI asset) that needs maintenance has an SMP associated with it
- We will review all 13 SMPs today!

SMP ID	Maintenance Task	GI Asset Includes
SMP 01	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 02	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 03	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 04	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 05	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 06	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 07	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 08	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 09	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 10	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 11	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 12	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.
SMP 13	Annual Assessment/Inspection	Planted Assets, Perennials, Annuals, Groundcovers, Tree Seedlings, Shrubs, Palms, Palmettos, Ferns, Grasses, etc.

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Overview of Maintenance: Seasonal Activities


- Table 3 in your packet provides a seasonal summary of Maintenance Activities
- Use as a guide to plan maintenance activities for your GI projects
- SMPs do not cover activities during contractor-specified warranties (landscaping and green roof)

Season	Activity	Description
SPRING	Planting	Planting of new plants and trees in the spring.
SUMMER	Watering	Watering of plants and trees during the summer months.
FALL	Pruning	Pruning of trees and shrubs in the fall.
WINTER	Snow Removal	Removal of snow from the green infrastructure.

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Overview of Maintenance: Recording Observations

- Included in your packet is a copy of the Maintenance Report Log
- Prepared for OCDWEP as part of their maintenance management system;
- OCDWEP: Requires documentation for each SMP and requests active participation from others



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Maintenance Requirements for GI


- Overview of Maintenance
- Maintenance Efforts To Date
- **Specific GI Maintenance Tasks**
 - **Porous Pavements**
 - Stormwater Structures
 - Landscaping Features
 - Trees
 - Vegetation
 - Meadow
 - Green Roof



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Maintenance of Porous Pavements


- **SMP-01:**
 - **Porous Pavement Vacuuming**
- **SMP-02:**
 - **Porous Pavement Power Washing**
- **SMP-03:**
 - **Porous Paver Maintenance (Restoring Aggregate)**
- **SMP-08:**
 - **Winter Maintenance for Porous Pavements**



Save the Rain 98

Detailed Visual Inspection


- Confirm “good house keeping” practices are in place.
- Surface should be checked for signs of ponding.
- Inspect for spalling and surface deterioration.
- Voids should be checked for accumulation of fine material.
- Check for accidental or illicit spillage.
- A log should be kept detailing annual inspection and maintenance activities.



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SMP-01: Porous Pavement Vacuuming


- **Porous Pavement Vacuuming** is done in order to remove sediment that may lead to a clogging of the porous surface, preventing water from infiltrating through the pavement into the stone reservoir



Save the Rain 100

SMP-01: Porous Pavement Vacuuming

- **Frequency:**
 - **Semi-Annually for Porous Concrete, Porous Asphalt, Flexible Porous Pavement**
 - **Annually for Porous Pavers (Spring)**
- **Tools and Supplies:**
 - **Porous pavement vacuum**
 - **Water source**
 - **Safety cones, trash bags, gloves, street broom**



Save the Rain 101

Sweeper Types

Mechanical Sweepers

They effectively remove gross pollutants and large debris (i.e. appropriate for spring clean-up), dirt and fine particles are actually forced into cracks by the broom head. The broom also tends to “push” the finer particles creating large amounts of dust. Mechanical broom sweepers are not typically recommended for porous surfaces.

Vacuum Sweepers

Vacuum sweepers utilize a windrow broom to push debris over to a vacuum suction nozzle. Only a small area is actually vacuumed, the majority of the pass is swept with a broom (creating the potential for dust). Vacuum sweepers are acceptable for use on porous surfaces.

Regenerative Air Sweepers

A controlled jet of air is directed into the cracks to dislodge dirt and fine particles. At the same time, a debris pick-up head vacuums particle across the entire length of the pass. Because there are no internal brooms and they utilize a closed loop system, dust is minimized. Regenerative Air sweepers are an acceptable method for sweeping porous surfaces.

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Mechanical Sweepers



“Spring Clean-Up”

Save the Rain 103

Vacuum Sweepers



Save the Rain 104

Regenerative Air VACUUM Sweeper



Save the Rain 105

Regenerative Air VACUUM Sweeper



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Save the Rain 107

SMP-01: Porous Pavement Vacuuming Procedures

1. Set up safety perimeter
2. Inspect
 - Visually inspect porous pavement surface for damage
 - Inspect aggregate in porous pavers to see if additional replacement aggregate is needed
 - Record observations in Maintenance Report Log
3. Prepare Site
 - Remove debris/trash
 - Sweep to loosen debris as needed

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SMP-01: Porous Pavement Vacuuming Procedures

4. Vacuum per manufacturer's recommendation
 - Engage water function
 - Two passes over area
 - Empty bag as needed
5. Inspect area to ensure adequate debris removal
6. Record observations in Maintenance Report Log
7. Clean-up; Remove safety perimeter

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109

SMP-02: Porous Pavement Power Washing


- Power washing should be done if porous pavement surfaces become clogged with fine dirt or sand.
- This allows partial restoration of the original void space and permeability of surface
- Should immediately follow the porous pavement vacuum task
- Once every three years or more often as necessary.
- NEVER power wash porous pavers



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110

SMP-02: Porous Pavement Power Washing

- Frequency:
 - Once every three years
 - Perform immediately after thorough vacuuming
 - Recommended season is Spring
- Tools and Supplies:
 - Power washer
 - Water source
 - Safety cones, trash bags, gloves, street broom



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111

SMP-02: Porous Pavement Power Washing Procedures


1. Set up safety perimeter
2. Inspect
 - Visually inspect for damage;
 - Record observations in Maintenance Report Log
3. Prepare Site
 - Remove debris/trash
 - Sweep to loosen debris as needed

Save the Rain
112

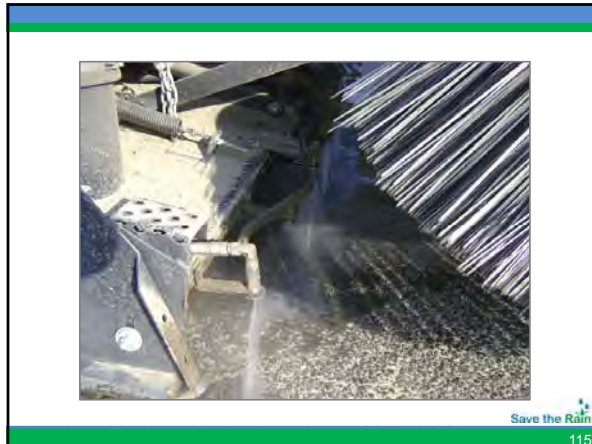
SMP-02: Porous Pavement Power Washing Procedures

4. Power Wash per manufacturer's recommendation
 - Water pressure no greater than 500 dpi
 - Two passes over area; no longer than 5 sec
5. Inspect area to ensure adequate debris removal
6. Record observations in Maintenance Report Log
7. Clean-up; Remove safety perimeter

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113



Save the Rain
114



Save the Rain 115

Combination Sometimes Required



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Stormcrete™ - Modular Precast Porous Concrete Stormwater System



Save the Rain

REMOVABLE



REPLACEABLE

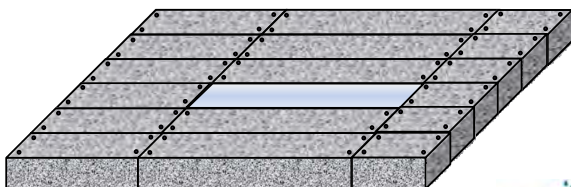


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Maintenance

Can be removed and backwashed to “regenerate” and re-insert

Option to remove and **replace** with new slab when needed



Save the Rain

SMP-03: Porous Paver Maintenance Procedures




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SMP-03: Porous Paver Maintenance

1. Set up safety perimeter
2. Inspect
 - Visually inspect for damage; missing pavers; clogged voids
 - Record observations in Maintenance Report Log
3. Prepare Site
 - Remove debris/trash from surface of pavers
4. Clean Clogged Voids
 - If voids are clogged, use a manhole pick to tool out joint until clean aggregate is found

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121



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123

SMP-03: Porous Paver Maintenance (Restoring Aggregate)



Refilling the voids between pavers with additional aggregate material to replace any material that has been lost by vacuuming and/or due to natural migration, settlement, and erosion.

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Stone Migration

Save the Rain



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SMP-03: Porous Paver Maintenance (Restoring Aggregate)

- **Frequency:**
 - As needed when gravel infill is not within ½ inch of the paver surface
 - Immediately following vacuuming
- **Tools and Supplies:**
 - Wheelbarrow, Shovel, Manhole Pick
 - Clean-washed small aggregate (gravel) per project specifications
 - Safety cones, trash bags, gloves, street broom

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127

Restoring Aggregate

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128

SMP-03: Porous Paver Maintenance Restoring Aggregate Procedures

5. **Add Aggregate**
 - Use a shovel to spread aggregate over the surface of the pavers
 - Use a broom to sweep aggregate into the voids between porous paves, taking care to fill in any obvious holes
 - Perform a final sweeping pass with the hand broom to remove any excess gravel from the paver surface
6. **Record observations in Maintenance Report Log**
7. **Clean-up; Remove safety perimeter**

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SMP-08: Winter Maintenance for Porous Pavements Procedures

- **Frequency:**
 - As necessary following snowfall or icy conditions
- **Tools and Supplies:**
 - Truck with snow plow
 - Salt/Deicers and appropriate machinery as needed
 - Hand shovel

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130

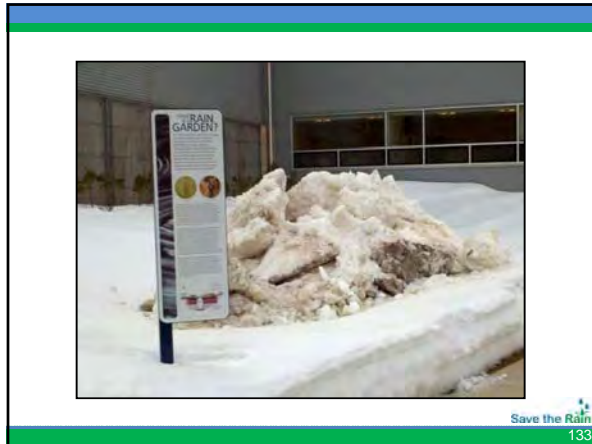
SMP-08: Winter Maintenance for Porous Pavements

Save the Rain
131

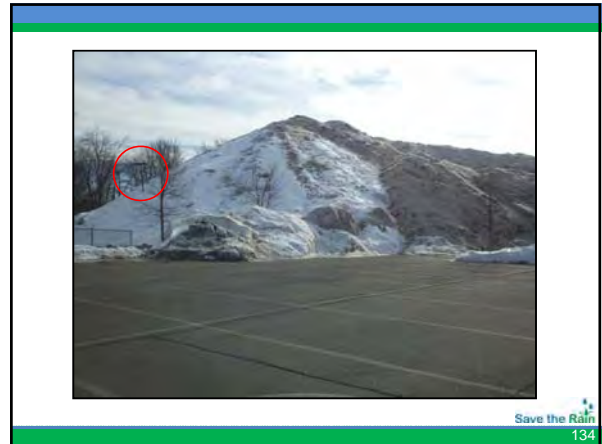
SMP-08: Winter Maintenance for Porous Pavements Procedures

1. **Set up safety perimeter**
2. **Inspect**
 - Refer to project site plan if necessary to identify location of landscape elements and porous pavement surfaces
 - Note presence of trees, shrubs, landscape features, and wheel stops or bollards so that plow does not hit them during plowing and cause physical damage
 - Record observations in Maintenance Report Log

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132



Save the Rain
133



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SMP-08: Winter Maintenance for Porous Pavements Procedures

3. **Plow**
 - Raise blade level 1" higher to prevent the plow from catching edges and dislodging paver units
 - Rubber plow blade is recommended
4. **Storage of snow piles**
 - Do not leave plowed snow piles on top of porous pavement surfaces
 - Move snow piles to standard/conventional pavement area or to grassy/lawn area
5. **Salting**
 - Use in moderation
 - Only us 25% of amount that is routinely applied
6. **Record observations in Maintenance Report Log**
7. **Clean-up; Remove safety perimeter**

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SMP-08: Winter Maintenance for Porous Pavements

- Salting must be to a minimal
- Plow blade heights may need to be set higher
- Plowed snow should not be stockpiled directly on top of porous pavement if possible.

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136

Sanding of porous pavement surfaces is prohibited

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137

Salt use in Moderation

Excessive salting at Pearl Street during Winter 2011/2012 Sunnycrest Lot

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138

Snow Plow Operators

Save the Rain
139

Maintenance Requirements for GI

- Overview of Maintenance
- Specific GI Maintenance Tasks
 - Porous Pavements
 - Stormwater Structures
 - Landscape Features
 - Trees
 - Vegetation
 - Meadow
 - Green Roof

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Maintenance of Stormwater Structures

- SMP -04:
 - Stormwater Structure Cleaning
- SMP-05:
 - Inlet Filter Insert Cleaning

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141

SMP -04: Stormwater Structure Cleaning

- Structures used to capture runoff, connect pipes, provide access, control the water level in stormwater management systems
 - Catch basin
 - Inlet
 - Sediment trap
 - Manhole
 - Overflow structure with or without removable weir
 - Observation well
 - Clean-out
 - Domed riser

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142

SMP -04: Stormwater Structure Cleaning Procedures

- Frequency:
 - Semi-Annually
- Tools and Supplies:
 - Manhole Pick
 - Vacuum/Vactor truck
 - Screwdriver or similar tool for cleaning clogged orifices in sediment trap/sump
 - Wrench, if necessary, for removing weir
 - Safety cones, trash bags, gloves, street broom

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143

SMP -04: Stormwater Structure Cleaning Procedures

1. Set up safety perimeter
2. Inspect
 - Inspect stormwater structure and adjacent area for any immediate damage
 - Record observations in Maintenance Report Log
3. Prepare site
 - Remove any debris that has accumulated on top of the structure
 - Remove lid, set aside
 - Visually inspect interior of the structure for defects and evidence of illegal dumping

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144


SMP -04: Stormwater Structure Cleaning Procedures

4. Prepare Site (Cont'd)
 - Examine unintended or excessive standing water
 - Inspect the drainage orifices for signs of clogging
 - Remove any and all material clogging these orifices
 - If structure has filter insert, follow SMP-05
5. Clean Structure
 - If using vacuum truck, clean the interior of the structure and remove all debris or sediment contained in sump

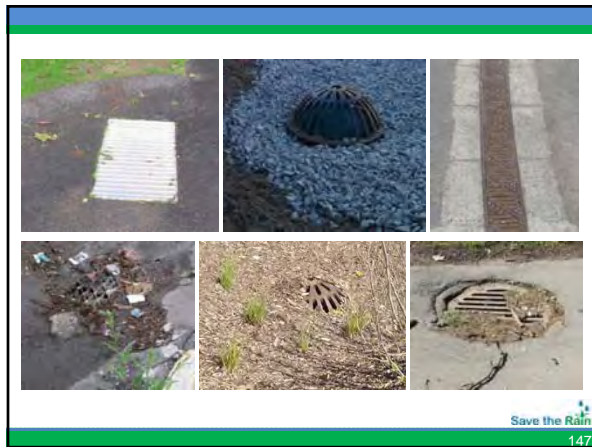
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145

SMP -04: Stormwater Structure Cleaning Procedures

6. Disposal
 - Properly dispose of waste/sediment
7. Replace structure lid; secure tightly
8. Record observations in Maintenance Report Log
9. Clean-up; Remove safety perimeter



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SMP-05: Inlet Filter Insert Cleaning

- Inlet filter inserts are designed to trap sediment, debris, trash, oil and grease
- Are located inside a catch basin or stormwater inlet
- Replacement of the filter insert pouch should occur at least annually, or as necessary, during a cleaning task



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SMP-05: Inlet Filter Insert Cleaning

- Frequency:
 - Quarterly,
 - Unless established that a particular inlet requires less frequent cleaning
- Tools and Supplies:
 - Manhole Pick
 - Replacement filter insert pouch (one pouch per inlet)
 - Industrial vacuum and/or vacuum truck with hose
 - Safety cones, trash bags, gloves

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149

SMP-05: Inlet Filter Insert Cleaning Procedures

1. Set up safety perimeter
2. Inspect
 - Remove catch basin lid/grate with manhole pick and set safely aside
 - Visually inspect filter insert for evidence of defects and deterioration
 - Record observations in Maintenance Report Log
3. Clean filter liner/mesh
 - Use an industrial vacuum or vacuum truck hose to remove any collected materials from the liner



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150

SMP-05: Inlet Filter Insert Cleaning Procedures

4. **Inspect filter hardware (follow manuf. Spec)**
 - Unsnap the tether from the D-ring (or equivalent)
 - Inspect the filter liner, gaskets, stainless steel frame, and mounting brackets, etc. for continued serviceability
5. **Insert filter**
 - Reattach the pouch tethers to the liner's D-ring (or equivalent)
6. **Replace grate/lid; secure tightly**
7. **Record observations in Maintenance Report Log**
8. **Clean-up; Remove safety perimeter**

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SMP-07: Riverstone Edge Maintenance

- The riverstone edge/stone gutter is a 1 to 3-foot wide (width varies) gravel edge around some porous pavement areas that serves as a backup mechanism for runoff to enter the subsurface infiltration bed should the porous pavement ever be adversely modified such that its permeability is reduced.
- Riverstone edges also provide protection for upslope debris/run-on

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SMP-07: Riverstone Edge Maintenance

- **Frequency:**
 - Annually in spring
- **Tools and Supplies:**
 - Rake
 - Clean-washed riverstone per project specifications
 - Trash bag, gloves

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SMP-07: Riverstone Edge Maintenance

1. **Remove trash/debris**
2. **Weed:**
 - Remove any obvious weed growth that has established itself within the limits of the riverstone edge/stone gutter.
3. **Rake to establish even surface:**
 - Gently rake riverstone edge/stone gutter to re-establish an even surface and even out any irregular depressions or high points
4. **Replenish:** Add new riverstone only if shallow and/or bare areas exist after raking has been completed.
 - Add only enough riverstone to bring entire riverstone edge/stone gutter to a consistent and level grade, approximately even with the elevation of the adjacent edge of pavement.

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155

Maintenance Requirements for GI

- Overview of Maintenance
- **Specific GI Maintenance Tasks**
 - Porous Pavements
 - Stormwater Structures
 - **Landscape Features**
 - Trees
 - Vegetation
 - Meadow
 - Green Roof

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Maintenance of Trees

- SMP-09a:
 - Tree General Maintenance - Tree Pit Weeding, Tree Pit Mulching, Soil Amendment with Organic Matter
- SMP-10a:
 - Tree Watering
- SMP-11a:
 - Tree Pruning

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157


SMP-09a: General Maintenance

- Inspection for problems
- Remove trash and debris
- Weeding
- Mulching
- Soil Amendment with Organic Matter

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158

Reminders....




- Remove trash and weed **before** mulching
- Form a saucer with a raised perimeter
- Don't let mulch touch the bark, no "volcanoes"
- 3-4 inches deep only - O₂ exchange
- Minimum 4'-6' diameter

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159

SMP-09a: General Maintenance

Soil Amendment with Organic Matter

- Years 2 and 4 only
- Apply 2 inches of compost into top 2 inches of soil
- No contact with exposed roots or the trunk of trees or shrubs



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160



Keep weed whackers and lawn mowers more than 2 feet from the trunk!!




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161

SMP-10a: Watering

- Water weekly whenever rainfall is less than 1" per week
- 2x per week in 1st year

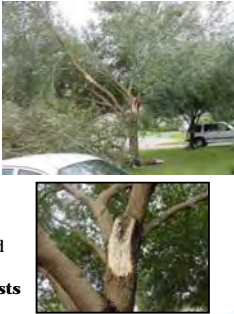
Water –

- Essential for photosynthesis = FOOD
- Essential for soil nutrient uptake into roots

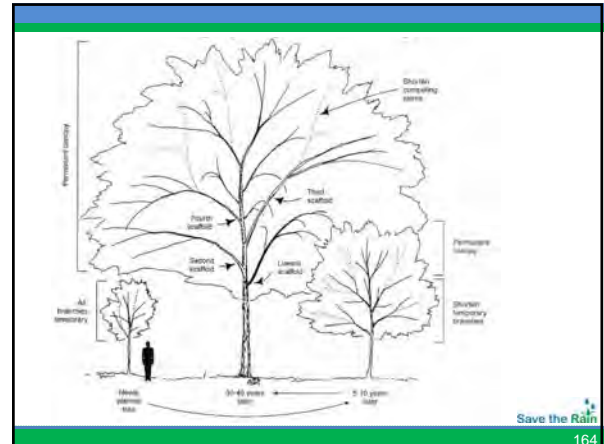
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162

SMP-11a: Pruning

- Improve structural strength and reduce failure potential
- Prevent or mitigate a pest problem
- Improve aesthetic characteristics
- Provide clearance for pedestrians, vehicles, and structures
- Improve safety and security for residents and visitors
- Repair structural damage from wind loading
- **Reduce future maintenance costs**



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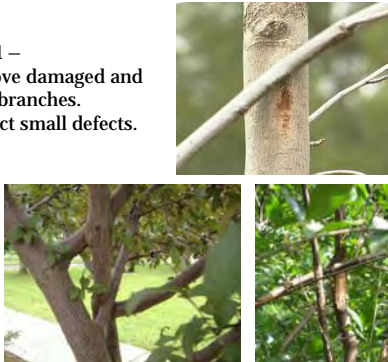


SMP-11a: Tree Pruning Procedures

- Year 1 – remove damaged and dead branches

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Year 1 –
Remove damaged and dead branches.
Correct small defects.



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SMP-11a: Tree Pruning Procedures

- Year 1 – remove damaged and dead branches
- Year 3 – correction of structural issues
 - **Reduce or remove codominant stems.**
 - Eliminate included bark and crossing branches.
 - Create balanced canopy.
 - Retain at least 75% of canopy.
 - Reduce or remove large lower limbs. Temporary branches should be maintained at <2' diameter.

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Maintain a central leader

On **excurrent** trees, maintain a single trunk to the top.



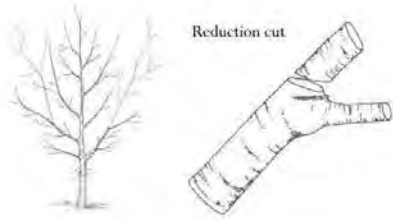
e.g. Linden, Tulip Poplar, Ginkgo

On **decurrent** trees, maintain a single dominant trunk to at least two-thirds of the tree's mature height.



e.g. Elm, Sycamore, Kentucky Coffeetree

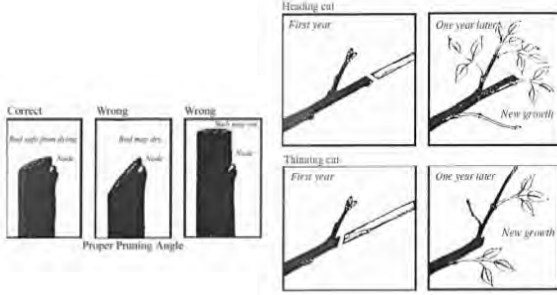
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Reduction cut

Reduction cuts are for suppressing growth.
Reduce to an outward directed branch at least 1/3 the diameter of the branch removed

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Heading cut

First year

One year later

New growth

Thinning cut

First year

One year later


New growth

Heading and thinning cuts have different effects on subsequent growth

Correct Wrong Wrong

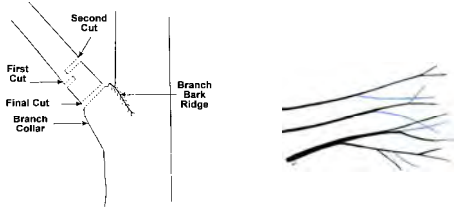
Proper Pruning Angle

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Removal cuts



First Cut

Second Cut

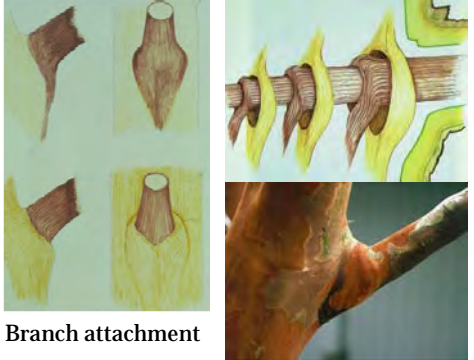
Final Cut

Branch Collar

Branch Bark Ridge


Removal takes a branch back to the trunk or a parent branch
Used for cleaning and thinning and during structural pruning

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Branch attachment

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3 way cut for branches with diameter > 1"

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SMP-11b: Shrub Pruning Procedures

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www.isa-arbor.com

www.ansi.org

- Fran Lawlor
- Urban Forester
- FML7@cornell.edu
- (315) 424-9485 xt 230

Cornell University
Cooperative Extension
Onondaga County

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Maintenance Requirements for GI

- Overview of Maintenance
- Specific GI Maintenance Tasks
 - Porous Pavements
 - Stormwater Structures
 - Landscape Features
 - Trees
 - Vegetation
 - Meadow
 - Green Roof

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Maintenance of Vegetation

- SMP-09b: General Maintenance, Weeding, Mulching
 - Planter/Plant Bed, Rain Garden, and Bioswale (Shrub and Herbaceous Plant Material) General Maintenance, Weeding, Mulching
- SMP-10b: Watering
 - Plant Bed (Planter) Watering, Rain Garden/Bioswale Watering, Meadow Watering
- SMP-11b: Pruning and Cutback
 - Plant Bed/Planter/Rain Garden/Bioswale (Shrub and Herbaceous Groundcover) Pruning and Cutback
- SMP-13a: Landscape Replacement
 - Plant (Shrub and Herbaceous Plant Material) Replacement

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What is "VEGETATION"?

Annuals	Perennials	Grasses
Zinnia	New England Aster	Switch Grass

Photo from: <http://www.perennial-garden-plants.com>

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Types of Vegetation

- **Annual:** completes its life cycle in one growing season.
- **Perennial:** Plants that live for more than 2 years.
 - **Grass**
 - A slender leaved, perennial with a jointed stem that dies back to the ground in the winter
 - **Forb**
 - A broad leaved perennial with a smooth stem that dies back to the ground in the winter. Typically when a gardener talks about "perennials", this is what they mean
 - **Shrub**
 - A woody plant of relatively low height, having several stems arising from the base and lacking a single trunk
 - **Tree**
 - A woody plant usually having 1 stem, called the trunk arising from the base, relatively taller than a shrub

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Gardens are Dynamic

They change season to season





Spring
Summer

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Gardens are Dynamic

And even from early Spring to late Spring




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GARDENS CHANGE YEAR TO YEAR




Photo taken by Eroy Edwards, HHQ

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Gardens are dynamic because plants are dynamic







Beardtongue from emergence to bloom

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SMP-09b: Landscaping General Maintenance (Weeding, Mulching)



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Which are the weeds and which are "the plants" ???

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Cheap tricks for telling the plants and weeds apart

- Forthcoming Manual on STR website!
- Use plant markers
- Use the plant list for each project and the picture page
- The rule of P's, pull pricklers, leave pearls and pots
- Use the list of common weeds
- Other resources: "Weeds of the Northeast"
- <http://njaes.rutgers.edu/weeds/thumbnaill.asp>
- <http://www.garden.org/weedlibrary/>

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SMP-09b: Landscaping Maintenance (Weeding)

- Weed early and often
 - SMP: 3x/year-spring clean-up, summer and fall put to bed
 - Weeding more often will save time in the long run
- Pull weeds out by the roots before they set seed
 - Grasp the plant firmly at base or use a tool
- Weeding is easiest when the soil is moist
- Avoid compacting the soil and trampling the plants!
- Tools and Supplies
 - Gloves, trowel, weeding fork, spade or pitch fork, trash bag, weed id guide

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SMP-09b: Landscaping Maintenance (Mulching)


- Apply 2-3 inches of double- shredded hardwood mulch in Spring
- Keep mulch away from stems
- May need to remove old mulch to maintain functionality of rain gardens and bioswales



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SMP-10b: Landscape Watering

- Plant Bed (Planter)
- Rain Garden/Bioswale
- Meadow



off the mark by Mark Parisi
www.offthemark.com

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SMP-10b: Landscape Watering

- Frequency
 - 1 inch/wk first year (to supplement rainfall)
 - ½ inch water/wk during first 4-6 weeks of growing season years 2&3 and during extended drought in years 2&3
 - Amy's tip: For trophy plantings, 1-2in water/wk year 1&2 during the summer, 1-2 inches water every two weeks other times during the growing season
- Tools and Supplies
 - See hand-out

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SMP-10b: Landscape Watering Procedures and Techniques

- Water the roots not the leaves
- Water deeply to encourage good root development, soil should remain moist at least 2-3 inches below grade
- Properly used hoses are better than sprinklers

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SMP-11b: Landscape Pruning, Thinning, and Removing Dead Plant Material



Thin disease-prone plants such as phlox and beebalm

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Plant Division

Why

- Reinvigorate plants
- Provide space for plants to grow
- Get more plants!

How

- Dig up the whole plant and wash or brush the soil off the roots
- Use a knife, spade or ax to cut the plant. Each piece will need roots and a portion of crown
- Re-plant the newly divided plants into a larger area than the plant once occupied

When? Spring or Fall: depends on plant



From familyzip.com

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SMP-11b: Landscape Pruning, Thinning and Removing Dead Plant Material



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SMP-11b: Landscape Pruning, Thinning and Removing Dead Plant Material


- Plant Bed
- Planter
- Rain Garden
- Bioswale



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199

SMP-11b: Landscape Pruning and Removal of Dead Vegetation

- Frequency
 - 1x/year; putting the garden to bed for the winter versus a spring clean-up
- Tools and Supplies
 - See hand-out




Seed heads provide winter interest and food for the birds

Save the Rain
200

SMP-11b: Landscape Cutback Procedures-putting the garden to bed

1. A fall cleanup can include cutting most perennials back to about 4 inches above the ground
2. Some plants such as iris should not be cut back while the foliage is still green



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201

SMP-13a: Landscape Plant Replacement

- Plant (shrub and herbaceous material) replacement involves replacing missing, dead, or diseased species in planter beds, planters, rain gardens, and/or bioswales if replacement has been deemed necessary
- Does not include tree replacement (separate contract)



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202

SMP-13a: Landscape Plant Replacement

- Frequency
 - Planting is done in Spring and Fall, replacement as necessary
- Tools and Supplies
 - See SMP for detailed instructions

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203

SMP-13a: Landscape Plant Replacement Procedures (Detailed Instructions in SMP)

1. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required
2. Set balled and potted and container-grown stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
3. Carefully remove root ball from container without damaging root ball or plant.
4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

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204

Maintenance Requirements for GI

- Overview of Maintenance
- Specific GI Maintenance Tasks
 - Porous Pavements
 - Stormwater Structures
 - Landscape Features
 - Trees
 - Vegetation
 - Meadow
 - Green Roof

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205


Maintenance of Meadows

- SMP-09c:
 - Meadow Inspection, Control of Invasive Species
- SMP-12:
 - Meadow Mowing and Invasive Species Management
- SMP-13b:
 - Meadow Replacement

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206

SMP-09c: Meadow Inspection, Control of Invasive Species

- A meadow is a field consisting primarily of herbaceous grasses, forbs, wildflowers, and other non-woody plants. Meadow inspection consists of a visual inspection, trash/debris removal, and invasive species management.



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207

SMP-09c: Meadow Inspection, Control of Invasive Species

- Frequency
 - Minimum 3x/year (Spring, Summer, Fall)
- Tools and Supplies
 - See SMP for detailed instructions

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SMP-09c: Meadow Inspection, Control of Invasive Species Procedures

- Inspect meadow area for evidence of invasive species and woody plant establishment. (Monthly recommended)
- Examples of invasive species: thistle, knapweed, phragmites, and general weeds such as dandelions. (Refer to Weed ID Sheet)
- Managing invasive species in meadows is primarily done through mowing
- For the control of certain types of invasive species not able to be managed by mowing, such as Crown Vetch, spot spraying and hand pulling should be conducted.

Save the Rain
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SMP-12: Meadow Mowing and Invasive Species Management

- Mowing a meadow helps to prevent and control woody plant and weed establishment, while also helping to disperse seeds of desirable species. Mowing manages for cool season weeds, which helps promote warm season grass establishment.



Example of a flail-type mower

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SMP-12: Meadow Mowing and Invasive Species Management

- Frequency**
 - Year 1: Mow meadow **once a month** during growing season
 - Year 2: Mow **once in fall**
 - Long Term Maintenance regime: Year 3 and after:
Mow **once every 2 years in early to mid-spring** prior to significant warm season grass regrowth, but when cool season weeds are actively growing. If basin bottom is too wet for spring mowing, mow in late fall (after plants have set seed).
- Tools and Supplies**
 - Hand Scythes (small meadows)
 - Power Trimmer (String Trimmer/Weed Whacker) (small meadows)
 - Power Scythe (large meadows)
 - Flail-type Mower – suggested mower for large meadows
 - Riding or Push Mower – suggested mower for small to medium meadows

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SMP-12: Meadow Mowing and Invasive Species Management Procedures

Initial establishment: 1st Growing Season (Year 1)

- Mow meadow when plants/grasses reach a height of approximately 10-inches (10"), which is about once a month during the growing season. Mow down to height of 6" (or just above the height of emerging native grass seedlings).
- Remove, finely chop, and redistribute mowings to prevent cut weeds from smothering native grass seedlings.

Initial establishment: Year 2

- Fall: Mow once during fall to a height of 8".


Long Term Maintenance regime: Year 3 and after:

- Mow to a height of 6-8" once every 2 years in early to mid-spring prior to significant warm season grass regrowth, but when cool season weeds are actively growing. If basin bottom is too wet for spring mowing, mow in late fall (after plants have set seed).
- Remove cut material, or mow with a flail mower to finely chop residue.
- If dry leaf litter builds up:
 - Mow every year or
 - Pull out lower litter that a mower can't reach with a harrow or rake.

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SMP-13b: Meadow Replacement

- Meadow replacement involves reseeding or replugging meadow grasses or herbaceous groundcover plants if replacement has been deemed necessary.



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SMP-13b: Meadow Replacement

- Tools and Supplies**
 - Planting equipment (for larger areas: 'Truax' no-till drill or a double box 'Brillion' grass/legume broadcast seeder)
 - Plant plugs and seed
 - Mulch



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SMP-13b: Meadow Replacement Procedures (Detailed Instructions in SMP)

- Replacement Requirements:**
 - Re-plugging: see **SMP-13a Plant (Shrub and Herbaceous Groundcover) Replacement** for detailed instructions.
- Reseeding Requirements:**
 - Reseed bare areas with same materials specified for respective grasses & forbs. Seed mixture shall be fresh, clean, new crop seed.
 - Seeded areas to be lightly scarified with springy rake to loosen soil before reseeding.

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SMP-13b: Meadow Replacement Procedures (Detailed Instructions in SMP)

Reseeding Instructions:

- For small areas, hand broadcast seed to match initial seeding rate specified for site.
- For larger areas, use no-till seed drill or broadcast seeder, without inert matter added.

Reseeding Restrictions:

- Seed during one of the following periods.
- Meadow Seeding: March 15th to June 15th
- Warm-Season Meadow Seeding: April 15th to June 15th and August 15th to September 15th

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Maintenance Requirements for GI

- Overview of Maintenance
- Specific GI Maintenance Tasks
 - Porous Pavements
 - Stormwater Structures
 - Landscape Features
 - Trees
 - Vegetation
 - Meadow
 - Green Roof

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SMP-06: Green Roof Maintenance

- Follows initial 2-3 year establishment period/contractor warranty period
- Routine maintenance is intended to increase survival of the vegetated cover, promote the development of robust and durable green roof plants, and prevent drainage problems and erosion.



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SMP-06: Green Roof Maintenance

- Frequency
 - Spring and Fall (Semi-annually)
- Tools and Supplies
 - Hand Pruners
 - Safety equipment, including fall protection as applicable
 - Trash bag, gloves

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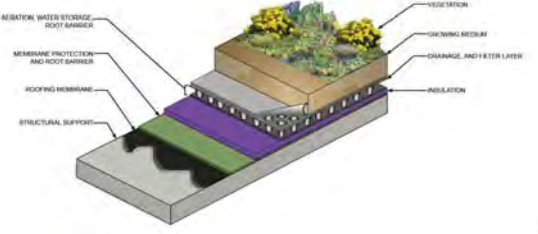
SMP-06: Green Roof Maintenance Procedures

1. **Inspect:** Visually inspect the green roof system for the following:
 - Plant Material:** Inspect for large bare spots; colonization of the green roof by annual grass, moss, weeds, woody material, etc.; high mortality rates for one or more plant species; loss of plant material/growing media to wind scour or erosion; or consistently moist or spongy areas of the roof.
 - Waterproofing System:** Inspect exposed components of the waterproofing system, including flashings and counter-flashings.
 - Drainage System:** Inspect drain outlets (scuppers) to make certain that they are free from clogging or obstructions. Look for evidence of prolonged ponding of water following rainfall events.



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SMP-06: Green Roof Maintenance Procedures - Components of Green Roof



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SMP-06: Green Roof Maintenance Procedures

2. **Weed:** Weed the green roof plantings as necessary by hand pruning/pulling. Immature extensive green roofs are vulnerable to colonization by annual grass, especially crabgrass.
3. **Plant Pruning:** Trim any plant material that may be growing within the drainage medium or interfering with the drainage system or waterproofing system.
4. **Replenish:** Patches of bare growing media (bare green roof) may be re-planted by taking cuttings from adjacent green roof plants or by separating and transplanting healthy plants. Plant cuttings should be at least one-inch long and should preferably include some 'air roots'.

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What's Next?

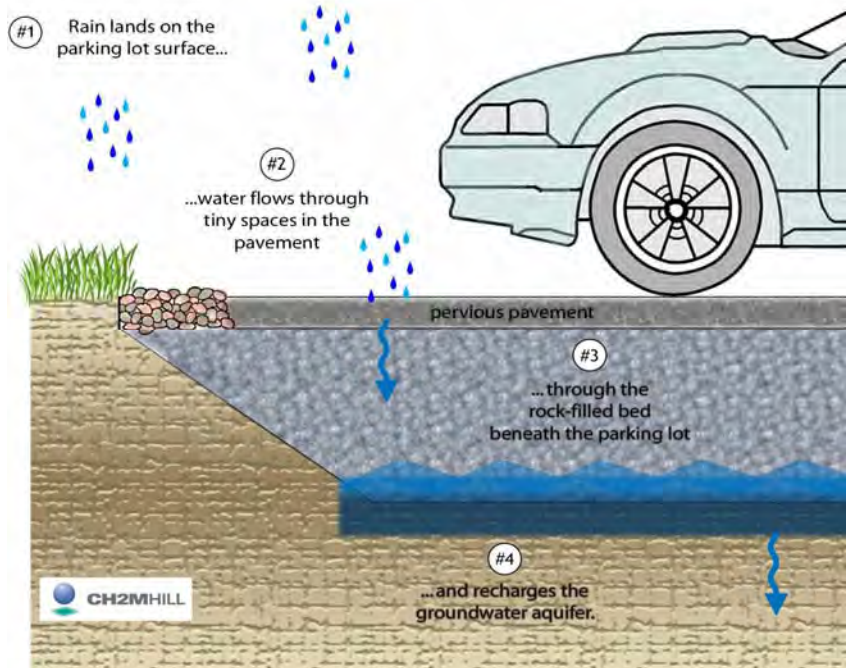
- Maintenance Report Logs – Submit to OCDWEP
- Please fill out an evaluation form before you leave
- Next Training in 2013
- Final Questions?

Green Infrastructure Technology Fact Sheets

FACT SHEET: Porous Pavement with Infiltration

Porous pavement is a Green Infrastructure (GI) technique that combines stormwater infiltration, storage, and structural pavement consisting of a permeable surface underlain by a storage/infiltration bed. Porous pavement is well suited for parking lots, walking paths, sidewalks, playgrounds, plazas, tennis courts, and other similar uses.

A porous pavement system consists of a pervious surface course underlain by a storage “bed” (i.e. reservoir) placed on uncompacted subgrade to facilitate stormwater infiltration. This storage reservoir, which is typically designed to store at least 1-inch of runoff, may consist of



a bed of uniformly graded and washed coarse aggregate with a void space of approximately 40% (NYSDOT No. 3A) or other pre-manufactured structural storage units (RainTank, StormTank, etc). The depth of the storage reservoir varies and is based on the management objectives, total drainage area, traffic load, and in-situ soil characteristics. The porous pavement may consist of asphalt, concrete, permeable paver blocks, reinforced turf/gravel, or other emerging types of pavement (e.g. Flexipave, Permapave, etc).

For more detailed design guidance, refer to section 5.3.11 of the New York State Stormwater Management Design Manual, August 2010, as well as the following industry references: Information Series 131 – Porous Asphalt Pavements for Stormwater Management by the National Asphalt Pavement Association; Pervious Concrete Pavements by the Portland Cement Association and the National Ready Mixed Concrete Association (2004); and Permeable Interlocking Concrete Pavements, Third Edition, by the Interlocking Concrete Pavement Institute (2006).

POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	High	Capital Cost	Medium
Commercial	Yes	Groundwater Recharge	High	Maintenance	Medium
Ultra Urban	Yes	Peak Rate	Medium/High	Winter Performance	Medium/High
Industrial	Yes	Erosion Reduction	Medium/High	Fast Track Potential	Low/Medium
Retrofit	Yes	Flood Protection	Medium/High	Aesthetics	Low/Medium
Highway	Limited	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	High	Total Nitrogen	High
Public	Yes	Total Phosphorus	Medium	Temperature	High

Key Design Features

- Infiltration testing required
- Do not infiltrate on compacted soil
- Level storage bed bottoms
- Provide positive storm water overflow from bed (overflow weir plates should be removable and not prone to clogging by large debris or trash)
- Stormwater control structures should be large enough for a person to enter; the preferred size is either 4'x4' or 4' diameter
- If possible, outlet pipes should connect to existing pipes immediately downstream of existing inlets
- Surface permeability >20"/hr
- Secondary inflow mechanism recommended (inlet grates should be ADA compliant and bicycle safe)
- Pretreatment for sediment-laden runoff

Site Factors

- Water Table/Bedrock Separation: 3-foot minimum
- Soils: HSG A&B preferred; HSG C&D may require underdrains
- Feasibility on steeper slopes: Low
- Potential "Hotspots": Not without design of pretreatment system/impervious liner

Maintenance

- Clean inlets
- Vacuum annually
- Maintain adjacent landscaping/planting beds

Cost

- Varies by surface type
- Generally more than standard pavement, but saves on cost of other GI techniques and drainage infrastructure

Benefits

- Volume control & groundwater recharge, moderate peak rate control
- Versatile with broad applicability
- Dual use for pavement structure and stormwater management

Limitations

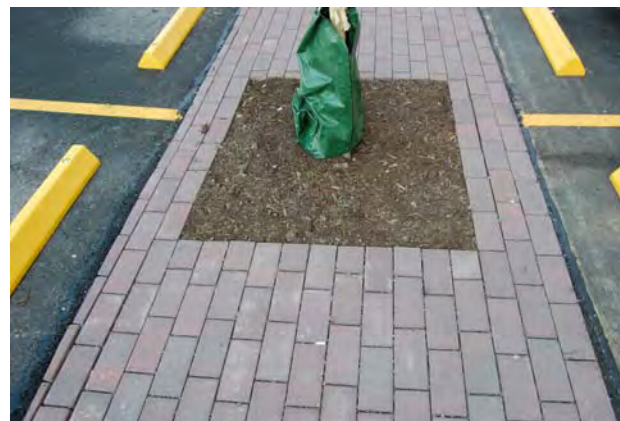
- Careful design & construction required
- Higher maintenance needs than standard pavement
- Steep slopes



Porous asphalt parking spaces at SUNY ESF parking lot in Syracuse, NY



Flexipave installation at SUNY ESF in Syracuse, NY

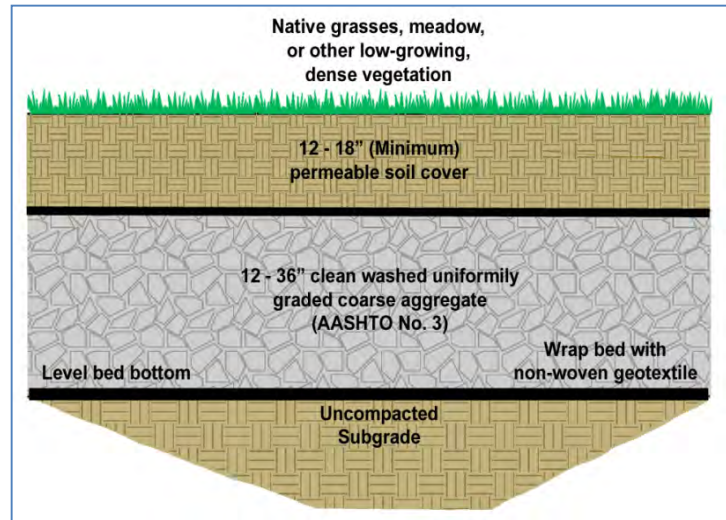


Porous pavers at City Lot #21 in Syracuse, NY

FACT SHEET: Infiltration Practices

Infiltration practices are natural or constructed areas located in permeable soils that capture, store, and infiltrate stormwater runoff. Infiltration practices come in a variety of shapes and sizes.

Dry wells, also referred to as seepage pits, French drains or Dutch drains, are subsurface storage facilities (structural chambers or excavated pits backfilled with a coarse aggregate or alternative storage media) that temporarily store and infiltrate stormwater runoff from rooftops. Due to their size, dry wells are typically designed to handle stormwater runoff from smaller drainage areas (i.e. less than one acre in size).



Infiltration basins are shallow surface impoundments that temporarily store, capture, and infiltrate runoff over a period of several days on a level and uncompacted surface. Infiltration basins are typically used for drainage areas of 5 to 50 acres with land slopes that are less than 15 percent.

Infiltration berms use a site's topography to manage stormwater and prevent erosion. Berms may function independently in grassy areas or may be incorporated into the design of other stormwater GI technologies, such as Rain Gardens. Berms may also serve various stormwater drainage functions including: creating a barrier to flow, retaining flow for volume control, and directing flows.

Infiltration trenches are linear subsurface infiltration structures typically composed of a stone trench wrapped with geotextile that is designed for both stormwater infiltration and conveyance in drainage areas less than five acres in size.

Subsurface infiltration beds generally consist of a rock storage (or alternative) bed below surfaces such as parking lots, lawns, and playfields for temporary storage and infiltration of stormwater runoff with a maximum drainage area of 10 acres.

Rain Gardens are often considered to be infiltration practices and are further discussed in the Rain Garden fact sheet.

Porous Pavement is typically considered an infiltration practice and is further discussed in the Porous Pavement fact sheet.

For more detailed design guidance, refer to sections 5.3.7 – Rain Gardens, 5.3.11 – Porous Pavement, and 6.3 – Stormwater Infiltration of the New York State Stormwater Management Design Manual, August 2010.

	Residential	Commercial	Ultra Urban	Industrial	Retrofit	Highway/Road	Recreational	Private
Dry Well	Yes	Yes	Yes	Limited	Yes	N/A	Yes	Yes
Infiltration Basin	Yes	Yes	Limited	Yes	Yes	Limited	Yes	Yes
Infiltration Berm	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes
Infiltration Trench	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsurface Infiltration Bed	Yes	Yes	Yes	Yes	Yes	Limited	Yes	Yes

Stormwater Quantity Functions

	Volume	Groundwater Recharge	Peak Rate	Erosion Reduction	Flood Protection
Dry Well	Medium	High	Medium	Medium	Low
Infiltration Basin	High	High	High	Medium/High	High
Infiltration Berm	Low/Medium	Low/Medium	Medium	Medium/High	Low/Medium
Infiltration Trench	Medium	High	Low/Medium	Medium/High	Low/Medium
Subsurface Infiltration Bed	High	High	High	Medium/High	Medium/High

Stormwater Quality Functions

	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Temperature
Dry Well	Medium (85%)	High/Medium (85%)	Medium/Low (30%)	High
Infiltration Basin	High (85%)	Medium/High (85%)	Medium (30%)	High
Infiltration Berm	Medium/High (60%)	Medium (50%)	Medium (40%)	Medium
Infiltration Trench	Medium (85%)	High/Medium (85%)	Medium/Low (30%)	High
Subsurface Infiltration Bed	High (85%)	Medium/High (85%)	Low (30%)	High

Additional Considerations

Capital Cost	Medium
Life Cycle Costs	Medium
Maintenance	Medium
Winter Performance	High
Resistance to Heat	High
Fast Track Potential	Medium
Aesthetics	Medium

Key Design Features

- Depth to water table or bedrock
- Pretreatment is often needed to prevent clogging
- Level infiltration surface
- Proximity to buildings, drinking water supplies, karst features, and other sensitive areas
- Soil types (permeability, limiting layer, etc.)
- Provide positive overflow in most uses
- Typical loading ratio of 5:1 (impervious to infiltration area); maximum loading ratio of 10:1

Site Factors

- Minimum infiltration rate of 0.5 inches per hour
- Maximum Site Slope: 15 percent
- Minimum depth to bedrock: 3 feet
- Minimum depth to seasonally high water table: 3 feet
- Potential Hotspots: yes with pretreatment and/or impervious liner
- HSG Soil type: A and B preferred, C & D may require an underdrain

Maintenance

- All catch basins and inlets should be inspected and cleaned at least twice per year
- The overlying vegetation of a subsurface infiltration facility should be maintained in good condition and any bare spots re-vegetated as soon as possible
- Vehicular access on subsurface infiltration areas should be prohibited (unless designed to allow vehicles) and care should be taken to avoid excessive compaction by mowers

Cost

- Dry Well: Construction costs – \$4-9/ft³, Maintenance Costs – 5-10% of capital costs
- Infiltration basin: Construction costs – varies depending on excavation, plantings, and pipe configuration
- Infiltration Trench: Construction costs – \$20-30/ft³, Maintenance Costs – 5-10% of capital costs
- Subsurface Infiltration Bed: Construction costs – \$13/ft³

Benefits

- Reduces volume of stormwater runoff
- Reduces peak rate runoff
- Increases groundwater recharge
- Provides thermal benefits
- Increased aesthetics
- Multiple use/Dual use

Limitations

- Pretreatment requirement to prevent clogging
- Not recommended for areas with steep slopes



Subsurface Infiltration Bed using Rainstore™ blocks for storage media, Washington National Cathedral, DC



Infiltration Trench in Chester County, PA



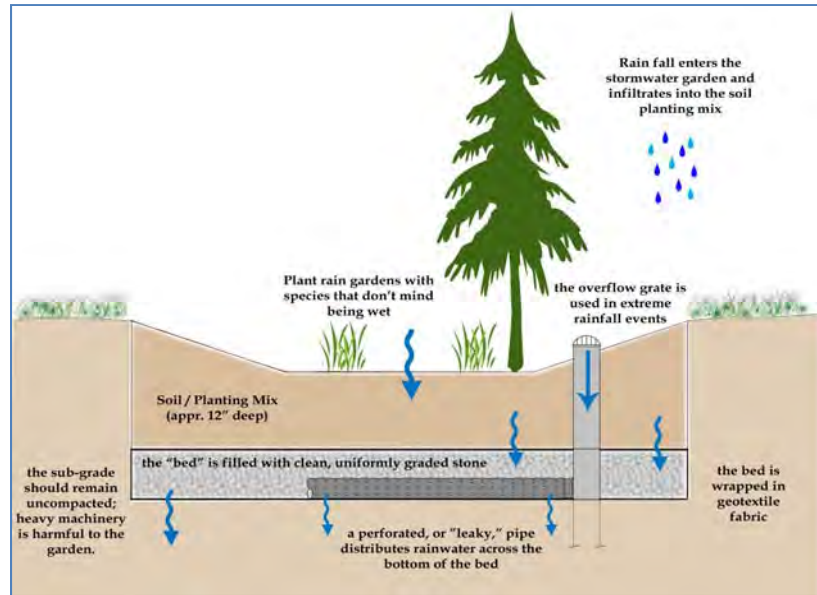
The Subsurface Infiltration Bed beneath this playfield manages rooftop runoff from the adjacent school building, Philadelphia, PA

FACT SHEET: Rain Garden

Rain Gardens (or Bioretention Areas) are shallow surface depressions planted with specially selected native vegetation to treat and capture stormwater runoff and are sometimes underlain by sand or a gravel storage/infiltration bed. A Rain Garden is a method of managing stormwater by pooling water within a planting area and then allowing the water to either infiltrate into the surrounding soil or evapotranspire. In addition to managing runoff volume and mitigating peak discharge rates, this process filters suspended solids and related pollutants from stormwater runoff. A Rain Garden can thus be

designed into a landscape as a garden feature that helps to improve water quality while reducing runoff quantity. In addition, Rain Gardens can be integrated into a site with a high degree of flexibility and can balance nicely with other GI technologies including porous pavement parking lots, infiltration trenches, and other non-structural stormwater practices. Rain Gardens typically require little maintenance once established and often replace areas that were intensively landscaped and require high maintenance.

For more detailed design guidance, refer section 5.3.7 – Rain Gardens of the New York State Stormwater Management Design Manual, August 2010.



POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	Medium/High	Capital Cost	Medium
Commercial	Yes	Groundwater Recharge	Medium/High	Maintenance	Medium
Ultra Urban	Limited	Peak Rate	Medium	Winter Performance	Medium
Industrial	Yes	Erosion Reduction	Medium	Fast Track Potential	Medium
Retrofit	Yes	Flood Protection	Low/Medium	Aesthetics	High
Recreational	Yes	STORMWATER QUALITY FUNCTIONS			
Public/Private	Yes	Total Suspended Solids	High (70-90%)	Total Nitrogen	Medium 40-50%
Residential	Yes	Total Phosphorus	Medium (60%)	Temperature	High

Variations

- Subsurface storage/infiltration bed
- Use of underdrain
- Use of impervious liner

Key Design Features

- Flexible in size and configuration
- Typical ponding depth of 6 inches (maximum 18 inches) for drawdown within 48 hours
- Plant selection (native vegetation that is tolerant of hydrologic variability, salts, and environmental stress)
- Amend soil as needed
- Provide positive overflow for extreme storm events
- Provide stable inflow/outflow conditions
- A length to width ratio of 2:1 is recommended
- Design should include 6-12 inch layer of uniformly graded, clean washed gravel (1.5-2.0-inch diameter rock) under 12-18 inches of soil mix; if an underdrain is used (i.e. poor infiltration or hotspot), then use 12 inches of gravel and 18-24 inches of soil

Site Factors

- Water Table/ Bedrock Separation: 3-foot minimum
- Soils: HSG A and B preferred; C & D may require an underdrain
- Feasibility on steeper slopes: medium
- Potential Hotspots: yes with pretreatment and/or impervious liner
- Maximum loading ratio of 5:1 (impervious to garden area); not more than 1 acre to one rain garden

Maintenance

- Water, mulch, trim, prune, weed, and remove litter as needed
- Inspect for erosion, sediment buildup, and vegetation health
- Remove organic material approximately 2x/year
- Biannual inspection of cleanouts, inlets, outlets, etc.

Cost

- \$5-7 per cubic foot of storage to construct

Benefits

- Volume control & groundwater recharge, moderate peak rate control
- Versatile w/ broad applicability
- Enhance site aesthetics and habitat
- Potential air quality & climate benefits

Limitations

- Higher maintenance until vegetation is established
- Limited impervious drainage area to each garden
- Requires careful selection & establishment of plants



Residential rain garden at the Village at Springbrook Farm in Lebanon, PA



Rain garden at Woodlawn Library in Wilmington, DE.



Commercial rain garden in Traverse City, Michigan

Example Design Details:

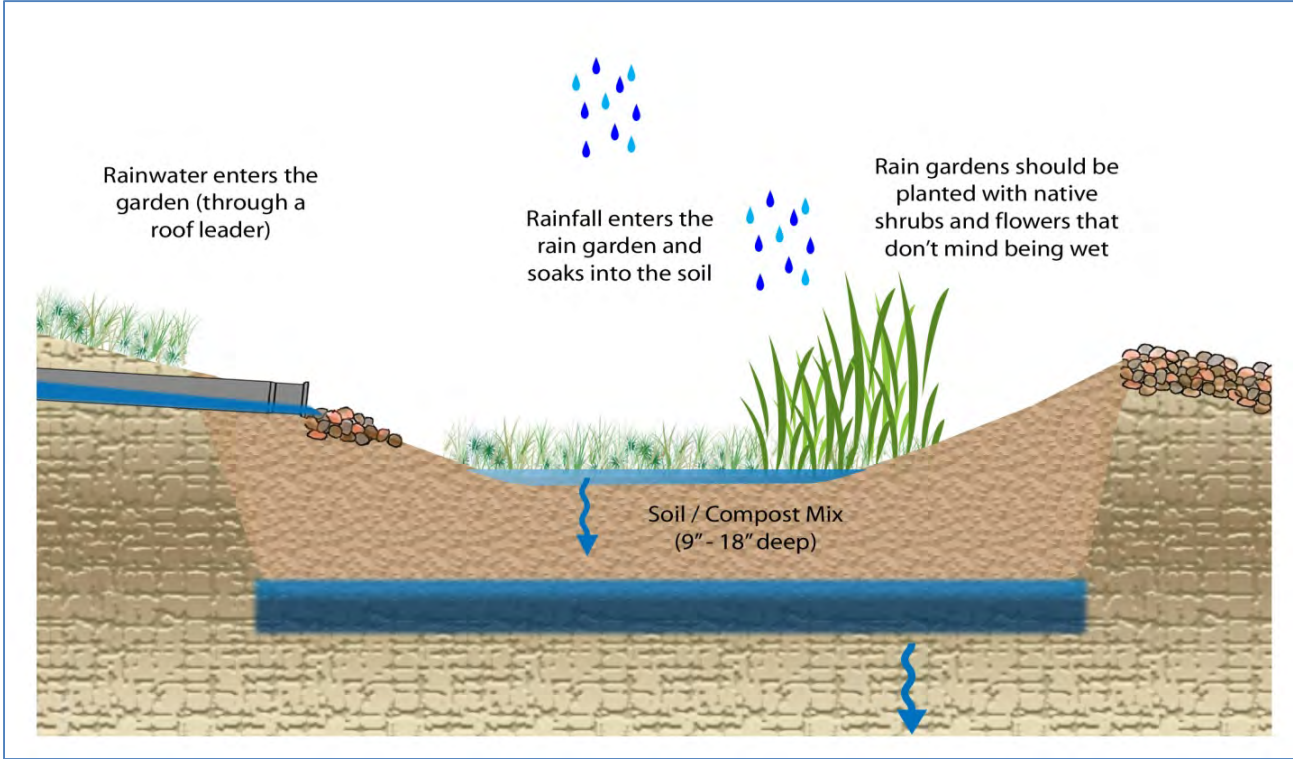


Figure 1: Typical rain garden section without a subsurface infiltration bed

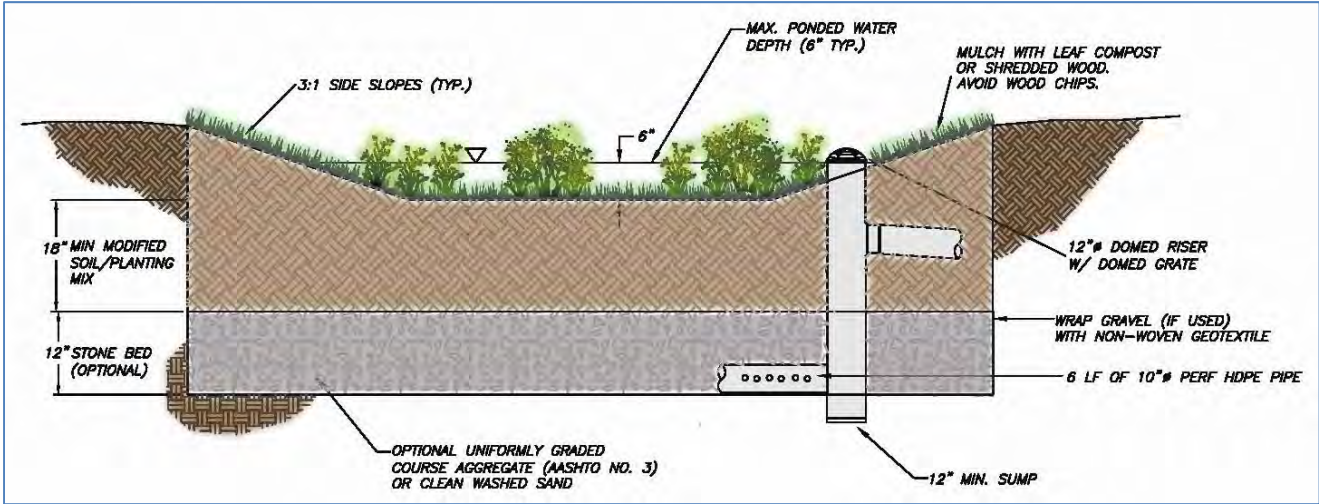


Figure 2: Typical rain garden section with a subsurface infiltration bed

FACT SHEET: Vegetated Roof

A vegetated roof cover is a veneer of vegetation that is grown on and covers an otherwise conventional flat or pitched roof, endowing the roof (< 30 degree slope) with hydrologic characteristics that more closely match surface vegetation than the roof. The overall thickness of the veneer typically ranges from 2 to 6 inches and may contain multiple layers, consisting of waterproofing, synthetic insulation, nonsoil engineered growth media, fabrics, and synthetic components. Vegetated roofs, also called “green rooftops” can be optimized to achieve water quantity and water quality benefits. Through the appropriate selection of materials, even thin vegetated covers can provide significant rainfall retention and detention functions.



Depending on the plant material and planned usage for the roof area, modern vegetated roofs can be categorized as systems that are intensive, semi-intensive, or extensive. **Intensive** vegetated roofs utilize a wide variety of plant species that may include trees and shrubs, require deeper substrate layers (usually > 4 inches), are generally limited to flat roofs, require ‘intense’ maintenance, and are often park-like areas accessible to the general public. **Extensive** vegetated roofs are limited to herbs, grasses, mosses, and drought tolerant succulents such as sedum, can be sustained in a shallow substrate layer (<4 inches), require minimal maintenance once established, and are generally not designed for access by the public.

These vegetated roofs are typically intended to achieve a specific environmental benefit, such as rainfall runoff mitigation. Extensive roofs are well suited to rooftops with little load bearing capacity and sites which are not meant to be used as roof gardens. **Semi-intensive** vegetated roofs fall between intensive and extensive vegetated roof systems. More maintenance, higher costs and more weight are the characteristics for this intermediate system compared to that of the extensive vegetated roof. For more detailed design guidance, refer to section 5.3.8 – Green Roofs of the New York State Stormwater Management Design Manual, August 2010.

POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Limited	Volume	Medium/High	Capital Cost	High
Commercial	Yes	Groundwater Recharge	N/A	Maintenance	Medium
Ultra Urban	Yes	Peak Rate	Medium	Winter Performance	Medium
Industrial	Yes	Erosion Reduction	Low/Medium	Fast Track Potential	Low
Retrofit	Yes	Flood Protection	Low/Medium	Aesthetics	High
Highway/Road	No	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	Medium	Total Nitrogen	Medium
Public/Private	Yes/Yes	Total Phosphorus	Medium	Temperature	Medium

Variations

- Single media system; Dual media system; Dual media system with synthetic layer; Intensive, Extensive, or Semi-intensive

Key Design Features

- Engineered media should have a high mineral content. Engineered media for extensive vegetated roof covers is typically 85% to 97% nonorganic.
- Vegetated roof covers intended to achieve water quality benefits should not be fertilized.
- Irrigation requirement depends on the green roof system selected. Extensive green roofs grown from cuttings need irrigation in the beginning.
- Internal building drainage, including provision to cover and protect deck drains or scuppers, must anticipate the need to manage large rainfall events without inundating the cover.
- Porous media should be included in drainage layer in order to store water for plant uptake and allow storm buffering
- Assemblies planned for roofs with pitches steeper than 2:12 (9.5 degrees) must incorporate supplemental measures to insure stability against siding.
- The roof structure must be evaluated for compatibility with the maximum predicted dead and live loads. Typical dead loads for wet extensive vegetated covers range from 8 to 36 pounds per square foot.
- The waterproofing must be resistant to biological and root attack. In many instances a supplemental roof-fast layer is installed to protect the primary waterproofing.
- Plants best suited to weather conditions that exist on a roof should be selected. Plants typically native to seashore, alpine, and desert regions are equipped to cope with such environments.

Maintenance

- Once vegetation is established, little to no maintenance needed for the extensive system

Cost

- Depends on building height, accessibility, depth/complexity of assembly, remoteness from material sources, and size
- Typical range: \$15-20 per square foot (not including waterproofing)

Benefits

- High runoff volume reduction (annual basis)
- Insulation from heat, cold and outside noise (Energy savings)
- Moderate ecological value and habitat
- High aesthetic value
- Urban heat island reduction
- Improve air quality

Limitations

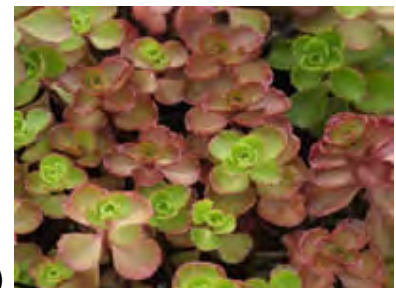
- Higher maintenance needs until vegetation is established
- Need for adequate roof structure; can be challenging on retrofit application
- Extreme weather conditions may inhibit plant survival



Vegetated Roof at SUNY-ESF in Syracuse, NY



Residential vegetated roof in the City of Lancaster; (Source: LiveGREEN)



a)



b)

a) Sedum spurium; b) Sedum "Green Spruce"; (Source: Apex Green Roofs)

Example Design Details:

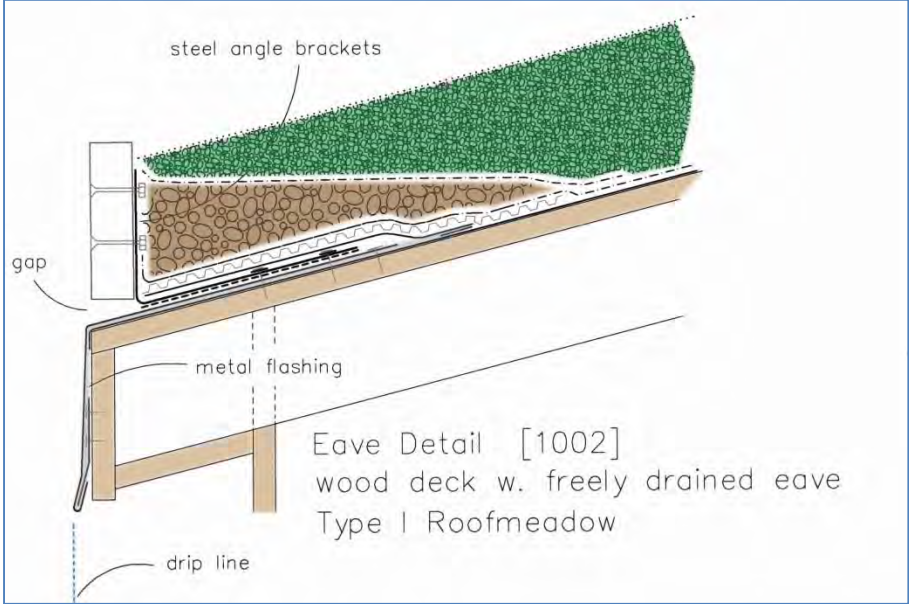
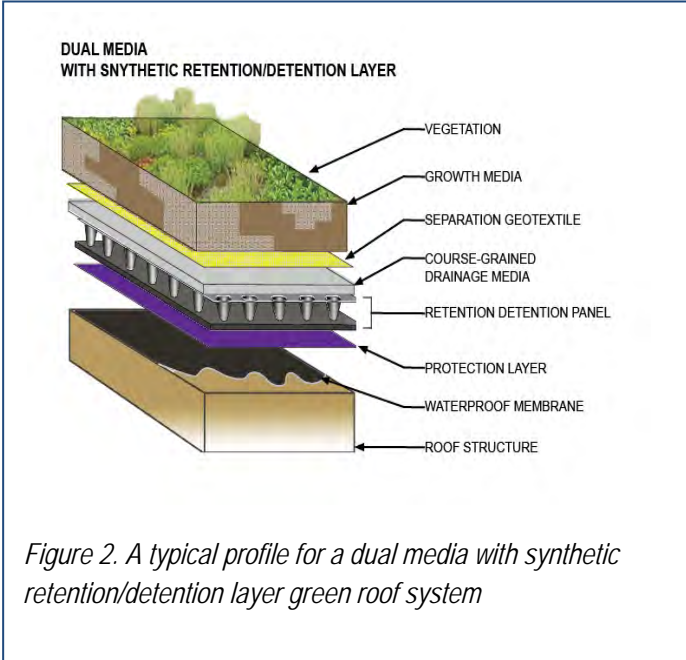
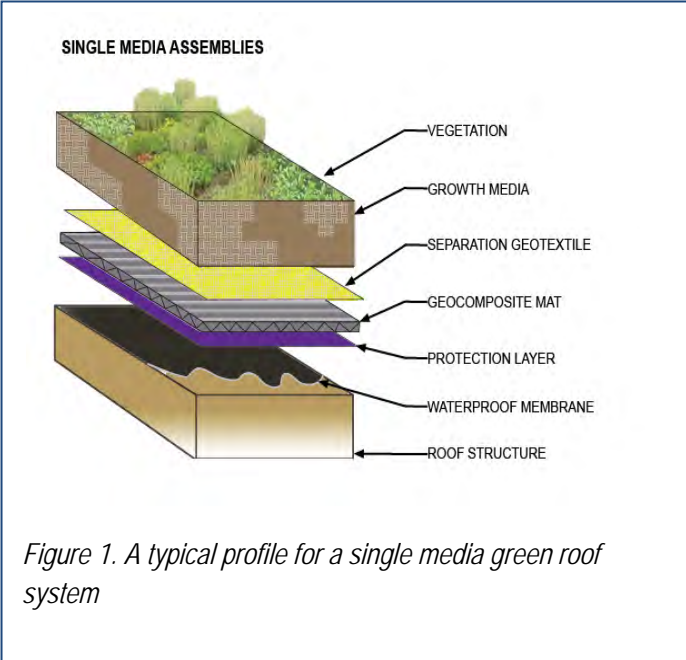


Figure 3. Example eave detail for sloped roof (courtesy Roofscapes, Inc.)

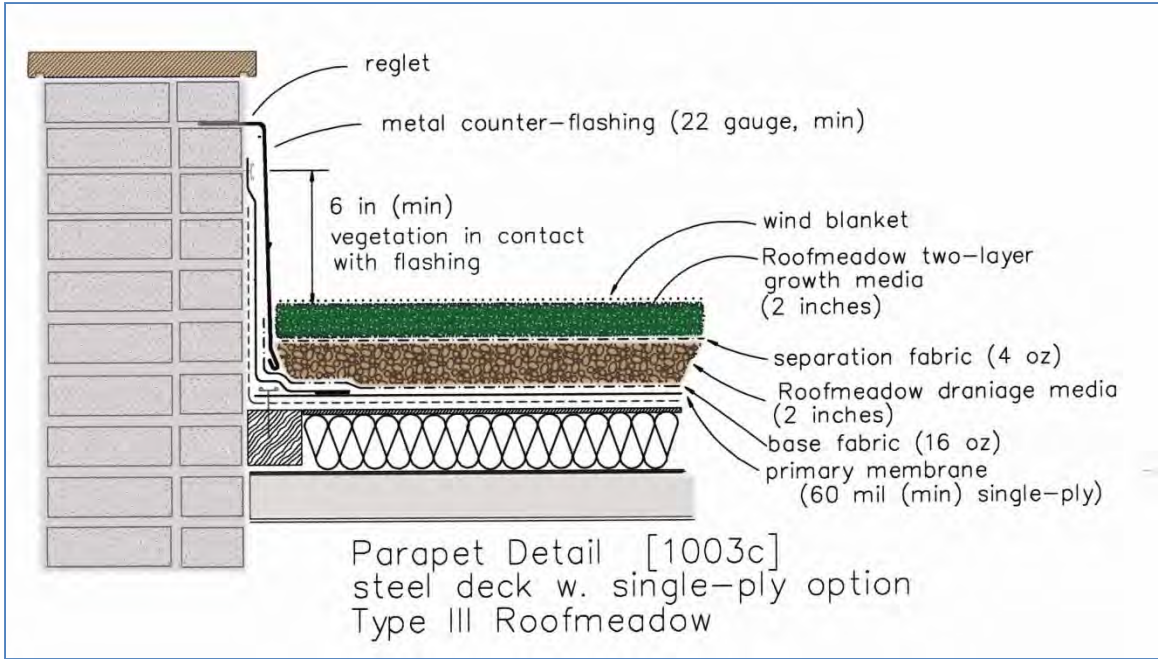


Figure 4. Example parapet flashing detail (courtesy Roofscapes, Inc.)

Local Project Examples:

1. Onondaga County Correctional Facility

Project Name: Onondaga County Correctional Facility
Date Completed: September 15, 2009
Location: Jamesville, NY, USA
Building Type: Municipal/Government
Type: Extensive, Test/Research
Size: 7500 sq.ft.
Slope: 2%
Access: Inaccessible, Private
Objective: mitigating stormwater problems
Specifics: The greenroof slope of ¼":12" has a fully adhered Carlisle TPO system and includes a MiraDRAIN G4 drainage composite, 3" of extensive growth media, and seven varieties of Sedum.



(Source: Greenroofs.com)

2. SUNY ESF Green Roof

Project Name: University of Syracuse, Baker Lab (SUNY ESF)
Year: 2005
Location: Syracuse, NY, USA
Building Type: Educational
Type: Extensive
Size: 7000 sq.ft.
Slope: 1.5%
Access: Accessible, Private
(Source: Greenroofs.com)



ESF green roof in early summer

(Source: <http://www.esf.edu/sustainability/action/greenroof.htm>)

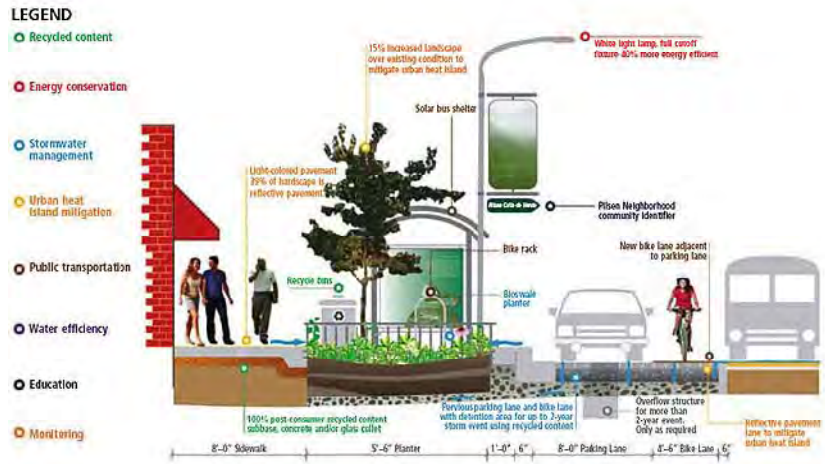


ESF green roof planting

(Source: <http://www.esf.edu/sustainability/action/greenroof.htm>)

FACT SHEET: Green Street

Green Streets incorporate a wide variety of Green Infrastructure (GI) elements including street trees, porous pavement, rain gardens, water quality devices/inserts, planter boxes and swales. Although the design and appearance of Green Streets will vary, the functional goals are the same: provide source control of stormwater, limit its transport and pollutant conveyance to the collection system, restore predevelopment hydrology to the extent possible, and provide environmentally enhanced roads. Also, other benefits include aesthetics, safety, walkability, and heat island reduction.



Cross section through a green street showing the various components and benefits (Source: Chicago Department of Transportation)

Green Street technologies can be applied to residential, commercial and arterial streets, as well as to alleys. The range of GI technologies that can be incorporated into a Green Street allow its developer to manipulate the stormwater management strategy of a given project.

For specific details on the individual GI technologies (e.g., porous pavement, rain gardens, planter boxes, etc) that can be incorporated into a Green Street, please consult the specific GI fact sheet. For more detailed design guidance, refer to sections 5.3.3 – Vegetated Swale, 5.3.4 – Tree Planting/Tree Pit, 5.3.7 – Rain Gardens, 5.3.9 – Stormwater Planters, 5.3.11 – Porous Pavement, 6.3 – Stormwater Infiltration, 6.4 – Stormwater Filtering Systems, and 6.5 – Open Channel Systems of the New York State Stormwater Management Design Manual, August 2010, as well as the EPA’s “A Conceptual Guide to Effective Green Streets Design Solutions – Residential Streets, Commercial Streets, Arterial Streets, and Alleys”.

POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	Medium	Capital Cost	Medium
Commercial	Yes	Groundwater Recharge	Medium	Maintenance	Medium/High
Ultra Urban	Yes	Peak Rate	Medium	Winter Performance	High
Industrial	Yes	Erosion Reduction	Medium	Fast Track Potential	Low/Medium
Retrofit	Yes	Flood Protection	Low/Medium	Aesthetics	High
Highway/Road	Yes	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	High (70-90%)	Total Nitrogen	Medium (40-50%)
Public/Private	Yes	Total Phosphorus	Medium (60%)	Temperature	High

Key Design Features

- Porous pavement (street and/or sidewalk)
- Vegetated curb extensions
- Infiltration planters
- Infiltration trenches
- Enhanced tree plantings; native species that are salt and pH tolerant with a porous pavement-friendly seed/fruit (if necessary); species selection should consider shade and/or stormwater capture requirements
- Water quality inlets or filter inserts
- See individual GI fact sheets: Porous Pavement, Infiltration Practices, Rain Garden, Tree Trench and Enhanced Street Trees, and Inlet Filter Inserts

Site Factors

- Slope
- Soils
- Utilities
- Extent of right-of-way
- See site factors for individual GI practices

Maintenance

- See maintenance requirements for individual GI practices

Cost

- \$120-\$190 per linear foot of block managed (i.e. capture of 1" of runoff)

Benefits

- Balance parking spaces with landscape space
- Utilize surface conveyance of stormwater
- Add significant tree canopy
- Provide alternative transportation options/improve walkability
- Increased pedestrian safety, improved aesthetics
- Reduction of urban heat island
- Reduced runoff volume, increased groundwater recharge and evapotranspiration
- Significant public education potential
- Enhanced tree health/longevity

Limitations

- Maintenance needs
- Utility conflicts
- Conflicts with structures and other infrastructure (building foundations, etc)



Rain garden along New York street (Source: NYC Department of Parks and Recreation)



Route 9A, NYC, Source: New York Sustainable Stormwater Management Plan



Infiltration trench retrofit at Gorland Ave in Syracuse, NY

Example Design Details:

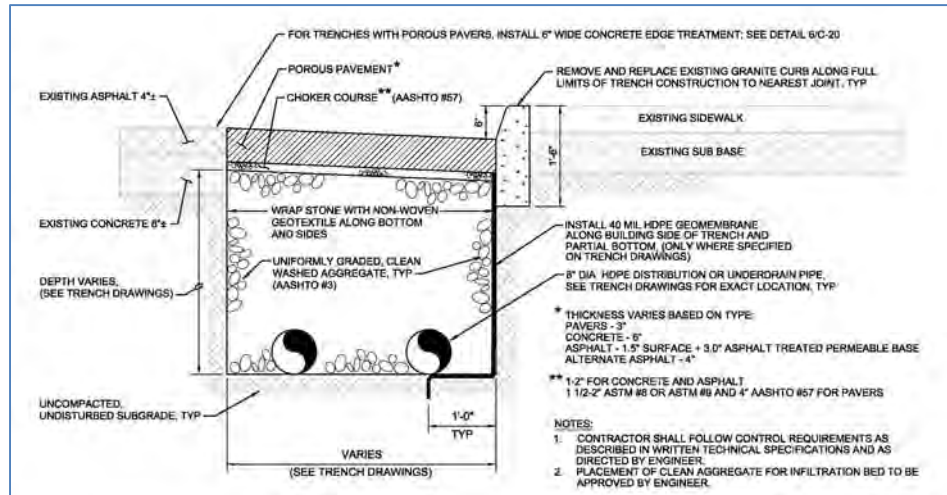


Figure 1: Typical stormwater trench under street

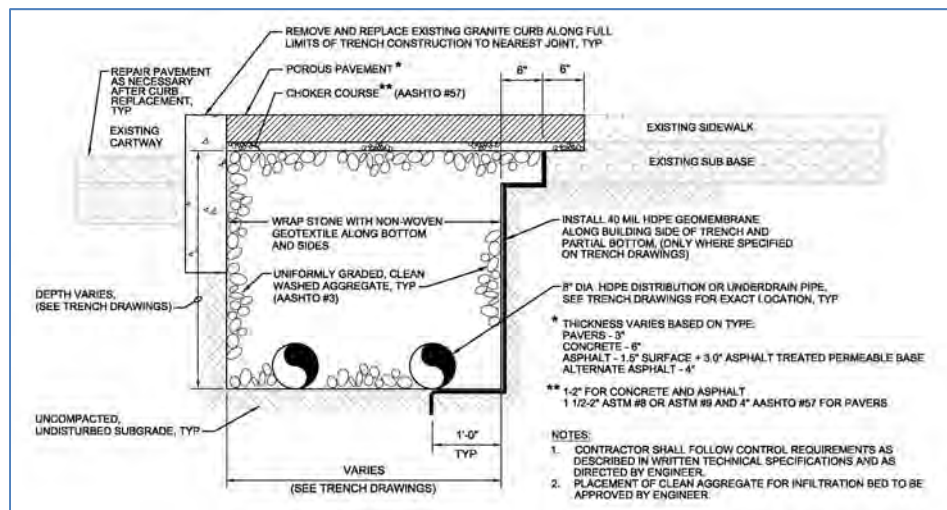


Figure 2: Typical stormwater trench under sidewalk

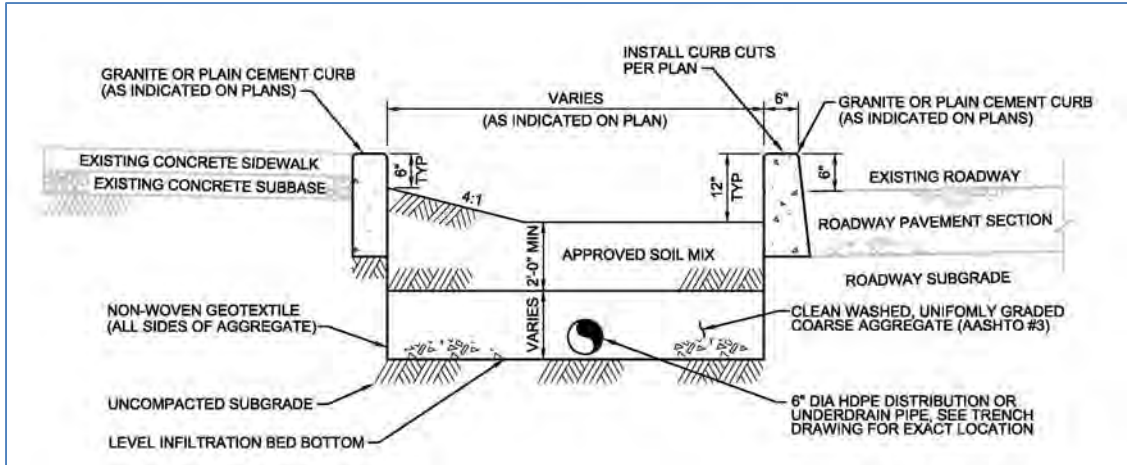


Figure 3: Vegetated curb extension with infiltration trench

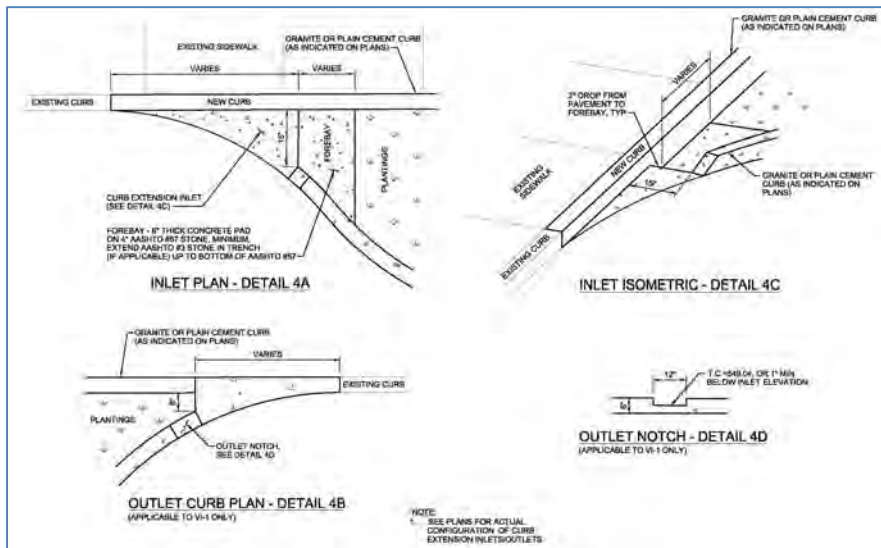


Figure 4: Inlet/outlet for curb extensions

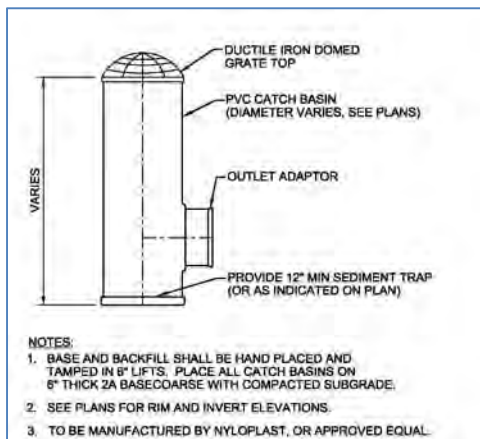


Figure 5: Domed outlet riser structure

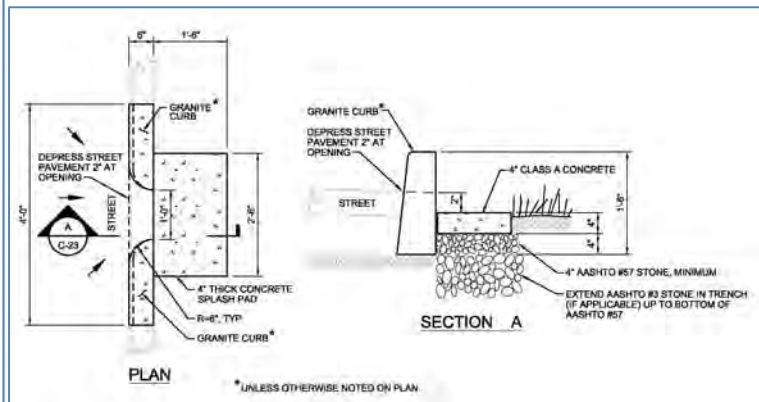


Figure 6: Curb cut

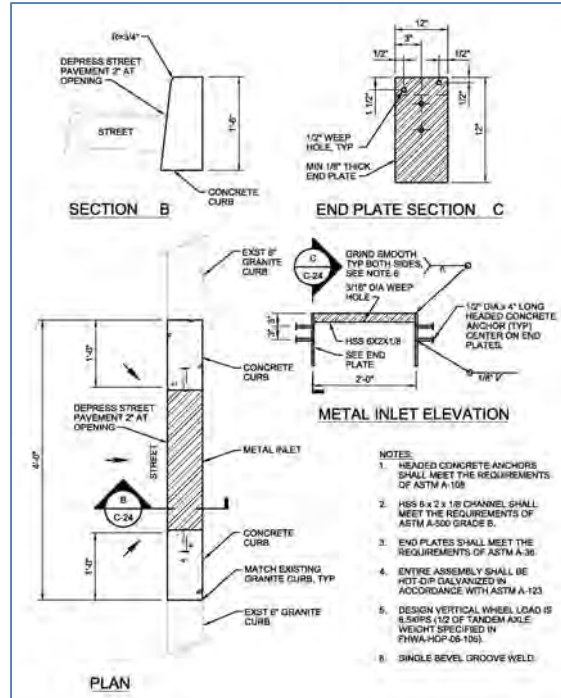


Figure 9: Metal curb inlet

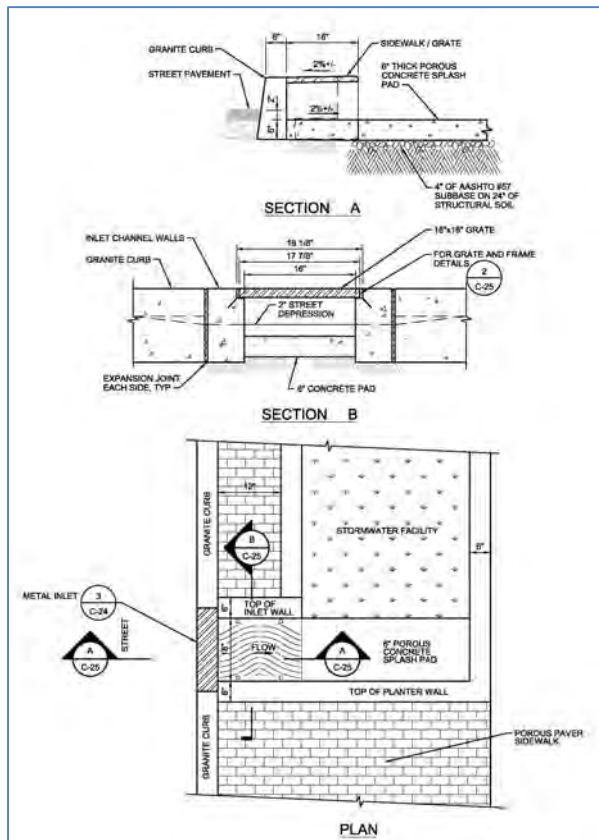


Figure 10: Channel and grate

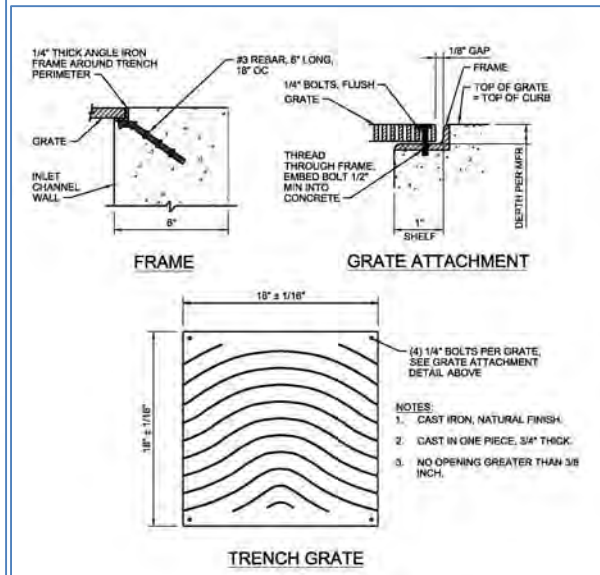


Figure 11: Trench grate and frame

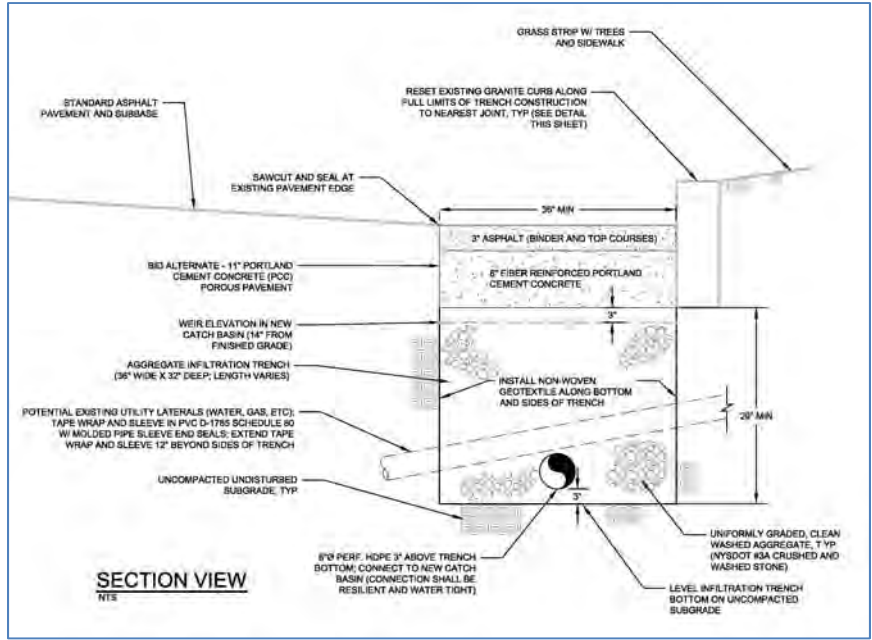


Figure 12: Street infiltration trench (section)

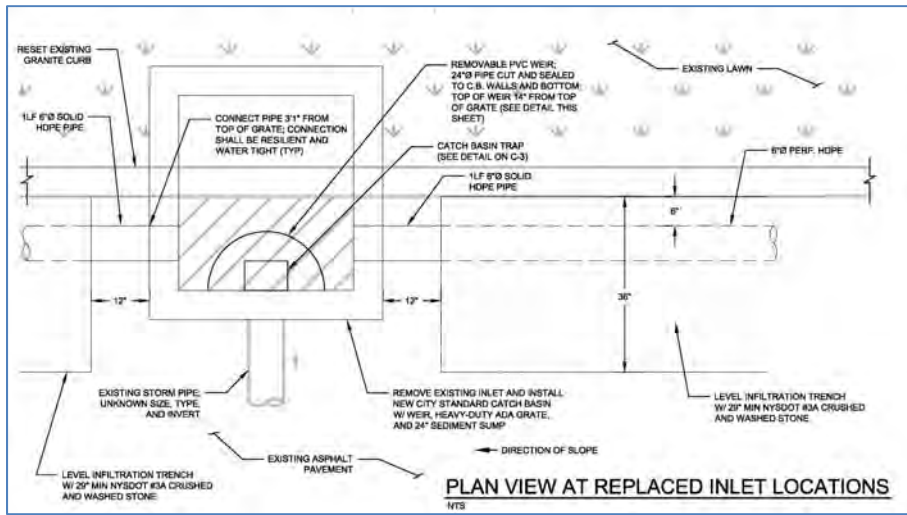
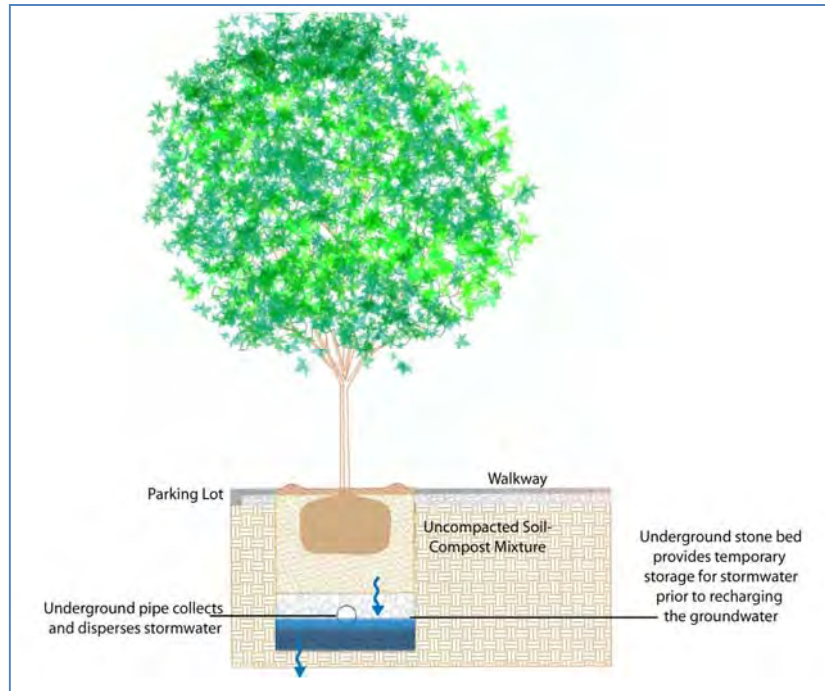


Figure 13: Street infiltration trench (plan)

FACT SHEET: Tree Trench and Enhanced Street Trees

Tree trenches perform the same functions that other infiltration practices perform (infiltration, storage, evapotranspiration etc.) but in addition provide an increased tree canopy.

For more detailed design guidance, refer to sections 5.3.3 – Vegetated Swale, 5.3.4 – Tree Planting/Tree Pit, 5.3.9 – Stormwater Planters, 5.3.11 – Porous Pavement, 6.3 – Stormwater Infiltration, and 6.5 – Open Channel Systems of the New York State Stormwater Management Design Manual, August 2010, as well as the City of Syracuse Forestry Standards and Specifications (May 2003), “Tree Space Design – Growing the Tree Out of the Box”, and “Up By Roots” by James Urban.



POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	Medium	Capital Cost	Medium
Commercial	Yes	Groundwater Recharge	Medium	Maintenance	Medium
Ultra Urban	Yes	Peak Rate	Medium	Winter Performance	High
Industrial	Yes	Erosion Reduction	Medium	Fast Track Potential	High
Retrofit	Yes	Flood Protection	Low/Medium	Aesthetics	High
Highway/Road	Yes	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	High (70-90%)	Total Nitrogen	Medium (40-50%)
Public/Private	Yes	Total Phosphorus	Medium (60%)	Temperature	High

Variations

- Structural soil or alternative (eg. Silva Cell) under pavement
- Porous pavement tree grates
- Open vegetated tree trench strip (planted with ground cover or grass)
- Utilize uniformly graded and washed coarse aggregate (NYSDOT No. 3A) or alternate storage media (modular storage units)

Key Design Features

- Flexible in size and infiltration
- Native species that are salt and pH tolerant with a porous pavement-friendly seed/fruit (if necessary); species selection should consider shade and/or stormwater capture requirements
- Quick drawdown; avoid prolonged periods of inundation (either above or below ground); provide underdrain if necessary
- Linear infiltration/storage trench
- Provide 600-1000cf of soil per tree (minimum 2 in/hr permeability); 3ft minimum soil depth
- Adequate tree species selection and spacing; species selection and spacing shall be coordinated with City Arborist; typical spacing is 10-20ft on center
- New inlets, curb cuts, or other means to introduce runoff into the trench

Site Factors

- Overhead clearance; potential utility conflicts; Sight distances
- Adequate space for root zone
- Water table
- Soil permeability/limiting zones

Maintenance

- Water, mulch, treat diseased trees, and remove litter as needed
- Annual inspection for erosion, sediment buildup, vegetative conditions
- Biannual inspection of cleanouts, inlets, outlets, etc.

Cost

- \$850 per tree
- For tree infiltration trench: \$120-\$190 per linear foot of block managed (i.e. capture of 1" of runoff)

Benefits

- Increased canopy cover
- Enhanced site aesthetics
- Air quality and climate benefits
- Runoff reductions; Water quality benefits
- High fast track potential
- Enhanced tree health/longevity

Limitations

- Requires careful selection of tree species
- Requires appropriate root zone area
- Utility conflicts, including overhead electric wires, posts, signs, etc.
- Conflicts with other structures (basements, foundations, etc.)



Tree trench with porous pavers and subsurface infiltration bed, located in City Lot No. 21, Syracuse, NY



Tree trench located at Upper Darby Park outside of Philadelphia, PA



Tree trench in urban setting (Viridian Landscape Studio)

FACT SHEET: Cistern/Rain Barrel

Cisterns and Rain Barrel are structures designed to intercept and store runoff from rooftops to allow for its reuse, reducing runoff volume and overall water quality impairment. Stormwater is contained in the cistern or rain barrel structure and typically reused for irrigation or other water needs. This GI technology reduces potable water needs while also reducing stormwater discharges.

Rain Barrel – rooftop downspouts are directed to an above-ground (typically) structure that collects rainwater and stores it until needed for a specific use, usually landscape irrigation. **Cistern** – Underground (typically) container or tank with a larger storage capacity than a rain barrel, and typically used to supplement greywater needs (i.e. toilet flushing) in a building, as well as irrigation. **Hybrid planter/rain barrel** - combines elements of both planter boxes and rain barrels.

Cisterns and rain barrels can be used in urbanized areas where the need for supplemental onsite irrigation or other high water uses is especially apparent. For more detailed design guidance, refer to sections 5.3.9 – Stormwater Planters and 5.3.10 – Rain Barrels and Cisterns of the New York State Stormwater Management Design Manual, August 2010.



POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	Low/Medium	Capital Cost	Low/Medium
Commercial	Yes	Groundwater Recharge	Low	Maintenance	Medium
Ultra Urban	Yes	Peak Rate	Low	Winter Performance	Medium
Industrial	Yes	Erosion Reduction	Low	Fast Track Potential	Medium/High
Retrofit	Yes	Flood Protection	Low/Medium	Aesthetics	Low/Medium
Highway/Road	N/A	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	Medium	Total Nitrogen	Medium
Public/Private	Yes/Yes	Total Phosphorus	Medium	Temperature	Medium

Variations

- Rain barrels
- Cisterns, both underground and above ground
- Tanks
- Storage beneath a surface using manufactured products
- Hybrid planters/rain barrels
- Various sizes, materials, shapes, etc.



Key Design Features

- Size of roof (catchment area)
- First flush bypass
- Water demand
- Rain barrel/cistern capacity
- Small storm events are captured with most structures
- Provide overflow for large storms events
- Discharge water before next storm event
- Consider site rainfall pattern, topography, placing structure upgradient of planting (if applicable) in order to eliminate pumping needs
- For hybrid planters/rain barrels, incorporate open reservoir for runoff storage below planting soil (separated by “false bottom” with weep holes); provide overflow just below soil; line soil bottom with geocomposite drainage mat

Site Factors

- Water table to bedrock depth – (must be considered only for subsurface systems)
- Potential hotspots – yes with treatment

Maintenance

- Discharge before next storm event
- Cisterns, rain barrels, and downspouts leading to them should be inspected regularly and cleaned
- The seals should be inspected periodically to prevent mosquito infestation
- May require flow bypass valves during the winter

Cost

- Rain Barrels \$100 to \$300
- Cisterns start at \$500

Benefits

- Provides supplemental water supply for irrigation and other nonpotable water use
- Reduces potable water use and the associated costs
- Reduced stormwater runoff impacts including downstream management and treatment system
- In the case of hybrid planters/rain barrels, can improve site aesthetics

Limitations

- Manages only relatively small storm events
- Typically requires additional management of runoff
- Requires a use for the stored water (irrigation, gray water, etc.)



Custom rain barrels in Wilmington, DE



Rain barrels in the City of Lancaster, PA
(Source: LiveGREEN)

FACT SHEET: Downspout Disconnection

In urban areas, roof runoff flows through gutters and downspouts and out to the storm or combined sewer. Disconnecting downspouts is the process of separating roof downspouts from the sewer system and redirecting roof runoff onto pervious surfaces. This reduces the amount of directly connected impervious area in a drainage area and also prevents basement flooding due to sewer backup during a storm.

For disconnection to be safe and effective, each downspout must discharge into a suitable receiving area. Roof runoff can be redirected to a garden, yard, planter, filtration/infiltration area, or a rain barrel or cistern for eventual reuse. Runoff must not flow toward building foundations or onto adjacent property.

A plan for downspout disconnection will work with the existing downspouts on a building assuming there is an adequate receiving area; however, for buildings with internal drainage, disconnecting internal downspouts may be difficult or impractical. For more detailed design guidance, refer to section 5.3.5 – Disconnection of Rooftop Runoff of the New York State Stormwater Management Design Manual, August 2010.



POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	Medium	Capital Cost	Low
Commercial	Yes	Groundwater Recharge	Medium/High	Maintenance	Low
Ultra Urban	Yes	Peak Rate	Medium	Winter Performance	High
Industrial	Yes	Erosion Reduction	Medium	Fast Track Potential	Low/Medium
Retrofit	Yes	Flood Protection	Low	Aesthetics	High
Highway/Road	N/A	STORMWATER QUALITY FUNCTIONS			
Recreational	Yes	Total Suspended Solids	Medium	Total Nitrogen	N/A
Public/Private	Yes	Total Phosphorus	N/A	Temperature	Medium/High

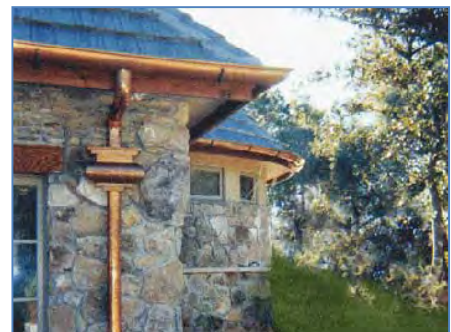
Variations

- Scuppers
- Drip chains
- Decorative gargoyles
- Various receiving GI technologies: rain garden, infiltration systems, rain barrel, etc.

Decorative Downspouts



(Source: Groovygreen.com)



(Source: Rutlandguttering.com)

Key Design Features

- Install splashblock at the end of the extension to prevent erosion
- Limit the contributing rooftop area to a maximum of 500 sq ft per downspout; larger roof areas up to 2,000 sq ft may be acceptable with level spreader
- Roof runoff must be discharged at least 5 feet away from the nearest property line and 10 feet from the nearest impervious surface
- Maximum contributing flow path length from impervious area shall be 75 feet
- Disconnected downspouts must be extended 4 to 6 feet from a basement foundation wall and at least 2 feet from an at-grade foundation or crawlspace
- Downspouts should not be disconnected: on slopes over 10% (average should be 5%), within 10 feet of a retaining wall, directly over a septic tank, drain field or underground oil tank unless they are no longer in use
- Rooftop runoff may also be directed to on-site depression storage areas

Maintenance

- Check materials for leaks and defects
- Remove accumulated debris, especially from gutters

Cost

- Inexpensive (excluding receiving GI technology); materials are readily available at hardware store

Benefits

- Provides supplemental water supply when used in conjunction with capture/reuse systems such as rain barrel and cistern
- Prevents sewer backup and subsequent basement flooding during storm events
- Related cost savings and environmental benefits
- Reduced runoff volume, CSOs, peak rate, and hence the demand on the sewer system, protecting the quality of rivers, streams and groundwater

Limitations

- Internal drainage more difficult to disconnect
- Do not disconnect onto adjacent property owner
- Need adequate receiving area



*Residential downspout disconnect in Portland Oregon
(Source: Portland Stormwater Website)*



Residential downspout disconnection in Lancaster, PA

Example Design Details:

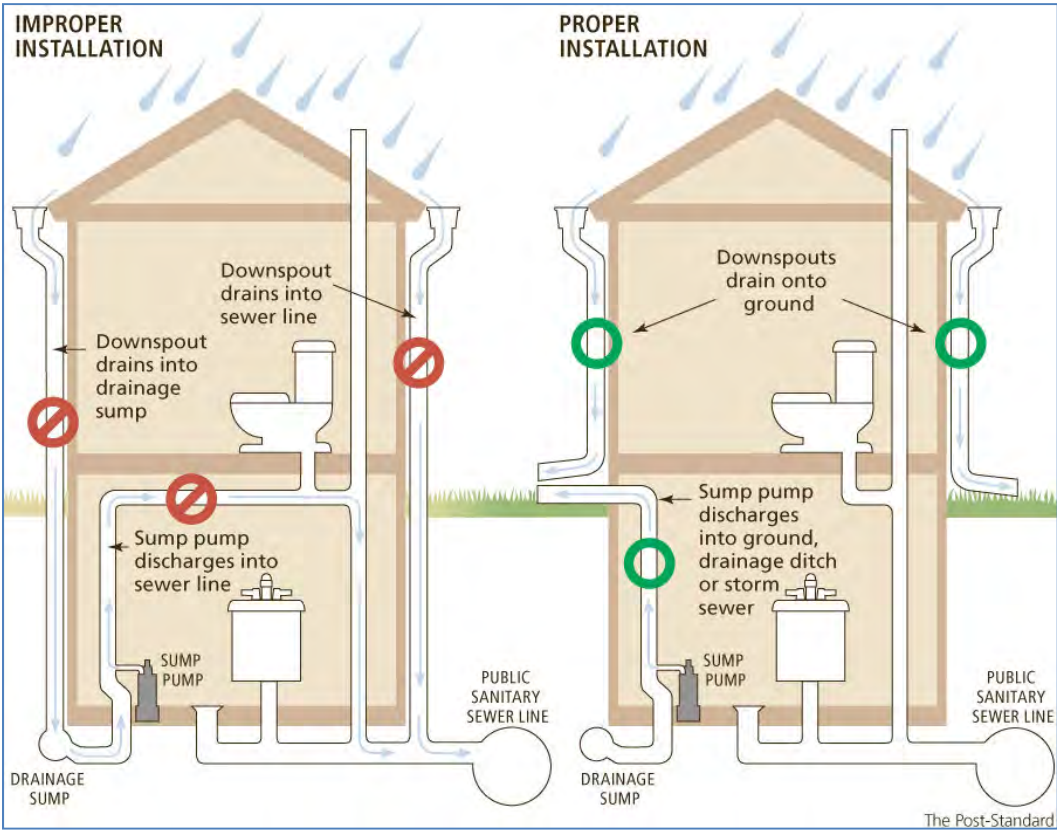


Figure 1: Installation of downspout disconnection (typical) (Source:www.syracuse.com)

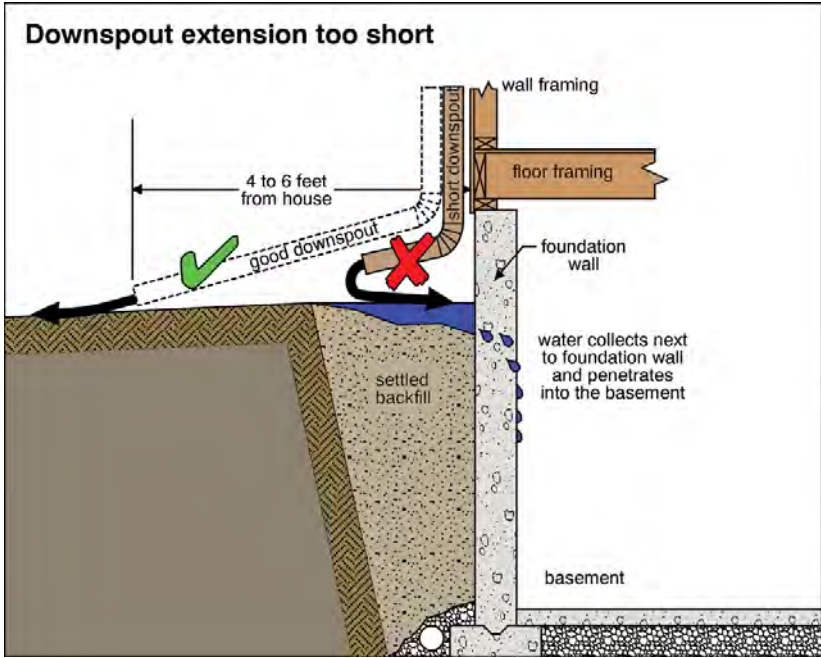


Figure 2: Recommended downspout extension length (Source: homestars.com)

Disconnecting Downspouts

(Source: Environmental Services, City of Portland, Oregon)

A. Measure the existing downspout from the top of the standpipe and mark it at about 9 inches above the standpipe. You may need to cut the downspout higher depending on the length of your extension.

B. Cut the existing downspout with a hacksaw at the mark. Remove the cut piece.

C. Plug or cap the standpipe using an in-pipe test plug or an over-the-pipe cap secured by a hose clamp. Do NOT use concrete to seal your standpipe.

D. Attach the elbow. Be sure to attach the elbow OVER the downspout. Do NOT insert the elbow up inside the downspout or it will leak. If the elbow does not fit over the downspout, use crimpers or needle-nose pliers to crimp the end of the cut downspout so it slides INSIDE the elbow.

E. Measure and cut the downspout extension to the desired length. Attach the extension to the elbow by slipping the extension OVER the end of the elbow. Do NOT install the elbow over the extension or it will leak. The length of the extension will depend on site conditions and where you want the downspout to drain.

- Downspouts must drain at least 6 feet from basement walls and at least 2 feet from crawl spaces and concrete slabs.
- The end of the downspout must be at least 5 feet from your property line, and possibly more if your yard slopes towards your neighbor's house.

F. Secure the pieces with sheet metal screws at each joint where the downspout, elbow, and extension connect. It helps to pre-drill holes for the screws.

G. Using a splash block at the end of the extension is optional, but it will help prevent soil erosion.

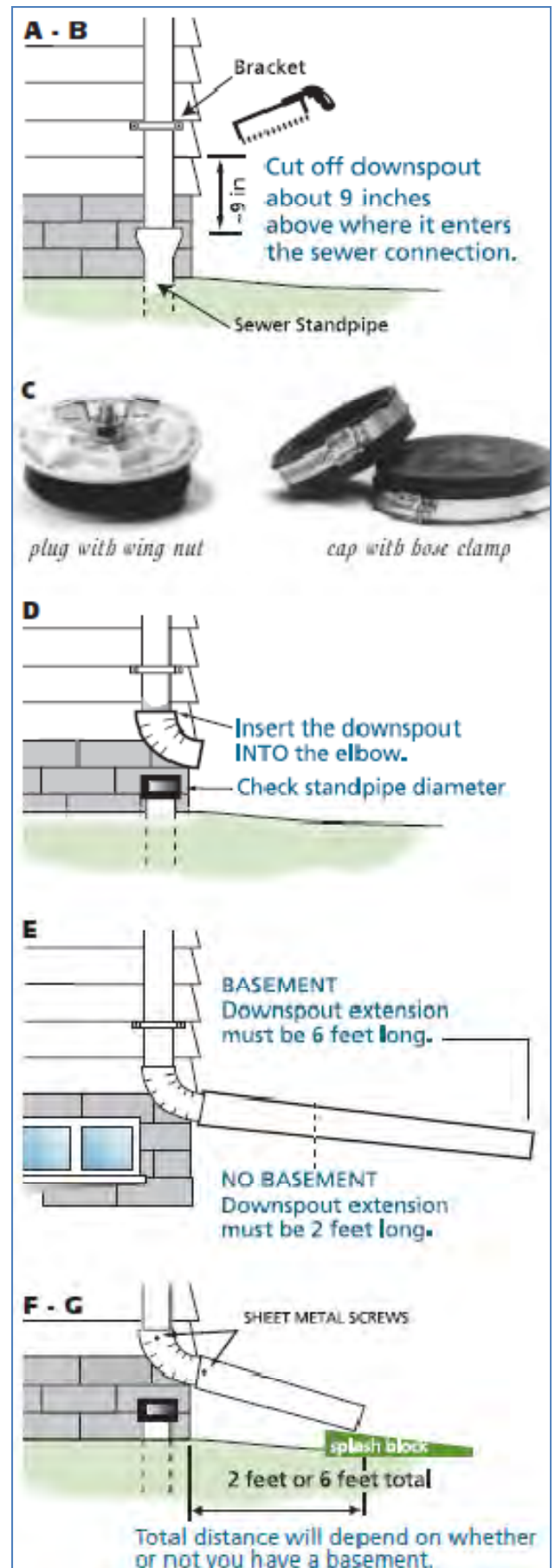


Figure 3: Recommended downspout disconnection guidelines (Source: Environmental Services, City of Portland, Oregon)



Figure 5: Example of downspout disconnection to rain garden (Source: The City of Gresham, Oregon Website)



Figure 6: Example of downspout disconnection to rain barrel
(Source: Onondaga County, New York <ongov.net>)

FACT SHEET: Inlet Filter Inserts (Catch Basin Inserts)

An Inlet Filter Insert (or Catch Basin Insert) is a device that reduces stormwater pollution from runoff, without requiring any land use. These devices are typically attached to the entrance of, or mounted inside of, a catch basin in order to filter incoming runoff. Though they vary in configuration and size, these devices all generally consist of a filter for low flows and overflow/bypass outlets for high flows. These devices are generally configured to remove pollutants including coarse sediment, oil and grease, litter, and debris. Some filtration devices employ additional absorbent/adsorbent material for removal of toxic pollutants. Pollutants attached to sediment such as phosphorus, nitrates, and metals may be removed from stormwater by effective filtration or settling of suspended solids. Regular maintenance is critical for the continued proper functioning of Catch Basin Inserts.

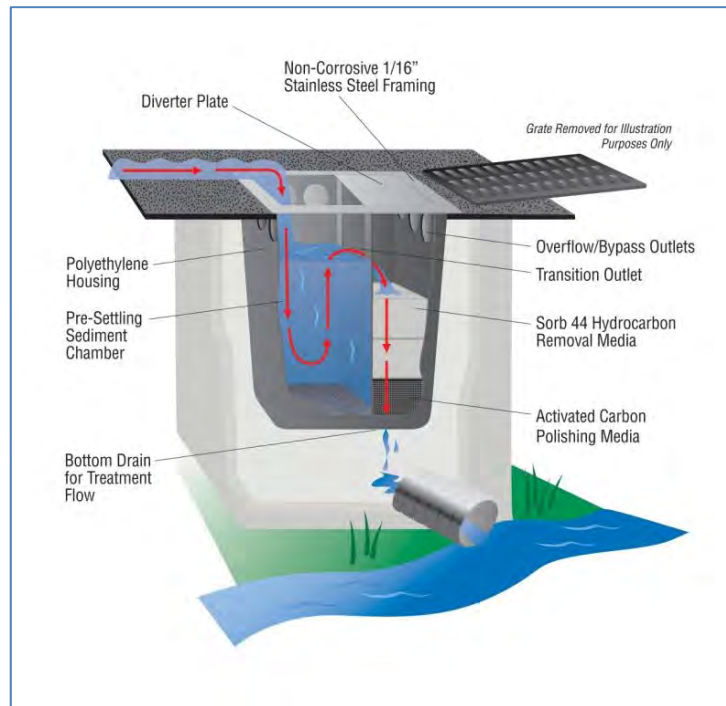


Figure 1: Hydro-Kleen Filtration System

For design guidance on proprietary water quality inlets, including hydrodynamic systems (gravity and vortex separators), wet vaults, and media filters, refer to section 9.5 – Alternative Stormwater Management Practices – Proprietary Practices of the New York State Stormwater Management Design Manual, August 2010, as well as the following references: “Assessment of Proprietary and Nonproprietary Products for Pretreatment of Larger Discharges” by the Center for Watershed Protection (April 2001) and “Field Study of Catch Basin Inserts for the Removal of Pollutants from Urban Runoff” by Callipo, Graves, Khan, Kostarelos, and Velasquez (June 2010). In addition, for a list of the New York State verified proprietary stormwater management practices for redevelopment projects, see: <http://www.dec.ny.gov/chemical/29089.html>

POTENTIAL APPLICATIONS		STORMWATER QUANTITY FUNCTIONS		ADDITIONAL CONSIDERATIONS	
Residential	Yes	Volume	None	Capital Cost	Varies
Commercial	Yes	Groundwater Recharge	None	Maintenance	Varies
Ultra Urban	Yes	Peak Rate	None	Winter Performance	High
Industrial	Yes	Erosion Reduction	None	Fast Track Potential	High
Retrofit	N/A	Flood Protection	None	Aesthetics	Low
Highway/Road	N/A	STORMWATER QUALITY FUNCTIONS			
Recreational	N/A	Total Suspended Solids	Varies (60%)	Total Nitrogen	Varies (20%)
Public/Private	N/A	Total Phosphorus	Varies (50%)	Temperature	None

Variations

- Various types, configurations, and sizes
- Absorbent pouches
- Acceptable products include, but are not limited to: Ultra Urban Filter, FloGard Plus, Hydro-Kleen, and the Siltsack (only where the collection of sediment is required)

Key Design Features

- Insert shall have an “initial” filtering bypass and an “ultimate” high flow bypass feature
- Follow manufacturer’s guidelines and sizing considerations (many manufacturers will determine the most appropriate device type and size to meet project needs)
- Located below ground, as part of the stormwater conveyance system or pretreatment for other BMPs
- Storage capacity shall be 80% of maximum solids collection prior to impeding filtering bypass

Site Factors

- High sediment loads
- Trees (high potential for leaf litter)

Maintenance

- Follow the manufacturer’s guidelines for maintenance taking into account expected sediment and pollutant load and site conditions
- Inspect each water quality device at least twice per year and after all major storm events if possible
- For areas with high leaf volumes, inserts should be inspected once every 2 weeks during the fall, as leaf litter can affect the operation of the insert

Cost

- Varies widely according to manufacture, type, and size of water quality devices
- Annual maintenance costs range from \$600-650 per insert

Benefits

- Can be used in a variety of applications including retrofitting existing stormwater systems
- Provides important pretreatment for other GI technologies
- Relatively easy to maintain

Limitations

- Virtually no water quantity benefits
- Typically require frequent maintenance
- Snow accumulation complicates inspection and maintenance of the inserts



Filtration insert with debris in St. Clair Shores, MI. Source: Environmental Consulting & Technology, Inc



FloGard Plus by KriStar



Ultra Urban Filter

**Table of Green Infrastructure Standard Maintenance
Procedures**

Table 1: Summary Matrix of Standard Maintenance Procedures (SMPs)

SMP ID #	Maintenance Task	GI Asset Included
SMP-01	Porous Pavement Vacuuming	Porous Asphalt, Porous Concrete, Porous Pavers, Flexible Pavement
SMP-02	Porous Pavement Power Washing	Porous Asphalt, Porous Concrete, Flexible Pavement
SMP-03	Porous Paver Maintenance (Restoring Aggregate)	Porous Pavers only
SMP-04	Stormwater Structure Cleaning	Catch basins, Inlets, Manholes, Observation Wells, Cleanouts, Domed PVC Risers
SMP-05	Inlet Filter Insert Cleaning or Filter Insert Pouch Replacement	Inlet Filter Bags/Filter Inserts
SMP-06	Green Roof Maintenance	Green Roof
SMP-07	Riverstone Edge Maintenance	Riverstone Edge/Stone Gutter (edge of Parking Lots)
SMP-08	Winter Maintenance for Porous Pavements	Porous Asphalt, Porous Concrete, Porous Pavers, Flexible Pavement
SMP-09 (a, b, c)	Landscape General Maintenance/Weeding/Mulching	Trees, Planters, Plant Beds, Rain Gardens, Bioswales, Meadows
SMP-10 (a, b)	Landscape Watering	Trees, Planters, Plant Beds, Rain Gardens, Bioswales, Meadows
SMP-11 (a, b)	Landscape Pruning	Trees, Planters, Plant Beds, Rain Gardens, Bioswales
SMP-12	Meadow Mowing	Meadows
SMP-13	Landscape Replacement (excludes Trees)	Planters, Plant Beds, Rain Gardens, Bioswales, Meadows

Green Infrastructure Seasonal Maintenance Schedule

Table 3:

Schedule of Green Infrastructure Maintenance Tasks by Season

Season	Months	Maintenance Task
SPRING	March – May	Spring Landscape Replacement (Shrubs, Landscape Plants) Porous Pavement Vacuuming Porous Paver Maintenance (Restoring Aggregate) Porous Pavement Power Washing (<i>only once every 3 years</i>) Riverstone Edge Maintenance Stormwater Structure Cleaning Inlet Filter Insert Cleaning/Inspection Tree and Landscape Watering to supplement rainfall (<i>weekly</i>) * Tree and Landscape General Maintenance* Tree and Landscape Pruning – Option 1 Green Roof Maintenance** Meadow Mowing (<i>Year 3 – 1 pass with mower</i>)
SUMMER	May/June – September	Inlet Filter Insert Cleaning/Inspection Tree and Landscape Watering to supplement rainfall (<i>weekly</i>) * Tree and Landscape General Maintenance* Meadow Mowing (<i>Year 1 – monthly mowing in growing season</i>)
FALL	Oct – November	Fall Landscape Replacement (Shrubs, Landscape Plants) Tree and Landscape Watering to supplement rainfall (<i>weekly</i>) * Tree and Landscape General Maintenance* Tree and Landscape Pruning – Option 2 Green Roof Maintenance** Meadow Mowing (<i>Year 2 – 1 pass with mower</i>)
	November – December	Stormwater Structure Cleaning Porous Pavement Vacuuming Inlet Filter Insert Cleaning/Inspection
WINTER	December – March	Winter Maintenance for Porous Pavement Inlet Filter Insert Cleaning/Inspection

* First year of Landscape General Maintenance and Landscape Irrigation to be covered by contractor warranty

** First 2-3 years of Green Roof Maintenance to be covered by contractor warranty (# years varies by project)

**Detailed Green Infrastructure Standard Maintenance
Procedures**

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-01: Porous Pavement Vacuuming

Porous Pavement Vacuuming is done in order to remove sediment that may lead to a clogging of the porous surface, preventing water from infiltrating through the pavement into the stone reservoir.

Porous Pavement Vacuuming applies to several types of porous pavements described below:

- Porous Pavers: an alternative to traditional hardscape paving which allows water to infiltrate between the pavers and through permeable layers below ground. When vacuuming porous pavers, the setting should be adjusted to a lower power in order to prevent complete removal of aggregate between voids (unless more intensive vacuuming is required to alleviate clogged areas).
- Porous Concrete: a type of concrete that has a high porosity due to an increased void space to facilitate water infiltration through the porous concrete into a stone reservoir and then into the ground.
- Porous Asphalt: a type of asphalt that has a high porosity due to an increased void space to facilitate water infiltration through the porous asphalt into a stone reservoir and then into the ground.
- Flexible Porous Pavement (e.g., Flexipave): a type of porous pavement that has a high porosity due to an increased void space to facilitate water infiltration through the porous pavement into a stone reservoir and then into the ground. This porous pavement is made from recycled rubber (tires) that is mixed with a bonding agent and aggregate and is somewhat flexible when weighted movement is applied on its surface.

Type of Maintenance: Preventative

Tools and Supplies:

- Porous pavement vacuum
- Water source
- Safety cones, trash bags, gloves, street broom

Frequency: Semi-Annually for Porous Concrete, Porous Asphalt, Flexible Porous Pavement
Annually for Porous Pavers (Spring)

Labor Requirements: 2 people for approximately 2 hours per acre

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up safety perimeter. Ensure that no vehicles are parked in the vicinity of the location and that area is closed to the public. Public notice announcing area closing needs to be posted per City/County standards of notification.
- 20 *Inspect:* Visually inspect porous pavement for damage, including holes, cracks, excessive scuffing, settlement, and areas of standing water. Inspect status of aggregate between voids in porous pavers before and after vacuuming to see if additional replacement aggregate is needed. Record observations/damage in the Maintenance Report Log, include photos if possible, and report as necessary.
- 30 *Prepare site for vacuuming:* Remove (by hand) bulky debris and waste materials from surface of porous pavement that may be too large to be picked up and/or block/clog the vacuum hose (i.e. litter, tree

branches, wire, car parts) prior to using vacuum. Use a rigid street broom to loosen debris as needed. Pay particular attention to pavement edges and heavily loaded areas.

40 *Vacuum:* Vacuum porous pavement per the vacuum manufacturer recommendations.

Note: If vacuuming porous pavers, set vacuum at a lower power in order to prevent complete removal of aggregate between voids (unless more intensive vacuuming is required to alleviate clogged areas).. Vacuum machine speed should be adjusted so that the vacuum draws out the first inch or so of stone and dirt in the openings between porous pavers, as this is where most unwanted sediment/debris typically collects.

Follow all steps in the Manufacturer's Operation Checklist for the specified vacuum.

41 Engage the Water Feature/ Water Dust Control Option of the vacuum (or equivalent on specific vacuum model).

42 Drive the vacuum over the porous pavement, operating at a slow speed setting not greater than 5 miles per hour. Overlap the edges of the vacuum runs and make two passes over the entire porous pavement area.

43 Frequently check and empty the filter bag (located above the debris bag) when vacuuming areas with excessive sediment.

50 *Post-vacuuming inspection:* After two passes, visually inspect porous pavement to ensure adequate debris removal. Any areas with visible debris/sediment still present should be vacuumed again until debris is removed. In the event that the surface of the porous pavement becomes clogged with fine dirt or sand, follow maintenance tasks outlined in **SMP-02 Porous Pavement Power Washing**. Record observations in the **Maintenance Report Log**.

60 *Review checklist:* Follow all steps in the post-operation checklist for the specified vacuum.

70 *Measure debris removal prior to disposal:* Remove material/debris from vacuum bag and hopper and put into a labeled trash bag. Label bag with date and project location, and note the weight on the **Maintenance Report Log**.

80 *Clean up:* Clean up work area and vacuum equipment (per Manufacturer's Operation Manual).

90 *Safety completion:* Remove safety perimeter and re-open lot for parking/public access.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-02: Porous Pavement Power Washing

Porous Pavement Power Washing applies to several types of porous pavements described below. Power washing should be done if porous pavement surfaces become clogged with fine dirt or sand. Power washing of the pavement surface allows partial restoration of the original void space and therefore permeability and should immediately follow the porous pavement vacuum task (once every three years or more often as necessary). Power washing of porous pavers should never occur as it may damage pavers and/or remove aggregate between pavers.

- Porous Concrete: a type of concrete that has a high porosity due to an increased void space to facilitate water infiltration through the porous concrete into a stone reservoir and then into the ground.
- Porous Asphalt: a type of asphalt that has a high porosity due to an increased void space to facilitate water infiltration through the porous asphalt into a stone reservoir and then into the ground.
- Flexible Porous Pavement (e.g., Flexipave): a type of porous pavement that has a high porosity due to an increased void space to facilitate water infiltration through the porous pavement into a stone reservoir and then into the ground. This porous pavement is made from recycled rubber (tires) that is mixed with a bonding agent and aggregate and is somewhat flexible when weighted movement is applied on its surface.

Type of Maintenance: Preventative

Tools and Supplies

- Power washer
- Water source
- Safety cones, trash bags, gloves, street broom

Frequency: Once every three years (perform immediately after thorough vacuuming) or more frequently if necessary, recommended time is Spring.

Labor Requirements: 2 people for approximately 2 hours per acre

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up safety perimeter. Ensure that no vehicles are parked in the vicinity of the location and that area is closed to the public. Public notice announcing area closing needs to be posted per City/County standards of notification.
- 20 *Inspect:* Visually inspect porous pavement for damage, including holes, cracks, settlement, excessive scuffing/raveling and areas of standing water. Record observations/damage in the Maintenance Report Log, include photos if possible, and report as necessary.
- 30 *Prepare site for power washing:* Remove (by hand) bulky debris and waste materials from surface of porous pavement that may block or impede power washer access to the surface (i.e. litter, tree branches, wire, car parts). Use a rigid street broom to loosen debris as needed. Pay particular attention to pavement edges and heavily loaded areas.
- 40 *Power wash:* Follow manufacturer's recommendations for use of the power washer unit with the clarifications noted below. Ensure that the water inlet valve and pump are both on.

- 41 Set the pressure levels to be no greater than 500 PSI.
- 42 Perform two passes over surface of pavement, with wand spraying at a 45 degree angle. Do not keep water flow on one location for longer than 5 seconds.
- 50 *Vacuuming:* Power washing may need to be followed immediately by vacuuming. Refer to SMP-01 Porous Pavement Vacuuming for detailed instructions. If sediment is exposed (brought to the surface) during power washing, this sediment must be immediately removed through vacuuming instead of allowing the sediment to migrate and re-enter the porous pavement.
- 50 *Post-power washing inspection:* Visually inspect porous pavement to ensure adequate sediment/debris removal. Any areas with visible debris/sediment still present should be washed again until debris is removed. Note if water remains ponded in any areas of the porous pavement. Record observations in the **Maintenance Report Log**.
- 60 *Store equipment:* Shut off pump and return hose and wand to proper storage place.
- 70 *Safety completion:* Remove safety perimeter and re-open lot for parking/public access.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-03: Porous Paver Maintenance (Restoring Aggregate)

Porous pavers are an alternative to traditional hardscape paving which allows water to infiltrate between the pavers and through the permeable layers below them. Pavers are laid out on the surface and clean-washed aggregate material (also called screening or gravel) are placed in the spaces (voids) between paver units to provide stability and surface drainage while keeping unwanted debris out of the system. This SMP refers specifically to the task of refilling the voids between pavers with additional aggregate material to replace any material that has been lost by vacuuming and/or due to natural migration, settlement, and erosion.

Type of Maintenance: Preventative

Tools and Supplies

- Safety cones
- Rigid Street Broom
- Shovel
- Manhole Pick
- Wheelbarrow
- Clean-washed small aggregate (gravel) per project specifications

Frequency: As needed when gravel infill is not within ½ inch of the paver surface, immediately following vacuuming

Labor Requirements: 2 people for approximately 3 hours per acre

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up safety perimeter. Ensure that no vehicles are parked in the vicinity of the location and that area is closed to the public. Public notice announcing area closing needs to be posted per City/County standards of notification.
- 20 *Inspect:* Visually inspect porous pavers for damage, including broken pavers, cracks, settlement, and any areas of standing water or evidence of standing water. Inspect status of aggregate infill material in the voids between porous pavers to see if additional replacement aggregate is needed. Evaluate if voids (joints) between porous pavers are clogged or not

Inspect to see if pavers themselves are missing from any areas and note need for replacement pavers. Record observations/ damage in the **Maintenance Report Log**, include photos if possible, and report as necessary.
- 30 *Prepare site:* Remove (by hand) bulky debris and waste materials from surface of pavers.
- 40 *Cleaning Clogged Voids:* If voids (joints) between porous pavers are still clogged even after area has been vacuumed (**SMP-01 Porous Pavement Vacuuming**), use a manhole pick to tool out joint until clean aggregate is found. Follow aggregate replacement instructions below.
- 40 *Add aggregate:* Using a shovel, spread aggregate over the surface of the pavers. Using a broom, sweep aggregate into the voids between porous paves, taking care to fill in any obvious holes. Once the aggregate

has been added to the pavers, and the voids have been filled, perform a final sweeping pass with the hand broom to remove any excess gravel from the paver surface.

50 *Clean up:* Clean-up work area.

60 *Safety completion:* Remove safety perimeter and re-open area for parking/public access.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-04: Stormwater Structure Cleaning

Stormwater Structures are structures used to capture runoff, connect pipes, provide access, control the water level in stormwater management systems, and/or allow excess runoff to discharge or overflow in a controlled manner. Stormwater structures may include the following:

- Catch basin
- Inlet
- Sediment trap
- Manhole
- Overflow structure with or without removable weir
- Observation well
- Clean-out
- Domed riser

Type of Maintenance: Preventative

Tools and Supplies

- Manhole Pick
- Vacuum/Vactor truck
- Safety cones, trash bags, gloves
- Screwdriver or similar tool for cleaning clogged orifices in sediment trap/sump
- Wrench, if necessary, for removing weir

Frequency: Semi-Annually

Labor Requirements: 2 people for approximately 30 minutes per structure, varies by structure type and configuration.

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up safety perimeter.
- 20 *Inspect:* Visually inspect stormwater structure and adjacent area for any immediate damage or potential problems, including any upstream pollution sources or locations of existing or potential vegetation debris. Inspect stormwater structure for signs of accumulated sediment, leaf litter, and/or debris. Look for signs of settlement and/or washout around structures and attached pipes. Record all observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.
- 30 *Prepare site for servicing:* Remove any debris that has accumulated on top of the structure. Remove structure lid (e.g., inlet grate, manhole cover, or observation well cover) and set aside. Visually inspect interior of the structure for defects and evidence of illegal dumping. If illegal dumping has occurred, notify the proper authorities as necessary. Record observations/ damage in the **Maintenance Report Log**, include photos if possible, and report as necessary.

- 31 Examine structure for any unintended or excessive standing water. Inspect for signs of mosquito larvae. If sediment trap is in place and contains standing water, inspect the drainage orifices for signs of clogging. These orifices are usually 1-inch diameter and located at the base of the structure. Remove any and all material clogging these orifices.
- 32 Observe if the structure has a filter insert and follow separate guidelines in **SMP-05 Inlet Filters** for maintenance and replacement of filter insert.
- 40 *Cleaning:* If using a vacuum truck, clean the interior of the structure and remove all debris or sediment contained in sump. Leave weir in place. Employees should be properly trained in use of the vacuum truck and should follow all recommended guidelines for use by the vacuum truck manufacturer. If removable weir is present and not sufficiently cleaned, use wrench/screwdriver or other tool to remove the bolts, lift it up and out of the structure, and set it to the side and repeat cleaning.
- 50 *Disposal:* Ensure that the removed waste/sediment is properly disposed of and securely contained as to not run back into the stormwater system. Follow guidelines for disposal of waste/sediment on the local, state, and federal levels.
- 60 *Record:* Make a note of any recorded observations in the **Maintenance Report Log**.
- 70 *Replace:* Replace the stormwater structure cover and confirm it is tightly secured.
- 80 *Safety completion:* Remove safety perimeter.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-05: Inlet Filter Insert Cleaning

Manufactured filter inserts are designed to trap sediment, debris, trash, oil and grease. Filter inserts are located inside a catch basin or stormwater inlet. Filter inserts should be cleaned quarterly. Replacement of the filter insert pouch should occur at least annually, or as necessary, during a cleaning task.

Type of Maintenance: Preventative

Tools and Supplies

- Manhole Pick
- Replacement filter insert pouch (one pouch per inlet)
- Industrial vacuum and/or vacuum truck with hose
- Safety cones, trash bags, gloves

Frequency: Quarterly, unless established that a particular inlet requires less frequent cleaning.

Labor Requirements: 2 people for approximately 30 minutes per inlet

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter.
- 20 *Inspect:* Remove catch basin lid/grate with manhole pick and set safely aside. Visually inspect filter insert for evidence of defects and deterioration. Extensive damage to the filter (torn liner/mesh, etc.) will require immediate replacement. Record all observations in the Maintenance Report Log and report as necessary.
- 30 *Clean filter liner/mesh:* Use an industrial vacuum or vacuum truck hose to remove any collected materials from the liner. Follow vacuum manufacturer's directions for operation of the vacuum.
- 40 *Inspect filter hardware:* After removal of collected materials from the filter, remove the filter insert as per manufacturer's instructions. In many filters, this is done by unsnapping the tether from the D-ring. Set inlet filter insert to one side. Inspect the filter liner, gaskets, stainless steel frame, and mounting brackets, etc. for continued serviceability. Refer to the manufacturer's manual to assist in locating these items. Correct minor damage and/or defects found during inspection. Record all damage and corrective actions undertaken in the Maintenance Report Log. Follow replacement guidelines attached to this SMP if filter is torn or in need of replacement.
- 50 *Insert filter:* After thoroughly inspecting the filter insert pouch for damage and continued serviceability, reattach the pouch tethers to the liner's D-ring (or equivalent part).
- 60 *Replace grate/lid:* Replace the catch basin grate/lid and make sure it is secure.
- 70 *Safety completion:* Remove safety perimeter.

Task Name: Inlet Filter Insert Pouch Replacement

Manufactured filter inserts are designed to trap sediment, debris, trash, oil and grease. Filter inserts are located in the interior of a catch basin or inlet. Replacement of the filter insert pouch should occur at least annually, or as necessary, in conjunction with cleaning task.

Type of Maintenance: Predictive

Tools and Supplies

- Manhole Pick
- Replacement filter insert pouch (one pouch per inlet)
- Industrial vacuum and/or truck
- Safety cones, trash bags, gloves

Frequency: as needed

Labor Requirements: Included in the time required to complete the filter insert cleaning task

Annually:

- 10 *Safety set-up:* Set up a safety perimeter.
- 20 *Remove lid/grate:* Remove catch basin lid/grate with manhole pick, and set safely aside.
- 30 *Remove and replace pouch:* Remove and replace filter insert pouch. Properly dispose of removed pouches and debris according to local, state and federal regulations. Record observations in the **Maintenance Report Log**, include photos if possible, and report as necessary.
- 40 *Replace lid/grate:* Replace the catch basin grate/lid and make sure it is secure.
- 50 *Safety completion:* Remove safety perimeter

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-06: Green Roof Maintenance (after initial 2-3 year establishment period)

NOTE: Green roof maintenance must adhere to the project specifications/warranty provisions so that the long-term waterproofing warranty is not voided. Typically this involves a maintenance agreement and contractor approved by the waterproofing manufacturer. See the individual project warranty provisions for details. **In the case of a conflict between this SMP and the approved project-specific maintenance plan, the project-specific plan shall govern.**

A green (vegetated) roof is a layer of vegetation that is grown on and covers a roof. A green roof typically consists of multiple layers, including waterproofing, synthetic insulation, non-soil engineered growth media, geotextile fabric, drainage components, and plants. Routine maintenance is intended to increase survival of the vegetated cover, promote the development of robust and durable green roof plants, and prevent drainage problems and erosion. Plants used in green roofs should be drought tolerant and winter hardy. No watering is typically required after the initial 2-3 year establishment period unless there are periods of extreme drought. Supplemental maintenance may be provided to satisfy additional aesthetic requirements.

When maintaining a green roof, avoid using sharp tools of any kind to prevent damage to the underlying waterproofing system beneath the plant material. Avoid using lawn staples or stakes for any purpose. Also, minimize foot traffic on top of the green roof vegetation during maintenance activities, as green roof plants are not generally intended for pedestrian access.

Type of Maintenance - Preventative

Tools and Supplies

- Hand Pruners
- Safety equipment including fall protection as applicable
- Trash bag, gloves

Frequency: Spring and Fall (two times/year)

Labor Hours: 2 people for approximately 0.5 to 1 hour per 1000 square feet

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter.

20 *Inspect:* Visually inspect the green roof system for the following:

Plant Material: Inspect for large bare spots; colonization of the green roof by annual grass, moss, weeds, woody material, etc.; high mortality rates for one or more plant species; loss of plant material/growing media to wind scour or erosion; or consistently moist or spongy areas of the roof.

Waterproofing System: Inspect exposed components of the waterproofing system, including flashings and counter-flashings.

Drainage System: Inspect drain outlets (scuppers) to make certain that they are free from clogging or obstructions. Look for evidence of prolonged ponding of water following rainfall events.

Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions. Follow approved maintenance agreement provisions closely to ensure warranty is not voided.

- 30 *Remove trash/debris:* Remove any large debris or trash that has accumulated on the green roof.
- 40 *Weed:* Weed the green roof plantings as necessary by hand pruning/pulling. Immature extensive green roofs are vulnerable to colonization by annual grass, especially crabgrass. A pre-emergent crabgrass treatment may be advisable in early spring.
- Do not use pointed or sharpened tools when weeding (such as trowels, shovels, spades, weeders, hand cultivators) to avoid damage to the underlying waterproofing system.
- Do not mow or scythe on a green roof.
- 50 *Plant Pruning:* Trim any plant material that may be growing within the drainage medium or interfering with the drainage system or waterproofing system.
- 60 *Replenish:* Patches of bare growing media (bare green roof) may be re-planted by taking cuttings from adjacent green roof plants or by separating and transplanting healthy plants. Plant cuttings should be at least one-inch long and should preferably include some 'air roots'. Cuttings set best in early spring or late fall, but can be planted at any time except when temperature is below freezing. Water and a light dusting of compost may accelerate plant growth.
- 70 *Fertilize:* Only fertilize if ideal total soluble nitrogen (nitrate plus ammonium) levels for the plantings fall below 5 ppm. Do not fertilize if soil test shows total soluble nitrogen levels exceeding 5 ppm. These measurements should be determined from annual (fall) soil tests. Apply fertilizers (nutrients) in early spring or fall. Over-fertilization can seriously disturb the green roof; use caution when applying and only apply approved/recommended fertilizers for green roofs.
- 80 *Record:* Make note of any additional observations in the **Maintenance Report Log**.
- 90 *Safety completion:* Remove safety perimeter.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-07: Riverstone Edge/Stone Gutter Maintenance

The riverstone edge/stone gutter is a 1 to 3-foot wide (width varies) gravel edge around some porous pavement areas that serves as a backup mechanism for runoff to enter the subsurface infiltration bed should the porous pavement ever be adversely modified such that its permeability is reduced.

Type of Maintenance - Preventative

Tools and Supplies

- Rake
- Clean-washed riverstone per project specifications
- Trash bag, gloves

Frequency: Annually in spring

Labor Hours: 2 people for approximately 1-2 hours per site

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter
- 20 *Inspect:* Visually inspect the riverstone edge/stone gutter for any areas of riverstone that are bare and/or need to be replenished or replaced. Inspect for signs of weed growth, dumping of debris, or plow damage. Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.
- 30 *Remove trash/debris:* Remove any large debris and trash that has accumulated in the riverstone edge/stone gutter area.
- 40 *Weed:* Remove any obvious weed growth that has established itself within the limits of the riverstone edge/stone gutter. The riverstone edge should be free of vegetative growth.
- 60 *Rake:* Gently rake riverstone edge/stone gutter to re-establish an even surface and even out any irregular depressions or high points (stones may have moved or shifted during the year).
- 70 *Replenish:* Add new riverstone only if shallow and/or bare areas exist after raking has been completed. Add only enough riverstone to bring entire riverstone edge/stone gutter to a consistent and level grade, approximately even with the elevation of the adjacent edge of pavement.
- 80 *Record:* Make note of any unrecorded observations in the Maintenance Report Log.
- 90 *Safety completion:* Remove safety perimeter.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-08: Winter Maintenance for Porous Pavements

During the winter, porous pavement surfaces require different maintenance practices from standard pavement surfaces in order to maintain performance and promote infiltration. Specifically, sanding of porous pavement surfaces is prohibited, salting must be minimal, and plow blade heights may need to be set higher in some instances. In addition, plowed snow should not be stockpiled directly on top of porous pavement if possible.

Type of Maintenance - Preventative

Tools and Supplies

- Truck with snow plow
- Salt/Deicers and appropriate machinery as needed
- Hand shovel

Frequency: As necessary following snowfall or icy conditions

Labor Hours: 2 people for approximately 1-2 hours per acre (varies with snow conditions)

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter
- 20 *Inspect:* Visually inspect entire area to be plowed prior to plowing snow and/or salting the porous pavement surface. Refer to project site plan if necessary to identify location of landscape elements and porous pavement surfaces. Note presence of trees, shrubs, landscape features, and wheel stops or bollards so that plow does not hit them during plowing and cause physical damage. Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.
- 30 *Remove trash/debris:* Remove any large debris and trash from porous pavement surface prior to plowing.
- 40 *Plow:* If plowing on top of porous pavers, raise plow blade to a slightly higher level (1" higher) than for other types of porous pavement (asphalt, concrete, or flexipave) to prevent the plow from catching paver edges and dislodging paver units. If possible, it is recommended that a rubber plow blade be used for plowing porous pavement surfaces.
- 50 *Storage of snow piles:* If possible, do not leave plowed snow piles on top of porous pavement surfaces to melt. This may result in sediment from the plow operations entering the porous pavement which can lead to clogging. Move snow piles to standard/conventional pavement area or to grassy/lawn area nearby. Refer to project site plan if necessary to identify location of landscape elements, porous and non-porous pavement surfaces, and snow stockpiling areas.

- 60 *Salting:* Use road salt in moderation on porous pavement surfaces. If possible, use an environmentally-safe road salt/deicer. Use approximately only 25% of the amount of deicing salt that is routinely applied to standard pavement parking lots or as needed to maintain acceptable driving conditions. (This is approximately a 75% reduction in salt use that is recommended).

Recommended Environmentally Safe Road Salts: Calcium magnesium acetate (CMA) and potassium acetate (KA) are highly recommended. A second suggestion is calcium chloride (CaCl), which is similar to sodium chloride but can be used in smaller amounts. A mix of sodium chloride or calcium chloride and CMA or KA is better than one of the salts alone. Recommended products include GEOMELT, ECO Salt, and GEOSALT.

- 70 *Record:* Make note of any unrecorded observations in the **Maintenance Report Log.**

- 80 *Safety completion:* Remove safety perimeter.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-09a: Tree General Maintenance - Tree Pit Weeding, Tree Pit Mulching, Soil Amendment with Organic Compost

Actions include visual inspection, weeding tree pits, straightening/resetting small caliper existing trees, mulching tree pits, and amending tree pits with organic compost.

Healthy trees should be able to withstand minor disease and insect damage without controls. Routine application of pesticides shall not be practiced, as this destroys natural predator-prey relationships in the environment. Where unusually high infestations or infections occur, an accurate identification of the disease or insect shall be made and the control selected with care, prior to application. All chemical controls must be applied under the supervision of a licensed and qualified pest control applicator, following the procedures set forth in the labeling of the product, as required by law.

Type of Maintenance - Preventative

Tools and Supplies

- Safety cones
- Safety gear (clothing, gloves, etc.)
- Mulch (as specified)
- Mulch fork
- Rake
- Trash bags for debris, weeds, etc.
- Hand Pruners, Weeding Tools
- Mowers
- Edgers

Frequency:

Inspection: Minimum 1x/year (Late May to early June and/or early September)

Weeding of Tree Pit Areas: Weed tree pits a minimum of 2 times per year, at least once in late spring/early summer and once in fall.

Mulching: Minimum 1x/year (Spring)

Amending Soil with Organic Compost: 1x/year (Spring) in Year 2 and Year 4

Labor Hours: 2 people for approximately 4-8 hours per site depending on size of site

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter. Protect existing trees from damage due to landscape operations and maintenance and operations of other contractors and trades.

20 *Inspect:* Note the species and location of dead trees. Visually inspect trees for dead, diseased or damaged branches. Inspect for signs of frost heave and note the location and species of those trees that need to be repositioned. Inspect trees for signs of excessive drought, disease, nutrient deficiency, and/or pest problems. Inspect tree pits for signs of soil compaction, soil subsidence, excessive salt deposits, or ponding of water. Inspect any areas of standing water in and around tree pits for mosquito larvae.

Note species and location of all trees experiencing any problems listed above. Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.

NOTE: Based on the above observations, determine if it is necessary for a skilled tree care professional/arborist to conduct a follow up visit to assess any potential tree health issues. Note this in the **Maintenance Report Log**.

30 *Remove trash/debris:* Remove any leaves, debris, and trash that have accumulated in or around the trees/treepits and legally dispose of them off Owner's property.

Disposal of refuse resulting from the maintenance operation is the responsibility of the party conducting the work.

40 *Weed:* Weeding of tree pits should occur 2 times a year, with a minimum of one spring and one fall visit.

Restrictions: Do not mow or use weed whackers (trimmers) within 2 feet of tree trunks. Hand weed instead.

Refer to project's **Plant ID Sheet** for photographs of plants in order to be able to identify what plants should remain and what plants are weeds and should be removed.

All tree pit areas shall be kept free of weeds, using mechanical methods defined below;

- a) Carefully hand pull or dig out weeds and invasive plants taking care not to damage surrounding plants.
- b) For control of invasive species, spot spraying with herbicide may be employed only by a Certified Pesticide Applicator after notifying the proper authorities and getting approval to apply herbicides. Spraying is allowed only after receiving approval. Before applying herbicides, the type of weed shall be identified and the control selected accordingly, using the most effective control for the species, the location and the season.

(See recommended herbicidal list in Appendix A: Herbicides for Control of Invasive Plants).

Weeds shall not be allowed to grow in paved areas such as driveways, walks, curbs, gutters, etc. If herbicide is applied, dead weeds shall be removed from the paved areas.

50 *Straightening and Raising Existing Small Caliper Trees:*

NOTE: The one-year warranty period after tree installation should cover the straightening and raising of small caliper trees.

If necessary, reset existing small caliper trees that are leaning and need to be straightened. Also reset (raise) trees where the top of root balls have sunken below "finish grade". If roots need to be cut they shall be done so with a sharp cutting tool. DO NOT CUT ROOTS THAT ARE MORE THAN 1-INCH (1") IN DIAMETER. Trees shall be set straight, back filled, and mulched. Ensure that trees are not planted too deep – the root flare must remain visible at finish grade.

Fill in soil subsidence that may occur because of settling or other processes as necessary.

60 *Amending Soil with Organic Compost (Only Years 2 and 4):*

Apply 2 (two) inches of compost and incorporate into the top 2 (two) inches of soil using a hand tool such as a trowel or a steel rake, keeping tools away from the trunk and being careful to leave tree roots intact as you encounter them.

Do not place compost directly against the trunk or a tree or shrub or exposed woody roots (as this could cause rot and invite pest or disease). Top surface of soil with mulch as described below.

70 *Mulch: After weeding the existing mulched area, apply additional mulch across surface of tree pit and/or planting bed in uniform manner; do not apply more than 3-4 inches thick. Mulch should be re-applied one time per year (in the spring), unless additional applications are needed after heavy rain events.*

a) Type of Mulch: shredded bark mulch:

- Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - Type: Shredded hardwood or ground or shredded bark.
 - Size Range: 3 inches maximum, 1/2 inch (13 mm) minimum.
 - Color: Natural.

b) Application rate:

- Apply organic mulch throughout plant bed to an average thickness, of 3 to 4 inches (75-mm) in a uniform manner.
- Do not place mulch within 3 inches (150 mm) of the base of the root flare.
- Mulch should be applied in a 4 to 6 foot diameter with the highest point at the outer edge of the ring and graded gently to the center of the ring. Do not shape mulch like a "volcano" at tree trunk.

80 *Clean up:* Remove surplus mulch and waste material including trash and debris, and legally dispose of them off Owner's property

90 *Record:* Make note of any additional observations in the **Maintenance Report Log.**

100 *Safety completion:* Remove safety perimeter.

SMP-09b: Planter/Plant Bed, Rain Garden, and Bioswale (Shrub and Herbaceous Plant Material) General Maintenance, Weeding, Mulching

Actions include visual inspection, weeding, and mulching

Plant beds, or planters, are typically a combination of trees, shrubs, and herbaceous perennials (flowering plants) in a contained planting bed, with a covering of mulch. Planters can be contained within concrete curbs or seatwalls, or are often at ground level.

Rain gardens and bioswales are shallow surface depressions planted with specially selected native vegetation (trees, shrubs, grasses, and perennials) to treat and capture stormwater runoff. They are often designed to be planted on top of a layer of sand or gravel storage.

Healthy plants and lawns should be able to withstand minor disease and insect damage without controls. Routine application of pesticides shall not be practiced, as this destroys natural predator-prey relationships in the environment. Where unusually high infestations or infections occur, an accurate identification of the disease or insect shall be made and the control selected with care, prior to application. All chemical controls must be applied under the supervision of a licensed and qualified pest control applicator, following the procedures set forth in the labeling of the product, as required by law.

Type of Maintenance - Preventative

Tools and Supplies

- Hand Pruners
- Mulch (as specified)
- Mulch fork
- Rake
- Spade shovel
- Pitchfork or spade
- Weeding fork
- Plant and Weed Photo ID Sheet
- Trash bag, gloves

Frequency:

Inspection: 1x/year minimum (Late May to early July, and/or late August/early September)

Weeding: 3x/year minimum (Spring clean up, summer maintenance, fall put to bed)

Mulching: Minimum 1x/year (Spring)

Labor Hours: 2 people for approximately 4-6 hours per site

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance and operations of other contractors and trades.
- 20 *Inspect:* Visually inspect for any bare areas of vegetation or for specimen vegetation that has died and needs to be removed and/or replaced. Inspect for signs of frost heave and note any plants that may need to be replaced. Inspect plants for signs of excessive drought, disease, nutrient deficiency, and/or pest problems. Inspect planting areas for signs of soil compaction, soil subsidence, excessive salt

deposits, or ponding of water. Inspect any areas of standing water for mosquito larvae. Also inspect areas (e.g. stabilized outfalls) that may experience erosion or increased sediment deposits which would inhibit infiltration.

Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.

NOTE: Based on the above observations, determine if it is necessary for a skilled horticulture professional to conduct a follow up visit to assess any potential plant health issues. Note this in the **Maintenance Report Log**.

- 30 *Remove trash/debris:* Remove any leaves, debris, and trash that have accumulated in or around the plant beds/planters and legally dispose of them off Owner's property.

All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the Manager/Owner.

- 40 *Weed:* Weeding shall occur 3x/year at minimum (spring, summer, and fall).

Weeding is easiest if done when soil is moist. It is also recommended to pay attention to specific sites and keep track of weed presence on the **Maintenance Report Log** for each site. Weeding is easier and more effective if done consistently throughout the growing season and done BEFORE weeds go to seed.

Refer to project's **Plant ID Sheet** for photographs of plants in order to be able to identify what plants should remain and what plants are weeds and should be removed.

All planting areas shall be kept free of weeds, using either mechanical or chemical methods defined below;

- a) Carefully hand pull or dig out weeds and invasive plants taking care not to damage surrounding plants.
- b) For control of invasive species, spot spraying with herbicide may be employed by a Certified Pesticide Applicator only after notifying the proper authorities and getting approval to apply herbicides. Spraying is allowed only after receiving approval. Before applying herbicides, the type of weed shall be identified and the control selected accordingly, using the most effective control for the species, the location and the season.

(See recommended herbicidal list in **Appendix A: Herbicides for Control of Invasive Plants**).

Weeds shall not be allowed to grow in paved areas such as driveways, walks, curbs, gutters, etc. Dead weeds shall be removed from the paved areas.

- 60 *Mulch:* After weeding, apply specified mulch across surface of planter and/or planting bed in uniform manner; do not apply more than 3-4 inches thick. Mulching is only once/year in the spring, unless additional applications are needed after heavy rain events.

- a) Type: organic shredded hardwood mulch (or mulch specified for specific site)

- Shall be free of ceramic, man-made trash or debris of any kind, wood or other objectionable materials.
- b) Application rate: 3 inches applied to a settled thickness of 2 inches.
- Do not place mulch within 2 inches (150 mm) of shrub trunks or perennial/plant stems in order to prevent rot from occurring
 - Do not shape mulch like a “volcano”. Spread mulch evenly to a uniform, level height.

70 *Clean up:* Remove surplus mulch and waste material including trash and debris, and legally dispose of them off Owner's property

80 *Record:* Make note of any additional observations in the **Maintenance Report Log.**

90 *Safety completion:* Remove safety perimeter.

SMP-09c: Meadow Inspection, Control of Invasive Species

A meadow is a field consisting primarily of herbaceous grasses, forbs, wildflowers, and other non-woody plants. Meadow inspection consists of a visual inspection, trash/debris removal, and invasive species management.

Refer to **SMP-12 Meadow Mowing** for meadow maintenance and management of most meadow weeds.

Healthy plants and lawns should be able to withstand minor disease and insect damage without controls. Routine application of pesticides shall not be practiced, as this destroys natural predator-prey relationships in the environment. Where usually high infestations or infections occur, an accurate identification of the disease or insect shall be made and the control selected with care, prior to application. All chemical controls must be applied under the supervision of a licensed and qualified pest control applicator, following the procedures set forth in the labeling of the product, as required by law.

Type of Maintenance - Preventative

Tools and Supplies

- Hand Pruners
- Trowel
- Spade
- Pitchfork and Weed fork
- Plant and Weed Photo ID Sheet
- Trash bag, gloves

Frequency:

Inspection: Minimum 3x/year (Spring, Summer, Fall)

- Monitor meadow **monthly** during growing season for invasive species during the first 2 to 3 years

Labor Hours: 2 people for approximately 4-8 hours per site

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance.

20 *Inspect:* Visually inspect for any bare areas of vegetation or specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, nutrient deficiency, and/or pest problems. Inspect any areas of standing water for mosquito larvae.

Inspect meadow area for evidence of invasive species and woody plant establishment. Monitor meadow monthly during growing season for invasive species during the first 2 to 3 years. Examples of invasive species include thistle, knapweed, phragmites, and general weeds such as dandelions.

Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.

NOTE: Based on the above observations, determine if it is necessary for a skilled horticulture professional to conduct a follow up visit to assess any potential plant health issues. Note this in the **Maintenance Report Log**.

30 *Control of Invasive Species:*

Refer to **SMP-12 Meadow Mowing** for information on managing invasive species in meadows, which is primarily done through mowing.

Refer to project's **Plant ID Sheet** for photographs of plants in order to be able to identify what plants should remain and what plants are weeds and should be removed.

For the control of certain types of invasive species not able to be managed by mowing, such as Crown Vetch, spot spraying and hand pulling should be conducted as directed below:

- a) Carefully hand pull or dig out invasive plant species taking care not to damage surrounding plants in meadow.
- b) For control of invasive species, spot spraying with herbicide may be employed only by a Certified Pesticide Applicator after notifying the proper authorities and getting approval to apply herbicides. Spraying is allowed only after receiving approval. Before applying herbicides, the type of weed shall be identified and the control selected accordingly, using the most effective control for the species, the location and the season.

(See recommended herbicidal list in Appendix A: Herbicides for Control of Invasive Plants).

40 *Remove trash/debris:* Remove any leaves, debris, and trash that have accumulated in or around the meadow. All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the Manager/Owner.

50 *Record:* Make note of any additional observations in the **Maintenance Report Log**.

60 *Safety completion:* Remove safety perimeter.

Appendix A: Herbicides for Control of Invasive Plants

HERBICIDES FOR CONTROL OF INVASIVE PLANTS

These sprays were reviewed with NPS and approved by the New River Gorge National River Natural Resources Branch (Ken Stevens, Chief) for use at the Sandstone Visitor/Orientation Center.

Glyphosphate

Glyphosphate herbicide may be used for total vegetation control and is safe to use immediately prior to planting and up to four days after seeding. Glyphosphate may also be used to target individual weeds as a careful spot spraying after planting, but some non-target plants are likely to be damaged and killed as well. A formulation such as Roundup can be used for total vegetation control prior to planting in the grassland and mow strip areas. A formulation approved for wetland use, such as Rodeo, can be used in storm water infiltration basins and swales.

Plateau (Best application for areas near Rain gardens)

Plateau herbicide is a very good herbicide for pre and post-emergent weed control for establishing warm-season grasses. Pre-emergent application prior to planting is best. Plateau's utility is limited when wildflowers or cool-season grasses are incorporated into the seeding mix. Native forbs, depending on the species, may or may not be tolerant of Plateau. Cool season grasses are not very tolerant of Plateau. Switch grass is not as tolerant to Plateau as other warm season grasses.

Transline

Transline is a selective herbicide for the control of composites, polygonums, and legumes such as Crown Vetch. If carefully used as directed, it is an effective post-planting spot spray, because it will not kill all of the desired vegetation that is touched by over-spray. Transline can be sprayed over the top of grass plantings where Crown Vetch is abundant and where there are no desired composite wildflowers or legumes. Control of Crown Vetch will likely require at least 2 to 3 years of scouting and retreating with spot spray applications. Legumes and composites should be planted sparingly in the successional grassland in treated Crown Vetch areas.

Note: All products mentioned here are for information only and are not an endorsement of a particular brand.

DEER REPELLENT

No one deer repellent appears to stand out as more effective than any other in our experience, but newer repellents are easier to apply and last longer than previous formulations.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-10a: Tree Watering

***NOTE:** Tree watering for the first year after installation should be covered by the one-year maintenance agreement as outlined in the project specifications and contract/warranty provisions.

This Tree Watering SMP takes effect one year after tree installation (beginning of Year 2).

Type of Maintenance - Preventative

Tools and Supplies

- Gator bags
- Sprinkler & Hose
- Hydrant
- Water truck (if no access to water hydrant)

Frequency:

Initial Tree Establishment (First Year After Tree Installation)*: Water twice a week in the absence of rain during first year after tree installation. (15-25 gallons of water twice per week).

Year 2: Water weekly (once a week) in the absence of rain during second year after tree installation. Water to supplement rainfall in order to maintain a rate of 1" of water per week. (15-25 gallons of water once per week)

Year 3 and beyond: Water as needed during extended periods of drought, only when ground is not frozen.

Labor Hours: 2 people for approximately 1-5 hours per site depending on site size

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter.

20 *Inspect:* Visually inspect for any trees or tree branches that have died and need to be removed and/or replaced (in the case of an entire tree being dead). Inspect for signs of frost heave and note any plants that may need to be replaced. Inspect trees for signs of vandalism, plow damage, excessive drought, disease, and/or pest problems. Inspect soil surface in tree pits for signs of overly compacted soils or evidence that trees were planted too deeply. Ensure that root flare is still visible at finish grade.

Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any litter, debris, and trash that have accumulated in the landscaped area around trees and/or in the tree pits.

40 *Water:*

During the first year after tree installation, regular watering to supplement rainfall shall occur between the months of April/May through November. Apply 15-25 gallons of water twice a week in the absence of rain in Year One.

During the second year after tree installation, apply 15-25 gallons of water once a week in the absence of rainfall, between the months of April/May through November.

In general, water to supplement rainfall in order to maintain a rate of 1" of water per week during the growing season, especially during late summer months experiencing higher temperatures and when available water in soil from spring snow melt has depleted.

There is no need to water trees if rainfall has fulfilled the 1" of water per week requirement.

Discontinue watering activities once temperatures create frozen soil conditions. Start again in spring when tree buds swell and sprout new leaves.

After the first two years, only water in the manner above between April/May and November during extended periods of drought.

Watering Technique:

Using a hose, water at the base of the tree but avoid watering directly on the tree trunk. Water deeply, allowing 15-25 gallons to seep slowly down to the roots.

If watering from a piped water source, water for approximately 10 minutes for each tree, with water at half pressure, or when water starts ponding and running off.

If watering in clay soils, water at a rate of ¼ inch per hour because infiltration will be slower. Crews may need to repeat an "on/off watering cycle" to get water throughout the top 18-24 inches. This may take a couple of days, especially during long periods of drought.

Water as necessary so planting soil remains moist 2-3 inches below the finished grade. Use a trickling hose or a Tree Gator to ensure steady, slow water flow.

50 *Record:* Make note of any additional observations in the Maintenance Report Log.

60 *Safety completion:* Remove safety perimeter.

SMP-10b: Plant Bed (Planter) Watering, Rain Garden/Bioswale Watering, Meadow Watering

NOTE: Landscape watering for the first year after installation should be covered by the one-year maintenance agreement as outlined in the project specifications and contract/warranty provisions.

This Landscape Watering SMP takes effect one year after tree installation (beginning of Year 2).

Plant beds, or planters, are typically a combination of trees, shrubs, and perennials (flowering plants) in a contained planting bed, with a covering of mulch. Planters can be contained within concrete curbs or seatwalls, or are often at ground level.

Rain gardens and bioswales are shallow surface depressions planted with specially selected native vegetation (trees, shrubs, grasses, and perennials) to treat and capture stormwater runoff. They are often designed to be planted on top of a layer of sand or gravel storage.

A meadow is a field consisting primarily of herbaceous grasses, forbs, wildflowers, and other non-woody plants.

If Trees are present, refer to **SMP-10a Tree Watering**.

Type of Maintenance - Preventative

Tools and Supplies

- Hose
- Sprinkler
- Hydrant
- Water backpack (for small areas)
- Water truck (if no access to water hydrant)

Frequency:

Initial Establishment (First Year after Plant Installation): Water in absence of rainfall in order to maintain a rate of 1" of water per week.

Year 2, Year 3: Water as needed (generally up to ½" of water per week) during the first 4-6 weeks of the growing season, and then only during extended periods of drought and only when ground is not frozen.

Year 4 and Beyond: Water to supplement rainfall only during extended periods of drought and only when ground is not frozen.

Labor Hours: 2 people for approximately 1-5 hours per site depending on site size

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter.

20 *Inspect:* Visually inspect for any bare areas within planters/plant beds/rain gardens/bioswales and also for specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, and/or pest problems. Inspect any areas of standing water for mosquito larvae.

Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any large debris and trash that has accumulated in the plant beds/planters.

40 *Water:*

During the first year after plant installation, water to supplement rainfall throughout the growing season (April through November) if soil conditions are dry. Do not water if ground is frozen. The amount of water recommended (combination of rainfall and/or supplemental watering) is 1" of water per week. *If resources permit, 2" of water per week is recommended during extreme drought conditions for ideal plant growth and peak performance.*

During the second and third year after plant installation, water to supplement rainfall in the first 4-6 weeks of each growing season (April through May) if soil conditions are dry and there is not adequate spring snow melt to provide soil moisture. Do not water if ground is frozen. Also water throughout the growing season if there is extreme drought. The amount of water recommended (combination of rainfall and/or supplemental watering is 1" of water per week). *If resources permit, 2" of water per week is recommended during extreme drought conditions for ideal plant growth and peak performance.*

There is no need to water plants if rainfall has fulfilled the 1" of water per week requirement.

Discontinue watering activities once temperatures create frozen soil conditions. Start again in spring when tree buds swell and sprout new leaves.

Watering Technique:

For tree watering, refer to **SMP-10a Tree Watering**.

Water as necessary so planting soil remains moist 2-3 inches below the finished grade. Use a trickling hose if possible to ensure steady, slow water flow. Water plant roots and avoid watering plant leaves (foliage). Water deeply to promote deeper root growth, which will ultimately enable plants to be more tolerant of drought in the long term.

50 *Record:* Make note of any additional observations in the **Maintenance Report Log**.

60 *Safety completion:* Remove safety perimeter.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-11a: Tree Pruning

NOTE: This SMP includes activities that should be supervised by a certified arborist.

Tree pruning standards shall comply with the following benchmark standards:

ANSI A300 Standard

ANSI Z133.1 Safety Standards

ISA Best Management Practices: Tree Pruning

To ensure that pruning is appropriate for the species and tree/site conditions, it is important to have a clear understanding of the specific needs of the tree and the objectives for pruning. Pruning objectives for shade trees include the following:

- Improve structural strength and reduce failure potential (including dead branch removal)
- Prevent or mitigate a pest problem
- Improve aesthetic characteristics
- Provide clearance for pedestrians, vehicles, and structures
- Improve safety and security for residents and visitors
- Repair structural damage from wind loading
- Reduce maintenance costs (i.e., when applied to young trees)
- Influence flowering and fruiting of some species

Type of Maintenance - Preventative

Tools and Supplies

- Hand Pruners (including hand pruners on pole attachment)
- Pruning Equipment (poles with pruning and saw attachment)
- Bucket Truck (required for pruning once tree is over 20' tall)
- Trash bag, gloves

Frequency:

Pruning: **Year 1 (Pruning of deadwood only)** 1x per tree in Year 1, either January to March or June to September

Year 3 (Correction of Structural Issues) 1x per tree in Year 3, either January to March or June to September:

- a. Reduce or Remove codominant stems
- b. Eliminate included bark and crossing branches
- c. Create balanced canopy
- d. Prevent lion's tailing and over-lifting

- e. Remove large lower limbs

Year 5, 8, 12, 18, 24, 30, 36, 44, 52, 60 (Initiation of Structural pruning) 1x per tree in these years, either January to March or June to September:

- a. Develop or maintain central leader
- b. Identify lowest branches in the permanent canopy. Prevent branches below the permanent canopy from growing too large
- d. Keep all branches less than one half the trunk diameter
- e. Space main branches along one dominant trunk
- f. Suppress growth on branches with included bark

Labor Hours: 1 person per tree Years 1-12;
10 minutes per tree Years 1 through 6;
20 minutes per tree Years 6 to 12;

Bucket truck required after year 12 (typically when tree has reached 20' in height);
20 minutes per crew Years 12 to 24;
30 minutes per crew Years 25 to 36.

Approximate labor hours may vary depending on tree size.

Maintenance Procedure (numbers correspond with Maximo sequencing):

- 10 *Safety set-up:* Set up a safety perimeter. During pruning, keep adjacent paving and construction clean and work area in an orderly condition. Protect existing plants from damage due to landscape maintenance operations and operations of other contractors and trades.
- 20 *Inspect:* Visually inspect for any trees or tree branches that are dead or broken and need to be removed and/or replaced (in the case of an entire tree being dead). Inspect for signs of frost heave and note any plants that may need to be replaced. Inspect trees for signs of vandalism, trunk damage, excessive drought, disease, and/or pest problems. Inspect soil surface in tree pits for signs of overly compacted soils or evidence that trees were planted too deeply (ensure that root flare is still visible).

Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.

- 30 *Remove trash/debris:* Remove any large debris and trash that has accumulated around trees and tree pits and legally dispose of them off Owner's property.
- 40 *Tree Canopy Structural Pruning:*
 - a. Develop or maintain central leader
 - b. Identify lowest branches in the permanent canopy.

- c. Prevent branches below the permanent canopy from growing too large
- d. Keep all branches less than one half the trunk diameter
- e. Space main branches along one dominant trunk
- f. Suppress growth on branches with included bark

Pruning may be done before or after planting at the direction of the City-County Arborist or authorized representative. Pruning shall be done with clean, sharp tools, and not by snapping or chopping portions of the tree

Prune, thin, and shape trees according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by City Arborist, do not cut or remove the central tree leader; remove only injured, dying, or dead branches. Remove all sucker growth from trees and remove overlapping branches to prevent rubbing.

Prune to retain natural character/form. All trees shall be allowed to grow to their natural genetic form and size, unless specifically accepted. Any pruning shall be done to promote structural strength and to accentuate the natural form and features of the tree.

Pruning of street trees shall be carried out to permit unobstructed passage to pedestrians and motor vehicles. Branches shall be maintained to a minimum of 7-1/2 feet above sidewalks and a minimum of 12 feet immediately above vehicular use areas. Within sight clearance restricted areas at traffic intersections, tree canopies shall be maintained at a minimum of 8-1/2 feet above finished grade. Trees in planters or plant beds which do not obstruct passage shall not be limbed up unless otherwise instructed.

Stripping of lower branches of young trees shall not be permitted. Lower branches shall be retained in a pinched condition with as much foliage as possible to promote trunk caliper. Lower branches should be cut off only after the tree is able to stand erect without staking or other support.

Thinning of certain species and individual specimens may be required to prevent wind damage. Suckers, water sprouts, rubbing and heavily laden branches shall be removed to provide less wind resistance.

50 *Disposal:* Gather and dispose of vegetation debris as appropriate.

60 *Record:* Make note of any additional observations in the **Maintenance Report Log.**

70 *Safety completion:* Remove safety perimeter.

SMP-11b: Plant Bed/Planter/Rain Garden/Bioswale (Shrub and Herbaceous Groundcover) Pruning, Division, and Cutback (Removal of Dead Vegetation)

Plant beds, or planters, are typically a combination of trees, shrubs, and perennials (flowering plants) in a contained planting bed, with a covering of mulch. Planters can be contained within concrete curbs or seatwalls, or are often at ground level.

Rain gardens and bioswales are shallow surface depressions planted with specially selected native vegetation (trees, shrubs, grasses, and perennials) to treat and capture stormwater runoff. They are often designed to be planted on top of a layer of sand or gravel storage.

Plants are chosen for their natural shape and growth habit and maintenance should encourage vegetation health and enhance the natural form of plant material. Activities such as trimming and pruning should not alter plant form considerably.

Type of Maintenance - Preventative

Tools and Supplies

- Hand Pruners
- Trowel
- Spade shovel
- Pitchfork
- Bow saw (if necessary)
- Trash bag, gloves

Frequency: 1x/year, see below:

Shrubs: 1x/year in March/April or September/October depending on species

Perennials: 1x/year cutback in March/April or September/October (March/April recommended)

Grasses: 1x/year cut back as needed, March/April

Labor Hours: 2 people for approximately 1-8 hours per site, depending on site size

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter. During pruning, keep adjacent paving and construction clean and work area in an orderly condition. Protect plants from damage due to landscape maintenance operations and operations of other contractors and trades.

20 *Inspect:* Visually inspect for any bare areas of vegetation, or for specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, and/or pest problems. Inspect any areas of standing water for mosquito larvae.

Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any large debris and trash that has accumulated in and around planters/plant beds and legally dispose of them off Owner's property.

40 *Prune:*

Shrubs:

Prune, thin, and shape shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by City Arborist, remove only injured, dying, or dead branches from shrubs; and prune to retain natural character/form. Do not prune for shape.

Shrubs shall be pruned to maintain growth within space limitations, to maintain or enhance the natural growth habit, or to eliminate diseased or damaged growth. Some species shall be trimmed appropriately to influence flowering and fruiting, or to improve vigor.

Shrubs must be trimmed as needed to permit unobstructed passage to residents or vehicles. Trimming shrubs within site clearance restricted areas at intersections is appropriate and shall have a maximum height of 2-1/2 feet from vehicular surface. Any curbs or raised planting areas shall be factored into the maximum 2-1/2 feet height. Shrubs must be trimmed 4 inches from the edges of sidewalks and curbs.

Shrubs shall be pruned to conform to the design concept of the landscape. Individual shrubs shall not be clipped into balled or boxed forms, except where specifically instructed.

Perennials and Herbaceous Plants:

Established plants bordering sidewalks or curbs shall be edged as often as necessary to prevent encroachment. Plants shall not be allowed to cover the crowns of shrubs or trees.

Refer to **Plant ID Sheet** to identify weeds from intended plants.

Perennial cutback/clean-up/removal of dead vegetation: Removing dead vegetation (on perennials) shall occur a minimum of 1x/year during the spring or fall, with a recommendation towards mid-spring before new vegetated growth has emerged or when plant is dormant. Use hand shears to remove dead vegetation and cut back perennials to 6-8" above root crown.

If dried seed pods or dried flowers are considered desirable by the property owner, then the dead vegetation may be allowed to remain through the winter and should be cut back in the spring. Some species have seed pods that act as food for birds/wildlife and/or decorative dried features, however other species may spread seed or look unkempt when dried and this may not be desired.

Perennial Division and Thinning: Depending on the species, perennials may need dividing every 3 – 5 years. This is because as certain plants get older, they die back starting from the center. Division is also done in order to prevent crowding as a plant grows and becomes larger in size. To divide perennials, dig up the old plant, remove the dead vegetation entirely, and replant the healthier sections. To thin perennials, selectively remove individual plant stems (either healthy or dead) if overcrowding is occurring. Thinning of perennials is done to prevent overcrowding and mildew by encouraging air circulation between individual plants.

Grasses:

Refer to **Plant ID Sheet** to identify weeds from intended plants.

Grass cutback: Cut back foliage to 6 – 10" above root crown in mid-spring before warm season grasses emerge, but when cool season weeds are actively growing. Leave a minimum 4-6" of previous growing

season's growth depending on the ornamental grass species. Shorter species such as Blue Fescue will be 4" while taller species such as Switchgrass will be 6".

Grass division: Ornamental and/or clumping grasses shall also be divided every 3 to 5 years to increase vigor. Groundcover grasses and meadow grasses do not need dividing.

List of example grasses that require division:

Sedges (Carex spp.)
Miscanthus (Maiden Grass)
Pennisetum (Fountain Grass)
Andropogon gerardii (Big Bluestem)
Schizachyrium scoparium (Little Bluestem)
Panicum virgatum (Switchgrass)
Calamagrostis x acutiflora (Feather Reed Grass)
Chasmanthium latifolium (Northern Sea Oats)
Festuca ovina var. glauca (Blue Fescue)

50 *Record:* Make note of any additional observations in the Maintenance Report Log.

60 *Safety completion:* Remove safety perimeter

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-12: Meadow Mowing and Invasive Species Management

A meadow is a field consisting primarily of herbaceous grasses, forbs, wildflowers, and other non-woody plants. Mowing a meadow helps to prevent and control woody plant and weed establishment, while also helping to disperse seeds of desirable species. Mowing manages for cool season weeds, which helps promote warm season grass establishment. Using a flail-type mower for large grassland areas results in finely chopped plant material, encourages more rapid breakdown of leaf litter and eliminates the need to bale and remove any cut grasses and/or weeds.

Type of Maintenance - Preventative

Tools and Supplies (see Appendix B: Meadow Maintenance Equipment List)

- Hand Scythes (small meadows)
- Power Strimmer (String Trimmer/Weed Whacker) (small meadows)
- Power Scythe (large meadows)
- Flail-type Mower – suggested mower for large meadows
- Riding or Push Mower – suggested mower for small to medium meadows
- Trash bag, gloves

Frequency:

Initial establishment: 1st Growing Season (Year 1)

- Mow meadow **once a month** during growing season (April through November)

Initial establishment: Year 2

- Mow **once in fall**

Long Term Maintenance regime: Year 3 and after:

- Mow **once every 2 years in early to mid-spring** prior to significant warm season grass regrowth, but when cool season weeds are actively growing. If basin bottom is too wet for spring mowing, mow in late fall (after plants have set seed).

Labor Hours: 2 people for approximately 2-6 hours per site, depending on site size

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter.

20 *Inspect:* Visually inspect the meadow for any bare areas of vegetation or for specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, and/or pest problems. Inspect any areas of standing water for mosquito larvae.

Inspect meadow area for evidence of invasive species establishment. Examples of invasive species include thistle, crown vetch, knapweed, phragmites, and general weeds such as dandelions.

Note areas that will require hand pulling and spot spraying of invasive species (only if the invasive species will not be managed through mowing). Refer to SMP-11c for the instructions on hand pulling and spot spraying of invasives.

Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any large debris and trash that has accumulated in the meadow area and legally dispose of them off Owner's property.

40 *Mowing:*

Never mow when soil is saturated with water.

During mowing, keep adjacent paving and construction clean and work area in an orderly condition. Protect plants from damage due to landscape maintenance operations and operations of other contractors and trades.

Small meadows can be cut/mown with hand scythes or a power strimmer. Larger meadows can be cut/mown with a power scythe or a tractor mower (flail-type mower is recommended).

Refer to Appendix B: Meadow Maintenance Equipment List

- **Initial establishment: 1st Growing Season (Year 1)**
 - Mow meadow when plants/grasses reach a height of approximately 10-inches (10"), which is about once a month during the growing season. Mow down to to height of 6" (or just above the height of emerging native grass seedlings).
 - Remove, finely chop, and redistribute mowings to prevent cut weeds from smothering native grass seedlings.
- **Initial establishment: Year 2**
 - Fall: Mow once during fall to a height of 8".
- **Long Term Maintenance regime: Year 3 and after:**
 - Mow to a height of 6-8" once every 2 years in early to mid-spring prior to significant warm season grass regrowth, but when cool season weeds are actively growing. If basin bottom is too wet for spring mowing, mow in late fall (after plants have set seed).
 - Remove cut material, or mow with a flail mower to finely chop residue.
 - If dry leaf litter builds up:
 - Mow every year or
 - Pull out lower litter that a mower can't reach with a harrow or rake.

50 *Record:* Make note of any additional observations in the Maintenance Report Log.

60 *Safety completion:* Remove safety perimeter.

Appendix B: Meadow Maintenance Equipment List

Riding or Push Mower with 30" Max. Cutting Deck

Use this mower to maintain the fescue mow strips, Landscape Management Zone 4.0 "Mow strips/ Grassed Edges." Use a 3" minimum mow height.

Flail-type mower

Flail mowers are suggested for maintenance of large grassland/meadow areas. The advantage to using flail mowers is that they chop material into fine pieces, encouraging more rapid breakdown of leaf litter and eliminating the need to bale and remove cut grasses or weeds. A flail mower with an arm will be useful in mowing islands and slopes.

Harrow

Harrows may be necessary to rejuvenate meadow stands periodically if flail mowers do not remove enough old plant litter, but they are not needed for annual use.

Save the Rain: Green Infrastructure Program Standard Maintenance Procedure (SMP)

SMP-13a: Plant (Shrub and Herbaceous Plant Material) Replacement

Plant (shrub and herbaceous plant material) replacement involves replacing missing, dead, or diseased shrubs and herbaceous plant material (perennials, forbs, grasses) in planter beds, planters, rain gardens, and/or bioswales if replacement has been deemed necessary.

NOTE: Tree replacement is not part of this SMP and will occur separately.

Type of Maintenance - Replacement

Tools and Supplies

- Safety cones
- Safety gear (clothing, gloves, etc.)
- Planting and Mulching Equipment – shovels, pitchfork, rake, etc.
- Shrubs, plants, and seeds (to be planted)
- Mulch (as specified)
- Trash bags for debris, weeds, etc.

Frequency: Spring and Fall, Replacement as necessary

Labor Hours: 2 people for approximately 2-6 hours per site depending on scope of replacement

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance.

20 *Inspect:* Visually inspect for any bare areas of vegetation or specimen vegetation that has died and needs to be removed and/or replaced. Inspect areas where plants will be planted (replaced) and note signs of soil subsidence, soil compaction, standing water, evidence of disease/fungus, and animal burrowing.

Record observations in the Maintenance Report Log and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any leaves, debris, and trash that have accumulated in or around the plant beds/planters.

All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the Manager/Owner.

40 *Replacement:* Follow the below instructions if shrub and herbaceous groundcover replacement has been deemed necessary. **Tree replacement will occur separately.**

- a) Replacement requirements for shrubs and groundcover:

- Shrubs: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required.
 - Set balled and potted and container-grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 - Pit should be twice as wide as it is deep
 - Use planting soil for backfill, of types specified and scheduled.
 - Carefully remove root ball from container without damaging root ball or plant.
 - Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - If amending soil, place amendment tablets or incorporate amendments in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. If using amendment tablets, place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - Continue backfilling process. Water again after placing and tamping final layer of soil.
- Groundcover and Perennial Plugs: For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
 - Set out and space ground cover and plants in swaths to fill in vegetated gaps in plant bed.
 - Dig holes large enough to allow spreading of roots.
 - Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
 - Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
 - Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - Shrubs:
 - Spring Planting: March 1 to May 1.
 - Fall Planting: September 1 to November 1.
 - Grass & Perennial Plugs:
 - Spring Planting: April 1 to June 15.
 - Fall Planting: August 1 to September 15.

- Bulbs:
 - Fall Planting: September 15 to October 30.

50 *Cleanup:* Stones, debris, tools, equipment, rope, pruned branches, tree debris, etc., shall be removed from the site upon completion of work. Excess soil outside of the saucer areas shall be removed and the area raked smooth. Paved areas shall be broom cleaned.

60 *Record:* Make note of any additional observations in the Maintenance Report Log.

70 *Safety completion:* Remove safety perimeter.

SMP-13b: Meadow Replacement

Meadow replacement involves reseeding or replugging meadow grasses or herbaceous groundcover plants if replacement has been deemed necessary.

Type of Maintenance - Replacement

Tools and Supplies

- Safety cones
- Safety gear (clothing, gloves, etc.)
- Planting Equipment – shovels, etc.
- Plant plugs and seed (to be planted)
- Mulch (as specified)
- Trash bags for debris, weeds, etc.

Frequency: Spring and Fall , Replacement/Reseeding as Necessary

Labor Hours: 2 people for approximately 4-6 hours per site depending on scope of replacement

Maintenance Procedure (numbers correspond with Maximo sequencing):

10 *Safety set-up:* Set up a safety perimeter. Protect plants from damage due to landscape operations and maintenance.

20 *Inspect:* Visually inspect for any bare areas of vegetation or specimen vegetation that has died and needs to be removed and/or replaced. Inspect areas where plants will be planted (replaced) and note signs of soil subsidence, soil compaction, standing water, evidence of disease/fungus, and animal burrowing.

Record observations in the **Maintenance Report Log** and report as necessary. If possible, take photographs to document site conditions.

30 *Remove trash/debris:* Remove any leaves, debris, and trash that have accumulated in or around the meadow.

All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the Manager/Owner.

50 *Replace Plants (Planting/Reseeding):* Follow the below instructions if meadow reseeding has been deemed necessary. For Shrubs and Herbaceous Groundcover, see **SMP-15 Plant (Shrub and Herbaceous Groundcover) Replacement**.

a) Replacement Requirements:

- Re-plugging: see **SMP-13a Plant (Shrub and Herbaceous Groundcover) Replacement** for instructions.

b) Reseeding Requirements:

- Reseed bare areas with same materials specified for respective grasses & forbs.
- Seed mixture shall be fresh, clean, new crop seed. Seed shall be of the previous year's crop and in no case shall the weed seed content exceed 0.25% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and

properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed that has become wet, moldy or otherwise damaged shall not be acceptable.

- Percent Pure Live Seed (PLS) shall be calculated for all seed lots using each seed lot's own unique purity and germination test results. Percent Pure Live Seed is defined by the following formula: $\text{Percent (\% Purity)} \times \text{Percent (\% Germination)} / 100 = \text{Percent (\% Pure Live Seed (PLS))}$. The minimum % PLS shall be 75% for each seed lot. A "PLS Pound" is defined as the bulk weight of seed required to equal one pound of 100% pure, germinable seed.

b) Reseeding Instructions:

- Weather Limitations: Proceed with seeding only when existing and forecasted weather conditions permit.
- Seeded areas to be lightly scarified with springy rake to loosen soil before reseeding.
- For small areas, hand broadcast seed to match initial seeding rate specified for site.
 - Mix seed with two-thirds of a bushel of moist vermiculite before sowing. Divide seed and vermiculite mix into quantities for each area to be reseeded.
 - Broadcast seed evenly across meadow area.
 - After broadcast seeding by hand, firm the seeded area with a land roller, such as a cultipacker or equivalent machinery. Cultipacking is not required if using a Truax no-till drill or a Brillion seeder.
- For larger areas, use no-till seed drill or broadcast seeder, without inert matter added.
 - Seeders such as a "Truax" no-till drill or a double box "Brillion" grass and legume broadcast seeder are recommended. The use of other drill or seeder will require approval of seed supplier prior to use for meadow seeding. The Brillion seeder requires that a fine-graded seedbed be worked up prior to seeding.
- Maintain and establish vegetation by watering, reseeding, weeding, controlling pests and diseases, and other operations. Roll, regrade, and reseed bare or eroded areas and remulch to produce a uniformly smooth vegetative cover.
- Add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- Meadow Mowing: Refer to **SMP-12 Meadow Mowing**.

c) Reseeding Restrictions:

- Seed during one of the following periods.
 - Meadow Seeding: March 15th to June 15th
 - Warm-Season Meadow Seeding: April 15th to June 15th and August 15th to September 15th

Green Infrastructure Maintenance Report Log

Save the Rain: Green Infrastructure Program Maintenance Report Log

PM Task Name: Porous Pavement Maintenance – Porous Asphalt/Concrete & Flexipave

Truck Number: _____

Weather Conditions: _____

Location Name: _____

Location Address: _____

Task Code: _____

Task Description: _____

Task Start Date: _____

Personnel/Task Start Time: _____

Task End Date: _____

Personnel/Task End Time: _____

Labor Personnel Name: Phil Centore

Paul Legnetto Other: _____

Tools Used: Broom

Maximo Item No. 2376

Flat Shovel

Maximo Item No. 8491

Rake

Maximo Item No. 18209

Dust Pan

Maximo Item No. 8386

Other: _____

Maximo Item No. _____

Other: _____

Maximo Item No. _____

Materials Used: Plastic Bag

Maximo Item No. 4478 Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

VACUUMING (Please submit photos if necessary) Maximo Task Code: _____

Vacuum Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Weight/Amount of Material Collected (# bags x pounds or gallons/bag): _____

Description of Collected Materials: _____

Description of Vacuumed Materials: _____

Notes: _____

POWER WASHING (Please submit photos if necessary) Maximo Task Code: _____

Power Washer Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Notes: _____

WINTER MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Plow Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Plowing Notes: _____

Deicing Salt Type/Product Used, if Applicable: _____

Amount Used: _____

Notes: _____

RIVERSTONE EDGE MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Existing Condition of Riverstone and Amount of Weed Growth: _____

Weeds Removed from Riverstone? (YES/NO): _____

Type/Specification of Riverstone Used to Replenish Riverstone: _____

Amount of Riverstone Used: _____

Notes: _____

Save the Rain: Green Infrastructure Program Maintenance Report Log

PM Task Name: Porous Paver Maintenance

Truck Number: _____

Weather Conditions: _____

Location Name: _____

Location Address: _____

Task Code: _____

Task Description: _____

Task Start Date: _____

Personnel/Task Start Time: _____

Task End Date: _____

Personnel/Task End Time: _____

Labor Personnel Name: Phil Centore

Paul Legnetto Other: _____

Tools Used: Broom

Maximo Item No. 2376

Flat Shovel

Maximo Item No. 8491

Rake

Maximo Item No. 18209

Dust Pan

Maximo Item No. 8386

Other: _____

Maximo Item No. _____

Other: _____

Maximo Item No. _____

Materials Used: Plastic Bag

Maximo Item No. 4478 Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

VACUUMING (Please submit photos if necessary) Maximo Task Code: _____

Vacuum Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Weight/Amount of Material Collected (# bags x pounds or gallons/bag): _____

Description of Collected Materials: _____

Description of Vacuumed Materials: _____

Notes: _____

REFILLING VOIDS WITH AGGREGATE (Please submit photos if necessary) Maximo Task Code: _____

Type/Specification of Aggregate Used: _____

Amount of Aggregate Used to Refill Voids: _____

Notes: _____

WINTER MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Plow Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Plowing Notes: _____

Deicing Salt Type/Product Used, if Applicable: _____

Amount Used: _____

Notes: _____

RIVERSTONE EDGE MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Existing Condition of Riverstone and Amount of Weed Growth: _____

Weeds Removed from Riverstone? (YES/NO): _____

Type/Specification of Riverstone Used to Replenish Riverstone: _____

Amount of Riverstone Used: _____

Notes: _____

Save the Rain: Green Infrastructure Program Maintenance Report Log

PM Task Name: Stormwater Structure Cleaning

Truck Number: _____

Weather Conditions: _____

Location Name: _____

Location Address: _____

Task Code: _____

Task Description: _____

Task Start Date: _____

Personnel/Task Start Time: _____

Task End Date: _____

Personnel/Task End Time: _____

Labor Personnel Name: Phil Centore

Paul Legnetto Other: _____

Tools Used: Broom

Maximo Item No. 2376

Flat Shovel

Maximo Item No. 8491

Rake

Maximo Item No. 18209

Dust Pan

Maximo Item No. 8386

Other: _____

Maximo Item No. _____

Other: _____

Maximo Item No. _____

Materials Used: Plastic Bag

Maximo Item No. 4478 Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

STORMWATER STRUCTURE MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Type of Stormwater Structure: _____

Condition of Interior of Stormwater Structure: _____

Types of Debris/Leaf Litter/Sediment Found inside Structure: _____

Vacuum Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____

Weight/Amount of Vacuumed Material: _____

Description of Vacuumed Materials: _____

Notes: _____

INLET FILTER INSERT MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Condition of Existing Inlet Filter Insert: _____

Vacuum Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____

Description of Vacuumed Materials: _____

Notes about Vacuumed Materials: _____

Filter Insert Successfully Reattached? (YES/NO): _____

Replacement of Filter Insert? (YES/NO): _____

Type of Filter Insert Replaced: _____

Notes: _____

RIVERSTONE EDGE MAINTENANCE (*Please submit photos if necessary*) Maximo Task Code: _____

Existing Condition of Riverstone and Amount of Weed Growth: _____

Weeds Removed from Riverstone? (YES/NO): _____

Type/Specification of Riverstone Used to Replenish Riverstone: _____

Amount of Riverstone Used: _____

Notes: _____

Save the Rain: Green Infrastructure Program Maintenance Report Log

PM Task Name: Green Roof

Truck Number: _____

Weather Conditions: _____

Location Name: _____

Location Address: _____

Task Code: _____

Task Description: _____

Task Start Date: _____

Personnel/Task Start Time: _____

Task End Date: _____

Personnel/Task End Time: _____

Labor Personnel Name: Phil Centore

Paul Legnetto Other: _____

Tools Used: Broom

Maximo Item No. 2376

Flat Shovel

Maximo Item No. 8491

Rake

Maximo Item No. 18209

Dust Pan

Maximo Item No. 8386

Other: _____

Maximo Item No. _____

Other: _____

Maximo Item No. _____

Materials Used: Plastic Bag

Maximo Item No. 4478 Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

GREEN ROOF MAINTENANCE (Please submit photos if necessary) Maximo Task Code: _____

Condition of Green Roof Plants: _____

Condition of Waterproofing System (Flashings/Counter-Flashings): _____

Condition of Drainage System (Scuppers/Outlets): _____

Amount of Weeds Present: _____

Plant Replacement/Replenishment Necessary? (YES/NO): _____

Number/Amount of Plants Planted: _____

Types of Species (If Known): _____

Notes: _____

Save the Rain: Green Infrastructure Program Maintenance Report Log

PM Task Name: Landscaping - Trees/Shrubs/Vegetation

Truck Number: _____

Weather Conditions: _____

Location Name: _____

Location Address: _____

Task Code: _____

Task Description: _____

Task Start Date: _____

Personnel/Task Start Time: _____

Task End Date: _____

Personnel/Task End Time: _____

Labor Personnel Name: Phil Centore

Paul Legnetto Other: _____

Tools Used: Broom

Maximo Item No. 2376

Flat Shovel

Maximo Item No. 8491

Rake

Maximo Item No. 18209

Dust Pan

Maximo Item No. 8386

Other: _____

Maximo Item No. _____

Other: _____

Maximo Item No. _____

Materials Used: Plastic Bag

Maximo Item No. 4478 Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

Other: _____

Maximo Item No. _____ Qty: _____

LANDSCAPE GENERAL MAINTENANCE (Please submit photos if necessary) Maximo Task Code: _____

Condition of Trees: _____

Are Root Flares Present? Are trees planted too deep or too shallow? _____

Arborist Follow-Up Visit Necessary? If yes, note which trees: _____

Condition of Shrubs: _____

Condition of Perennials/Grasses/Herbaceous Plants: _____

Amount of Weeds Present: _____

Plant Replacement/Replenishment Necessary? (YES/NO): _____

Notes: _____

LANDSCAPE WEEDING (Please submit photos if necessary) Maximo Task Code: _____

Amount of Weeds Removed/Types of Weeds (If Known): _____

Are invasive species present? (YES/NO if known): _____

Herbicide Used? (Control of Invasive Species Only and Permission Obtained): _____

Type of Herbicide Used: _____

Amount Used: _____

Notes: _____

LANDSCAPE MULCHING (Please submit photos if necessary) Maximo Task Code: _____

What was mulched? Tree Pits Trees Plant Beds Rain Gardens Other: _____

Type of Mulch Used: _____

Amount of Mulch Used: _____

Notes: _____

LANDSCAPE WATERING (Please submit photos if necessary) Maximo Task Code: _____

Amount/Volume of Water Applied: _____

Rate of Watering: _____

Notes: _____

TREE FERTILIZATION (Please submit photos if necessary) Maximo Task Code: _____

Type of Organic Matter/Mycorrhizae Used: _____

Amount Organic Matter/Mycorrhizae Applied: _____

Notes: _____

PRUNING OF TREES AND SHRUBS (Please submit photos if necessary) Maximo Task Code: _____

Type of Pruning Done? Deadwood Structural Other: _____

What was pruned? Trees Shrubs Other: _____

Arborist Follow-Up Visit Necessary? If yes, note which trees: _____

Notes: _____

PLANT DIVISION/CUTBACK: (Please submit photos if necessary) Maximo Task Code: _____

Approximate number/square footage of plants cut back/dead vegetation removed: _____

Perennials divided? YES/NO _____

Grasses divided? YES/NO _____

Species divided (If known): _____

Notes: _____

LANDSCAPE REPLACEMENT (Please submit photos if necessary) Maximo Task Code: _____

Plant Replacement/Replenishment Necessary? (YES/NO): _____

What was replaced? (Circle answer) Trees Shrubs Perennials Grasses Other

Number/Amount of Plants Planted: _____

Types of Species (If Known): _____

Notes: _____

MEADOW MOWING (Please submit photos if necessary) Maximo Task Code: _____

Mower Type/Manufacturer: _____

Hour Meter Start: _____ Hour Meter End: _____ Number of Passes: _____

Height of Mow Blade: _____

Notes: _____

Additional Notes (Please submit photos if necessary):

- 50 *Cleanup:* Stones, debris, tools, equipment, rope, pruned branches, plant debris, etc., shall be removed from the site upon completion of work. Excess soil outside of the saucer areas shall be removed and the area raked smooth. Paved areas shall be broom cleaned.
- 60 *Record:* Make note of any additional observations in the **Maintenance Report Log.**
- 70 *Safety completion:* Remove safety perimeter.

Common Plants Used in Rain Gardens/Bioretenction
(Plant List and ID Manual –*Draft Version*)



Save the Rain

Green Infrastructure Maintenance Training

Common Rain Garden/Bioretention Plants

Working List: Updated March 2012

Ornamental Grass Species

CAREX AMPHIBOLA	CREEK SEDGE
CAREX EBURNEA	BRISTLELEAF SEDGE
CAREX FLACCOSPERMA	BLUE WOOD SEDGE
CAREX PENNSYLVANICA	PENNSYLVANICA SEDGE
CAREX INTERIOR	INLAND SEDGE
CAREX STRICTA	TUSSOCK SEDGE, UPRIGHT SEDGE
CAREX VULPINOIDEA	FOX SEDGE
DELOSPERMA NUBIGENUM 'BASTUTOLAND'	YELLOW ICE PLANT
HYPERICUM SP	ST. JOHNS WORT
JUNIPERUS HORIZONTALIS	HORIZONTAL JUNIPER
PACHYSANDRA PROCUMBENS	ALLEGHENY SPURGE
PHLOX DIVARICATA SP	WOODLAND PHLOX
PHLOX STOLONIFERA	CREEPING PHLOX
RHUS AROMATICA 'GRO-LOW'	FRAGRANT SUMAC
WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY

Groundcover Species

ANDROPOGON GLOMERATUS	BUSHY BLUESTEM
ANDROPOGON VIRGINICUS	BROOMSEDEGE
BOUTELOUA CURIPENDULA	SIDEOATS GRAMA
CALAMAGROSTIS ACUTIFLORA 'KARL FOERSTER'	KARL FOERSTER FEATHER REED GRASS
CALAMAGROSTIS CANADENSIS	BLUEJOINT GRASS
CHASMANTHIUM LATIFOLIUM	NORTHERN SEA OATS
DISTICHLIS SPICATA	SPIKE GRASS
ELYMUS RIPARIUS	RIVERBANK RYE
ELYMUS VIRGINICUS	VIRGINIA WILD RYE
ERAGROSTIS SPECTABILIS	PURPLE LOVE GRASS
FESTUCA GLAUCA 'ELIJAH BLUE'	BLUE FESCUE
JUNCUS EFFUSUS	SOFT RUSH, COMMON RUSH
PANICUM VIRGATUM 'HEAVY METAL'	HEAVY METAL SWITCH GRASS

PANICUM VIRGATUM 'SHENANDOAH'
SCHIZACHYRIUM SCOPARIUM
SPARTINA PECTINATA
SPOROBOLUS HETEROLEPIS 'TARA'

SHENANDOAH SWITCH GRASS
LITTLE BLUESTEM
PRAIRIE CORDGRASS
TARA PRAIRIE DROPSEED

Perennial Species

ACORUS CALAMUS	SWEET FLAG
ACHILLEA 'FEUERLAND' FIRELAND	FIRELAND YARROW
ACHILLEA MILLEFOLIUM 'OERTEL'S ROSE'	OERTEL'S ROSE COMMON YARROW
ACHILLEA 'MOONSHINE'	MOONSHINE YARROW
ACHILLEA 'TERRACOTTA'	TERRACOTTA YARROW
ASCLEPIAS INCARNATA	SWAMP MILKWEED
ASCLEPIAS TUBEROSA	BUTTERFLY MILKWEED
ASTER NOVAE-ANGLIAE 'PURPLE DOME'	PURPLE DOME NEW ENGLAND ASTER
ASTER NOVI-BELGII	NEW YORK ASTER
ASTER NOVI-BELGII 'WOODS LIGHT BLUE'	WOOD'S LIGHT BLUE ASTER
COREOPSIS VERTICILLATA	WHORLED TICKSEED
DICENTRA EXIMIA	BLEEDING HEART
ECHINACHEA PURPUREA	PURPLE CONEFLOWER
EUPATORIUM DUBIUM 'LITTLE JOE'	LITTLE JOE PYE WEED
GAILLARDIA ARISTATA	BLANKET FLOWER
GERANIUM MACULATUM	SPOTTED GERANIUM / WILD CRANSBILL
HELIANTHUS DIVARICATUS	WOODLAND SUNFLOWER
HEUCHERA 'CARAMEL'	CARAMEL CORAL BELL
HEUCHERA MICRANTHA 'PALACE PURPLE'	PALACE PURPLE CORAL BELL
HOSTA 'BLUE VISION'	BLUE VISION HOSTA
HOSTA 'HONEYBELLS'	HONEYBELLS HOSTA
IRIS VERSICOLOR	BLUE FLAG IRIS
LIATRIS SPICATA	DENSE BLAZING STAR
LOBELIA CARDINALIS	CARDINAL FLOWER
LOBELIA SIPHILITICA	GREAT BLUE LOBELIA, BLUE CARDINAL FLOWER
PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE
PHYSOSTEGIA VIRGINIANA	OBEDIENT PLANT
POLYGONATUM BIFLORUM	SOLOMONS SEAL
RUDBECKIA FULGIDA 'GOLDSTURM'	GOLDSTURM BLACK-EYED SUSAN
RUDBECKIA LACINATA	CUTLEAF CONEFLOWER
SOLIDAGO SEMPERVIRENS	SEASIDE GOLDENROD
SOLIDAGO RUGOSA 'FIREWORKS'	GOLDENROD
SOLIDAGO SHORTII 'SOLAR CASCADE'	SOLAR CASCADE GOLDENROD
VERNONIA NOVEBORACENSIS	NEW YORK IRON WEED

Shrub Species

ARONIA ARBUTIFOLIA 'BRILLIANTISSIMA'	RED CHOKEBERRY
BUXUS X 'GREEN MOUNTAIN'	GREEN MOUNTAIN BOXWOOD
CLETHRA ALNIFOLIA	SWEET PEPPERBUSH /SUMMERSWEET
COMPTONIA PEREGRINA	SWEETFERN
CORNUS SERICEA	RED-OSIER DOGWOOD
DIERVILLA LONICERA 'COPPER'	DWARF BUSH HONEYSUCKLE
HAMAMELIS VERNALIS	WITCHHAZEL
HYDRANGEA ARBORESCENS	HYDRANGEA
ILEX VERTICILLATA	WINTERBERRY
ITEA VIRGINICA 'LITTLE HENRY'	LITTLE HENRY VIRGINIA SWEETSPIRE
MYRICA PENNSYLVANICA	NORTHERN BAYBERRY
ROSA VIRGINIANA	VIRGINIA ROSE
VACCINIUM CORYMBOSUM	HIGHBUSH BLUEBERRY
VIBURNUM CASSINOIDES	WITHEROD VIBURNUM
VIBURNUM DENTATUM	ARROWWOD VIBURNUM

Fern Species

ATHRYIUM FELIX-FEMINA	LADY FERN
DRYOPTERIS MARGINALIS	EASTERN WOOD FERN
OSMUNDA CINNAMOMEA	CINNAMON FERN
OSMUNDA REGALIS 'SPECTABILIS'	ROYAL FERN
POLYSTICHUM ACROSTICHOIDES	CHRISTMAS FERN

Common Rain Garden/Bioretention Plant Species: ORNAMENTAL GRASSES

Andropogon species (Bluestem, BroomSedge)



Chasmanthium latifolium (Northern Sea Oats)



Bouteloua curtipendula (Sideoats Grama)



Distichlis spicata (Spike Grass)



Calamagrostis species (BlueJoint Grass)



Elymus species (Riverbank Rye, Virginia Wild Rye)



Eragrostis Spectabilis (Purple Love Grass)



Common Rain Garden/Bioretention Plant Species: ORNAMENTAL GRASSES

Festuca species (Fescue)



Schizachyrium Scoparium (Little Bluestem)



Juncus effusus (Soft Rush)



Spartina Pectinata (Prairie Cordgrass)



Panicum virgatum var. (Switchgrass)



Sporobolus heterolepis (Prairie Dropseed)



Common Rain Garden/Bioretention Plant Species: FERNS

Athyrium Felix-Femina (Lady Fern)



Osmunda Regalis (Royal Fern)



Dryopteris Marginalis (Eastern Wood Fern)



Polystichum acrostichoides (Christmas Fern)



Osmunda Cinnamomea (Cinnamon Fern)



Common Rain Garden/Bioretention Plant Species: **GROUNDCOVERS**

Carex spp. (Sedges)



Pachysandra Procumbens (Allegheny Spurge)



Phlox species (Phlox)



Delosperma Nubigenum (Yellow Ice Plant)



Rhus Aromatica (Fragrant Sumac)



Hypericum species (Hypericum)



Waldsteinia Fragarioides (Barren Strawberry)



Juniperus horizontalis (Horizontal Juniper)



Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Acorus calamus (Sweet Flag)

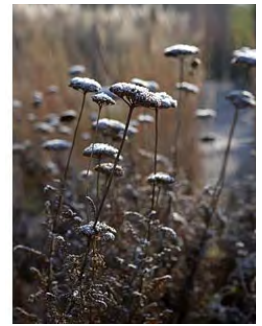
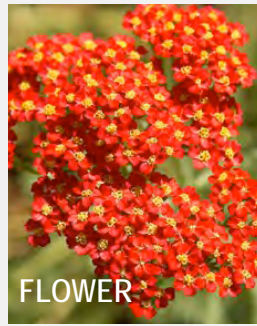


PHOTO COMING

PHOTO COMING

Achillea species (Yarrow)

PHOTO COMING



Asclepias species (Swamp Milkweed/Butterfly Weed)

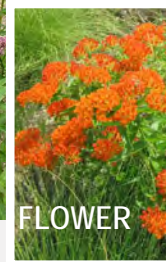


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Aster species (Asters)

PHOTO COMING



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Coreopsis verticillata (Whorled tickseed)



PHOTO COMING

Dicentra Eximia (Bleeding Heart)

PHOTO COMING

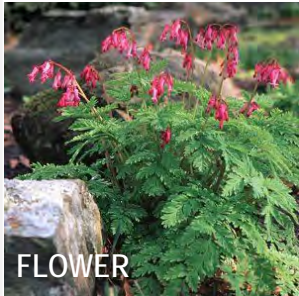
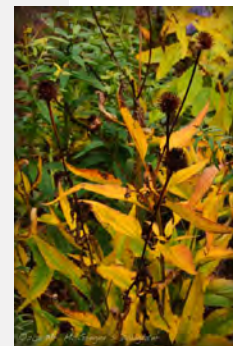


PHOTO COMING

Echinacea Purpurea (Purple Coneflower)



Eupatorium dubium (Joe-Pye Weed)



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Gaillardia species (Blanketflower)

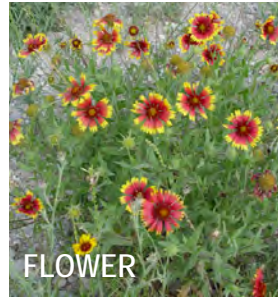


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Geranium maculatum (Spotted Geranium)



Helianthus divaricatus (Woodland Sunflower)



PHOTO COMING

Heuchera species (Coral Bell)



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Hosta species (Hosta)



PHOTO COMING

PHOTO COMING

Iris versicolor (Blue Flag Iris)

PHOTO COMING



PHOTO COMING

Liatis spicata (Blazing Star)



Lobellia species (Cardinal Flower/Great Blue Lobelia)

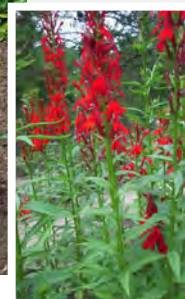


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Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Penstemon digitalis (Foxglove Beardtongue)



PHOTO COMING

Physostegia virginiana (Obedient Plant)



Polygonatum Biflorum (Solomon's Seal)



Rudbeckia species (Black-Eyed Susan)

PHOTO COMING



Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Solidago species (Goldenrod)



PHOTO COMING

Vernonia novaboracensis (New York Ironweed)

PHOTO COMING



Common Weed Species to Look For and REMOVE !

Weed species vary from site to site, depending on surrounding conditions, existing weed seeds, and other factors. Below are some of the common weeds that may be encountered.

Bird's Food Trefoil



Foxtail



Crabgrass



Knapweed



Crown Vetch



Nutsedge



Dandelion



Common Weed Species to Look For and REMOVE !

Weed species vary from site to site, depending on surrounding conditions, existing weed seeds, and other factors. Below are some of the common weeds that may be encountered.

Phragmites



Sweet Clover



Quack Grass



Thistle



Ragweed



Wild Parsnip



Common Rain Garden/Bioretention Plant Species: ORNAMENTAL GRASSES

Andropogon species (Bluestem, BroomSedge)



Chasmanthium latifolium (Northern Sea Oats)



Bouteloua curtipendula (Sideoats Grama)



Distichlis spicata (Spike Grass)



Calamagrostis species (BlueJoint Grass)



Elymus species (Riverbank Rye, Virginia Wild Rye)



Eragrostis Spectabilis (Purple Love Grass)



Common Rain Garden/Bioretention Plant Species: ORNAMENTAL GRASSES

Festuca species (Fescue)



Schizachyrium Scoparium (Little Bluestem)



Juncus effusus (Soft Rush)



Spartina Pectinata (Prairie Cordgrass)



Panicum virgatum var. (Switchgrass)



Sporobolus heterolepis (Prairie Dropseed)



Common Rain Garden/Bioretention Plant Species: FERNS

Athyrium Felix-Femina (Lady Fern)



Osmunda Regalis (Royal Fern)



Dryopteris Marginalis (Eastern Wood Fern)



Polystichum acrostichoides (Christmas Fern)



Osmunda Cinnamomea (Cinnamon Fern)



Common Rain Garden/Bioretention Plant Species: GROUNDCOVERS

Carex spp. (Sedges)



Pachysandra Procumbens (Allegheny Spurge)



Phlox species (Phlox)



Delosperma Nubigenum (Yellow Ice Plant)



Rhus Aromatica (Fragrant Sumac)



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spring

summer

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late fall/winter

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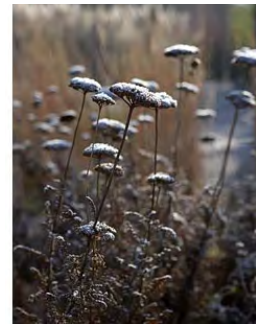
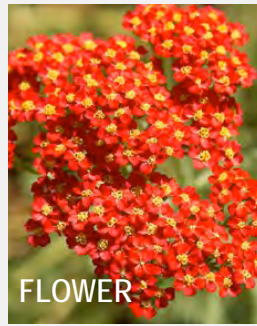


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Achillea species (Yarrow)

PHOTO COMING



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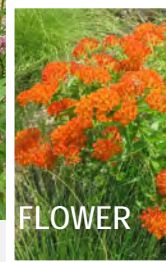


PHOTO COMING

Aster species (Asters)

PHOTO COMING



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Coreopsis verticillata (Whorled tickseed)



PHOTO COMING

Dicentra Eximia (Bleeding Heart)

PHOTO COMING

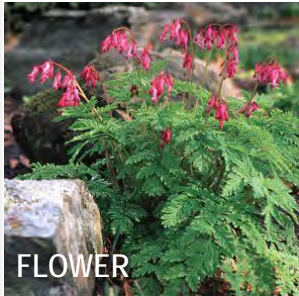
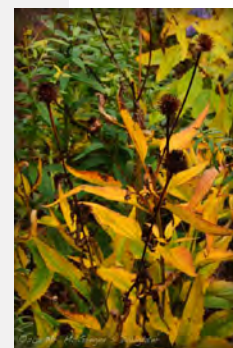


PHOTO COMING

Echinacea Purpurea (Purple Coneflower)



Eupatorium dubium (Joe-Pye Weed)



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

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Gaillardia species (Blanketflower)

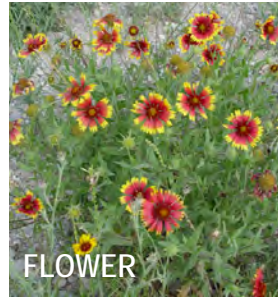


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Geranium maculatum (Spotted Geranium)



Helianthus divaricatus (Woodland Sunflower)



PHOTO COMING

Heuchera species (Coral Bell)



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Hosta species (Hosta)



PHOTO COMING

PHOTO COMING

Iris versicolor (Blue Flag Iris)

PHOTO COMING

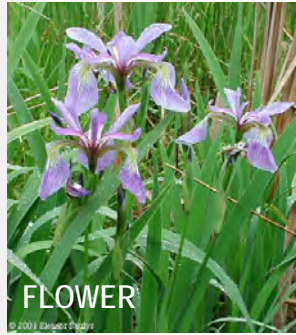


PHOTO COMING

Liatis spicata (Blazing Star)



Lobellia species (Cardinal Flower/Great Blue Lobelia)



PHOTO COMING

Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Penstemon digitalis (Foxglove Beardtongue)



PHOTO COMING

Physostegia virginiana (Obedient Plant)



Polygonatum Biflorum (Solomon's Seal)



Rudbeckia species (Black-Eyed Susan)

PHOTO COMING



Common Rain Garden/Bioretention Plant Species: PERENNIALS

spring

summer

fall

late fall/winter

Solidago species (Goldenrod)



PHOTO COMING

Vernonia novaboracensis (New York Ironweed)

PHOTO COMING



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Foxtail



Crabgrass



Knapweed



Crown Vetch



Nutsedge



Dandelion



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Phragmites



Sweet Clover



Quack Grass



Thistle



Ragweed



Wild Parsnip



Common Rain Garden/Bioretention Plant Species: ORNAMENTAL BULBS

spring

summer

fall

late fall/winter

Allium cernuum (Nodding Onion)



Allium Senescens (Ornamental Onion)



Narcissus var. (Daffodills)



Common Rain Garden/Bioretention Plant Species: ORNAMENTAL BULBS

spring

summer

fall

late fall/winter

Allium cernuum (Nodding Onion)



Allium Senescens (Ornamental Onion)



Narcissus var. (Daffodills)



Appendix: 11" x 17" Site Plans/Asset Tables

- a. City Lot 21**
- b. City Lot 3**
- c. Townsend Lot B**

Onondaga County Department of Water Environment Protection - Asset Identification for 2010 Constructed Green Projects

P-ID C-01
P-NAME City Lot # 21
P-ADDRESS SW Corner of West Washington Street and Clinton Street
INSTALL DATE 2010 October
LONGITUDE (X) 935226.8285
LATITUDE (Y) 1111349.128

NOTES

Craft	Asset	Manufacturer if known	Quantity	Units
Drainage	3' x 3' concrete catch basin w/ solid lid	East Jordan IronWorks	2	ea
Drainage	3' x 3' concrete catch basin w/ grate		2	ea
Drainage	Inlet filter inserts	Flogard Plus (Kristar)	2	ea
Drainage	Two-Piece HDPE Anti-Seep Collar	Lane Enterprises	2	ea
Drainage	Solid HDPE pipe with bedding		13	Linear Feet
Drainage	Perforated HDPE pipe without bedding		223.6	Linear Feet
Landscaping	Trees (<i>Species not specified in bid plan</i>)		6	ea
Landscaping	Hedgerow			
Landscaping	Root barrier	Deep Root	82.56	Sq. Yard
Landscaping	CU Structural Soil	Cornell University		
Paving	Porous Pavers		700	Sq. Feet
Paving	Paver Edge Bracket (between Pavers and Pavement)	PermaLoc		

Onondaga County Department of Water Environment Protection - Asset Identification for 2010 Constructed Green Projects

P-ID C-09
P-NAME Townsend Median Phase 1
P-ADDRESS 431 Harrison Street and Townsend Street
INSTALL DATE 2010
LONGITUDE (X) 937181.9573
LATITUDE (Y) 1109800.238

NOTES

Craft	Asset	Manufacturer if known	Quantity	Units
Drainage	18" Diameter PVC Catch Basin (Riser with Lid)		1	ea.
Drainage	18" Diameter PVC Catch Basin (Riser with Domed Grate)		8	ea.
Drainage	Anti-Seep Collar		3	ea.
Drainage	Standard City Inlet		4	ea.
Drainage	8" Diameter Perforated HDPE Piping		422	Linear Feet
Drainage	8" Diameter HDPE Piping		27	Linear Feet
Drainage	10" Diameter HDPE Piping		179	Linear Feet
Landscaping	6" Planting Soil (Tree Trench)		345	Cubic Yards
Landscaping	Structural Soil (Tree Trench)		340	Cubic Yards
Landscaping	Mulch (Tree Trench)		60	Cubic Yards
Landscaping	Canopy Trees (41 total)			
Landscaping	Sugar Maple		15	ea.
Landscaping	Black Gum		8	ea.
Landscaping	Swamp White Oak		7	ea.
Landscaping	Shingle Oak		11	ea.
Landscaping	Understory Trees (38 total)			
Landscaping	Serviceberry		38	ea.
Landscaping	Shrubs (276 Total)			
Landscaping	red twig dogwood		47	ea.
Landscaping	witchhazel		58	ea.
Landscaping	winterberry "red sprite"		98	ea.
Landscaping	winterberry "jim dandy"		10	ea.
Landscaping	Summersweet		63	ea.
Landscaping	Bloretention Plugs (Groundcover)		2272	ea.
Landscaping	swamp milkweed		494	ea.
Landscaping	new england aster		550	ea.
Landscaping	northern sea oats		1000	ea.
Landscaping	soft rush		836	ea.
Landscaping	switch grass		722	ea.
Landscaping	goldenrod		400	ea.
Landscaping	creek sedge		2272	ea.
Landscaping	Lawn seed		3162	Square Feet

Onondaga County Department of Water Environment Protection - Asset Identification for 2010 Constructed Green Projects

P-ID E-06
P-NAME City Lot # 3
P-ADDRESS 101 Oswego Boulevard
INSTALL DATE 2010 October
LONGITUDE (X) 935987.9255
LATITUDE (Y) 1112032.647

NOTES

Craft	Asset	Manufacturer if known	Quantity	Units
Drainage	Existing City Outlets		2	each
Drainage	Concrete Overflow Control Structure with Removable Weir		1	each
Drainage	Existing City Manhole		1	each
Drainage	Inlet filter inserts	Flogard Plus (Kristar)	3	each
Drainage	Two-Piece HDPE Anti-Seep Collar	Lane Enterprises	3	each
Drainage	Clean Outs	East Jordan IronWorks	10	each
Drainage	Anti-Seep Collars		4	each
Landscaping	Trees		23	each
Landscaping	Hedgerow			
Landscaping	Root barrier	Deep Root	170	Sq yards
Landscaping	CU Structural Soil	Cornell University	310	Cubic yards
Landscaping	Topsoil		260	Cubic yards
Paving	Asphalt Treated Permeable Base		8730	Sq Feet
Paving	Solid HDPE pipe with bedding		200	Linear feet
Paving	Perforated HDPE pipe without bedding		500	Linear feet

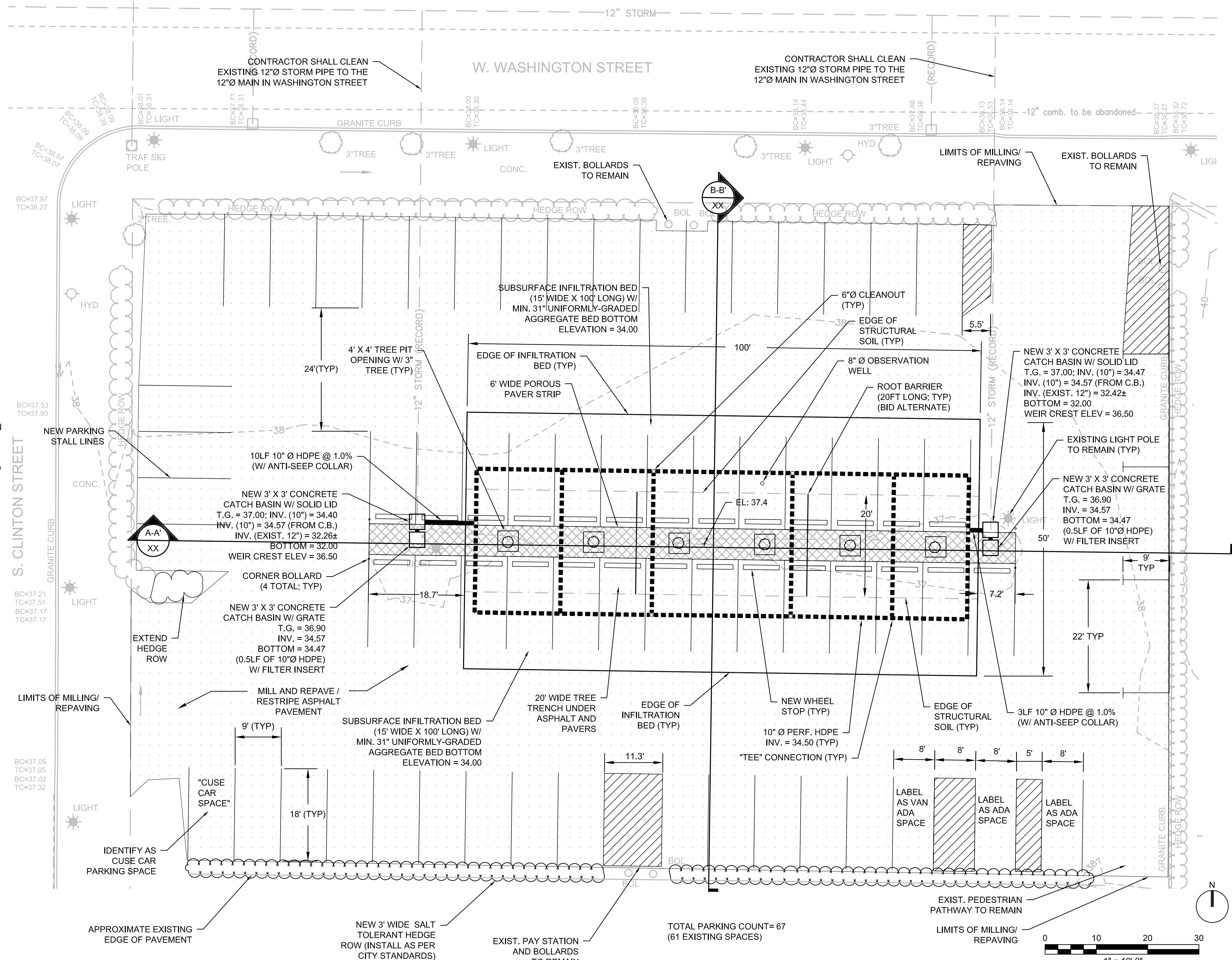
LEGEND

	PERF. HDPE
	POROUS PAVERS
	MILL/ NEW ASPHALT
	SOLID HDPE
	PARKING LOT STRIPING

CONSTRUCTION NOTES:

1. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES WHERE AND WHEN APPROPRIATE AS PER THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (AUGUST 2005, OR LATEST EDITION). PROTECT EXISTING SITE FEATURES UNLESS OTHERWISE NOTED. CONSULT ENGINEER PRIOR TO INFILTRATION BED INSTALLATION.
2. PROTECT INFILTRATION BED SUBGRADE FROM SEDIMENT DEPOSITION AND/OR COMPACTION DURING CONSTRUCTION. DO NOT ALLOW CONSTRUCTION VEHICLES TO TREAD ON THE INFILTRATION BED SUBGRADE.
3. CONTRACTOR SHALL FOLLOW INFILTRATION BED AND DRAINAGE CONTROL REQUIREMENTS AS SPECIFIED BY ENGINEER.
4. INSTALL STRUCTURAL SOIL (20' WIDE, 3' DEEP) IN TREE TRENCH UNDER PAVERS AND ASPHALT. BASE BID TO INCLUDE ONLY CU STRUCTURAL SOIL. BID ALTERNATES TO INCLUDE SILVA CELL BY DEEP ROOT (WITH NATURAL SANDY LOAM, OR AS RECOMMENDED BY DEEP ROOT OR APPROVED EQUAL) AND SAND-BASED STRUCTURAL SOIL AS SHOWN ON SHEET C5.
5. NOTIFY DIG SAFELY NEW YORK AT LEAST 72 HOURS PRIOR TO CONSTRUCTION.
6. INSTALL TWO-PIECE HDPE ANTI-SEEP COLLAR BY LANE ENTERPRISES, OR APPROVED EQUAL. INSTALL COLLAR ON THE INDICATED SOLID HDPE PIPES APPROXIMATELY 1' FROM EDGE OF THE INFILTRATION BED/TREE TRENCH.
7. ROOT BARRIER SHALL BE BY DEEP ROOT, OR APPROVED EQUAL, AND EXTEND FULL WIDTH AND DEPTH OF STRUCTURAL SOIL. TO BE BID AS AN ADD ALTERNATE.
8. REFER TO DETAILS AND PROFILES ON SHEETS C3-C5.
9. CLEANOUTS SHALL BE 6" PVC AS INDICATED ON DETAIL 1/C3.
10. INSTALL EDGE BRACKET BETWEEN PAVERS AND ADJACENT ASPHALT PAVEMENT. (ASPHALT EDGE BY PERMALOC, OR APPROVED EQUAL)
11. INSTALL FLOGARD+ (OR APPROVED EQUAL) FILTER INSERTS IN THE INDICATED CATCH BASINS (2).
12. PLACE CATCH BASINS WITH OPEN GRATES IN THE MIDDLE OF THE POROUS PAVER STRIP. THERE SHOULD BE APPROXIMATELY 18" OF PAVERS ON EITHER SIDE OF CATCH BASIN.
13. IMMEDIATELY FOLLOWING CONSTRUCTION, RETURN ALL EXISTING IMPROVEMENTS TO PRE-CONSTRUCTION CONDITIONS.
14. REUSE EXISTING HANDICAPPED PARKING SIGNS WHERE SHOWN.
15. FOR TREE SPECIES AND PLANTING INFORMATION, SEE SHEET C-4; INSTALL TREES AS PER CITY STANDARDS.
16. BOLLARDS SHALL BE PLACED AT THE FOUR CORNERS OF THE POROUS PAVERS. THEY SHALL BE REMOVABLE, PADLOCKABLE, AND FAUX WOOD PINE-COLORED PLASTIC, UNLESS OTHERWISE APPROVED BY ENGINEER.

NOTE: IT IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON TO ALTER THIS DOCUMENT IN ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. IF A DOCUMENT BEARING THE SEAL OF AN ENGINEER IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE DOCUMENT THEIR SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.



FOR BIDDING AND CONSTRUCTION

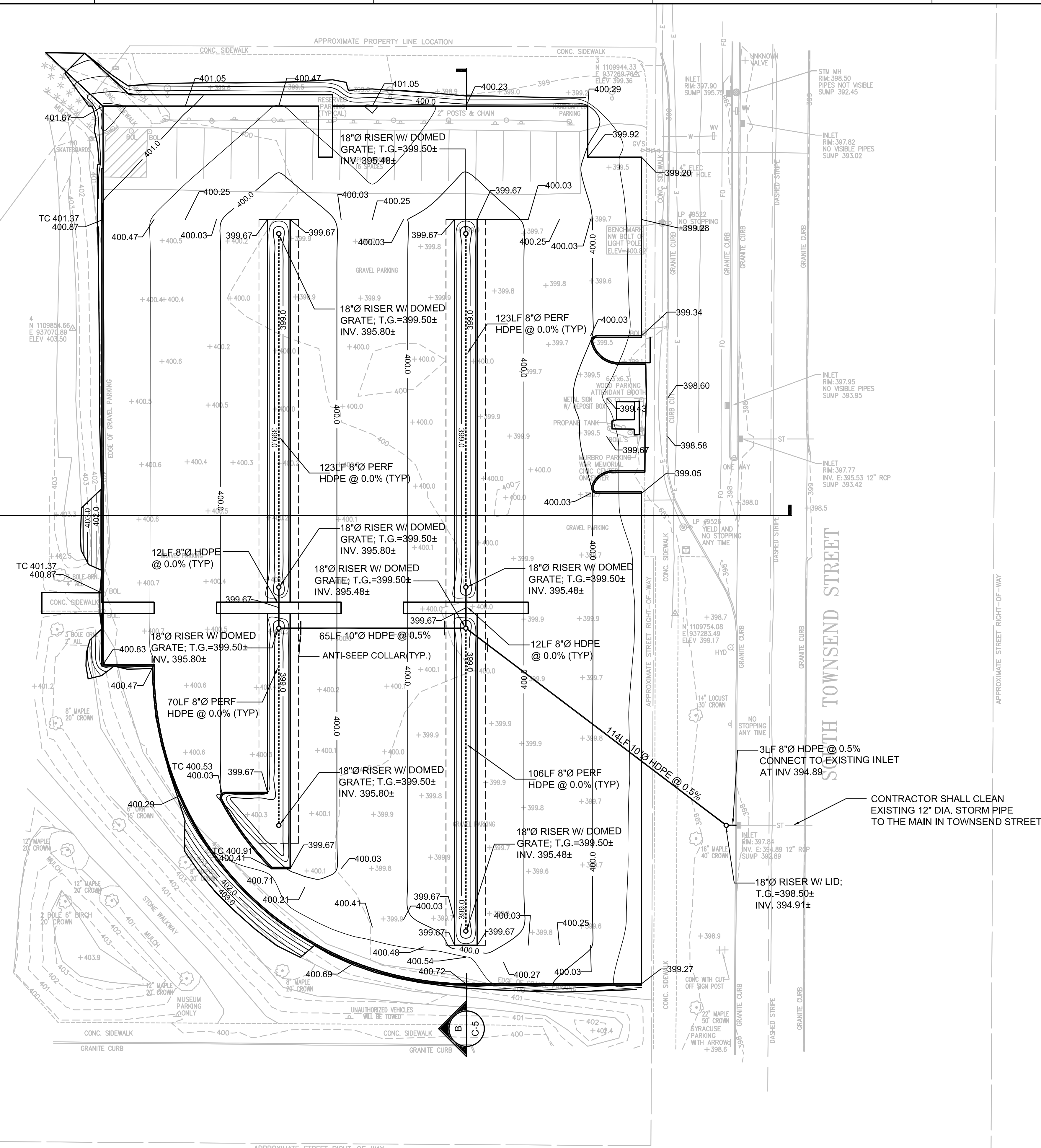
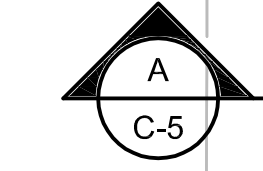


APVD	N	BY	APVD	M. MARKO
REVISION	DESCRIPTION	CHK	DR	A. POTTS
NO	DATE	NO	DATE	D. WIBLE
NO	DATE	NO	DATE	S. SMITH
NO	DATE	NO	DATE	DR

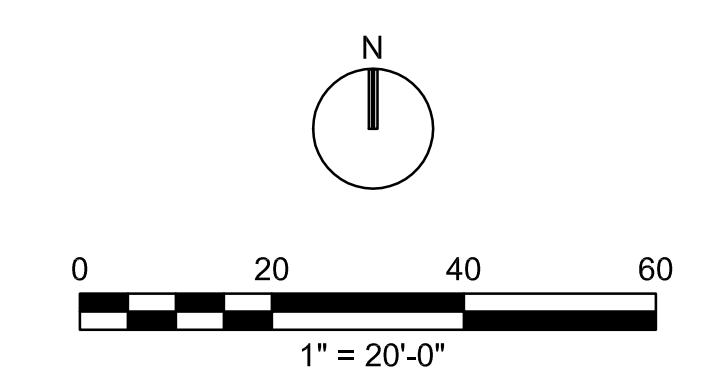
CH2MHILL
 1717 ARCH STREET, SUITE 4400
 PHILADELPHIA, PA 19103
 215-563-4220

PARKING LOT LAYOUT PLAN	
AS NOTED	
BAR IS ONE INCH ON ORIGINAL DRAWING.	
DATE	MARCH 22, 2010
PROJ	381098
DWG	C2
SHEET	2 OF 5

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NOTES:
 1. CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES AND IMPROVEMENTS PRIOR TO CONSTRUCTION AND IMMEDIATELY NOTIFY ENGINEER OF ANY CONFLICTS WITH PROPOSED WORK.



- CONSTRUCTION NOTES:
1. VERIFY ALL EXISTING UTILITIES AND OTHER IMPROVEMENTS PRIOR TO START OF WORK AND IMMEDIATELY NOTIFY ENGINEER OF POTENTIAL CONFLICTS WITH PROPOSED WORK.
 2. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES AS PER THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (AUGUST 2005, OR LATEST EDITION). PROTECT EXISTING SITE FEATURES UNLESS OTHERWISE NOTED. CONSULT ENGINEER PRIOR TO TREE TRENCH INSTALLATION.
 3. PROTECT TREE TRENCH SUBGRADE FROM SEDIMENT DEPOSITION AND COMPACTION DURING CONSTRUCTION. SCARIFY TOP 3" OF SUBGRADE. DO NOT ALLOW CONSTRUCTION VEHICLES TO TREAD ON THE TREE TRENCH SUBGRADE. SEE SPECIFICATIONS.
 4. CONTRACTOR SHALL FOLLOW INFILTRATION BED (TREE TRENCH) AND DRAINAGE CONTROL REQUIREMENTS AS SPECIFIED BY ENGINEER.
 5. NOTIFY DIG SAFELY NEW YORK AT LEAST 72 HOURS PRIOR TO CONSTRUCTION.
 6. REFER TO DETAILS AND PROFILES ON SHEETS C-5-C-7.
 7. IMMEDIATELY FOLLOWING CONSTRUCTION, RETURN ALL EXISTING IMPROVEMENTS TO PRE-CONSTRUCTION CONDITIONS.
 8. INSTALL TWO-PIECE HDPE ANTI-SEEP COLLAR BY LANE ENTERPRISES, OR APPROVED EQUAL. INSTALL COLLAR ON SOLID HDPE PIPES APPROXIMATELY 1FT FROM EDGE OF TREE TRENCH.

CONTRACTOR SHALL CLEAN EXISTING 12" DIA. STORM PIPE TO THE MAIN IN TOWNSEND STREET

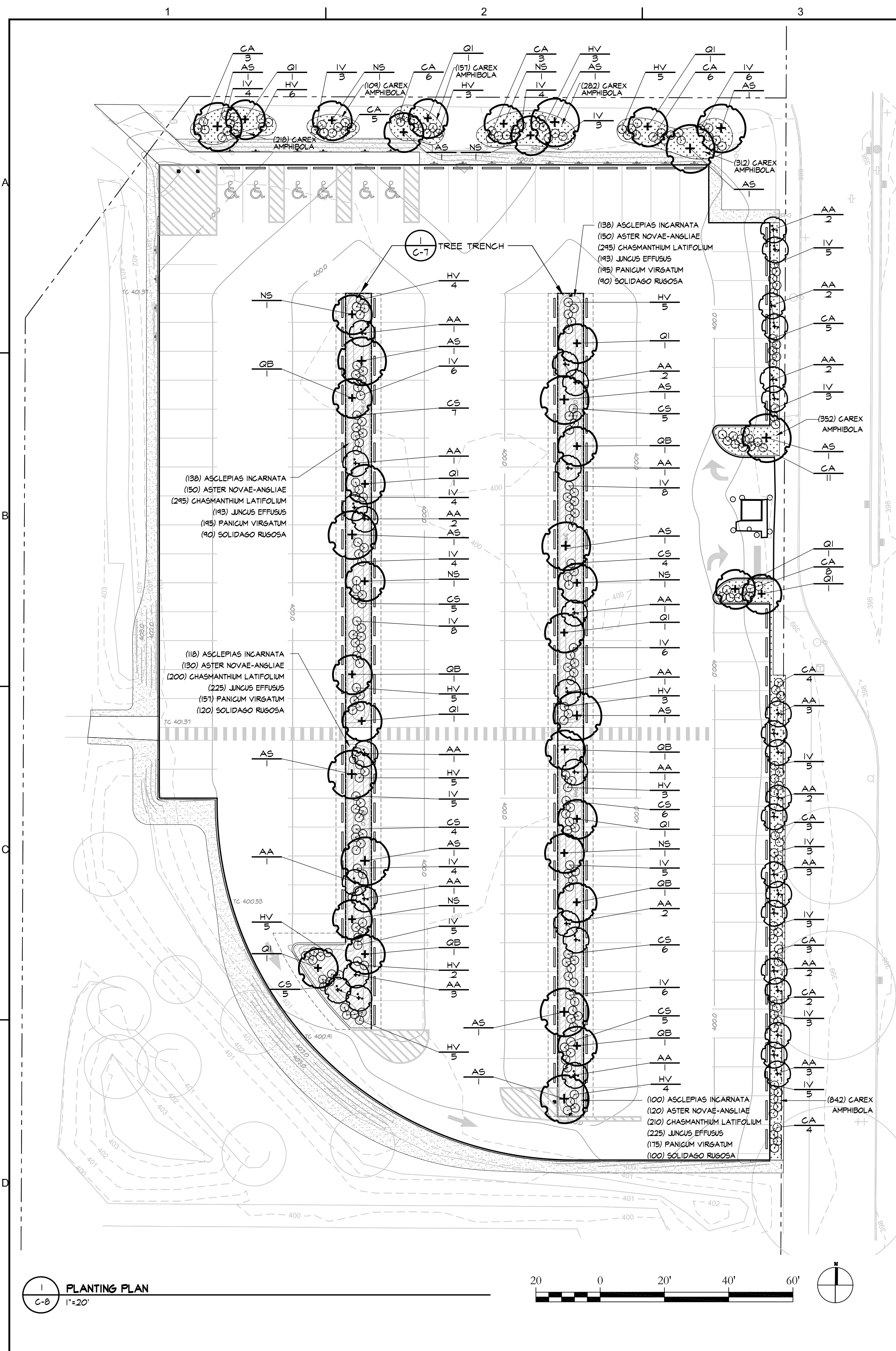


NO.	DATE	DR	CHK	REVISION	BY	APVD
		D. WIBLE	G. BOWLES	A. POTTS	M. MARKO	

CH2MHILL
 CIVIL
 TOWNSEND STREET PARKING LOT
 GRADING AND DRAINAGE PLAN

ISSUED FOR BIDDING AND CONSTRUCTION	VERIFY SCALE
	BAR IS ONE INCH ON ORIGINAL DRAWING.
DATE	SEPTEMBER, 2010
PROJ	381098
DWG	C-4
SHEET	4 OF 13

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TREE SCHEDULE

PLANT CATEGORY	CODE	#	SCIENTIFIC NAME	COMMON NAME	TYPE / SIZE	SPACING
CANOPY TREES						
AS	15		<i>Acer saccharum</i>	Sugar Maple	3.5"-4" caliper; B4B	As shown
NS	8		<i>Nyssa sylvatica</i>	Black Gum	2"-2.5" caliper; B4B	As shown
QB	7		<i>Quercus bicolor</i>	Swamp White Oak	2"-2.5" caliper; B4B	As shown
QI	11		<i>Quercus imbricaria</i>	Shingle Oak	2"-2.5" caliper; B4B	As shown
UNDERSTORY TREES						
AA	38		<i>Amelanchier arborea</i>	Serviceberry	4'-6" multitemmed; B4B	As shown

SHRUB SCHEDULE

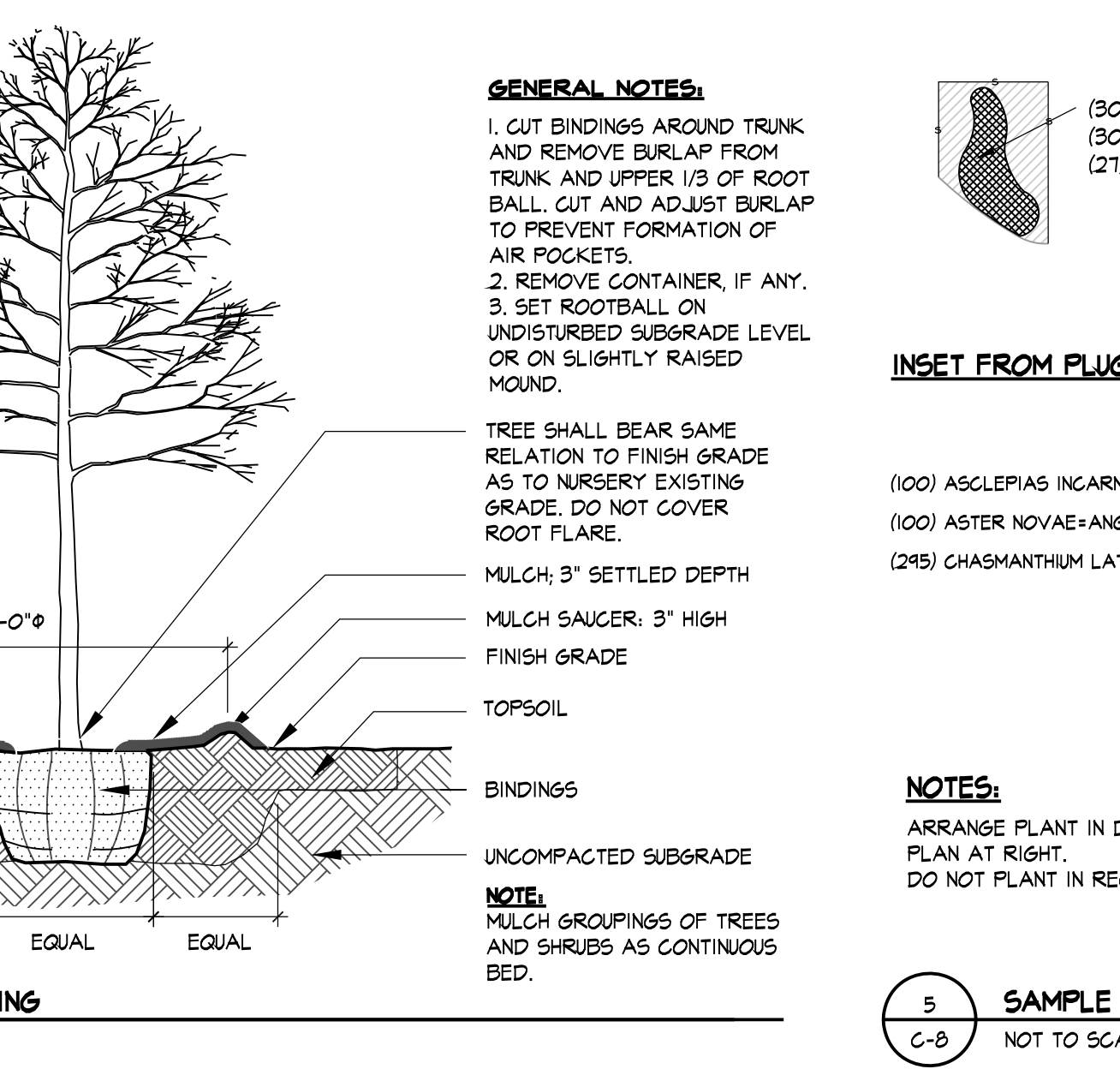
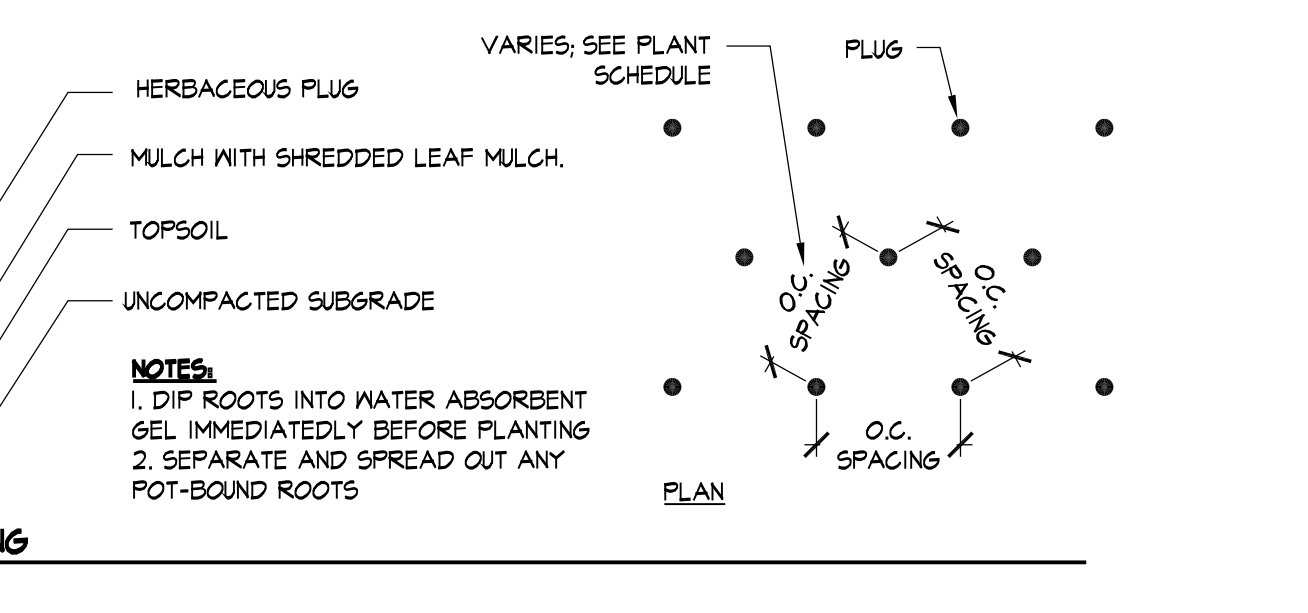
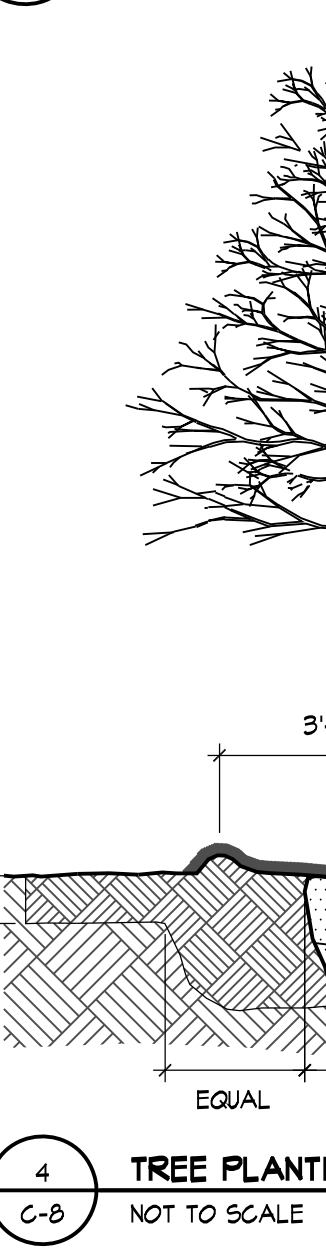
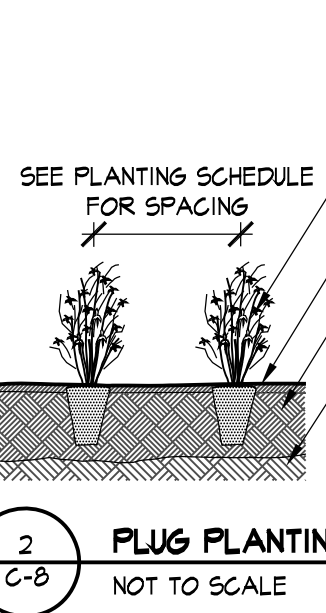
PLANT CATEGORY	CODE	#	SCIENTIFIC NAME	COMMON NAME	TYPE / SIZE	SPACING
SHRUBS						
CA	63		<i>Clethra alnifolia</i>	'Hummingbird'	Summersweet	#3 container or 18"-24"
CS	47		<i>Cornus sericea</i>	'Kelsey'	Red Twig Dogwood	#3 container or 18"-24"
HV	58		<i>Hamamelis vernalis</i>	Witchhazel		#3 container or 18"-24"
IV	48		<i>Ilex verticillata</i>	'Red Sprite'	Winterberry	#3 container or 18"-24"
IV	10		<i>Ilex verticillata</i>	'Jim Dandy'	Winterberry	#3 container or 18"-24" Plant 1 male every 10 female

PLUG SCHEDULE

PLANT CATEGORY	QUANTITY	SCIENTIFIC NAME	COMMON NAME	TYPE / SIZE	SPACING	NOTES
BIORETENTION PLUGS						
	494	<i>Asclepias incarnata</i>	Swamp Milkweed	DP 38 Plugs	12" O.C.	Place in clumps of 20 - 35
	550	<i>Aster novae-angliae</i>	'Purple Dome'	New England Aster	DP 50 Plugs	12" O.C. Place in clumps of 20 - 35
	1000	<i>Chasmanthum latifolium</i>	Northern Sea Oats	DP 50 Plugs	12" O.C.	Place in clumps of 20 - 35
	836	<i>Juncus effusus</i>	Soft Rush	DP 38 Plugs	12" O.C.	Place in clumps of 20 - 35
	122	<i>Panicum virgatum</i>	'heavy metal'	Switch Grass	DP 38 Plugs	12" O.C. Place in clumps of 20 - 35
	400	<i>Solidago rugosa</i>	'Fireworks'	Goldenrod	DP 50 Plugs	12" O.C. Place in clumps of 20 - 35
GROUNDCOVER PLUGS						
	2212	<i>Carex Amphibola</i>	Creek Sedge	DP 32 Plugs	12" O.C.	

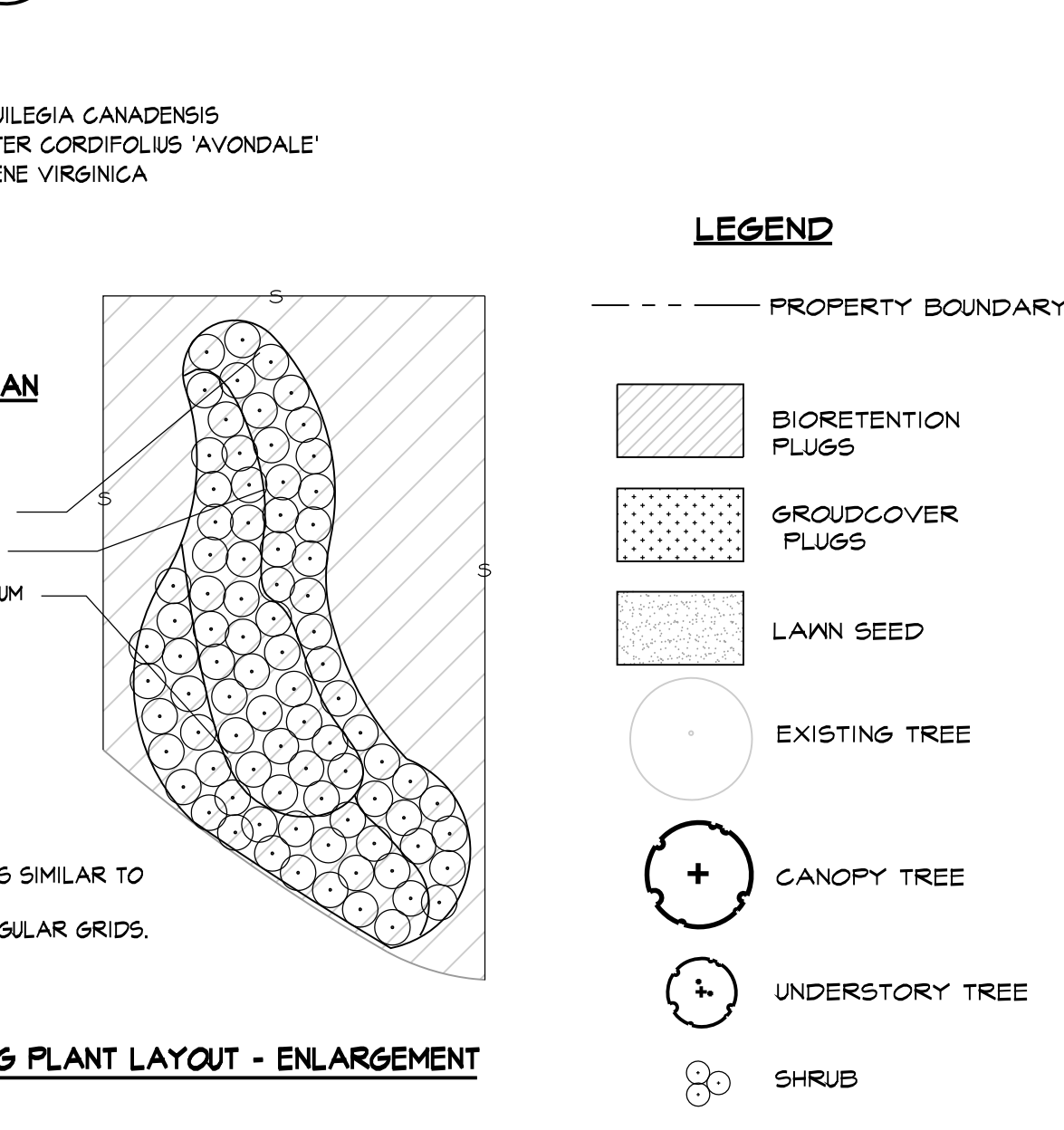
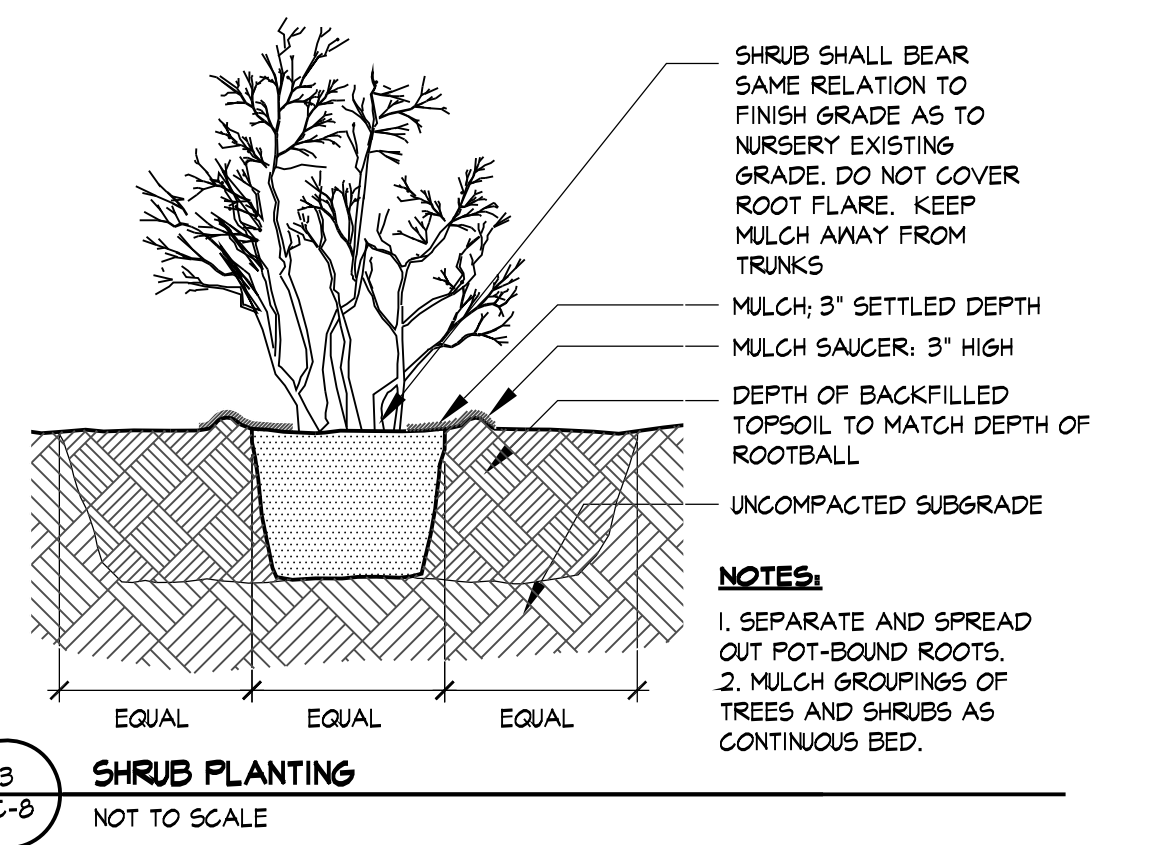
SEED SCHEDULE

PLANT CATEGORY	QUANTITY	SCIENTIFIC NAME	COMMON NAME	NOTES
LAWN SEED				
	3162sf		Lawn Seed	



- GENERAL PLANTING NOTES:**
- Plant material & Layout to be approved in the field by Landscape Architect prior to installation.
 - All plantings shall be done in the spring and the swales will be surfaced with mulch in the interim.
 - Stake locations of trees & shrubs before excavating plant pits for review in field by Landscape Architect.
 - Arrange sample drifts of perennials per Detail 5/C-8 for review by Landscape Architect.
 - Coordinate locations of plantings with utilities. Obtain "as-built" plan of utilities before beginning planting. Review with Landscape Architect.
 - Repair vegetative cover over utility trenches not shown on this drawing.
 - Provide the quantity of each plant indicated on the planting plan if those quantities do not agree with the quantities on the planting schedule.
 - See plant schedule for plug spacing unless otherwise noted.
 - In addition to seeding areas shown on the plan, seed all areas disturbed by utility work and proposed work beyond regraded areas.

- MAINTENANCE NOTES:**
- A. BIOINFILTRATION AREAS**
- Inspections shall be performed annually to evaluate sediment buildup, erosion, vegetative conditions, etc.
 - Debris and trash shall be disposed of at suitable disposal/recycling sites and must comply with state, local, and federal regulations.
 - Mowing may be required until vegetation is established. Weeds should be removed by hand.
 - Debris may need to be removed approximately twice per year. Dead or diseased plants should be replaced and noxious invasive plant species should be removed. Perennial plant species may be cut back at the end of the growing season, or before the beginning of the following growing season.
 - Mulch should be replaced when erosion is evident. Mulch for the entire planting area should be replenished annually until dense plant cover is established.
 - Watering may be required during periods of extended drought.
 - Plantings should be inspected for health twice per year.
- B. TREES AND SHRUBS**
- During the first 3 growing seasons provide supplemental watering during extended periods of drought. Maintain a rate of 1" per week for trees during first growing season.
 - Closely monitor newly planted trees and shrubs for first 3 seasons for signs of drought stress, disease, pest infestation or structural defect. Address any and all issues promptly in such a manner that contains contagion and prevents future problems.
- C. PERENNIAL BEDS AND OTHER HERBACIOUS LANDSCAPE AREAS**
- During the first 3 growing seasons monitor beds for invasive plant species and hand weed.
 - Provide supplemental watering during extended periods of drought.



Viridian landscape studio
3808 WOODBINE AVENUE SUITE 400
SYRACUSE, NY 13202
TEL: 315.482.7073
WWW.VIRIDIANLANDSCAPE.COM

CH2M HILL
430 E. GENESEE STREET
SUITE 400
SYRACUSE, NY 13202

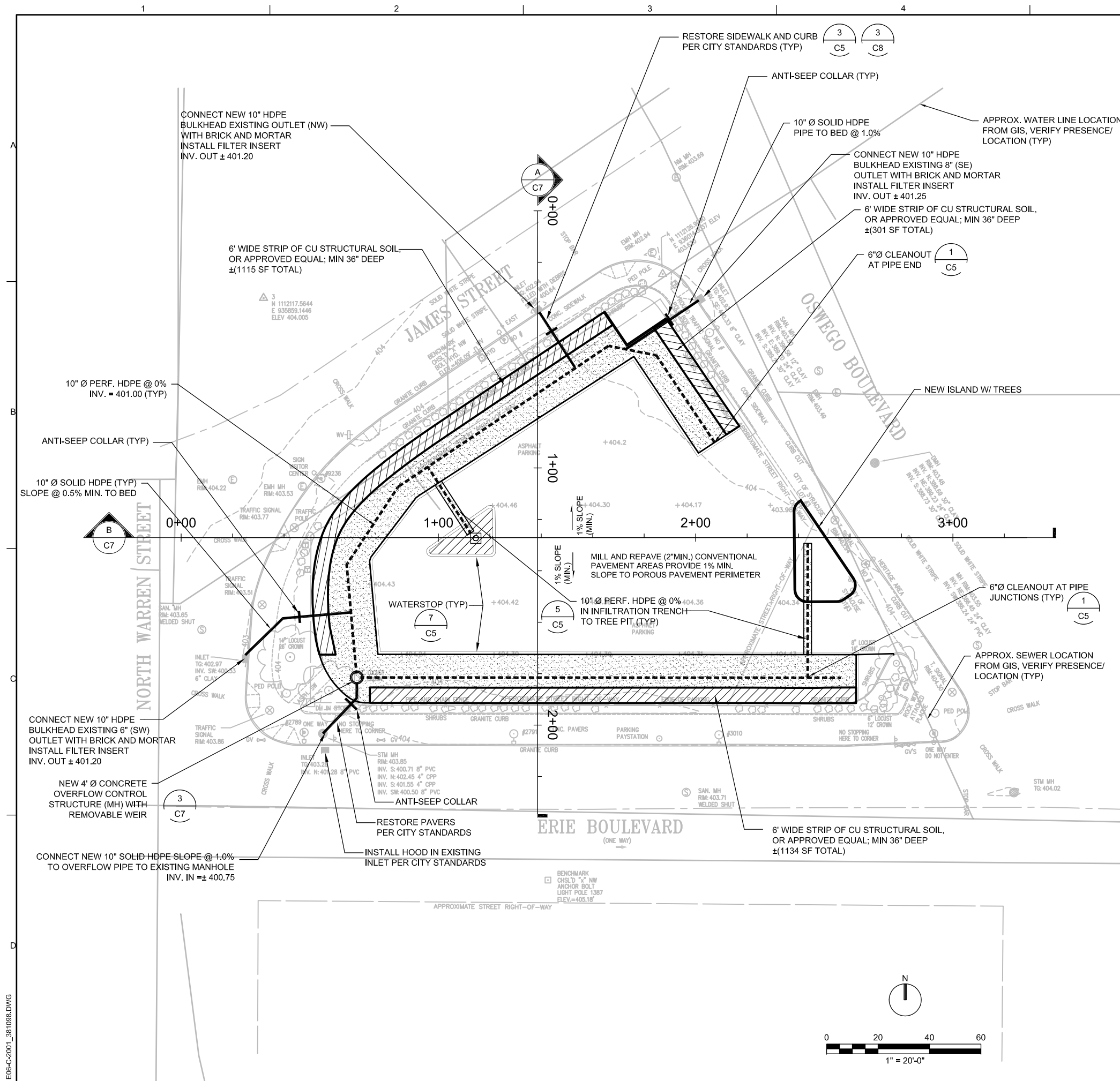
CH2MHILL
CIVIL
PLANTING PLAN

ISSUED FOR BIDDING AND CONSTRUCTION

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
DATE: SEPTEMBER 2010
PROJ: 381098
DWG: C-8
SHEET: 8 OF 13

NO. DATE DSGN
REVISION CHK
BY APVD
TD

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PROPOSED LEGEND

- PERF. HDPE
- SOLID HDPE
- INFILTRATION BED
- STRUCTURAL SOIL (UNDER POROUS PAVEMENT)

EXISTING LEGEND

- PROPERTY LINE/LEASE PARCEL LINE
- RIGHT-OF-WAY LINE
- EASEMENT LINE
- BUILDING LINE
- FENCE LINE
- EDGE OF WATER, STREAM OR DITCH
- EDGE OF WOODS OR BRUSH
- SA S O SANITARY SEWER LINE W/MANHOLE & C.O.
- ST S M STORM SEWER LINE W/MH & CATCH BASIN
- W V WATER LINE W/HYDRANT, VALVE & VAULT
- E M ELECTRIC LINE W/PULLBOX, METER & MANHOLE
- G NATURAL GAS LINE W/METER & VALVE
- OE, OT, OC OVERHEAD ELECTRIC, TELEPHONE & CABLE LINE
- T UNDERGROUND TELEPHONE LINE
- FO UNDERGROUND FIBER OPTIC LINE
- H HEATING LINE (STEAM)
- TS TRAFFIC POLE, SIGNAL & TRAFFIC PULLBOX
- TC TRAFFIC CONTROL LINE
- UTILITY POLE, GUY, LIGHT POLE & TOP MOUNT LIGHT

CONSTRUCTION NOTES:

1. PROTECT INFILTRATION BED SUBGRADE FROM SEDIMENT DEPOSITION AND/OR COMPACTION DURING CONSTRUCTION. DO NOT ALLOW CONSTRUCTION VEHICLES TO TREAD ON THE INFILTRATION BED SUBGRADE.
2. CONTRACTOR SHALL FOLLOW INFILTRATION BED AND DRAINAGE CONTROL REQUIREMENTS AS SPECIFIED BY ENGINEER.
3. INSTALL CU STRUCTURAL SOIL, OR APPROVED ALTERNATIVE, UNDER POROUS ASPHALT (WHERE SHOWN).
4. NOTIFY DIG SAFELY NEW YORK AT LEAST 72 HOURS PRIOR TO CONSTRUCTION.
5. INSTALL TWO-PIECE HDPE ANTI-SEEP COLLAR BY LANE ENTERPRISES, OR APPROVED EQUAL. INSTALL COLLAR ON THE INDICATED SOLID HDPE PIPES APPROXIMATELY 1' FROM EDGE OF THE INFILTRATION BED/TREE TRENCH.
6. REFER TO DETAILS AND PROFILES ON SHEETS C5-C8.
7. CLEANOUTS (6) SHALL BE 6" PVC AS INDICATED ON DETAIL 1/C5.
8. INSTALL FLOGARD+ (OR APPROVED EQUAL) FILTER INSERTS IN THE INDICATED CATCH BASINS (3).



NO.	DATE	DESCRIPTION	BY

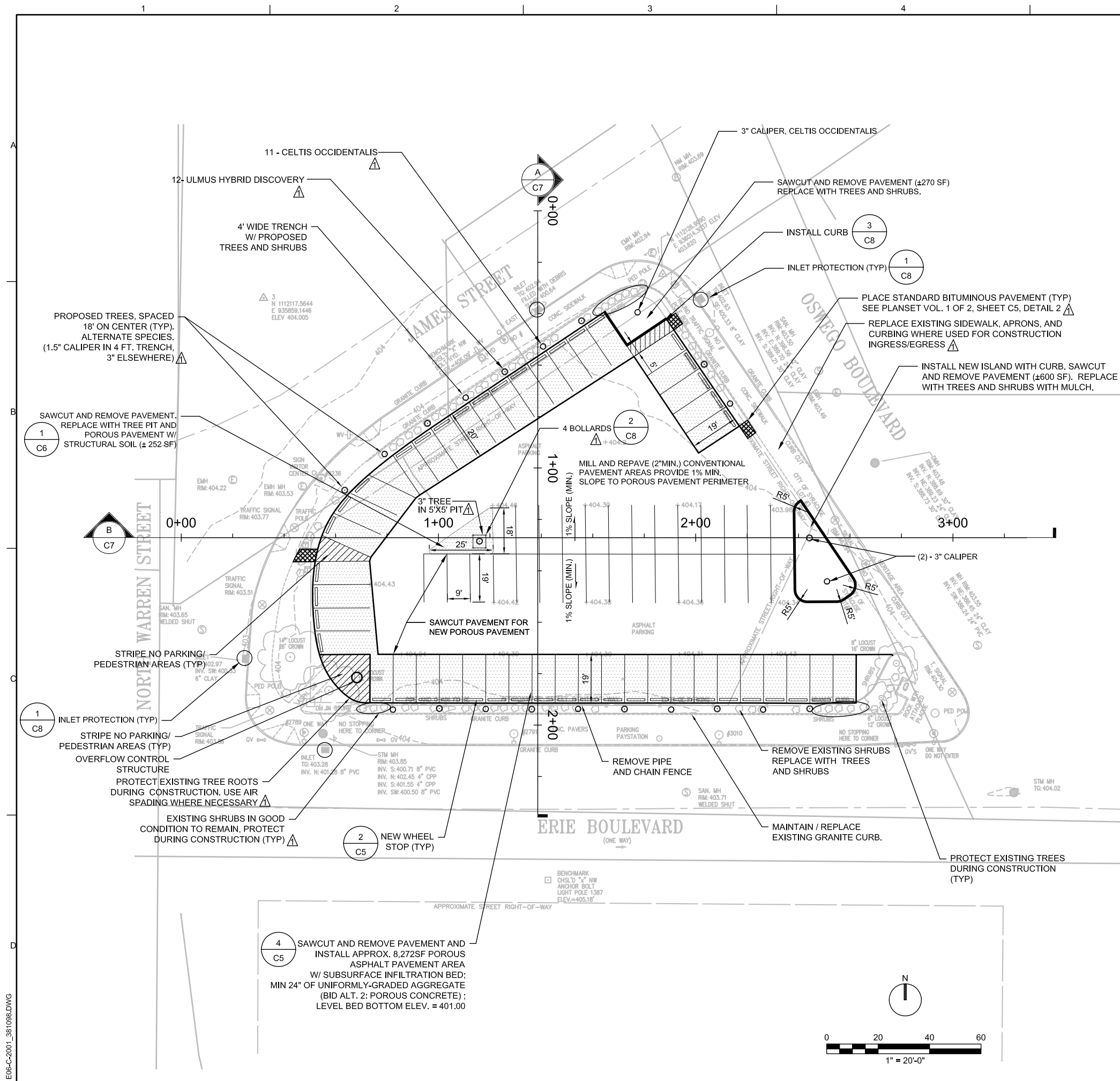
CH2M	290 ELWOOD DAVIS ROAD	SUITE 290	LIVERPOOL, NY 13088
CIVIL	PARKING LOT STORMWATER PLAN CITY PARKING LOT #3		

ISSUED FOR BIDDING AND CONSTRUCTION	VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.	DATE JULY 2, 2010
PROJ 381098	DWG C3
SHEET	3 OF 8

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PROPOSED LEGEND

- POROUS ASPHALT (BID ALT 2: POROUS CONCRETE)
- STANDARD BITUMINOUS ASPHALT PADS FOR PEDESTRIAN TRAFFIC

EXISTING LEGEND

- PROPERTY LINE/LEASE PARCEL LINE
- RIGHT-OF-WAY LINE
- EASEMENT LINE
- BUILDING LINE
- FENCE LINE
- EDGE OF WATER, STREAM OR DITCH
- EDGE OF WOODS OR BRUSH
- SA SANITARY SEWER LINE W/MANHOLE & C.O.
- ST STORM SEWER LINE W/MH & CATCH BASIN
- W WATER LINE W/HYDRANT, VALVE & VAULT
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- OE, OT, OC OVERHEAD ELECTRIC, TELEPHONE & CABLE LINE
- T UNDERGROUND TELEPHONE LINE
- FO UNDERGROUND FIBER OPTIC LINE
- H HEATING LINE (STEAM)
- TS TRAFFIC POLE, SIGNAL & TRAFFIC PULLBOX
- TC TRAFFIC CONTROL LINE
- UTILITY POLE, GUY, LIGHT POLE & TOP MOUNT LIGHT

CONSTRUCTION NOTES:

1. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES WHERE AND WHEN APPROPRIATE AS PER THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (AUGUST 2005, OR LATEST EDITION). AT A MINIMUM INSTALL INLET PROTECTION IN THE THE FOUR INLETS AROUND THE LOT. PROTECT EXISTING SITE FEATURES UNLESS OTHERWISE NOTED. CONSULT ENGINEER PRIOR TO INFILTRATION BED INSTALLATION.
2. REFER TO DETAILS AND PROFILES ON SHEETS C5-C8.
3. IMMEDIATELY FOLLOWING CONSTRUCTION, RETURN ALL EXISTING IMPROVEMENTS TO PRE-CONSTRUCTION CONDITIONS.
4. FOR TREE SPECIES AND PLANTING INFORMATION, SEE SHEET C-6; INSTALL TREES AS PER CITY STANDARDS.
5. SHRUBS SHALL BE A MINIMUM 3 GALLON CONTAINER, SPACED 2.5' O.C. (TYPICAL), APPROXIMATE QUANTITY 100. SHRUBS SHALL BE ILEX GLABRA "NORDIC" SPECIES OR APPROVED EQUAL.
6. PROTECT ALL EXISTING GRANITE CURB IN WORK AREA, REMOVE AND REPLACE IF NECESSARY.

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DATE	JULY, 2010
PROJ	381098
DWG	C4
SHEET	4 OF 8

CH2MHILL	CH2MHILL
290 ELWOOD DAVIS ROAD	CH2MHILL
SUITE 290	290 ELWOOD DAVIS ROAD
LIVERPOOL, NY 13088	SUITE 290

CH2MHILL

CIVIL

PARKING LOT SITE LAYOUT PLAN

CITY PARKING LOT #3

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.

DATE JULY, 2010

PROJ 381098

DWG C4

SHEET 4 OF 8

E06-C-2001_381098.DWG

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