Northeast Ohio
Regional Sewer District

Green Infrastructure Grant for the Combined Sewer Area Program

Operation & Maintenance Workshop Session

Reducing stormwater runoff from our combined sewer system

Northeast Ohio Regional Sewer District

2019 Cozad-Bates House GI Project
Funds Awarded: $205,503
Stormwater Captured: 93,986 gal/yr.
Practices: Bioretention and Permeable Pavement
Status: Completed – Long Term Maintenance

Agenda

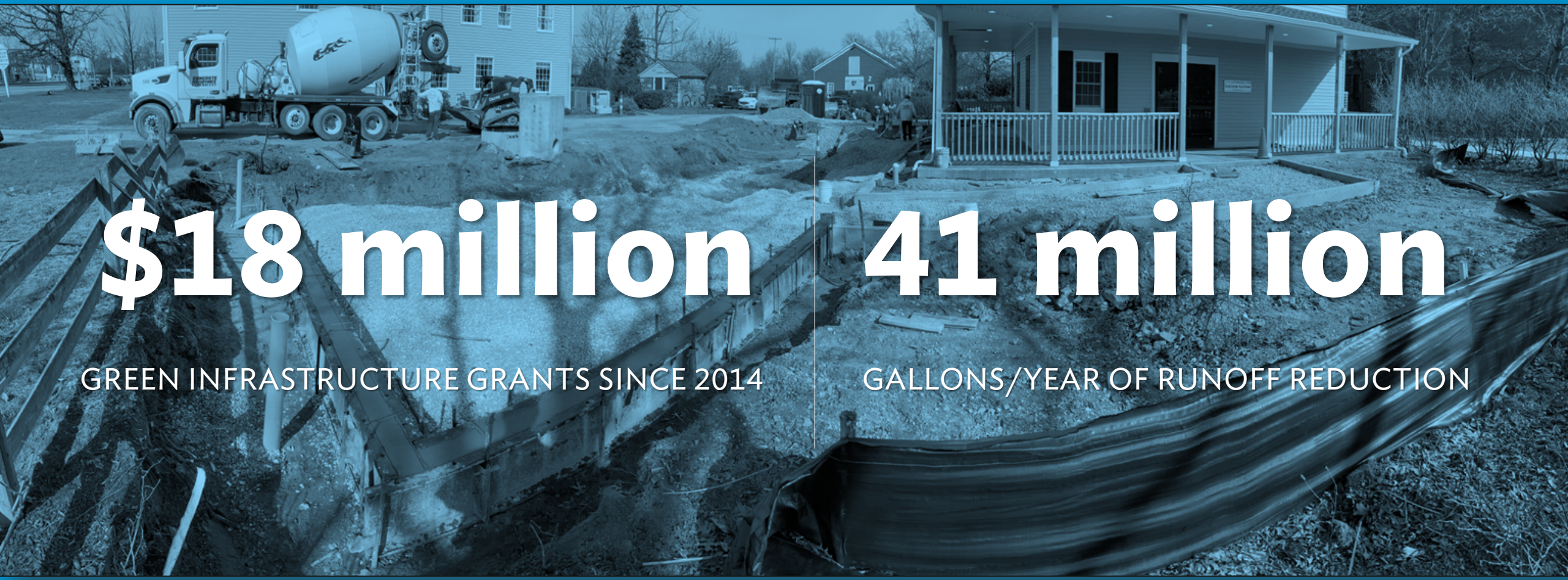
- Introduction & Overview
- Grant Reporting Tool
- Educational Signage
- O & M General Overview (Design, Construct, Maintain)
- Stormwater Control Measures
- Annual Inspections

Introductions

NAME

COMPANY

PROJECT



Northeast Ohio
Regional Sewer District

2025 Dunham Tavern Museum and Gardens Phase II GI Project
Funds Awarded: $250,000
Stormwater Captured: 176,696 gal/yr.
Practices: Permeable Pavement
Status: In Construction

Green Infrastructure Grant Program for the Combined Sewer Area

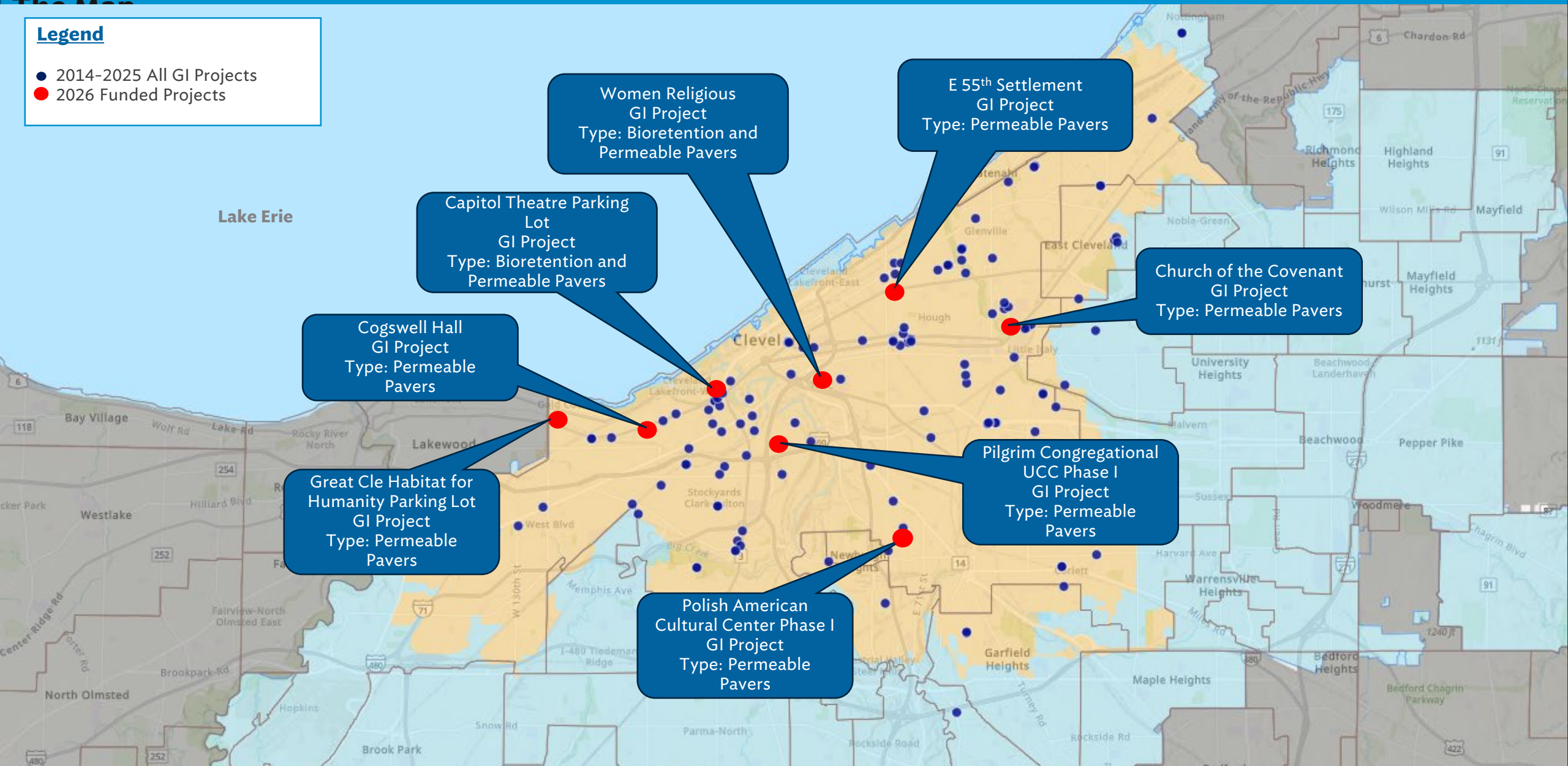
The Breakdown

Program Years	Number of Projects	Funding Awards	Runoff Reduction Gallons/Year
2014 – 2025	91	$16,085,758	39,191,912
2026	8	$2,000,000	2,638,081
TOTAL	**99**	**$18,085,758**	**41,829,993**

Program Years	Number of Projects	Funding Awards	Runoff Reduction Gallons/Year
2014	11	$1,746,274	7,138,890
2016	12	$1,974,747	9,658,777
2018	4	$1,000,000	1,730,668
2019	10	$1,908,361	4,918,266
2020	9	$1,935,944	1,300,166
2021	5	$895,432	2,978,459
2022	12	$1,500,000	2,034,232
2023	13	$2,125,000	3,957,809
2024	7	$1,500,000	2,904,305
2025	8	$1,500,000	2,570,340
2026	8	$2,000,000	2,638,081
TOTAL	**99**	**$18,085,758**	**41,829,993**

Green Infrastructure Grant Program for the Combined Sewer Area

The Map



NEORSD Green infrastructure (GI) Grant Program for the Combined Sewer Area

The Cleveland Foundation Headquarters

Applicant: The Cleveland Foundation
Project Location: 6601 Euclid Ave| Ward 7
Watershed: Lake Erie Direct Tributaries

Project Detail

GI Type: 2022 Design & Construction Project Award
GI Technology: Permeable Pavers
Drainage Area: 0.14 acres
GI Feature Area 0.14 acres
Stormwater Capture: 117,306 gal/yr.
Total Project Cost: $21,000,000
Grant Awarded: $73,372

OPTION 1
GI Grant Program
Reimbursement Request

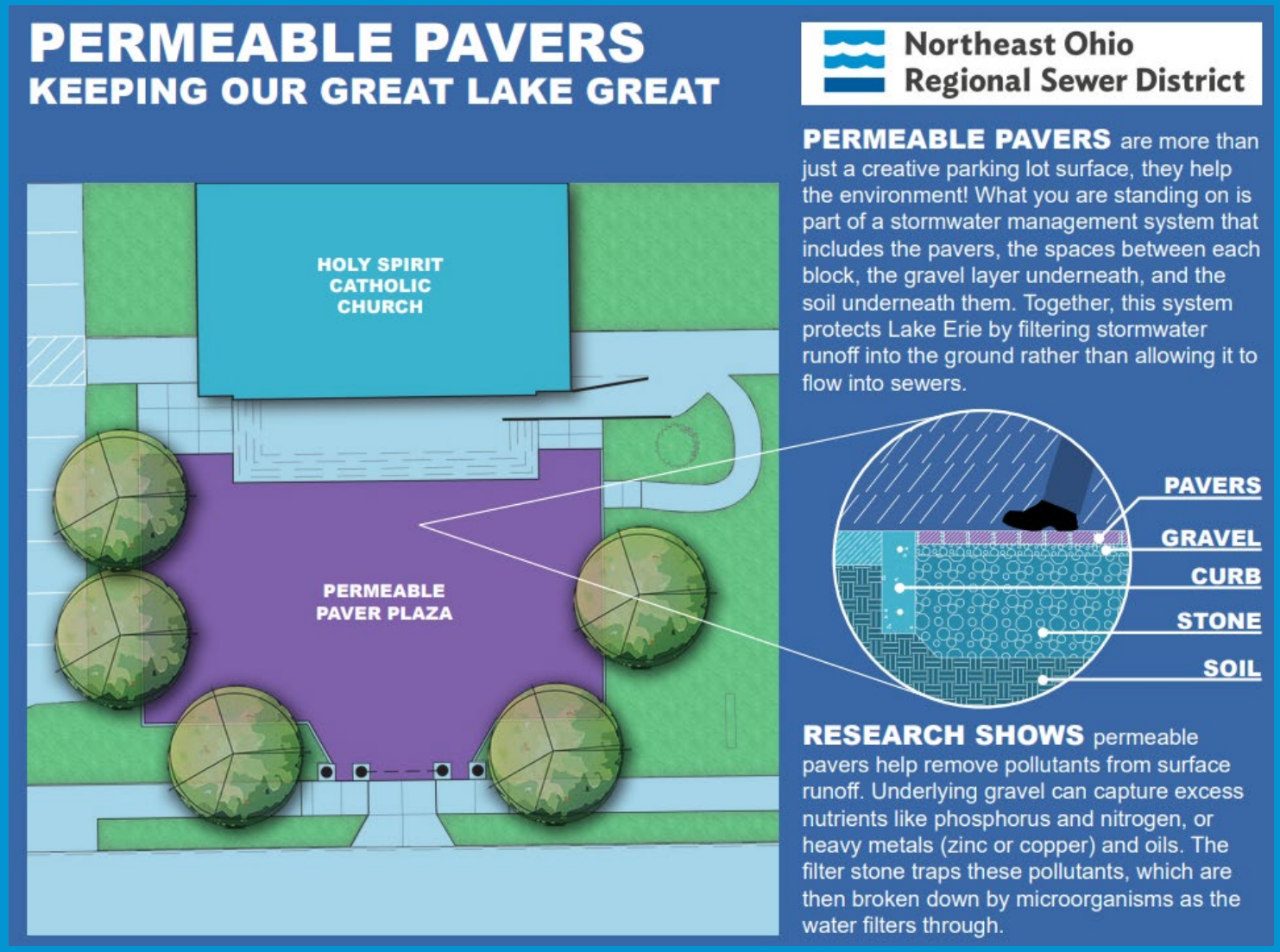
OPTION 2
GI Grant Program
Progress Report Only

OPTION 3
GI Grant Program
Request for Project Extension

DOCUMENT SUBMITTAL PROCESS

ALL ABOUT THE SIGNAGE

Educational Signage



Educational Signage

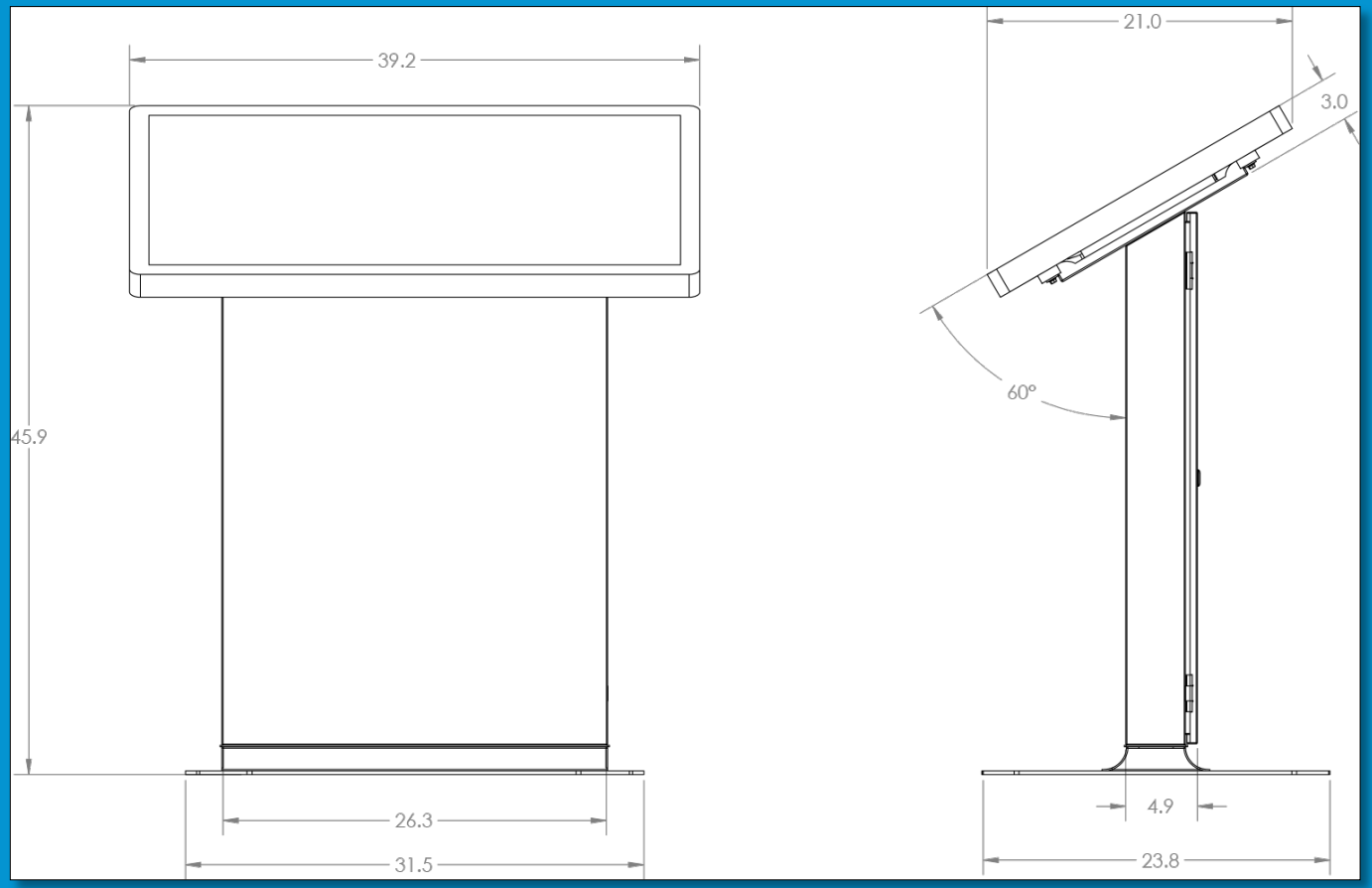
The Sewer District responsibility

- Permanent educational signage is required and must be reviewed and approved
- Will fund 1 sign per project.
- Providing minimum criteria regarding signage
- Logo on any public advertisement or outreach efforts related to the GI project.
- The Sewer District shall be permitted and have the right to photograph any project that has been selected for funding, to use for public outreach and education projects.

Educational Signage

Minimum Suggested Specs

- 3 feet (36”) above ground height
- 2’x3’ (24”x36)” panel dimensions
- Each project will need to take their own unique approach and design a customize sign.



Educational Signage
Too Small

Educational Signage Maintenance

Educational Signage

Educational Signage

Educational Signage

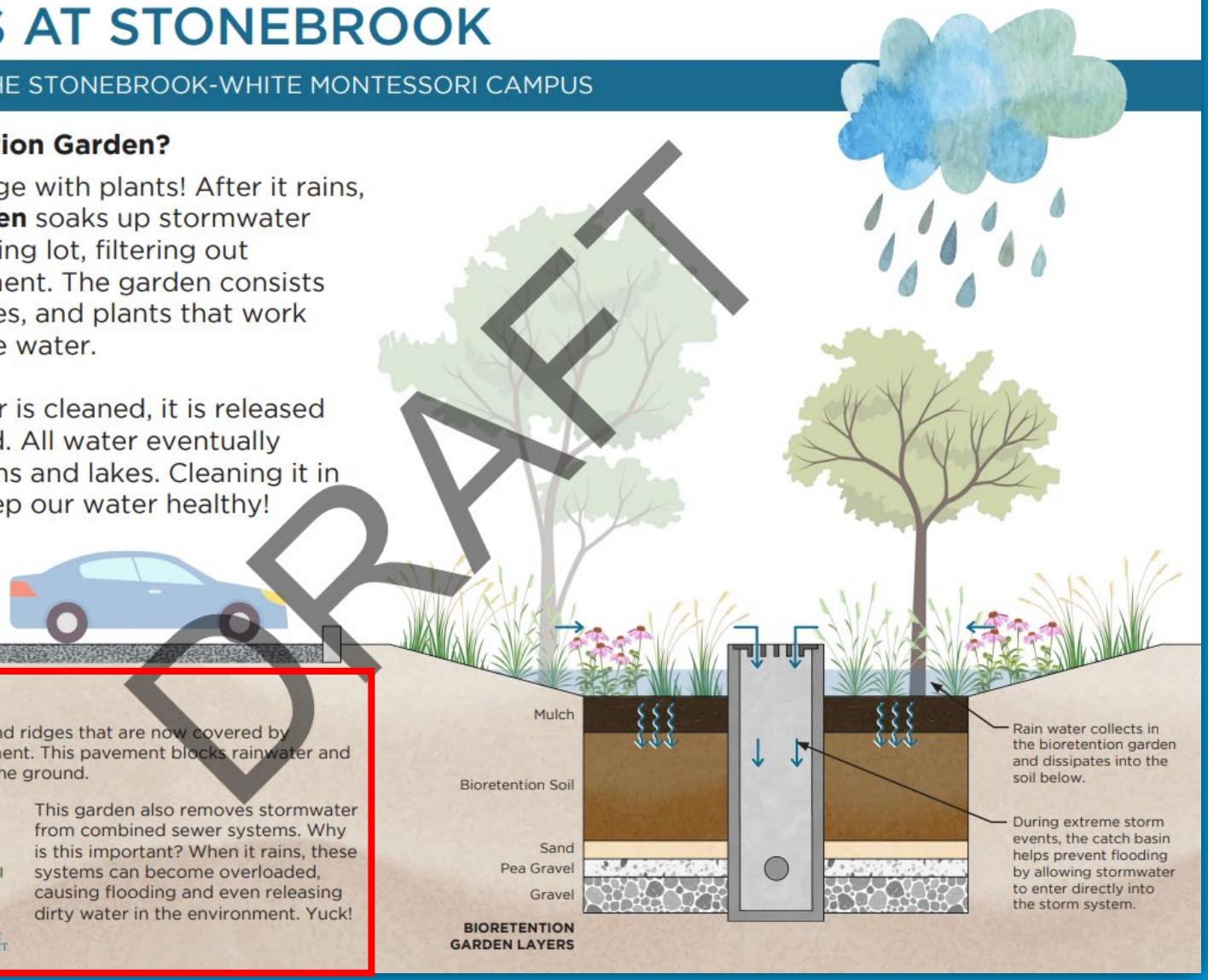
SHOWERS AT STONEBROOK

BIORETENTION AT THE STONEBROOK-WHITE MONTESSORI CAMPUS

What is a Bioretention Garden?

Think of it as a sponge with plants! After it rains, a **Bioretention Garden** soaks up stormwater runoff from the parking lot, filtering out pollutants and sediment. The garden consists of special soils, stones, and plants that work together to clean the water.

After the stormwater is cleaned, it is released back into the ground. All water eventually returns to our streams and lakes. Cleaning it in the garden helps keep our water healthy!



Did You Know?

Cleveland has many historic sand ridges that are now covered by roadway and parking lot pavement. This pavement blocks rainwater and stormwater from soaking into the ground.

This garden also removes stormwater from combined sewer systems. Why is this important? When it rains, these systems can become overloaded, causing flooding and even releasing dirty water in the environment. Yuck!

Northeast Ohio Regional Sewer District

Montessori Development Partnerships

Environmental Design Group

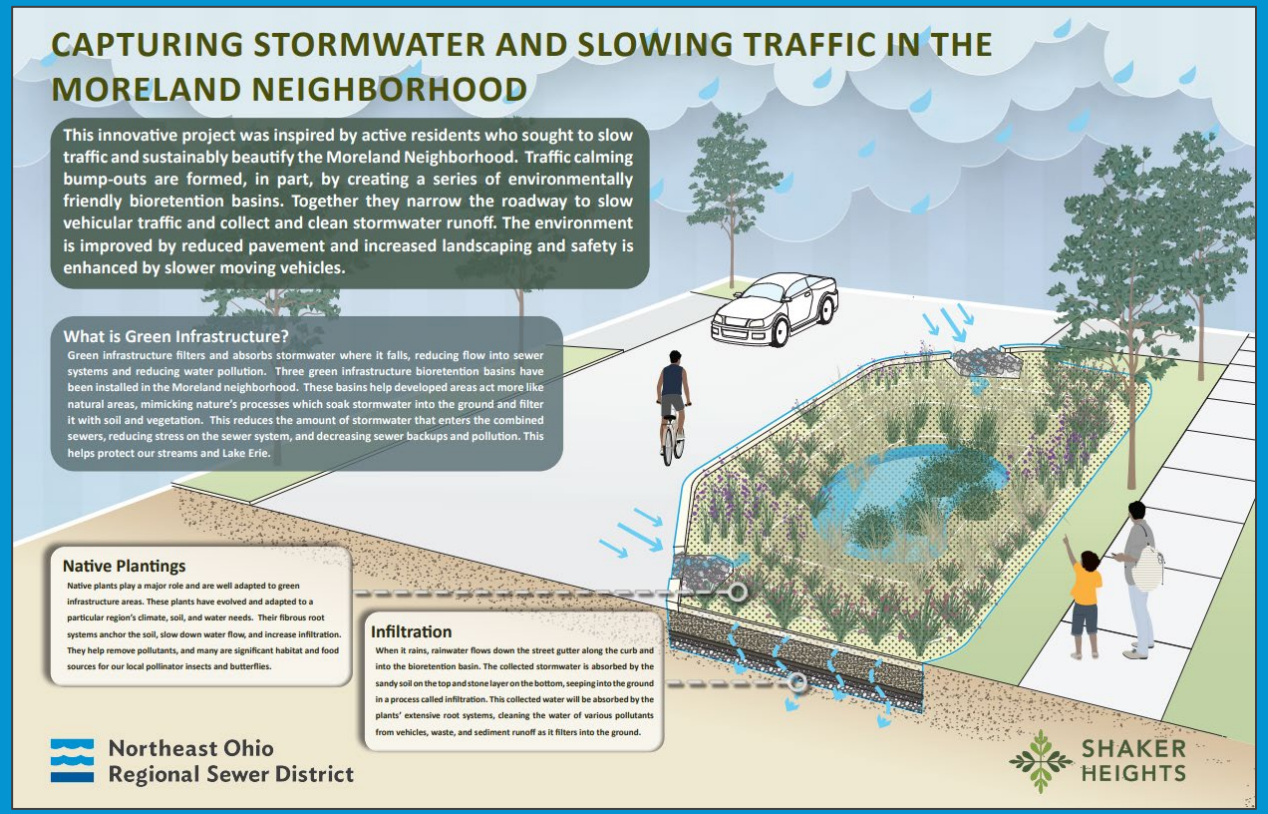
Doan Brook Watershed Partnership

Cleveland Metropolitan School District

Educational Signage
Single Post

Educational Signage Double Post

Educational Signage
Double Post



Educational Signage
Wall Mount

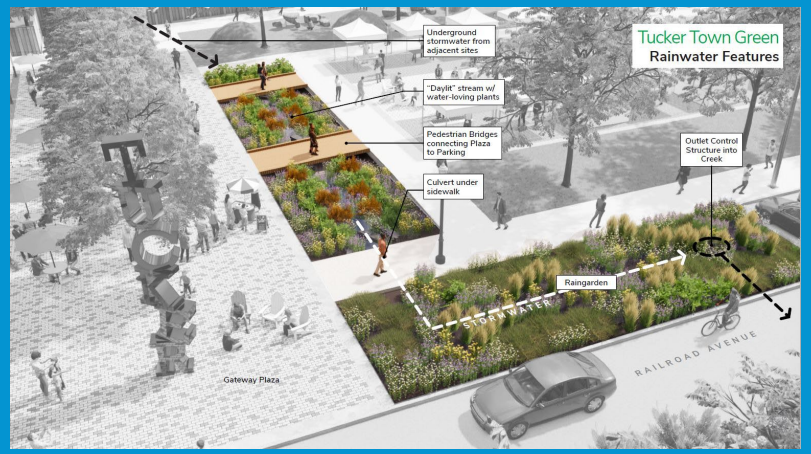
Educational Signage
Wall Mount

Educational Signage Location

Operation & Maintenance General Overview

Northeast Ohio Regional Sewer District

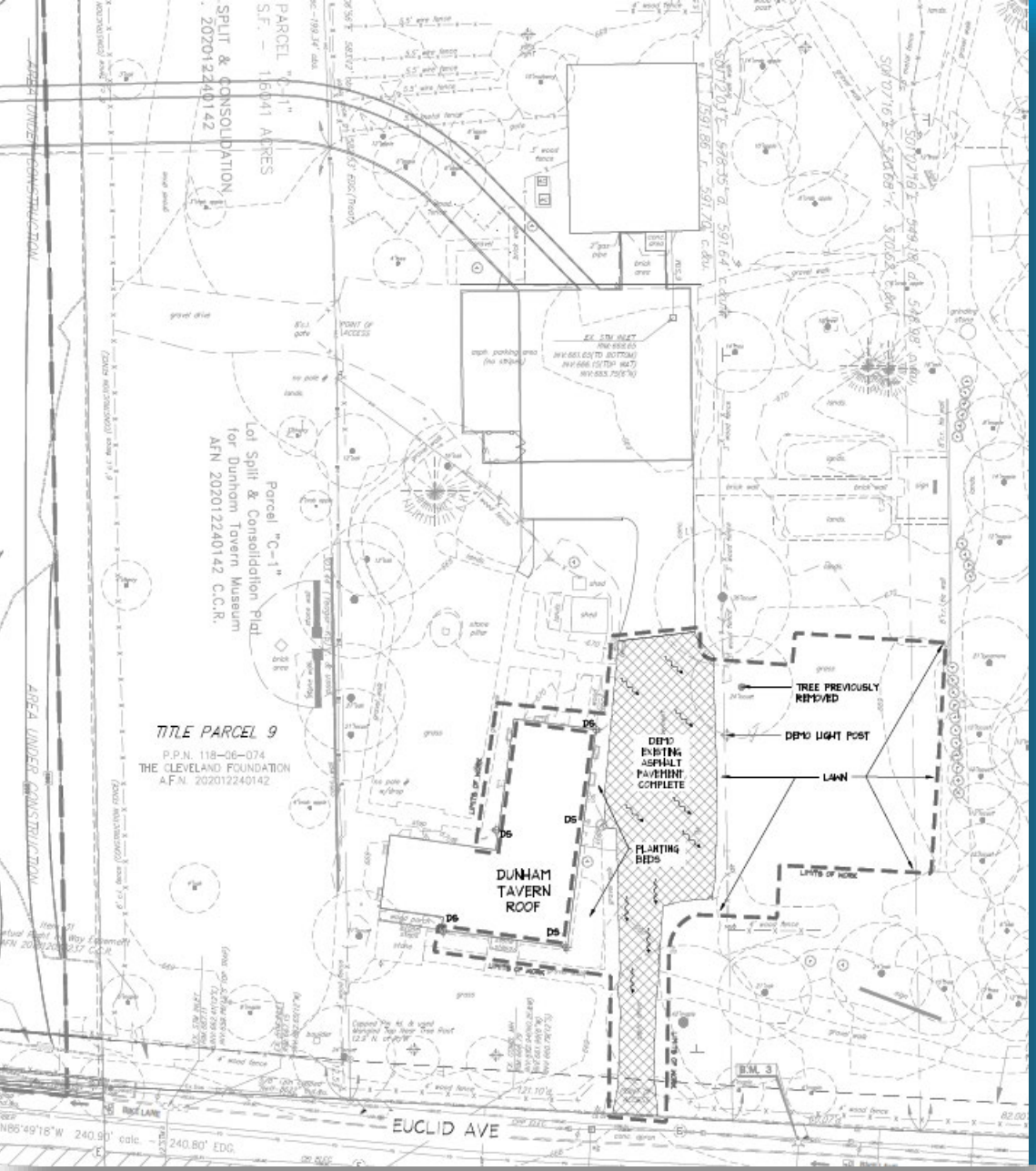
Design



Construct

Maintain

Operation & Maintenance Workshop Session



General Overview Design Considerations

How to minimize maintenance and simplify inspection

Northeast Ohio Regional Sewer District

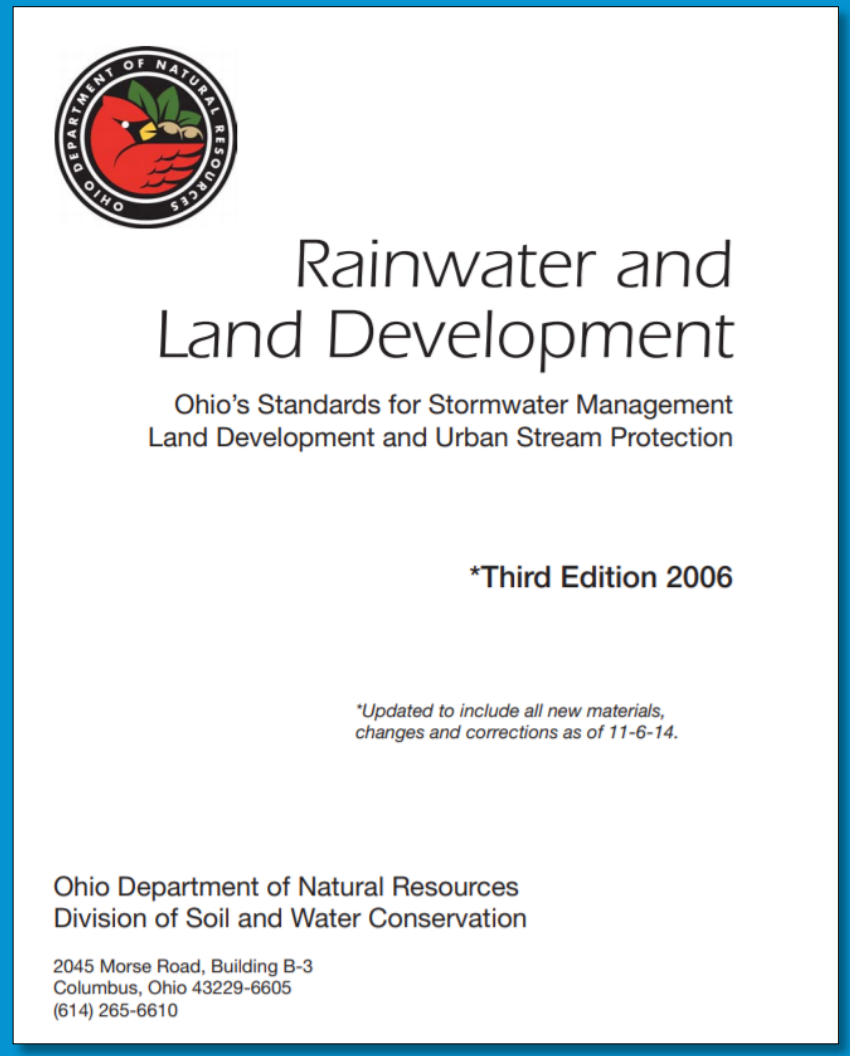
Operation & Maintenance Workshop Session

General Overview - Design

- Begin with the end in mind
- Setup project for success
  - Construction
  - Long-term maintenance

General Overview - Design

Refer to an accepted standard



General Overview - Design

Ensure accessibility by needed equipment

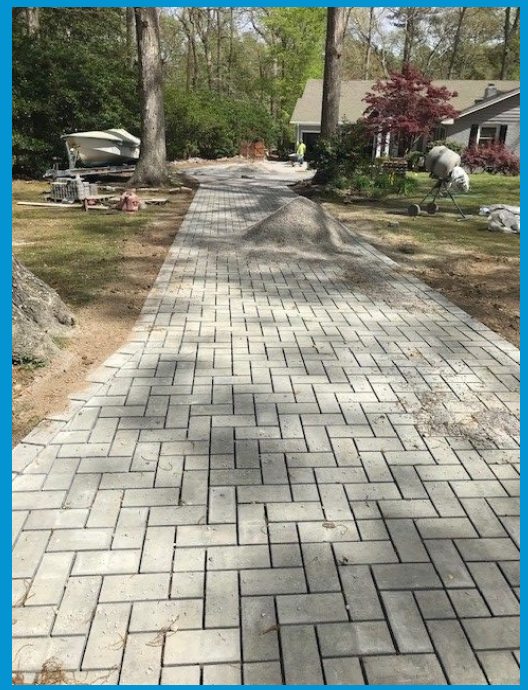
EASY ACCESS

DIFFICULT ACCESS

General Overview - Design

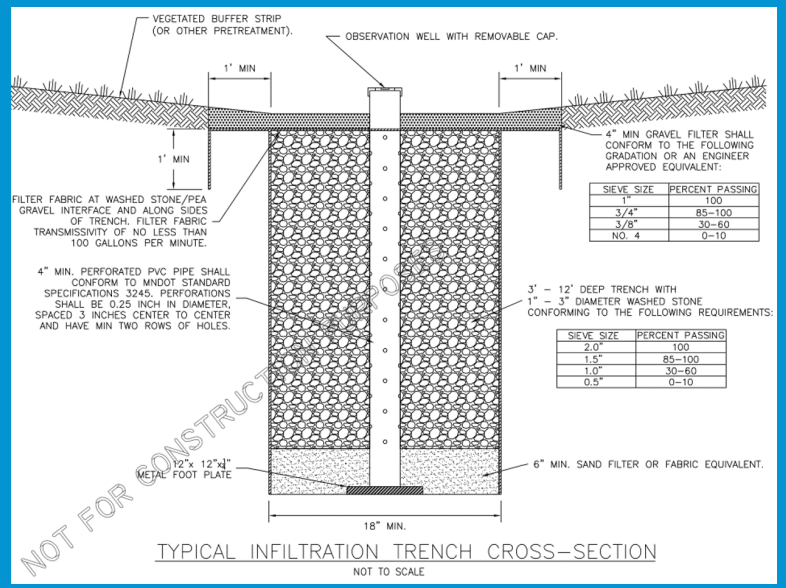
Schedule

1. **Timing of Construction -** Construction of bioretention practices shall take place after land grading is complete and the contributing drainage area has been stabilized. Construction may take place if the entire contributing area can be effectively diverted until construction is complete and fully-vegetated cover protects all soil areas. Construction shall not occur during periods of precipitation since clogging of soils, bedding, filter or planting media may occur.



General Overview - Design

Consider ways to simplify inspections (e.g., observation wells)



General Overview - Design

Flood Routing

What happens if the practice clogs/fails?

General Overview – Design

General Overview - Design

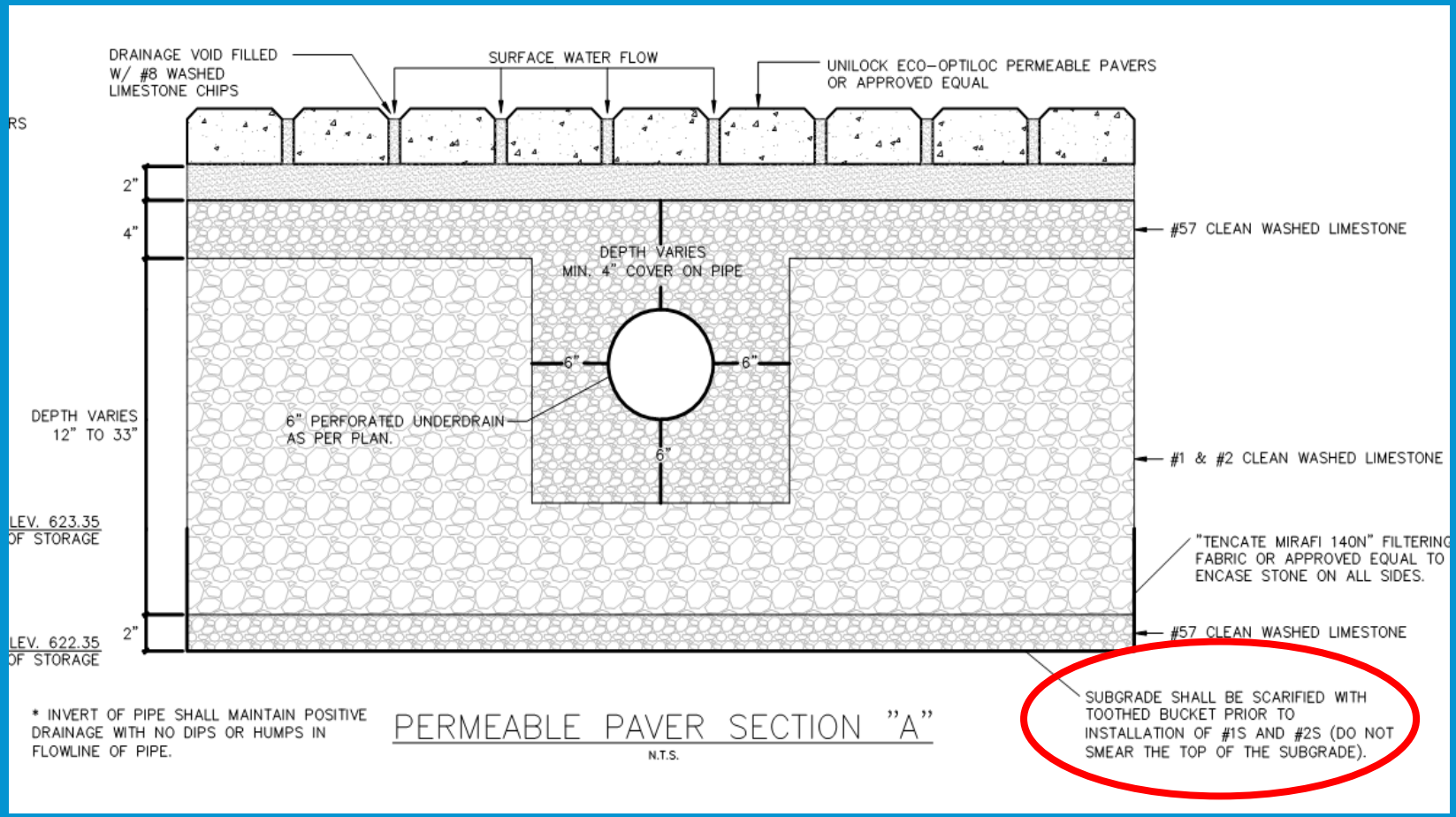
Materials Specifications

4. *Planting Soil* – The planting soil filters the treatment volume, detains runoff in the available void space and provides a media for plant growth and a biological community. Much of the pollutant removal occurs in this zone due to filtering, microbial activity, ion exchange, adsorption and plant uptake. The planting soil (an engineered soil media) shall be at least two feet deep and up to four feet in depth (settled) depending upon the planned vegetation. Greater depth is necessary to accommodate the root ball of trees planted in bioretention facilities. Soils and soil mixes must be certified by a qualified laboratory (1 test per 100 yd^3 of soil) and have the following attributes:

   - Texture class: loamy sand. Having no less than 80% sand and no greater than 10% clay considering only the mineral fraction of the soil.
   - pH range: 5.2 - 8.0
   - Soluble Salts: 500 ppm maximum.
   - Decomposed organic matter: 3-5% by weight [Note: this translates to 8-20% organic matter by volume. See note on "Creating a Suitable Soil Media" below.]
   - Phosphorus: phosphorus of the planting media should fall between 15 and 60 mg/kg (ppm) as determined by the Mehlich III test. For sites in watersheds with a phosphorus TMDL or sites with high phosphorus loads, the phosphorus content of the planting media should fall between 10 and 30 mg/kg as determined by the Mehlich III test.
   - Sand added shall be clean and meet AASHTO M-6 or ASTM C-33 with a grain size of 0.02-0.04" inches.

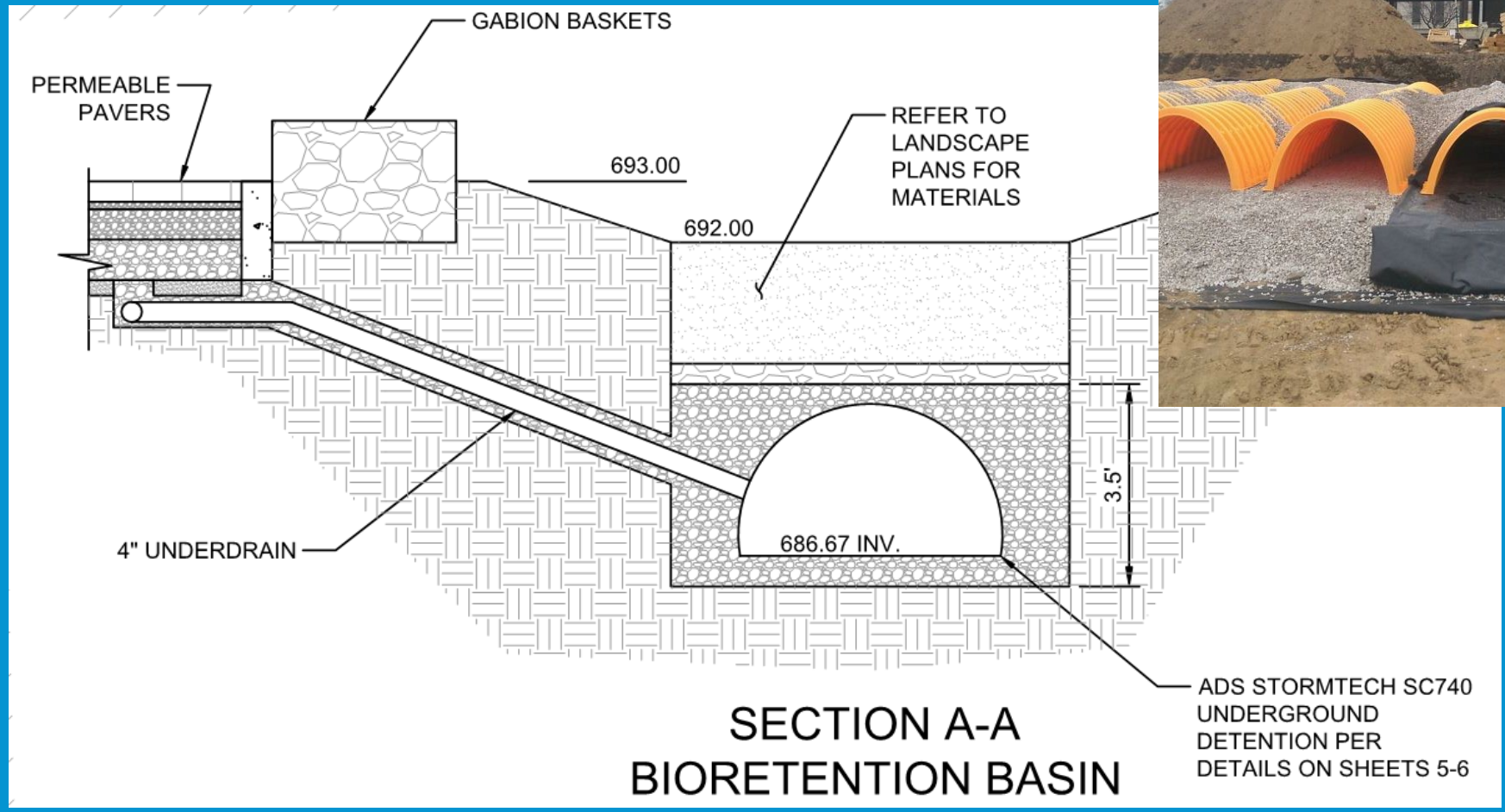
General Overview - Design

Applicable Notes & Details



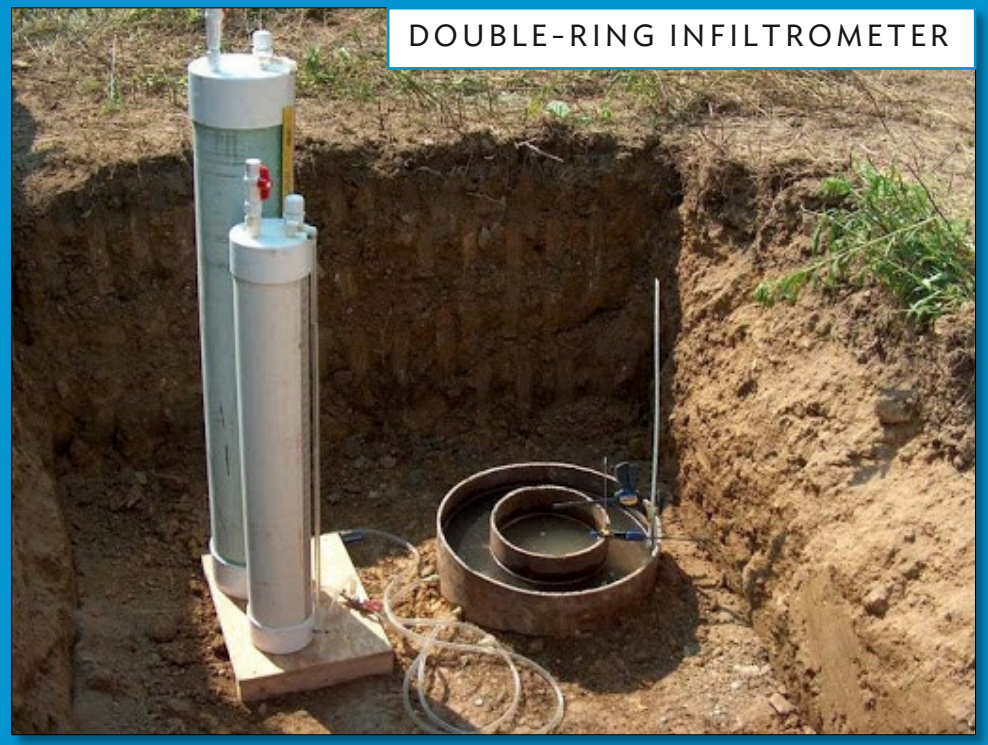
General Overview - Design

Applicable Notes & Details



General Overview - Design

Sub-grade infiltration testing for assumed locations & approximate depths of SCMs



DOUBLE-RING INFILTROMETER

INFILTRATION TEST PIT

General Overview - Design

Proximity of SCMs to Foundations

Horizontal Separation Distances

- separation from buildings - pervious pavement systems should be installed at least 10' away from up-gradient building foundations and 100' from down-gradient foundations, unless an acceptable barrier is provided or the building foundation can adequately handle additional water;

General Overview Construction Considerations

How to achieve your SCM's intended function

(a.k.a., how to not mess it up)

Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

General Overview - Construction

General Overview - Construction

Do not ruin your SCM!

General Overview - Construction

Follow the construction schedule (the recipe)

1. START–UP SEQUENCE:
- INSTALL TEMPORARY EROSION AND SEDIMENT CONTROL (SILT FENCE, CONSTRUCTION ENTRANCE, CONCRETE WASHOUT ETC...) INLET PROTECTION ON ALL PERMANENT STORM SEWER INLETS, STRUCTURES AND STRUCTURES TO REMAIN THROUGH CONSTRUCTION
- CONTRACTOR SHALL DEFINE STAGING AREA LIMITS
- INSTALL SAFETY SIGNAGE, HEALTH AND SAFETY PROCEDURES
- MARK STOCKPILE AREAS, CONSTRUCTION ENTRANCES AND LOADING/UNLOADING AREAS
-

2. CONSTRUCTION SEQUENCE:
- INSTALL PERIMETER TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES PER PLAN AND DIRECTION
- DEMOLITION AND CLEAR CONSTRUCTION AREA PER THESE PLANS
- FINAL GRADE WITH STONE PARKING LOT PER GRADING PLAN AND STABILIZE AREAS DRAINING TO BIORETENTION AREA
- TEMPORARY SEED AND MULCH DISTURBED AREAS AS REQUIRED
- INSTALL BIORETENTION AREA AS PER PLAN

3. FINAL SEQUENCE
- FINALIZE ALL CONSTRUCTION ACTIVITIES, INCLUDING PAVING
- PERMANENT SEED & LANDSCAPE AREAS AS NECESSARY
- REMOVE ANY REMAINING TEMPORARY SEDIMENT CONTROL DEVICES AS REQUIRED
- CLOSE OUT PROJECT

General Overview – Construction

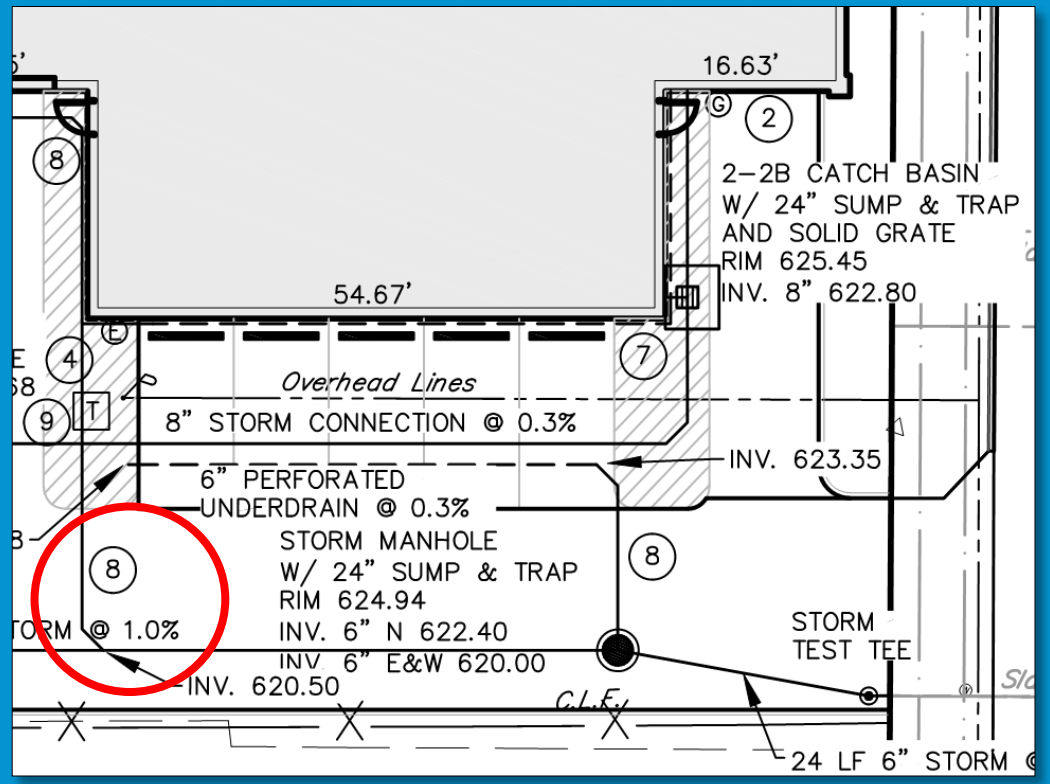
Scarify underlying subsoil of infiltrating practices

General Overview - Construction

Keep sediment out!!

General Overview - Construction

Refer to applicable notes

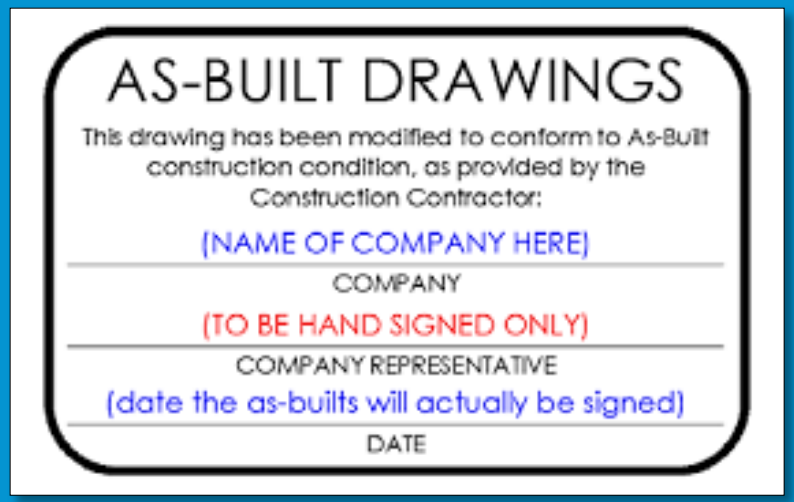


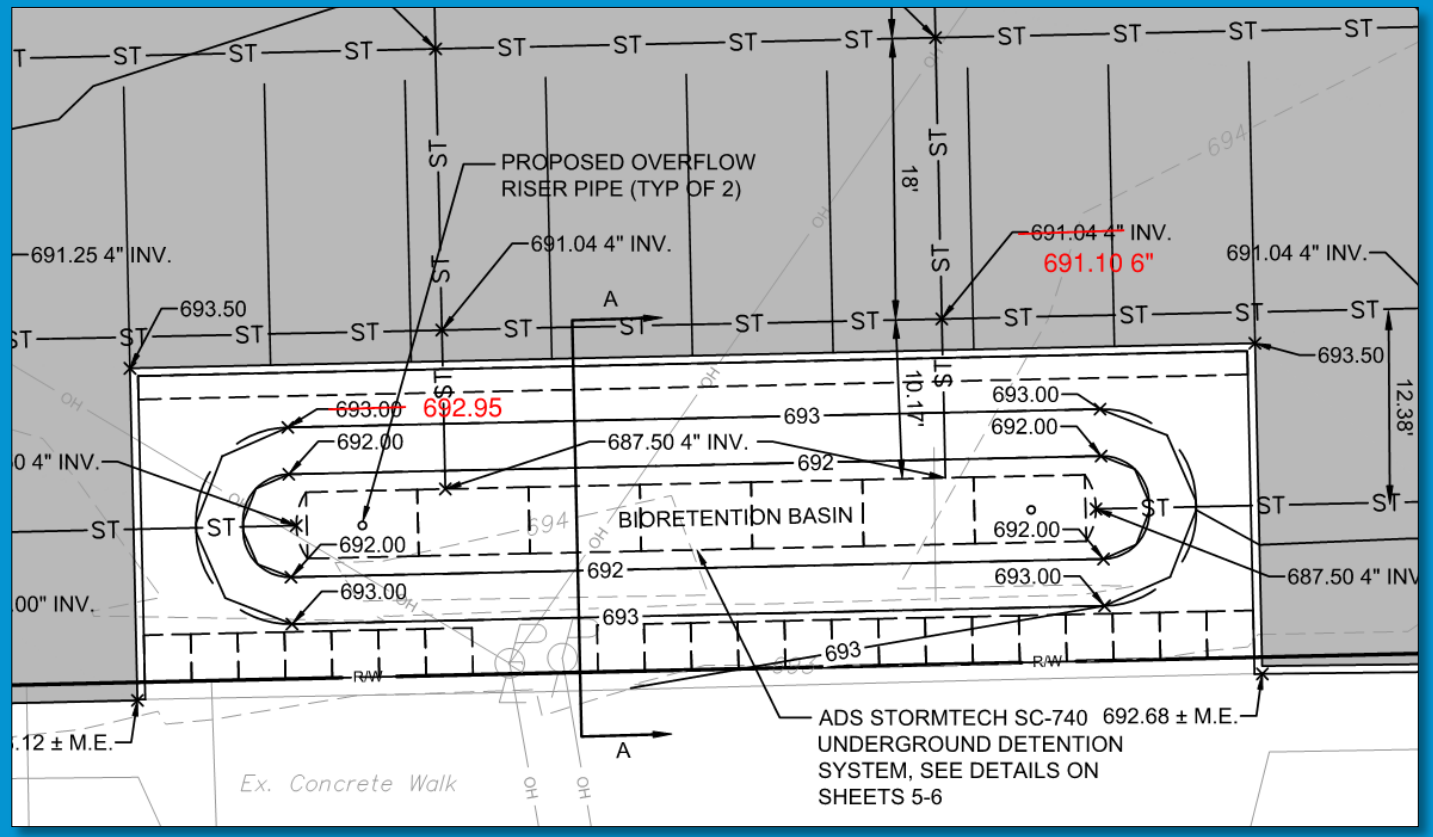
UTILITY NOTES:

1. PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL LOCATE EXISTING SLANTS #21 AND #28 FOR RE-USE. CONTRACTOR SHALL EXPOSE SLANT AND IT SHALL BE INSPECTED BY WATER POLLUTION CONTROL FOR REUSE. IF CONNECTION IS VIABLE CONTRACTOR SHALL NOTIFY ENGINEER OF LOCATION AND ELEVATION. IF WATER POLLUTION CONTROL DETERMINES THE SLANT IS NO LONGER VIABLE THE CONTRACTOR SHALL INSTALL A NEW 6" VCP SLANT PER WPC STANDARDS. CONTRACTOR TO COORDINATE WITH WATER POLLUTION CONTROL. SEWER WITHIN THE R/W, FROM TEST TEE TO THE MAIN SHALL BE 6" VCP @ A MINIMUM SLOPE OF 1.0%.
2. PROPOSED GAS METER. LOCATION AND SIZE AND CONNECTION TO BE COORDINATED WITH UTILITY COMPANIES PRIOR TO CONSTRUCTION.
3. RELOCATED WATER SPIGOT. CONTRACTOR TO COORDINATE FINAL LOCATION WITH OWNER PRIOR TO CONSTRUCTION. IF EXISTING SHUT OFF VALVE IS WITHIN CONSTRUCTION LIMITS, CONTRACTOR SHALL ALSO RELOCATE VALVE WITH WATER SPIGOT.
4. PROPOSED ELECTRIC METER AND TRANSFORMER. CONTRACTOR SHALL COORDINATE WITH MEP PLANS AND UTILITY COMPANIES PRIOR TO CONSTRUCTION.
5. PROPOSED 4" FIRE LINE AND 2" DOMESTIC LINE. METER AND BACKFLOW SHALL BE LOCATED INSIDE BUILDING.
6. CURB UNDERDRAIN. SEE DETAIL SHEET C6.01.
7. 6" PERFORATED UNDERDRAIN AT 0.3% SLOPE WHERE PAVERS MEET BUILDING. SEE DETAIL SHEET C6.02.
8. SOLID PIPE FOR CONNECTION BETWEEN PERFORATED PIPE AND COLLECTOR PIPE.

General Overview - Construction

Complete as-built drawings





General Overview - Construction

Update O&M plan as applicable when design changes are made during construction

General Overview - Construction

Sub-grade infiltration testing for exact locations & excavated depths of SCMs


DOUBLE-RING INFILTROMETER


INFILTRATION TEST PIT

NOTE: Unexpected infiltration rates can trigger design revisions.

General Overview - Construction

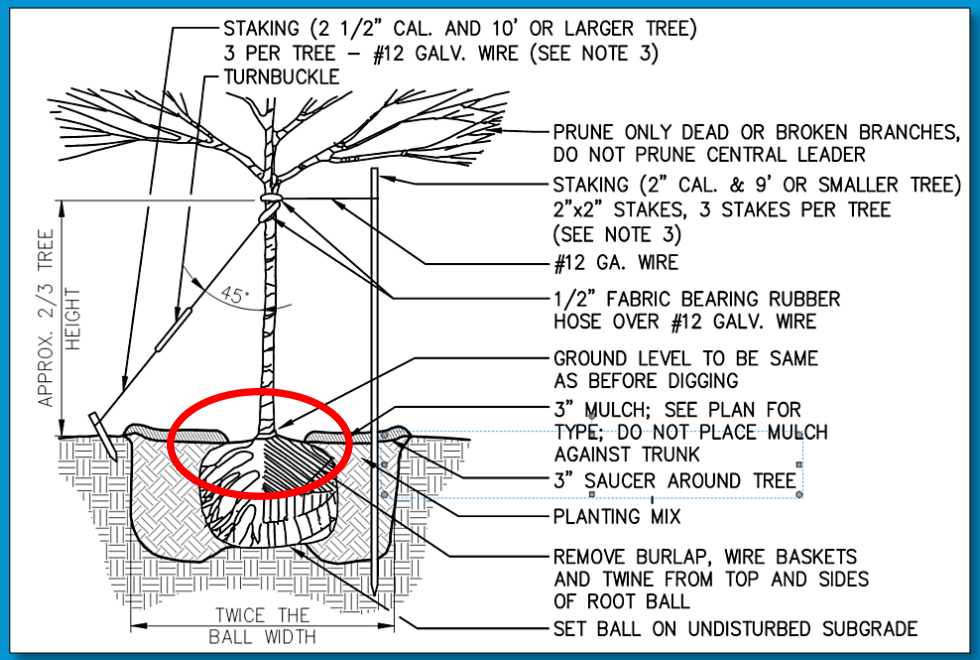
Construct infiltrating practices during dry weather only

General Overview - Construction

Ensure non-contaminated construction materials are used

General Overview - Construction

Ensure planting specifications are followed



General Overview Maintenance Considerations

Inspection: knowing what to look for and knowing how to remedy problems

General Overview – Day 1

General Overview – Day 1

General Overview – the first few months

General Overview – the awkward years

General Overview – Maturity

General Overview - Maintenance

What do the following have in common?

General Overview - Maintenance

A man-made feature that requires no maintenance

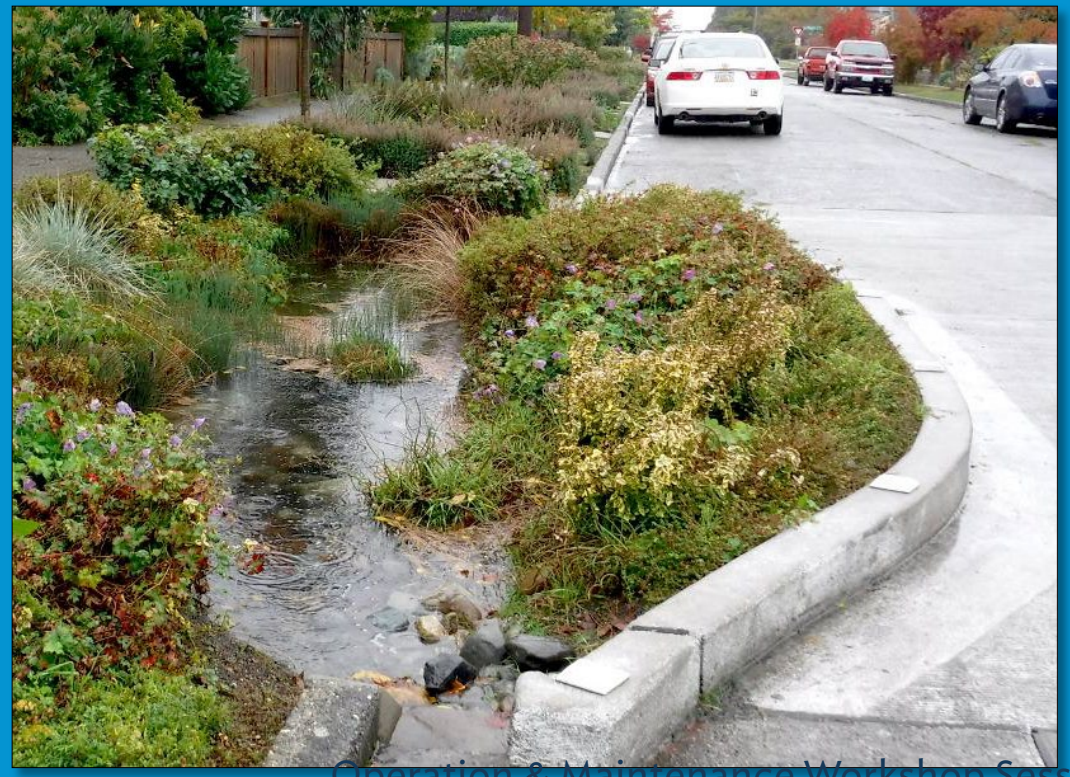
A prefect system of government

General Overview - Maintenance

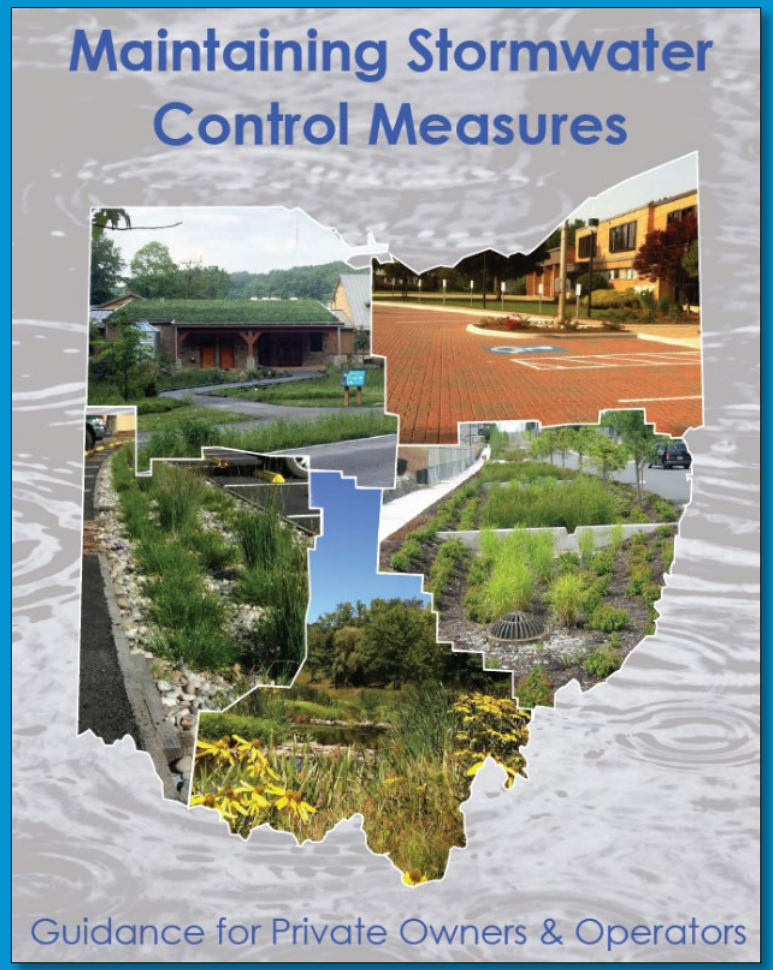
THEY DON'T EXIST!!!

General Overview - Maintenance

First year need$ vs long-term need$



General Overview - Maintenance



STORMWATER CONTROL MEASURES

Stormwater Control Measures

Over the next few pages we will discuss common SCMs approved for use in Ohio. A good understanding of SCM design and operation will enable property owners and operators of SCMs to plan and implement required maintenance activities on schedule.

If your SCM is not listed in this manual, please contact your local stormwater manager.

MAINTAINING STORMWATER CONTROL MEASURES
Guidance for Private Owners & Operators

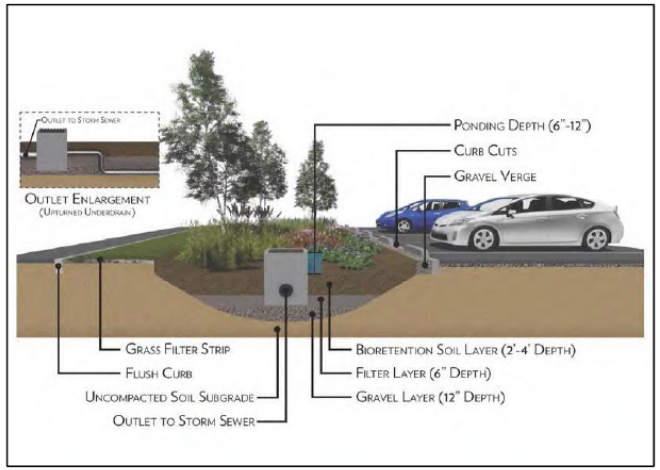
TABLE OF CONTENTS

https://ohioswa.com/wpfd_file/maintaining-stormwater-control-measures-neoswtc-2017/

General Overview - Maintenance

Bioretention Area

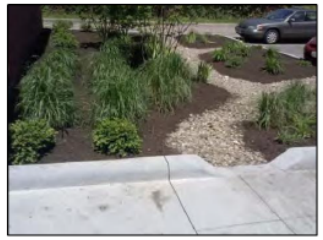
Bioretention areas are depressed areas that allow shallow ponding of stormwater runoff that utilize specified soil media, mulch and vegetation to capture and treat stormwater runoff from impervious surfaces such as parking lots and rooftops. The soil media, mulch and vegetation filter pollutants to improve water quality within urban environments. The specified soil media, composed of sand, is placed over layers of sand, pea gravel and gravel within the depression which enables ponded stormwater runoff to be treated and filtered and before either soaking into the underlying soils or leaving through an underdrain pipe. Underdrains may be installed to drain the bioretention area to local sewers or appropriate outlet. Bioretention areas are planted with specific types of plant material that can withstand both wet and dry weather conditions. Recommended plant material information for Bioretention Areas can be found in Appendix 5.



Typical bioretention area cross-section view. Credit: Chagrin River Watershed Partners, Inc.

MAINTAINING STORMWATER CONTROL MEASURES
Guidance for Private Owners & Operators

STORMWATER CONTROL MEASURES



Planted bioretention area with sidewalk curb cut in foreground. Stormwater runoff is conveyed through gravel to shallow depression of bioretention area. Credit: Northeast Ohio Regional Sewer District

Weeds and untrimmed plantings prevent stormwater runoff from entering the bioretention area from the curb cut. Credit: Northeast Ohio Regional Sewer District

Stormwater flow will be blocked by the dead vegetation on the outlet catch basin grate. Credit: Chagrin River Watershed Partners

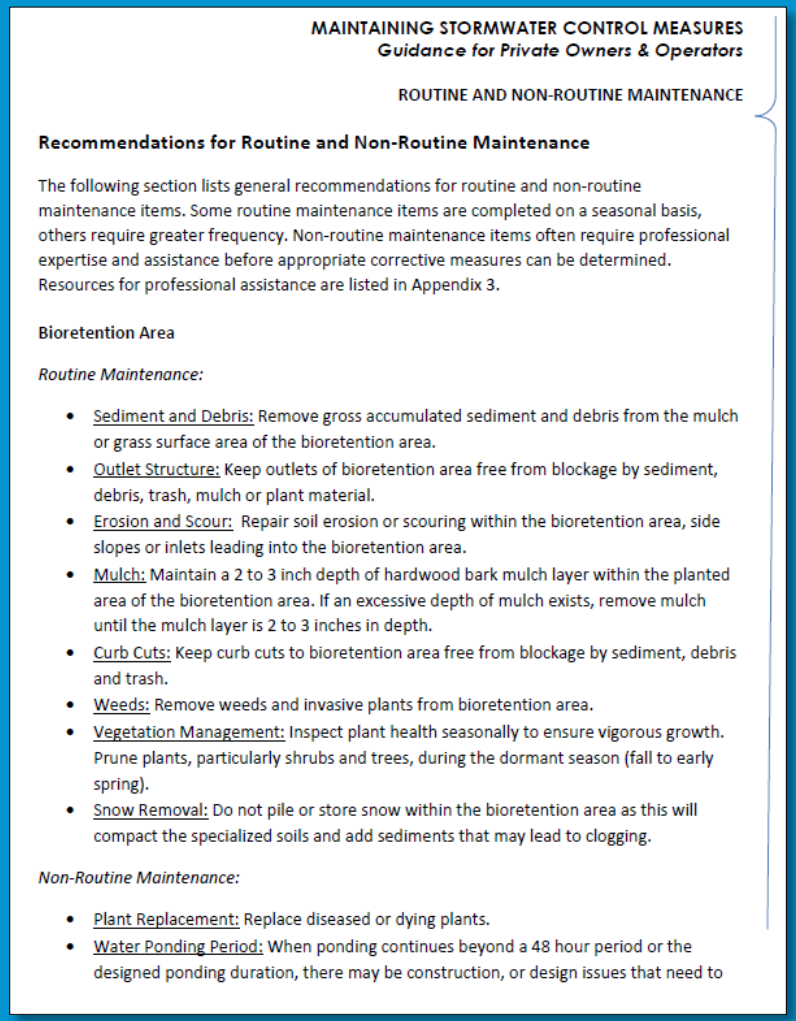
Erosion of side slopes and subsequent sediment accumulation within bioretention area and contribute to clogging issues. Credit: Summit Soil & Water Conservation District

MAINTENANCE REQUIRED WHEN:

- Standing water is visible 48 hours after a rain event.
- Erosion is visible within the bioretention area, or on the slopes and inlets leading into the bioretention area.
- Vegetation, sediment or debris is blocking inlets or outlets.
- Vegetation is wilting, discolored, or dying.
- Foul odors present.
- Sediment has accumulated over the mulch or soil media.

https://ohioswa.com/wpfd_file/maintaining-stormwater-control-measures-neoswtc-2017/

General Overview – Maintenance



MAINTAINING STORMWATER CONTROL MEASURES
Guidance for Private Owners & Operators

ROUTINE AND NON-ROUTINE MAINTENANCE

Recommendations for Routine and Non-Routine Maintenance

The following section lists general recommendations for routine and non-routine maintenance items. Some routine maintenance items are completed on a seasonal basis, others require greater frequency. Non-routine maintenance items often require professional expertise and assistance before appropriate corrective measures can be determined. Resources for professional assistance are listed in Appendix 3.

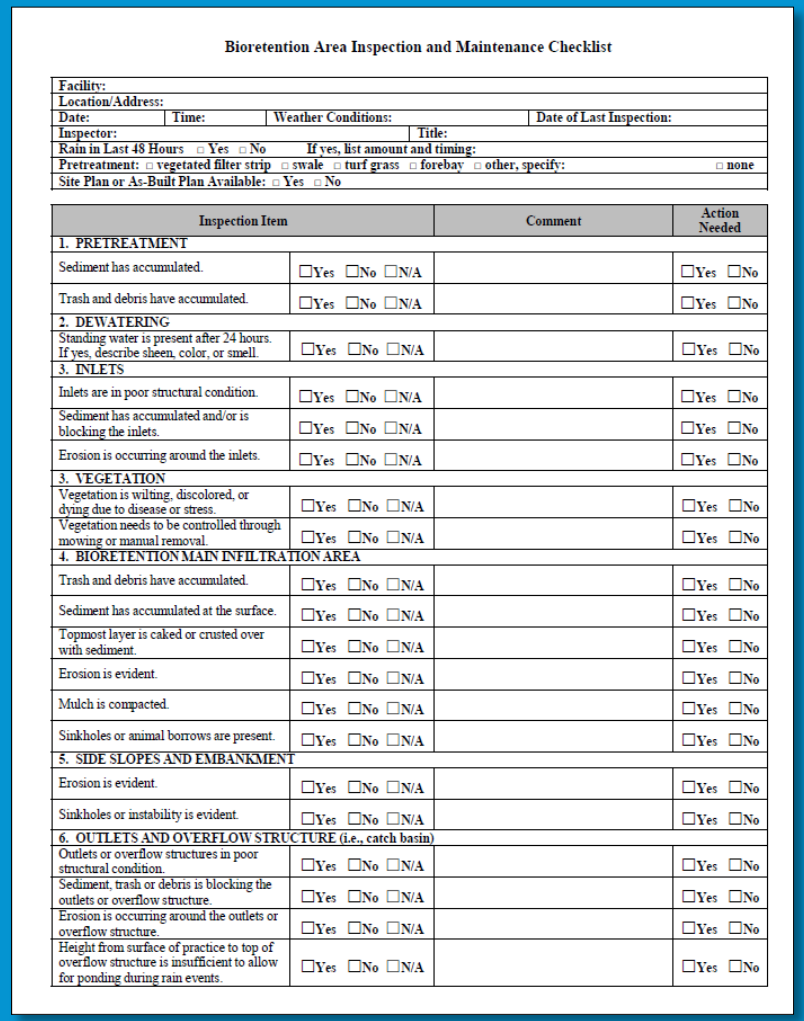
Bioretention Area

Routine Maintenance:

- Sediment and Debris: Remove gross accumulated sediment and debris from the mulch or grass surface area of the bioretention area.
- Outlet Structure: Keep outlets of bioretention area free from blockage by sediment, debris, trash, mulch or plant material.
- Erosion and Scour: Repair soil erosion or scouring within the bioretention area, side slopes or inlets leading into the bioretention area.
- Mulch: Maintain a 2 to 3 inch depth of hardwood bark mulch layer within the planted area of the bioretention area. If an excessive depth of mulch exists, remove mulch until the mulch layer is 2 to 3 inches in depth.
- Curb Cuts: Keep curb cuts to bioretention area free from blockage by sediment, debris and trash.
- Weeds: Remove weeds and invasive plants from bioretention area.
- Vegetation Management: Inspect plant health seasonally to ensure vigorous growth. Prune plants, particularly shrubs and trees, during the dormant season (fall to early spring).
- Snow Removal: Do not pile or store snow within the bioretention area as this will compact the specialized soils and add sediments that may lead to clogging.

Non-Routine Maintenance:

- Plant Replacement: Replace diseased or dying plants.
- Water Ponding Period: When ponding continues beyond a 48 hour period or the designed ponding duration, there may be construction, or design issues that need to



Bioretention Area Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	**Time:**	**Weather Conditions:**	**Date of Last Inspection:**
Inspector:		**Title:**	
Rain in Last 48 Hours □ **Yes** □ **No**		**If yes, list amount and timing:**	
Pretreatment: □ **vegetated filter strip** □ **swale** □ **turf grass** □ **forebay** □ **other, specify:**			□ **none**
Site Plan or As-Built Plan Available: □ **Yes** □ **No**			

Inspection Item		Comment	Action Needed
1. PRETREATMENT			
Sediment has accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
2. DEWATERING			
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. INLETS			
Inlets are in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment has accumulated and/or is blocking the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. VEGETATION			
Vegetation is wilting, discolored, or dying due to disease or stress.	☐Yes ☐No ☐N/A		☐Yes ☐No
Vegetation needs to be controlled through mowing or manual removal.	☐Yes ☐No ☐N/A		☐Yes ☐No
4. BIORETENTION MAIN INFILTRATION AREA			
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment has accumulated at the surface.	☐Yes ☐No ☐N/A		☐Yes ☐No
Topmost layer is caked or crusted over with sediment.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
Mulch is compacted.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sinkholes or animal borrows are present.	☐Yes ☐No ☐N/A		☐Yes ☐No
5. SIDE SLOPES AND EMBANKMENT			
Erosion is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sinkholes or instability is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
6. OUTLETS AND OVERFLOW STRUCTURE (i.e., catch basin)			
Outlets or overflow structures in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment, trash or debris is blocking the outlets or overflow structure.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around the outlets or overflow structure.	☐Yes ☐No ☐N/A		☐Yes ☐No
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	☐Yes ☐No ☐N/A		☐Yes ☐No

https://ohioswa.com/wpfd_file/maintaining-stormwater-control-measures-neoswtc-2017/

2026 Stormwater Control Measures

- Bioretention Cells
- Permeable Pavement

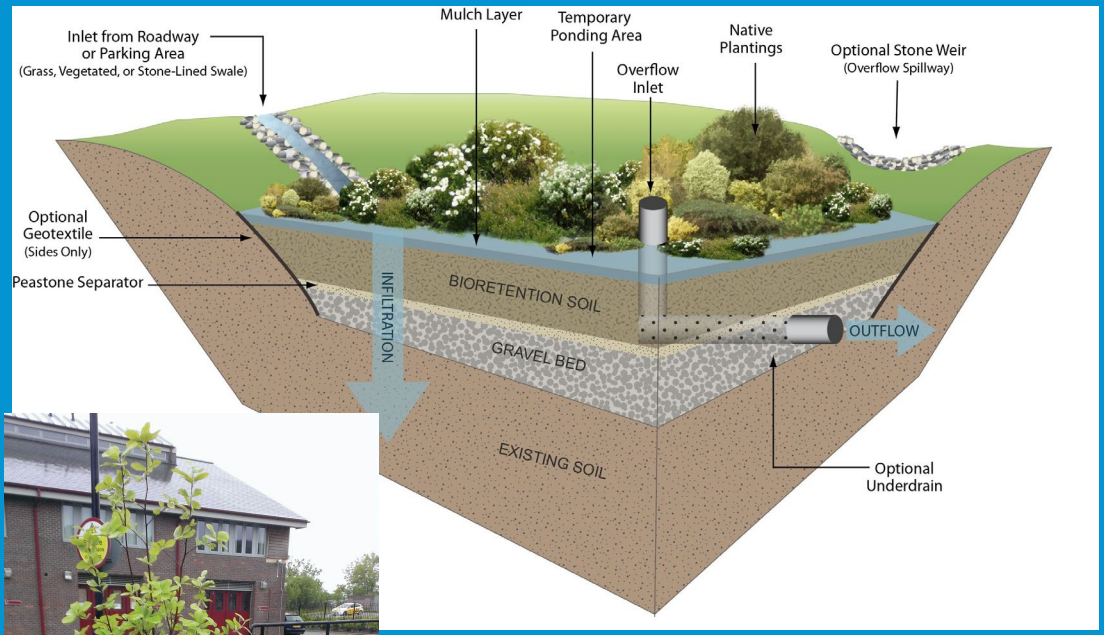
BIORETENTION

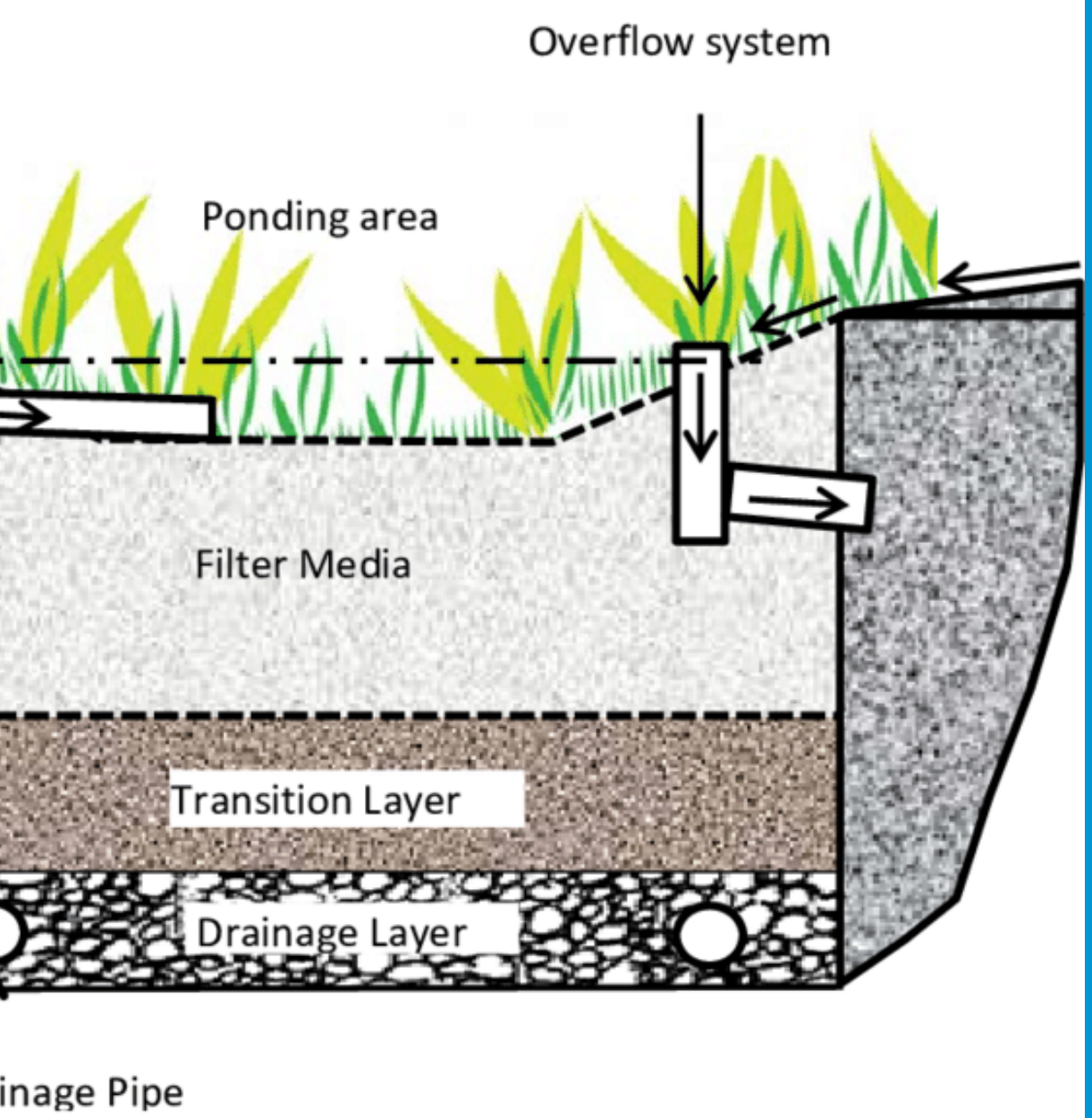
Northeast Ohio
Regional Sewer District

Operation & Maintenance Workshop Session

Bioretention

- Small-scale, vegetated depressions
- Small contributing areas (e.g., roads and roof tops)
- Stormwater runoff percolates through soil and plant roots
- Physical, chemical and biological processes
- Clean water infiltrates or is discharged





Bioretention Design

Bioretention – Design

General

- Use accepted standards
- Ensure accessibility
- Prepare logical schedule
- Keep inspection & maintenance in mind
- Include applicable notes & details
- Provide for flood routing
- Provide material specifications

Bioretention – Design

Design assumptions made

- Appropriate drainage area vs. filter bed area (4% of its watershed's impervious area)
- Adequate outlet
- No groundwater concerns (high water table, underlying bedrock)
- Setbacks have been met

Bioretention – Design

Assumptions

Appropriate drainage area vs. filter bed area (4% of watershed's impervious area)

Bioretention – Design

Pre-treatment options

FOREBAY

GRASS FILTER

GRAVEL VERGE

PROPRIETARY DEVICE

Bioretention – Design

Curb cuts: Sumps (easy) vs. Slopes (hard)

Bioretention – Design

Curb cuts: Use the right size stone

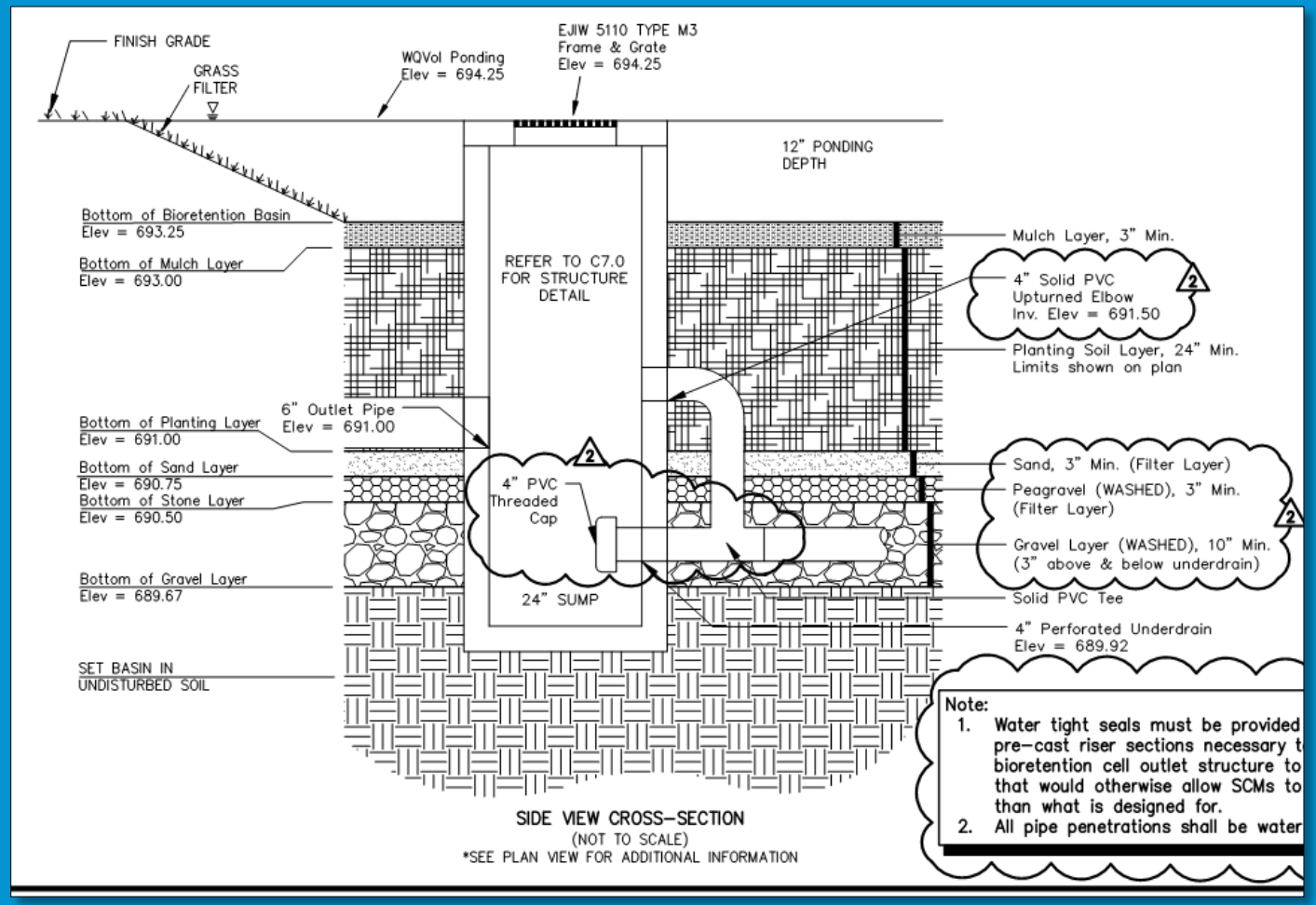
NICE

NAUGHTY

=

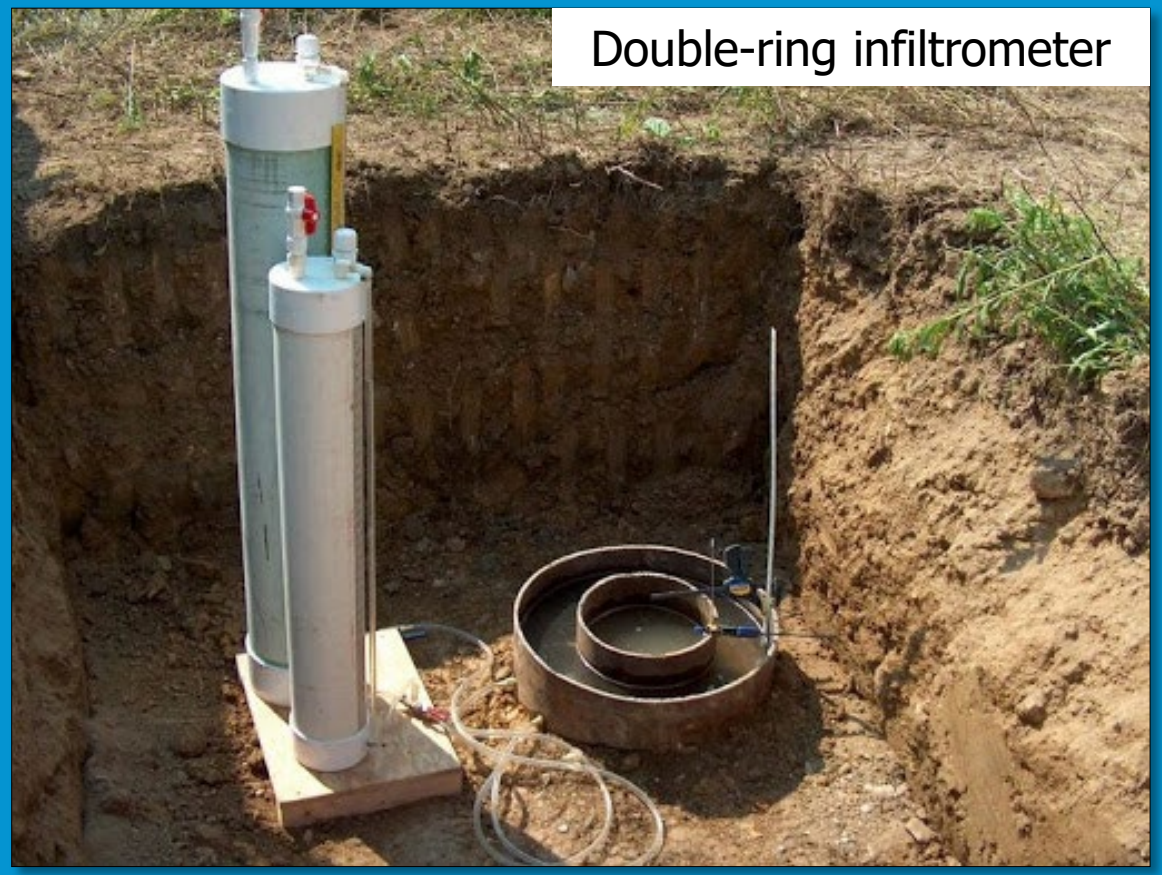
Bioretention – Design

Upturned elbows



Bioretention – Design

Infiltration Testing

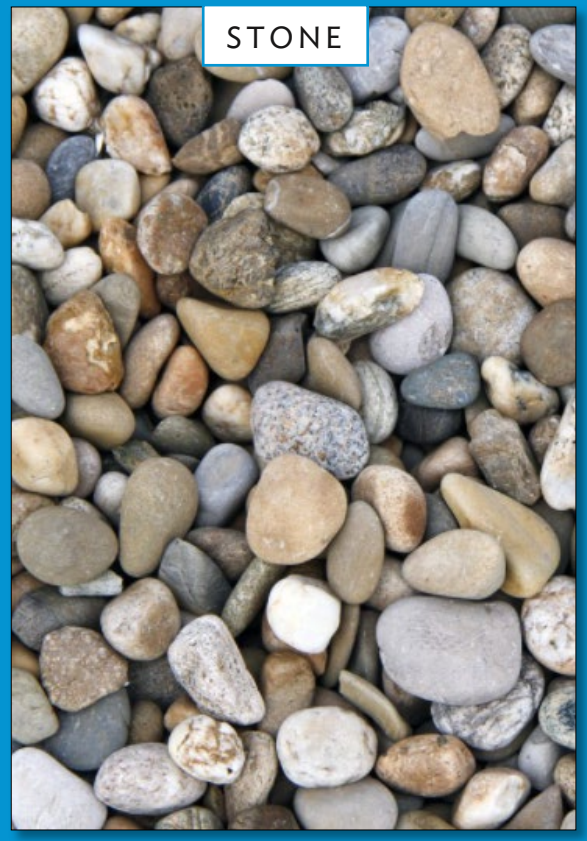


Double-ring infiltrometer

Infiltration test pit

Bioretention – Design

Mulch Selection



Bioretention – Design

Planting Soil Media

- Texture class: loamy sand. Having no less than 80% sand and no greater than 10% clay considering only the mineral fraction of the soil.
- pH range: 5.2 - 8.0
- Soluble Salts: 500 ppm maximum.
- Decomposed organic matter: 3-5% by weight [Note: this translates to 8-20% organic matter by volume. See note on "Creating a Suitable Soil Media" below.]
- Phosphorus: phosphorus of the planting media should fall between 15 and 60 mg/kg (ppm) as determined by the Mehlich III test. For sites in watersheds with a phosphorus TMDL or sites with high phosphorus loads, the phosphorus content of the planting media should fall between 10 and 30 mg/kg as determined by the Mehlich III test.
- Sand added shall be clean and meet AASHTO M-6 or ASTM C-33 with a grain size of 0.02-0.04" inches.

Bioretention – Design

Plant Selection

Bioretention Construction

Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

Bioretention – Construction

General

- Adhere to construction schedule
- Keep sediment away!
- Refer to applicable notes/details
- Construct during good weather
- Scarify subsoil (infiltrating practices)
- Use non-contaminated materials
- Plan revisions = O&M Plan revisions
- As-built drawings
- Milestone inspections

Bioretention – Construction

Avoid compaction

Bioretention – Construction

Account for settling of layers (additional 5% volume)

Bioretention – Construction

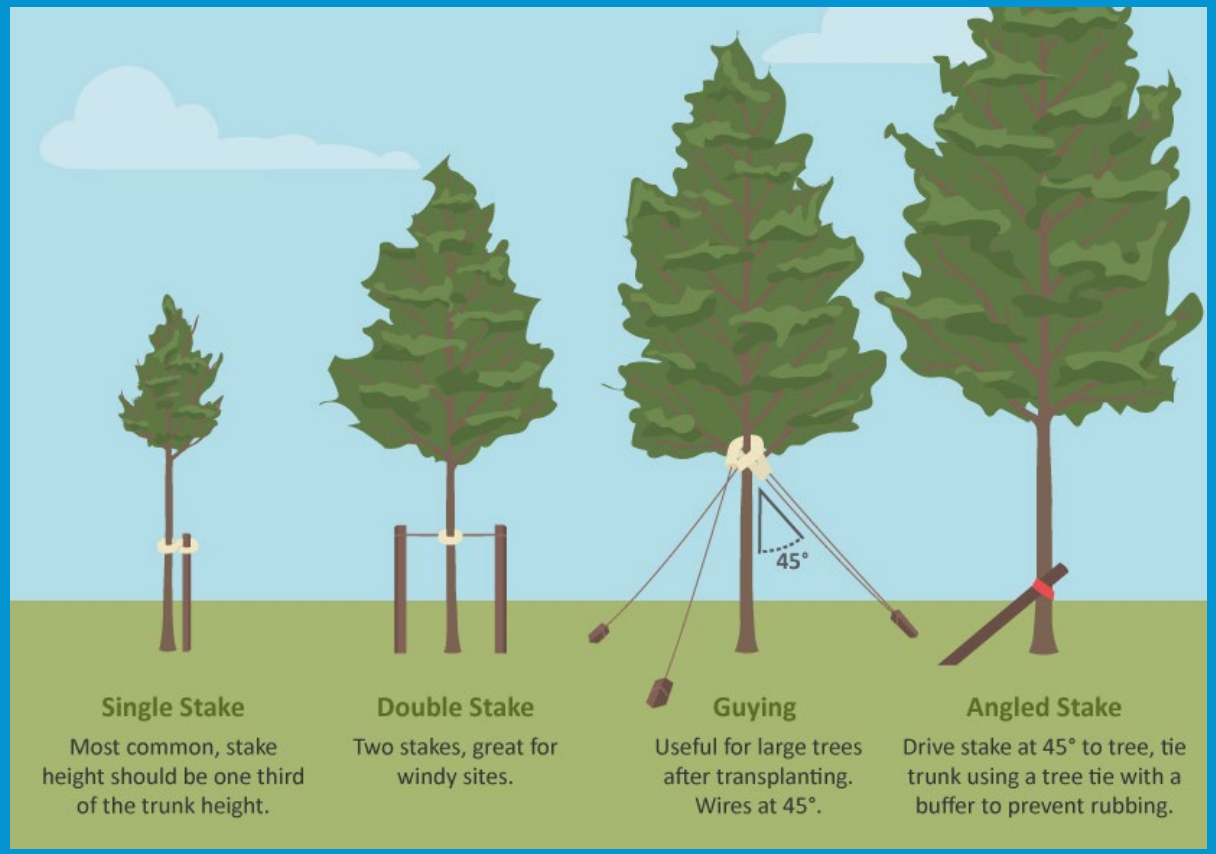
Keep sediment out!!!

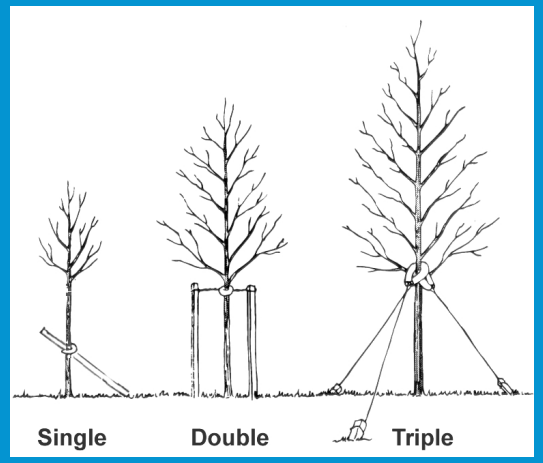
Bioretention – Construction

Pre-treatment grass filter strips…choose sod rather than seed & mulch

Bioretention – Construction

Properly stake taller plants





Bioretention Maintenance

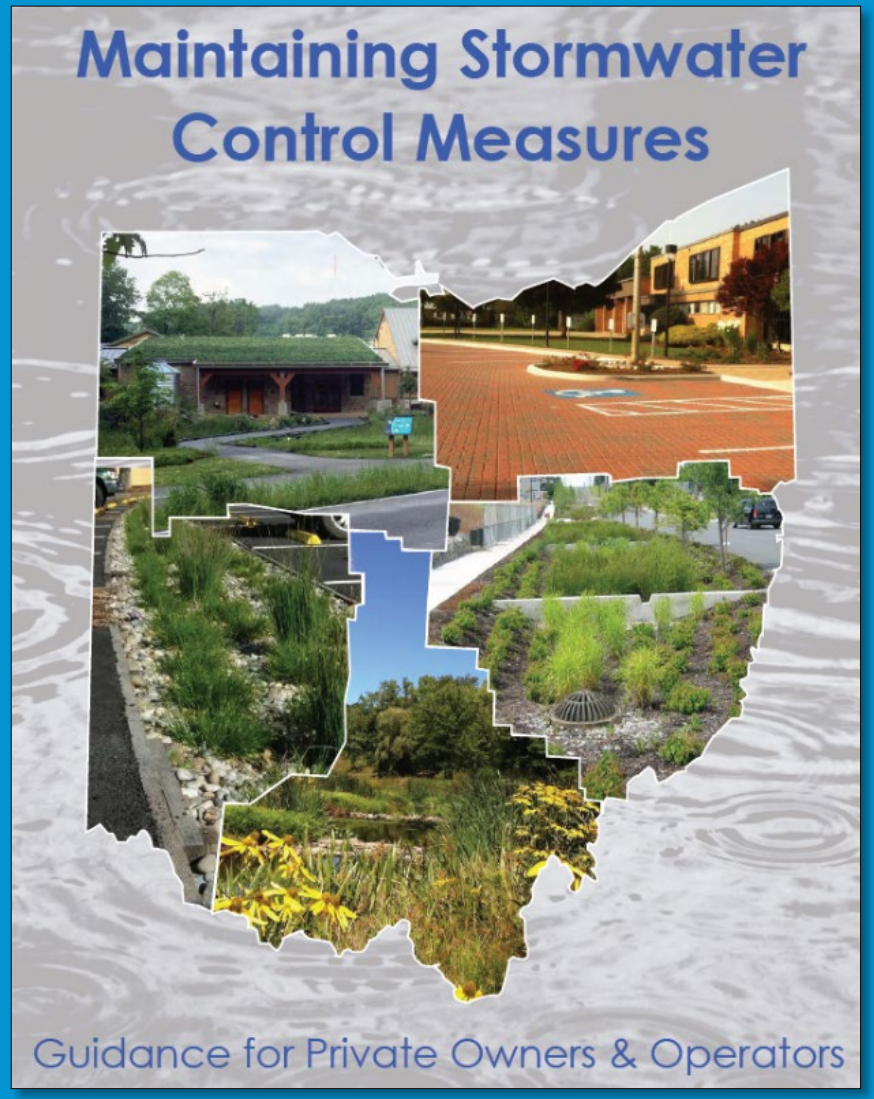
Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

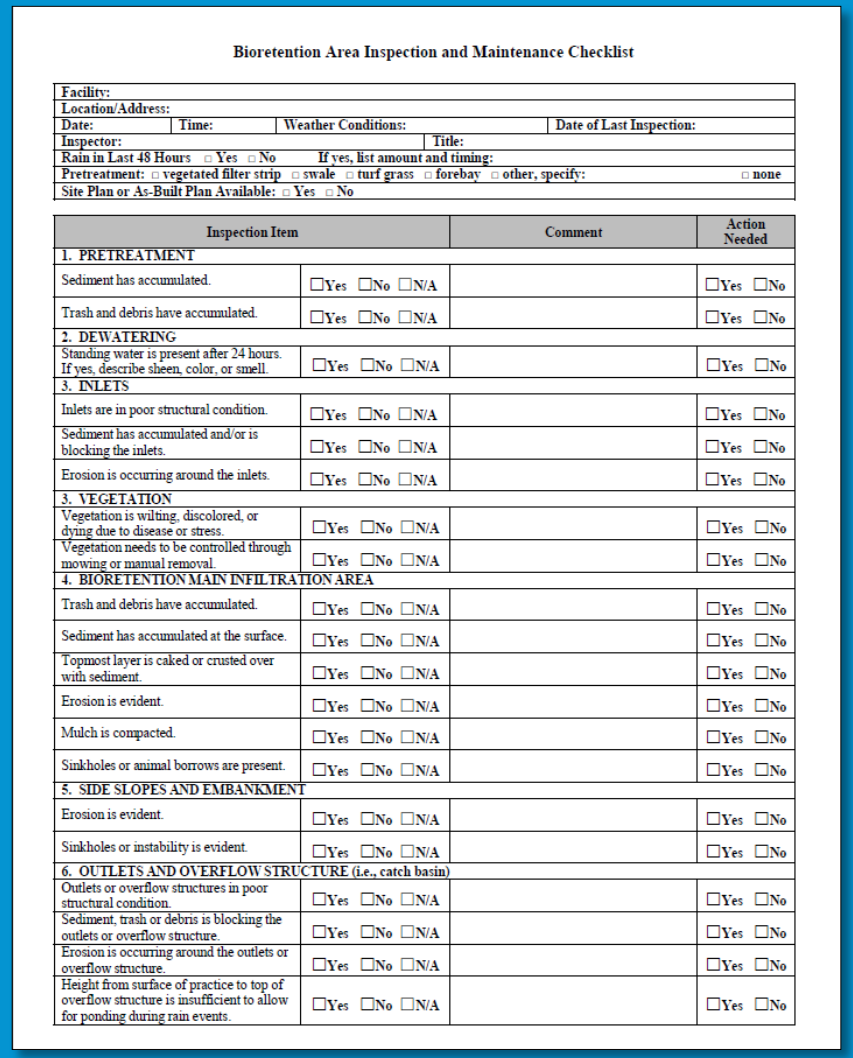
Bioretention- Maintenance

General

- All SCMs will require maintenance
- First year need $ vs. long-term need $



Bioretention – Maintenance



Bioretention Area Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	**Time:**	**Weather Conditions:**	**Date of Last Inspection:**
Inspector:		**Title:**	
Rain in Last 48 Hours □ **Yes** □ **No**		**If yes, list amount and timing:**	
Pretreatment: □ **vegetated filter strip** □ **swale** □ **turf grass** □ **forebay** □ **other, specify:**			□ **none**
Site Plan or As-Built Plan Available: □ **Yes** □ **No**			

Inspection Item		Comment	Action Needed
1. PRETREATMENT			
Sediment has accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
2. DEWATERING			
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. INLETS			
Inlets are in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment has accumulated and/or is blocking the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
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Mulch is compacted.	☐Yes ☐No ☐N/A		☐Yes ☐No
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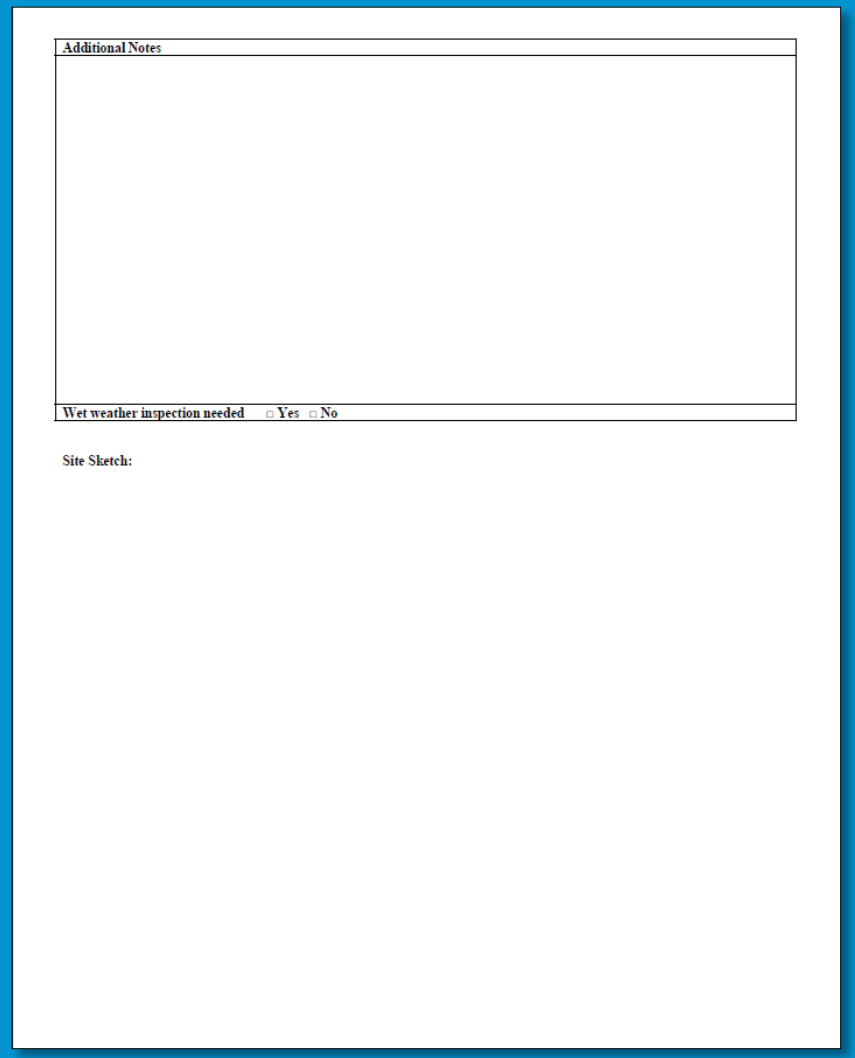
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	☐Yes ☐No ☐N/A		☐Yes ☐No



Additional Notes
Wet weather inspection needed □ **Yes** □ **No**

Site Sketch:

Bioretention- Maintenance

Pre-treatment

Remove accumulated sediments

De-watering

Ensure it drains

Bioretention- Maintenance

Inlets

Are they stabilized?

Vegetative Health

Watering & weeding

Trimming/pruning

Thinning

Winterizing

Bioretention- Maintenance

Infiltration bed

Bioretention- Maintenance

Outlet & Overflow

Bioretention- Maintenance

First-Year Maintenance

- Weeding…constantly!!!
- Remove accumulated sediments/debris from pre-treatment devices
- Stabilize eroding inlets & side slopes
- Vegetation – watering, mulching & winterization
- Remove trash & debris from bed
- Address any animal burrows
- Ensure overflow remains free-flowing

Bioretention Cell Maintenance

Time for a 10-minute break

PERMEABLE PAVEMENT

Permeable Pavement

- Provide structural support for vehicle, bicycle, and pedestrian traffic
- Allows water to permeate through the pavement surface, aggregate base, and to infiltrate into the subgrade soils
- Receive runoff from adjacent rooftops and/or traditional pa

Permeable Pavement

Permeable Pavement Design

Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

Permeable Pavement – Design

General

- Use accepted standards
- Ensure accessibility
- Prepare logical schedule
- Keep inspection & maintenance in mind
- Include applicable notes & details
- Provide for flood routing
- Provide material specifications

Permeable Pavement – Design

Design assumptions made

- Traffic loading patterns
- Contributing drainage area's land use impacts (i.e., sediments)
- Foundation offsets
- Groundwater issues addressed
- Flat subgrade provided

Permeable Pavement – Design

Drainage area ratios (max. 2:1, traditional pavement-to-permeable pavement)

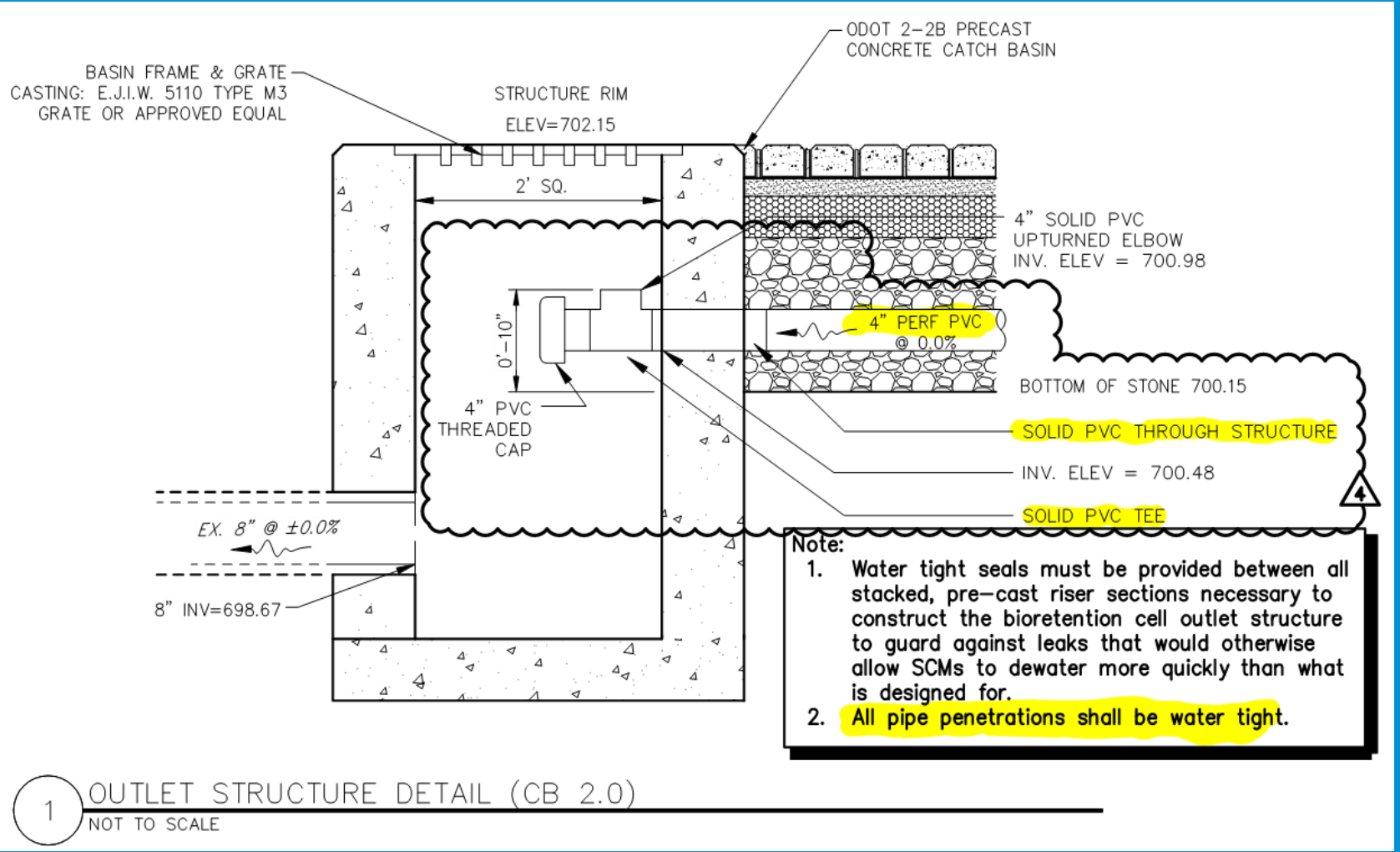
Paver field = 5,000 sq. ft.

Pavement drainage area = 7,500 sq. ft.

Permeable Pavement – Design

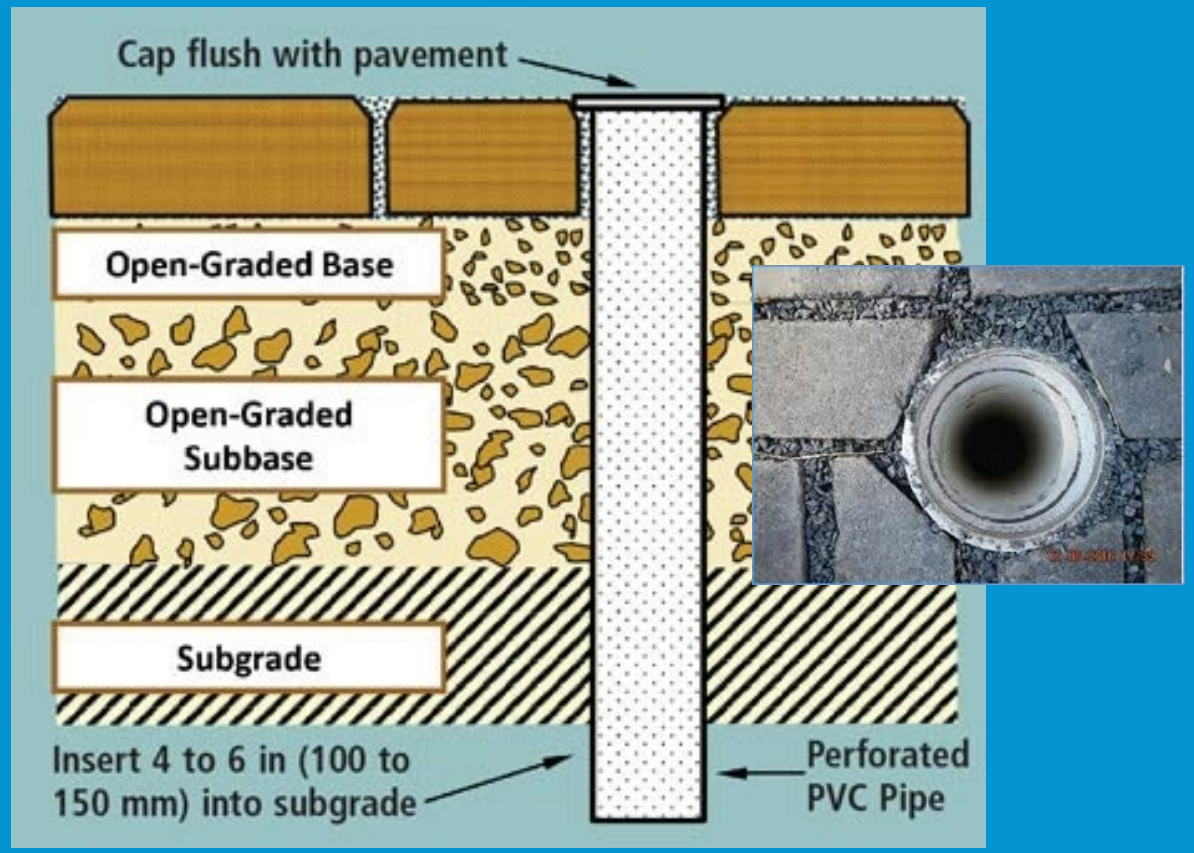
Underdrains & elbows

Permeable Pavement – Design



Permeable Pavement – Design

Observation wells



Edge restraints

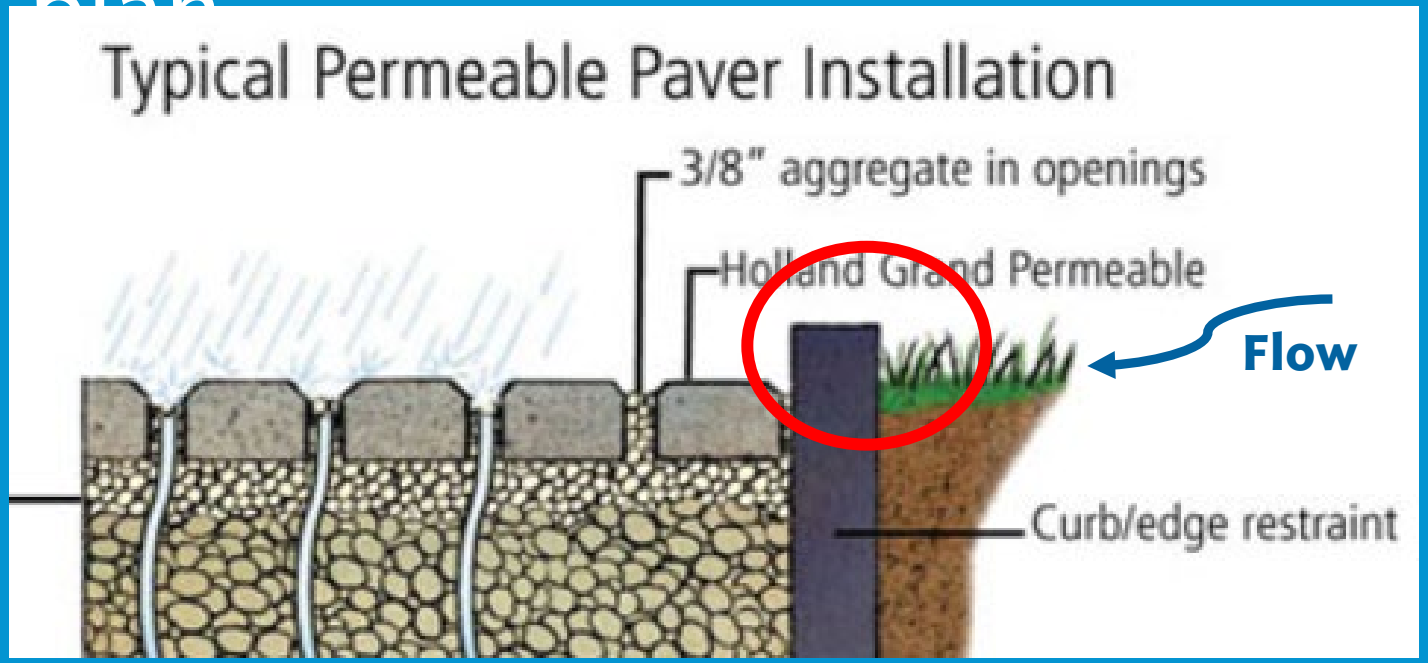
Permeable Pavement – Design

Infiltration testing*

* Based on finished compaction

Permeable Pavement – Design

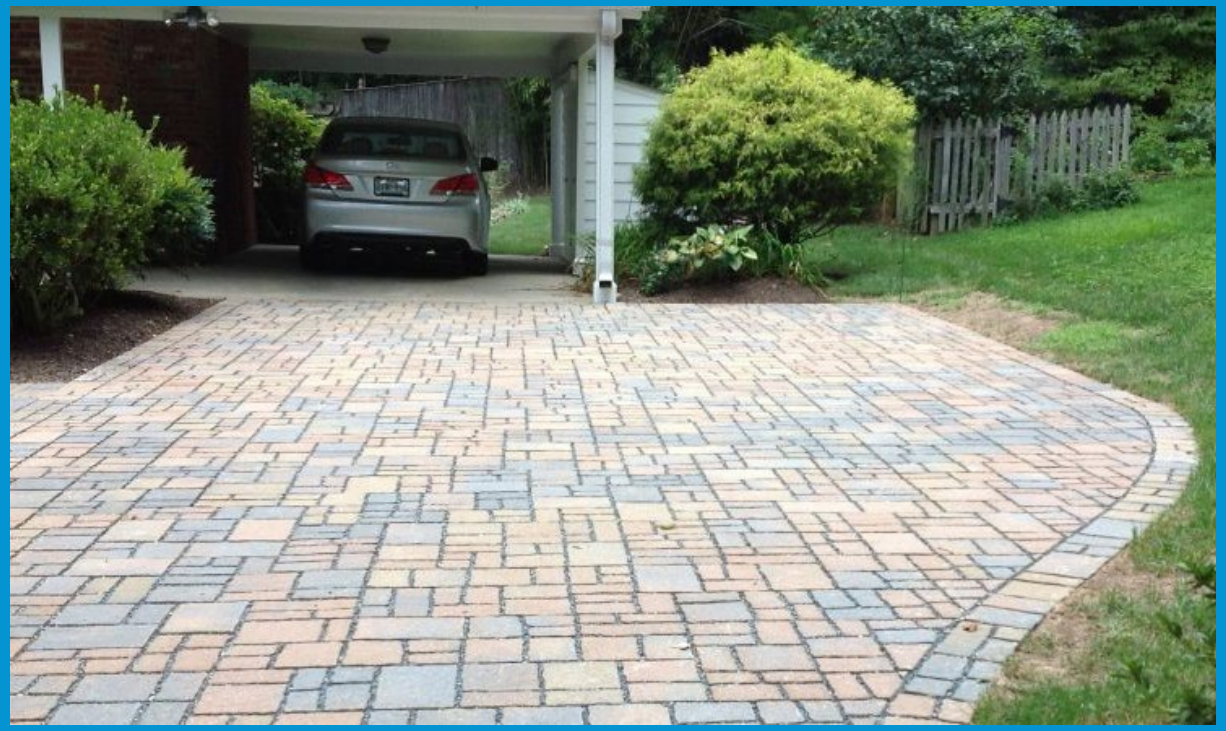
Erosion & sediment control plan



Permeable Pavement – Design

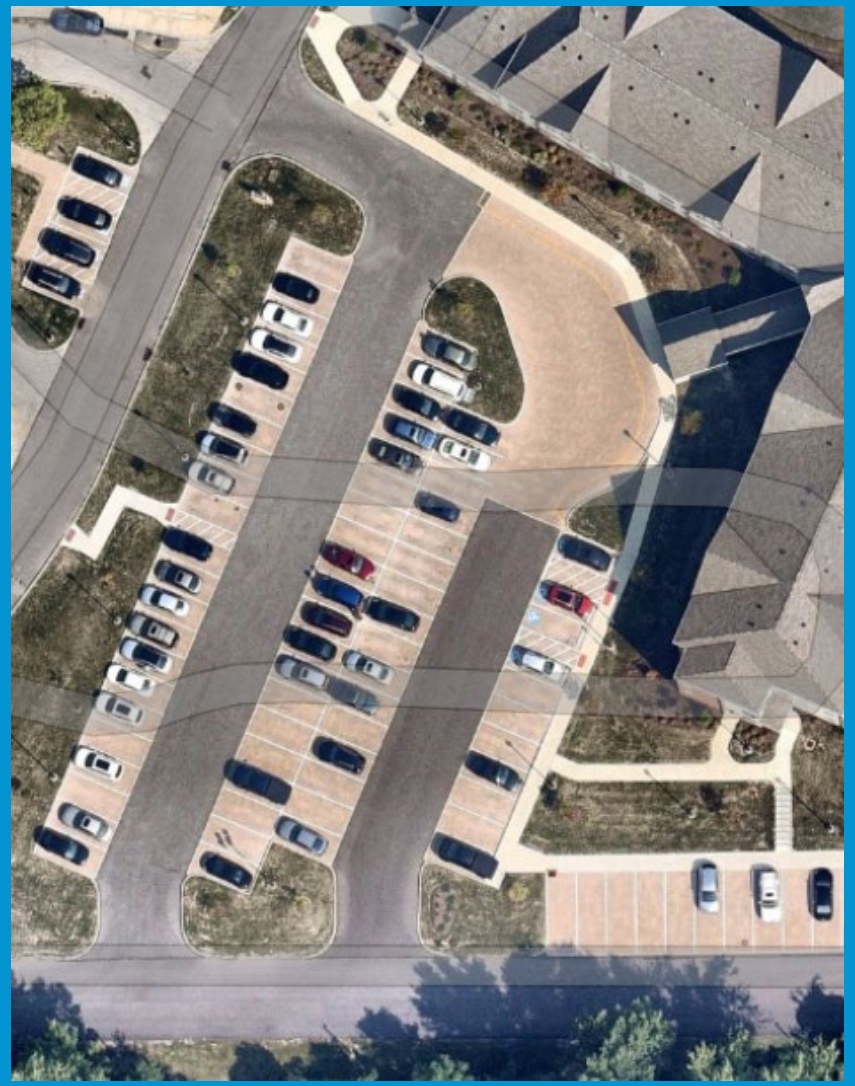
Maintain straight edging as much as possible

(pieces ≥ 1/3rd the brick)



Permeable Pavement – Design

Parking bays vs. drive aisles?



Permeable Pavement Construction

Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

Permeable Pavement – Construction

General

- Adhere to construction schedule
- Keep sediment away!
- Refer to applicable notes/details
- Construct during good weather
- Scarify subsoil (infiltrating practices)
- Use non-contaminated materials
- Plan revisions = O&M Plan revisions
- As-built drawings
- Milestone inspections

Permeable Pavement – Construction

Do not work on the subgrade when it is raining

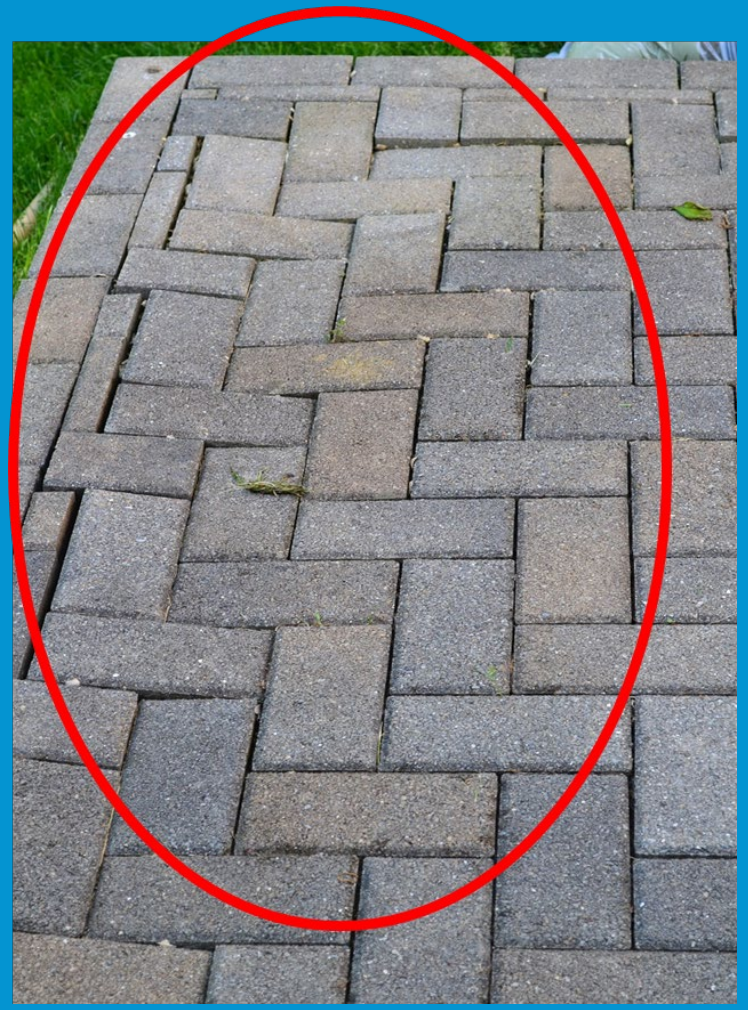
Remove unintended sediments before backfilling

Permeable Pavement – Construction

Vibration and top-dressing, 2 months later as well

Permeable Pavement – Construction

Settling of paver bricks is common. Consider setting them slightly higher than final elevation.



Permeable Pavement Maintenance

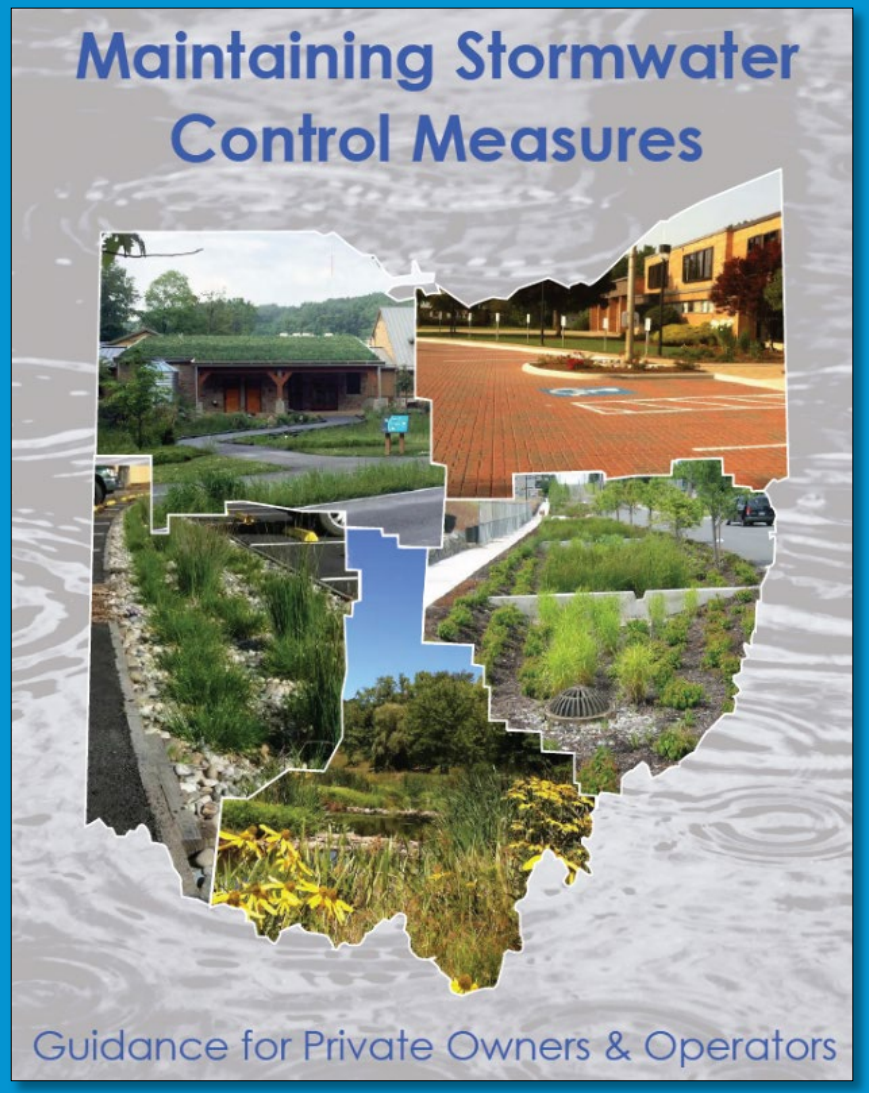
Northeast Ohio Regional Sewer District

Operation & Maintenance Workshop Session

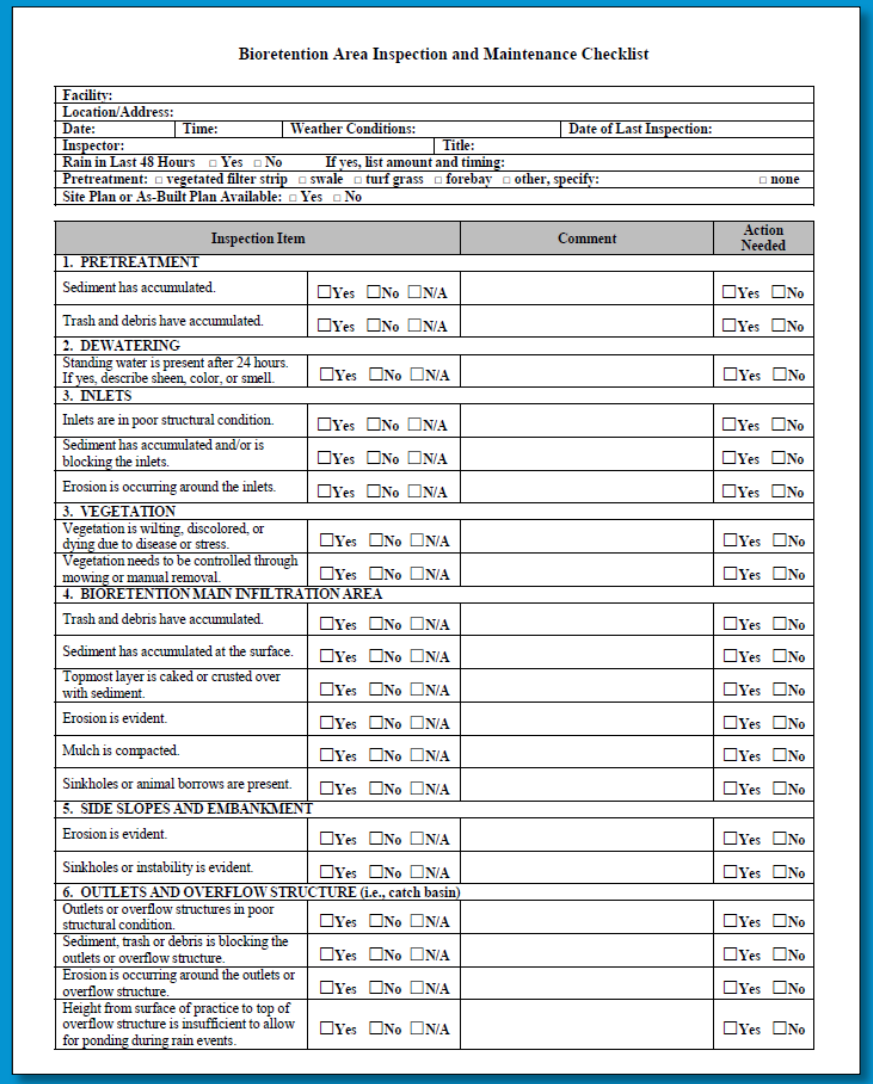
Permeable Pavement – Maintenance

General

- All SCMs will require maintenance
- First year need$ vs. long-term need$



Permeable Pavement – Maintenance



Bioretention Area Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	**Time:**	**Weather Conditions:**	**Date of Last Inspection:**
Inspector:		**Title:**	
Rain in Last 48 Hours □ Yes □ No	**If yes, list amount and timing:**		
Pretreatment: □ vegetated filter strip □ swale □ turf grass □ forebay □ other, specify:			□ none
Site Plan or As-Built Plan Available: □ Yes □ No			

Inspection Item		Comment	Action Needed
1. PRETREATMENT			
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Inlets are in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
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Mulch is compacted.	☐Yes ☐No ☐N/A		☐Yes ☐No
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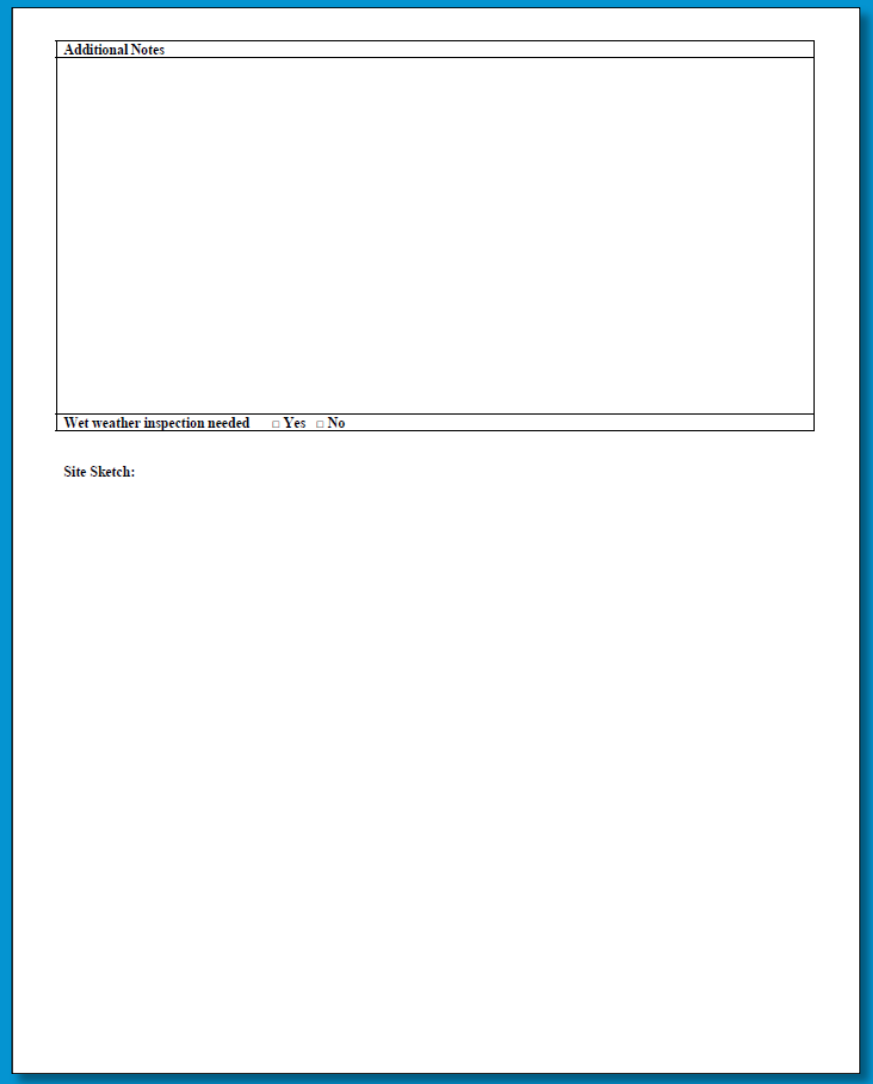


Additional Notes
Wet weather inspection needed □ Yes □ No

Site Sketch:

Permeable Pavement – Preventative Maintenance

Remove landscaping debris

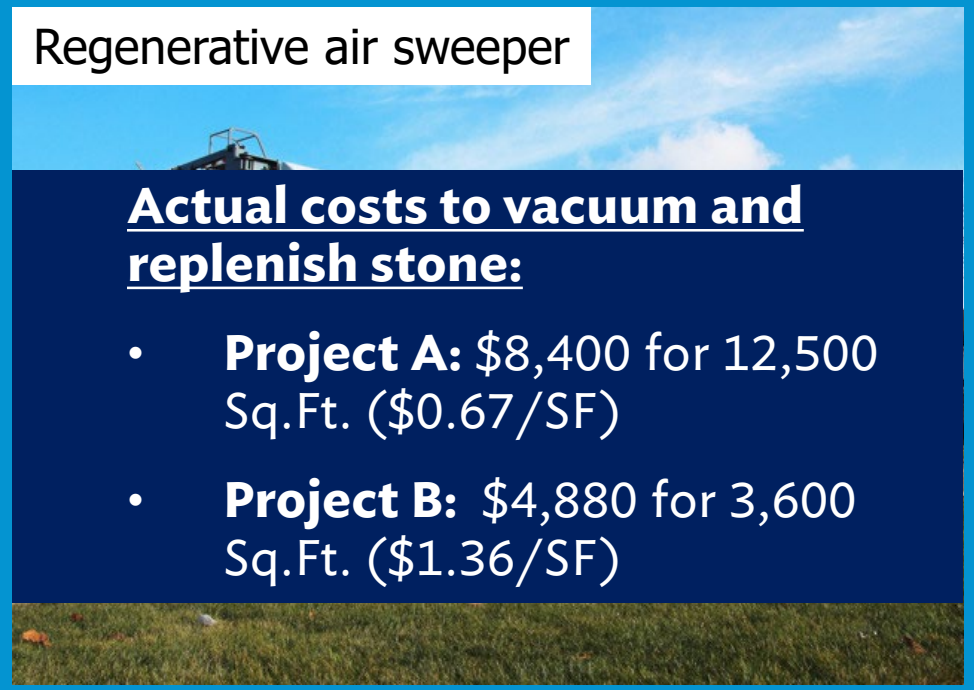
Stockpile snow piles

Permeable Pavement – Preventative Maintenance

Do not apply any sealants

Permeable Pavement – Routine Maintenance

Vacuum/sweep 1X – 2X per year (maybe less with consistent preventative m



Regenerative air sweeper

Actual costs to vacuum and replenish stone:

- **Project A:** $8,400 for 12,500 Sq.Ft. ($0.67/SF)
- **Project B:** $4,880 for 3,600 Sq.Ft. ($1.36/SF)

DIY old school

Stone refill

Permeable Pavement – Maintenance

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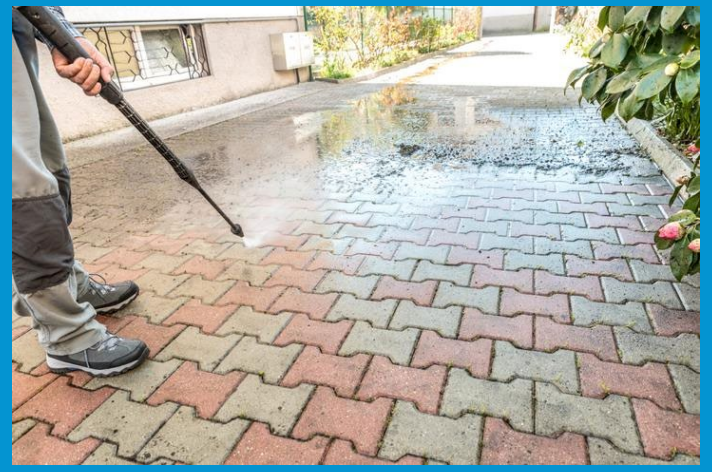
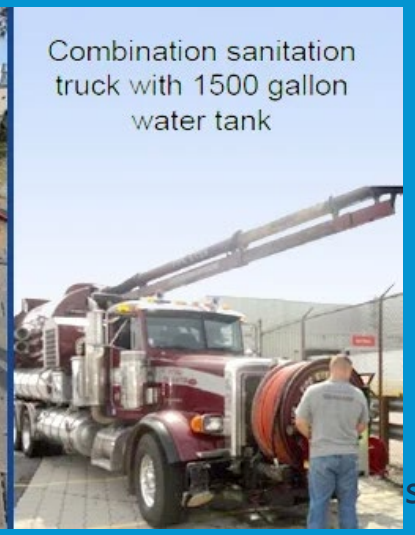
Permeable Pavement – Restorative Maintenance

Permeable Pavement – Restorative Maintenance





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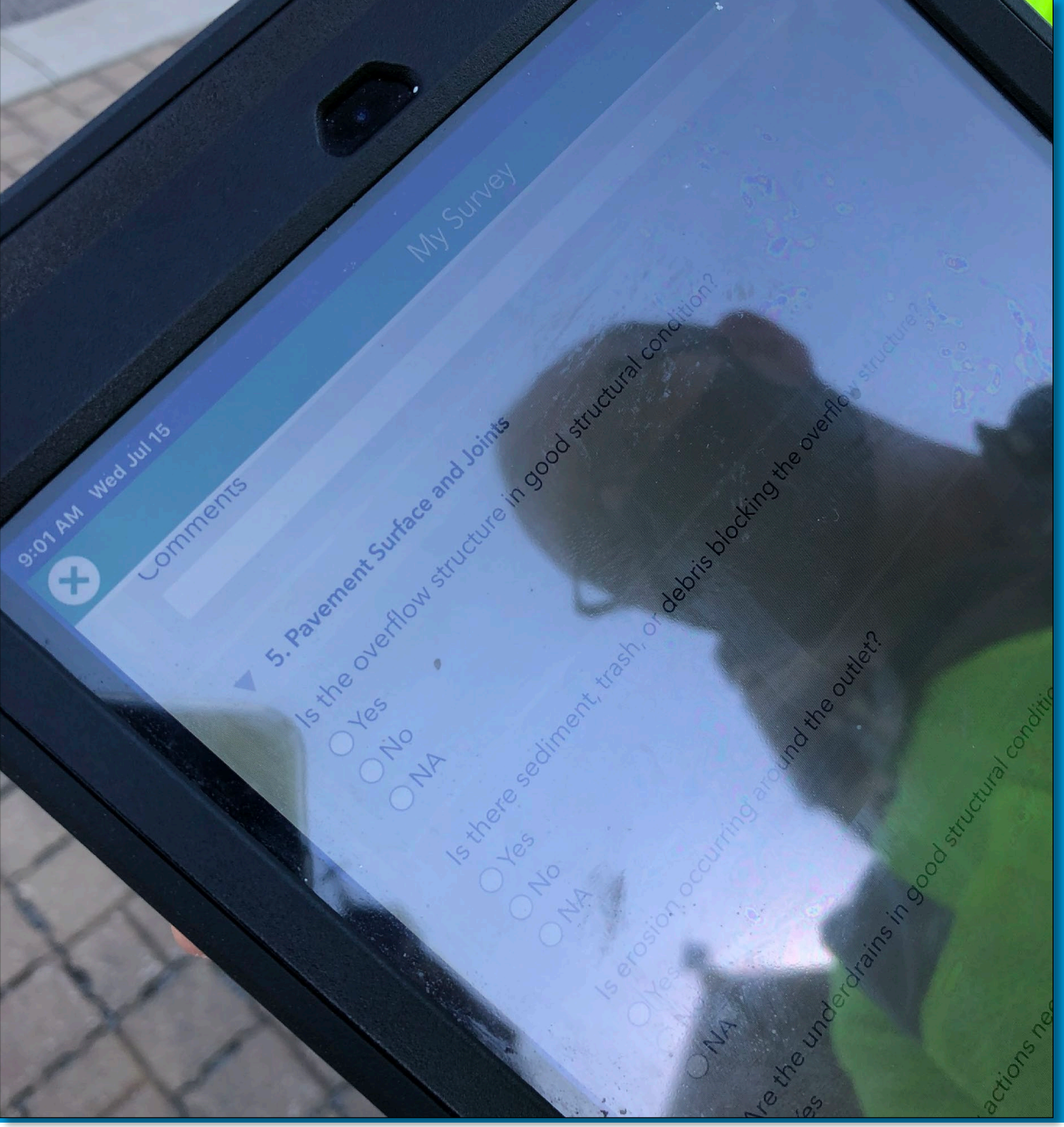
Permeable Pavement – Maintenance

First-Year Maintenance

- Remove accumulated sediments/debris from pre-treatment devices
- Remove landscaping debris ASAP – **PREVENTATIVE MAINTENANCE IS KEY!!!!!**
- Vacuum as necessary (early spring and late fall)

Permeable Pavement Maintenance



ANNUAL INSPECTIONS

Operation & Maintenance Workshop Session

Northeast Ohio
Regional Sewer District

Annual Inspection – For all SCMs

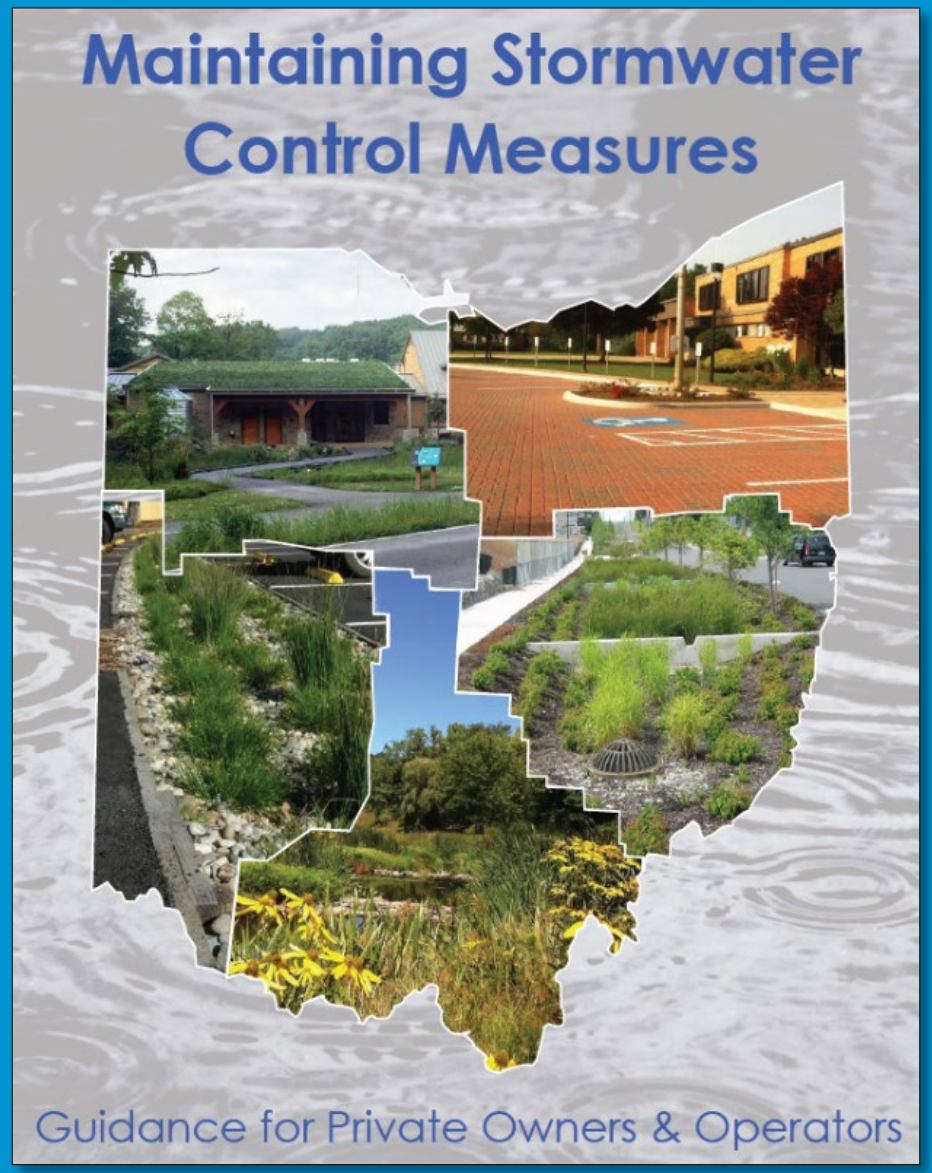
Annual Inspection needs to be completed and submitted by June 1st

- Dry weather – assess structural conditions
- Wet Weather – assess function

Annual Inspection – Form

Northeast Ohio Storm Water Training Council (NEOSWTC)

https://ohioswa.com/wpfd_file/maintaining-stormwater-control-measures-neoswtc-2017/



Annual Inspection – Form

Bioretention Area Inspection and Maintenance Checklist

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Inspection Item		Comment	Action Needed
1. PRETREATMENT			
Sediment has accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
2. DEWATERING			
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. INLETS			
Inlets are in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment has accumulated and/or is blocking the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. VEGETATION			
Vegetation is wilting, discolored, or dying due to disease or stress.	☐Yes ☐No ☐N/A		☐Yes ☐No
Vegetation needs to be controlled through mowing or manual removal.	☐Yes ☐No ☐N/A		☐Yes ☐No
4. BIORETENTION MAIN INFILTRATION AREA			
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment has accumulated at the surface.	☐Yes ☐No ☐N/A		☐Yes ☐No
Topmost layer is caked or crusted over with sediment.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
Mulch is compacted.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sinkholes or animal borrows are present.	☐Yes ☐No ☐N/A		☐Yes ☐No
5. SIDE SLOPES AND EMBANKMENT			
Erosion is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sinkholes or instability is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
6. OUTLETS AND OVERFLOW STRUCTURE (i.e., catch basin)			
Outlets or overflow structures in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment, trash or debris is blocking the outlets or overflow structure.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around the outlets or overflow structure.	☐Yes ☐No ☐N/A		☐Yes ☐No
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	☐Yes ☐No ☐N/A		☐Yes ☐No

Additional Notes
Wet weather inspection needed □ Yes □ No

Site Sketch:

CONCLUSION

Operation & Maintenance Workshop Session

Northeast Ohio
Regional Sewer District

Conclusion

Maintenance Consideration

DESIGN PHASE

CONSTRUCTION PHASE

LONG-TERM

Conclusion

Stormwater Fee Credits

- Provide Appendix A only
- GIG Program Agreement requires annual inspection by June 1st
- Credit renewal requires annual inspection
- Credit approval date will align with GIG inspection requirement

Questions?

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Thank you