

# Portland Maine's Design Standards and O&M Plan for Municipal Green Infrastructure

NEWEA Annual Conference 2016



**STORMWATER  
COMPLIANCE, LLC**

Maintaining your investment • Protecting our environment

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Woodard & Curran



# Presentation Outline

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- Why integrate stormwater treatment systems and Green Infrastructure (GI) in municipal projects?
- Why Portland is considering standard GI design details?
- Developing a municipally-owned stormwater treatment system operations and maintenance program.





# Portland At a Glance

- Population of 66,363 – Center of a 500,000 pop. metro area
- 69.44 sq. mile area
- Council with manager & mayor
- First settled in 1633



*Portland viewed from the waterfront – Old Port District*



*Portland viewed from the sea – Casco Bay*



*Portland viewed from the air - Peninsula*



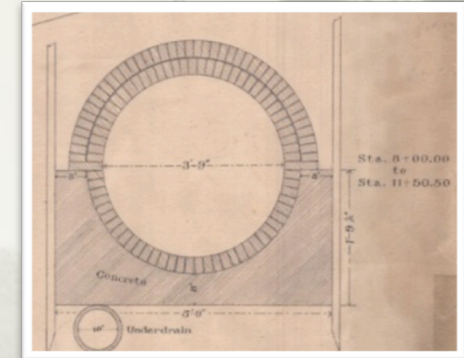
*Portland viewed from the land - Old Port District*



# Background Information

## City of Portland Sewer System

- Original sewers primarily combined
- Sewer system dates back to 1870's
- Sewer system managed jointly by City of Portland and Portland Water District
- Collection area of 4,200 acres
- Originally 43 CSO's to fresh & tidal waters
- East End Treatment Plant online in 1979



*Portland West Side  
Interceptor, 1940*



# A Daunting Problem

- CSO Consent Agreement with Maine DEP (1991)
  - Phase I & II cost - \$99 Million
  - Phase III starting in 2014 - \$170 million of projects (15 years)
- A.O. with Sanitary Sewer CMOM and Asset Management
  - September 2012 EPA Issued “Findings of Violation and Order of Compliance and Request for Information”
  - 2015 Compliance Schedule Approved
- MEPDES MS4 Permit
- CWA - Impaired Waters



*Portland Dartmouth Street  
Combined Sewer, 1918*



# Why Integrate Stormwater Quality Improvements?

***“Ethical behavior is doing the right thing when no one else is watching - even when doing the wrong thing is legal.”***

- Aldo Leopold



***CSO 36, West Side Interceptor Discharge to Fore River Estuary via lower Capisic Brook  
“Gorilla Cage”***



***Inside the “Gorilla Cage”***



# Why Integrate Stormwater Quality Improvements?

Portland has 4 listed “Urban Impaired Streams”:

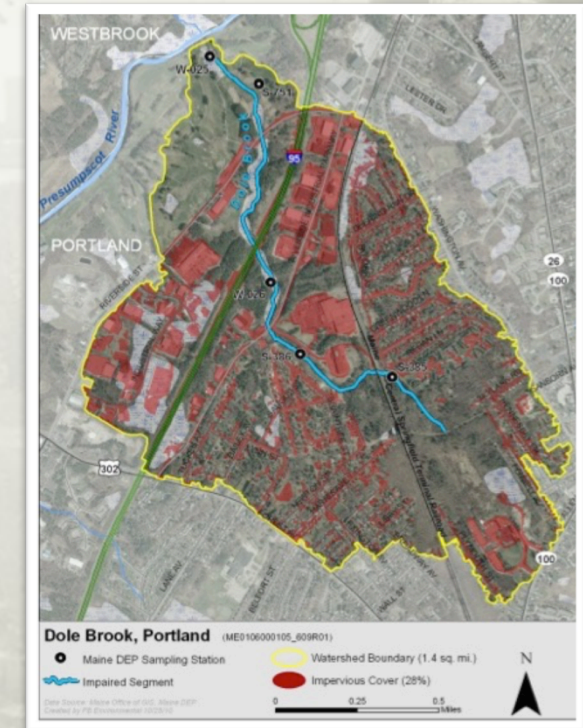
- Fall Brook
- Capisic Brook
- Nasons Brook
- Long Creek

+1 that meets the Criteria:

- Dole Brook



*Urban Impaired Streams  
in Portland - MaineDEP*



*Dole Brook Watershed  
FB Environmental 2010*



# Tier I & II Projects

- **Hydrodynamic Separators:**  
Control of sediment, floatable trash, and petroleum products

*Vortechs by Contech*



*Wellwood St, Torrey St, Read St  
Mellen St, Auburn St, Clifton St...*



*Downstream Defender  
by Hydro International*







# Tier I & II Projects

- **Proprietary Box Filter Systems:** Filtration of Sediment, Reduction of Petroleum, Metals, Trash, Nutrients, Bacteria

*Filterra Box Filter System*



**Mackworth & Austin Streets Clifton Street Sewer Separation 2009-2010**

*Filterra Box Filter System*



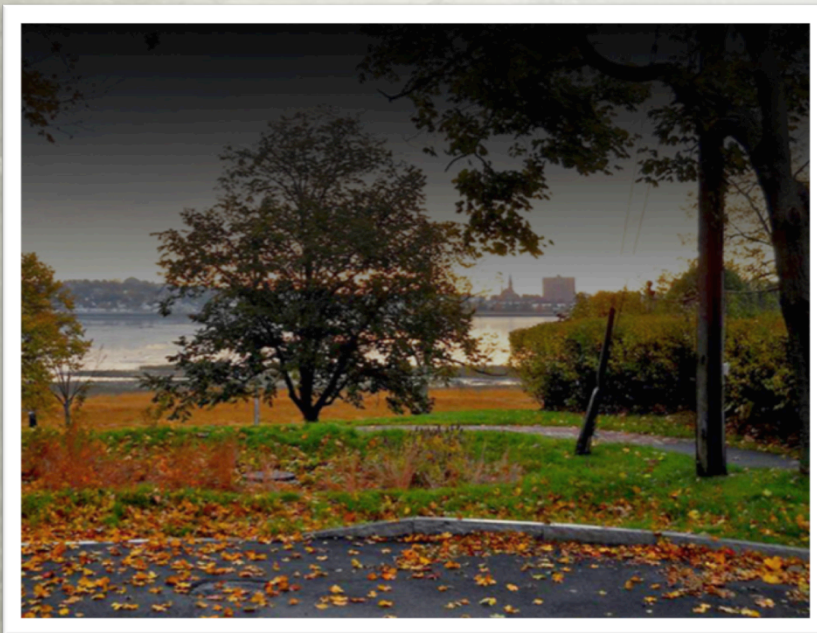
**Holm Ave Sewer Separation 2009-2010**



# Tier I & II Projects

- **Underdrain Soil Filters:** Filtration of Sediment, Reduction of Petroleum, Metals, Trash, Nutrients, Bacteria

*Vegetated Underdrained Soil Filter*



*Clifton Street Sewer Separation 2009-2010*

*Grassed Underdrained Soil Filter*

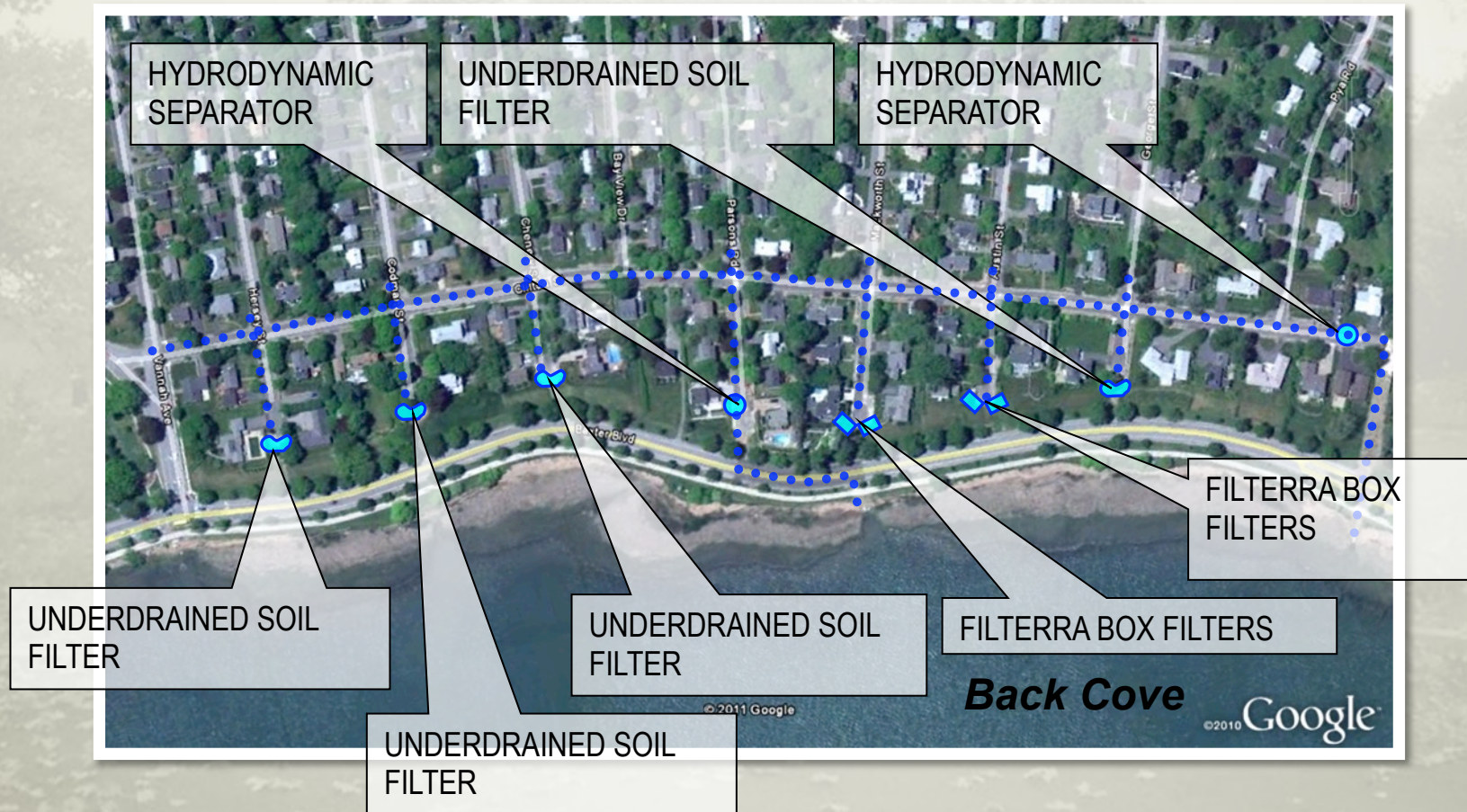


*Read Street Sewer Separation 2008-2009*



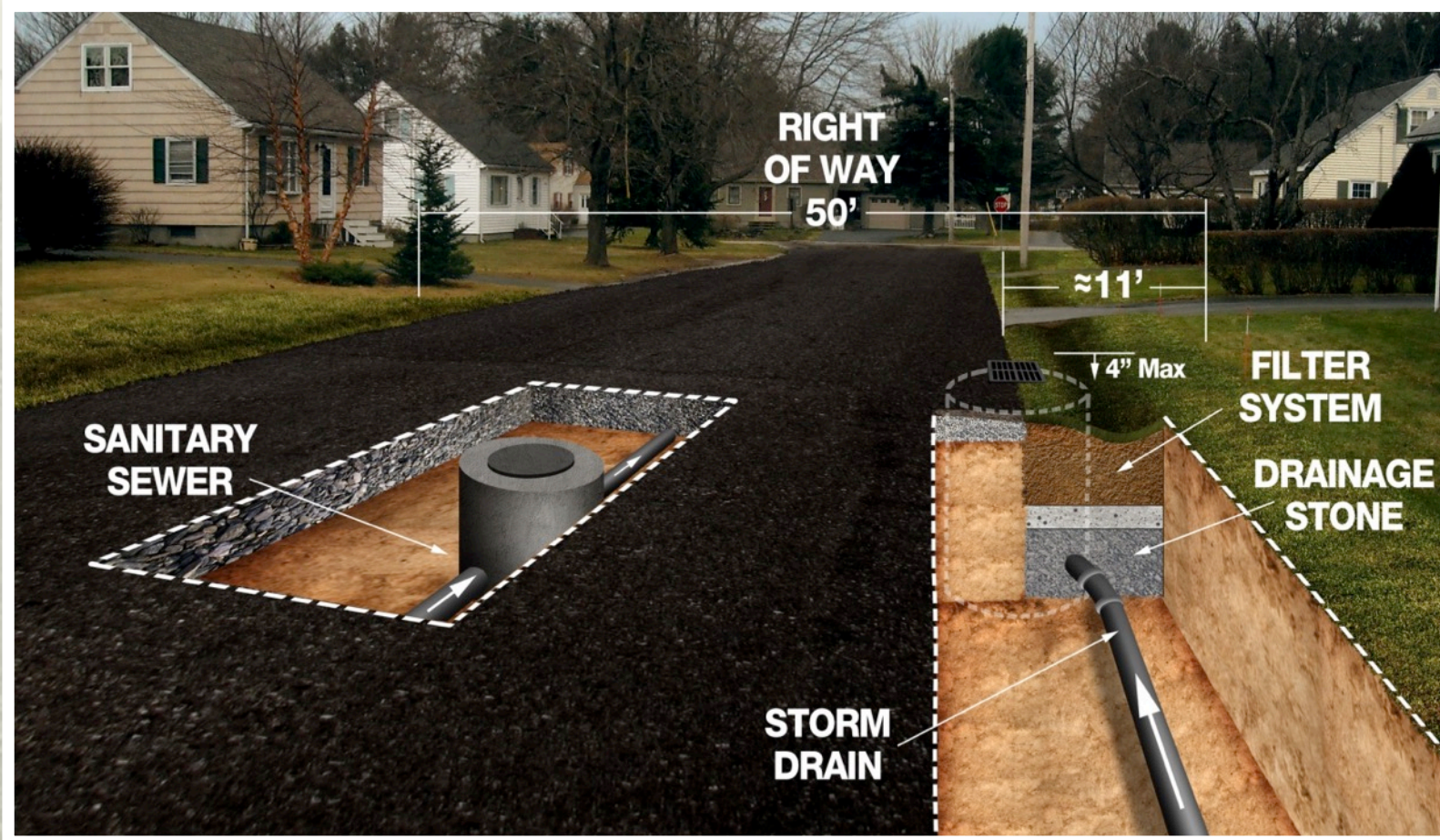
# Tier I & II Projects

## Clifton Street Sewer Separation



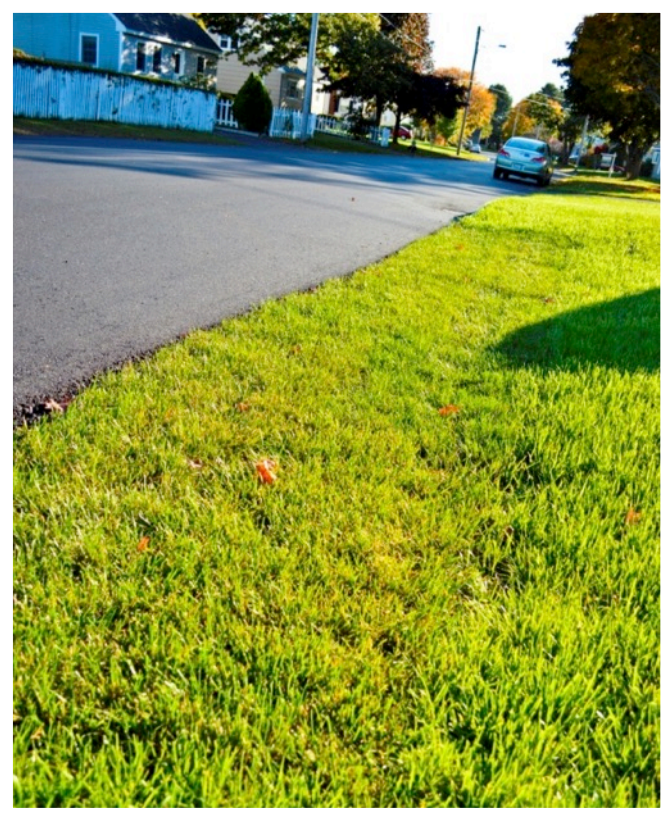


# Residential Street Retrofit Dorothy & Dibiase Sewer Separation Portland, ME





# Residential Street Retrofit Dorothy & Dibiase Sewer Separation Portland, ME



*Photos: Fall 2012*



# Residential Street Retrofit Winding Way Portland, ME



*Photos: May 2012*



*Photos: December 2012*





# Design Standards

## Covering:

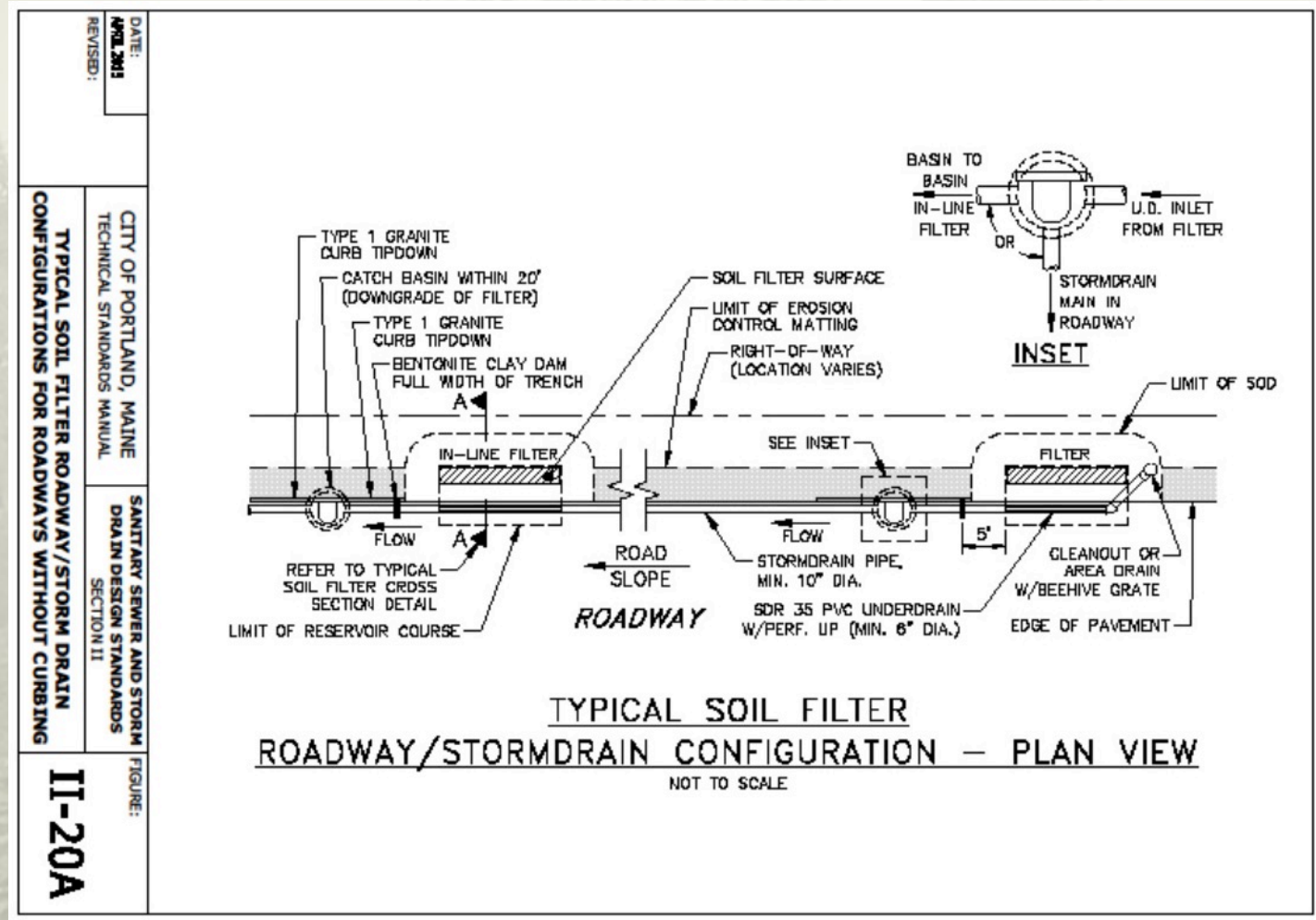
- Stormwater Management
- Transportation Systems & Streets
- Sanitary Sewer & Storm Drains
- Landscaping
- Erosion & Sediment Control
- And more...

## City of Portland Technical Manual





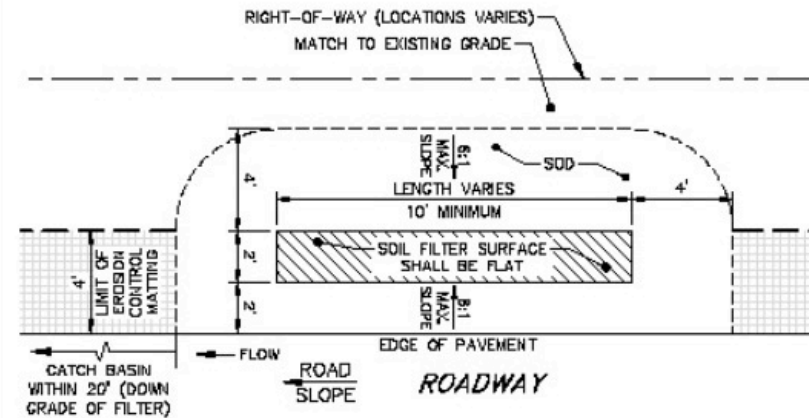
# Design Standards







# Design Standards



## TYPICAL SOIL FILTER LAYOUT PLAN

NOT TO SCALE

(NOTE: SUBSURFACE COMPONENTS & STORM DRAIN CONNECTIONS NOT SHOWN)

DATE:

APRIL 2015

REVISED:

CITY OF PORTLAND, MAINE  
TECHNICAL STANDARDS MANUAL

SANITARY SEWER AND STORM  
DRAIN DESIGN STANDARDS  
SECTION II

FIGURE:

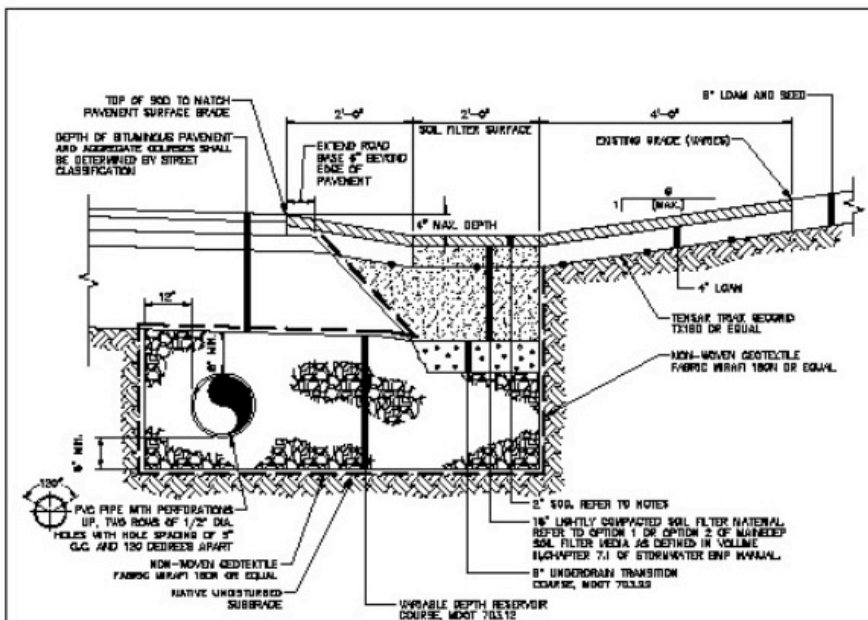
TYPICAL SOIL FILTER LAYOUT PLAN  
FOR ROADWAYS WITHOUT CURBING

II-20B





# Design Standards



**SECTION A-A**  
**TYPICAL SOIL FILTER CROSS SECTION**  
 NOT TO SCALE

### SOD NOTES:

SOD SHALL BE A FINE FESCUE GROWN IN A SAND BASE.

THE CONTRACTOR SHALL WATER THE SOD FREQUENTLY AND SHALL ENSURE CONTINUED GROWTH OF THE SOD. SOD SHALL RECEIVE WATER DAILY, EITHER BY MEANS OF APPLIED WATERING OR PRECIPITATION (RAINFALL OF 0.25"/DAY OR GREATER) FOR A MINIMUM OF THREE WEEKS FROM INSTALLATION. SOD NOT SURVIVING FOR 3 MONTHS AFTER INSTALLATION SHALL BE REMOVED AND REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.

SOD SHALL NOT BE PLACED PRIOR TO MAY 1ST OR AFTER OCTOBER 1ST OF ANY YEAR.

### LOAM NOTES:

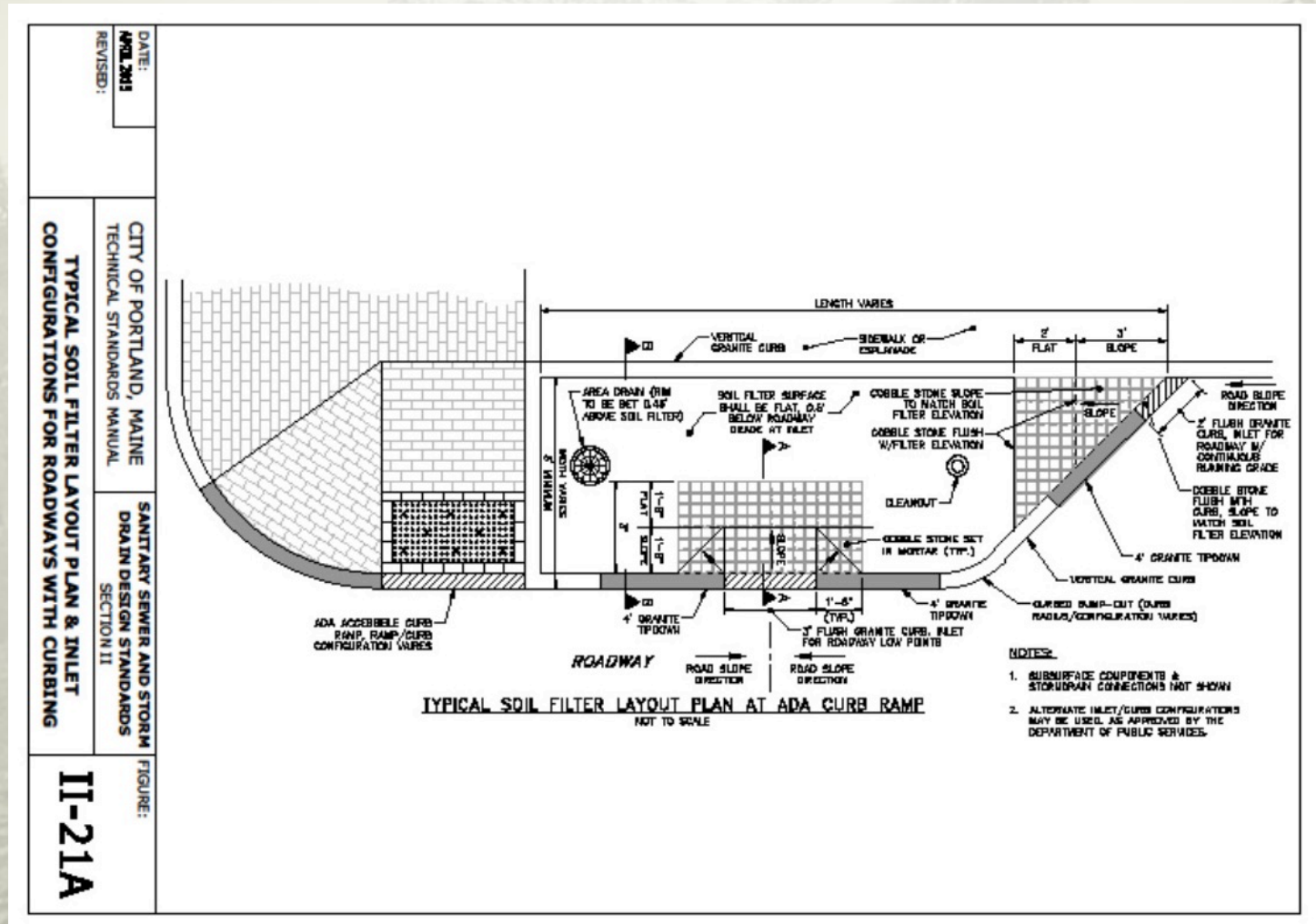
THE CONTRACTOR SHALL SUBMIT LOAM TESTING RESULTS IN CONFORMANCE WITH SECTION 615, MAINEDOT STANDARD SPECIFICATIONS. LOAM DEPTHS SHALL BE 4" IN AREAS OF SOD (WITH THE EXCEPTION OF THE SOIL FILTER SURFACE) AND 8" IN AREAS OF LOAM & SEED.

DATE: APRIL 2011	CITY OF PORTLAND, MAINE TECHNICAL STANDARDS MANUAL	SANITARY SEWER AND STORM DRAIN DESIGN STANDARDS SECTION II	FIGURE:
REVISED:	TYPICAL SUBSURFACE SOIL FILTER COMPONENTS FOR ROADWAYS WITHOUT CURBING		II-20C



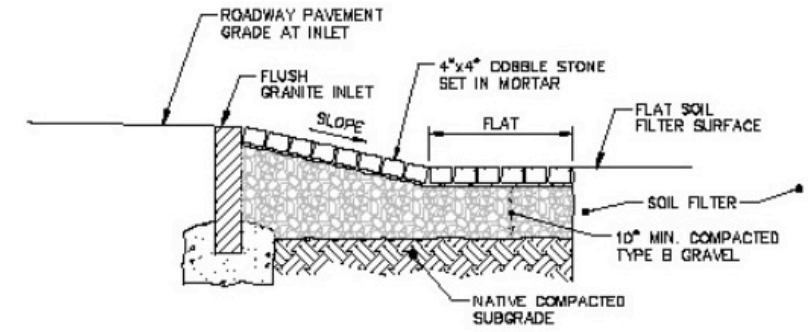


# Design Standards





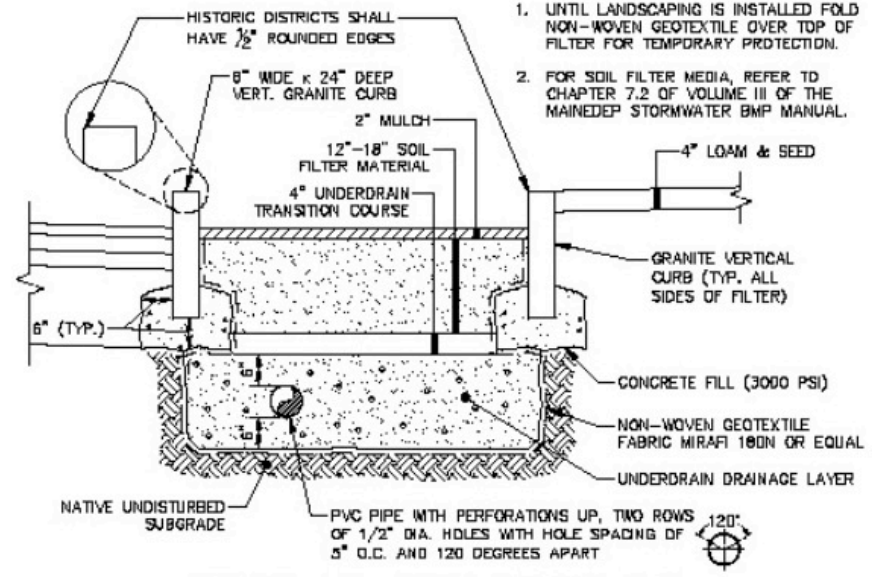
# Design Standards



**TYPICAL SOIL FILTER SECTION A-A**  
 NOT TO SCALE

**NOTES:**

1. UNTIL LANDSCAPING IS INSTALLED FOLD NON-WOVEN GEOTEXTILE OVER TOP OF FILTER FOR TEMPORARY PROTECTION.
2. FOR SOIL FILTER MEDIA, REFER TO CHAPTER 7.2 OF VOLUME III OF THE MAINE DEP STORMWATER BMP MANUAL.



**TYPICAL SOIL FILTER SECTION B-B**  
 NOT TO SCALE

DATE: APRIL 2013	CITY OF PORTLAND, MAINE TECHNICAL STANDARDS MANUAL	SANITARY SEWER AND STORM DRAIN DESIGN STANDARDS SECTION II	FIGURE:
REVISED:	TYPICAL SUBSURFACE SOIL FILTER COMPONENTS		II-21F





# Lessons Learned & Challenges to Maintenance

## Snow Happens



*Clifton Street Sewer Separation Project  
Hersey Street, February 2011*

## Plowing Happens



*Hersey Street, 2011*



*Darling Ave, 2011*



# Summer





# Winter





# Lessons Learned & Challenges to Maintenance

## Sediment Happens



***Clifton Street Sewer Separation Project  
George Street - March 2011***



***Clifton Street Sewer Separation Project  
Hersey Street - March 2011***





# Lessons Learned & Challenges to Maintenance

- **Hydrodynamic Separator Installation: Deep & Heavy**



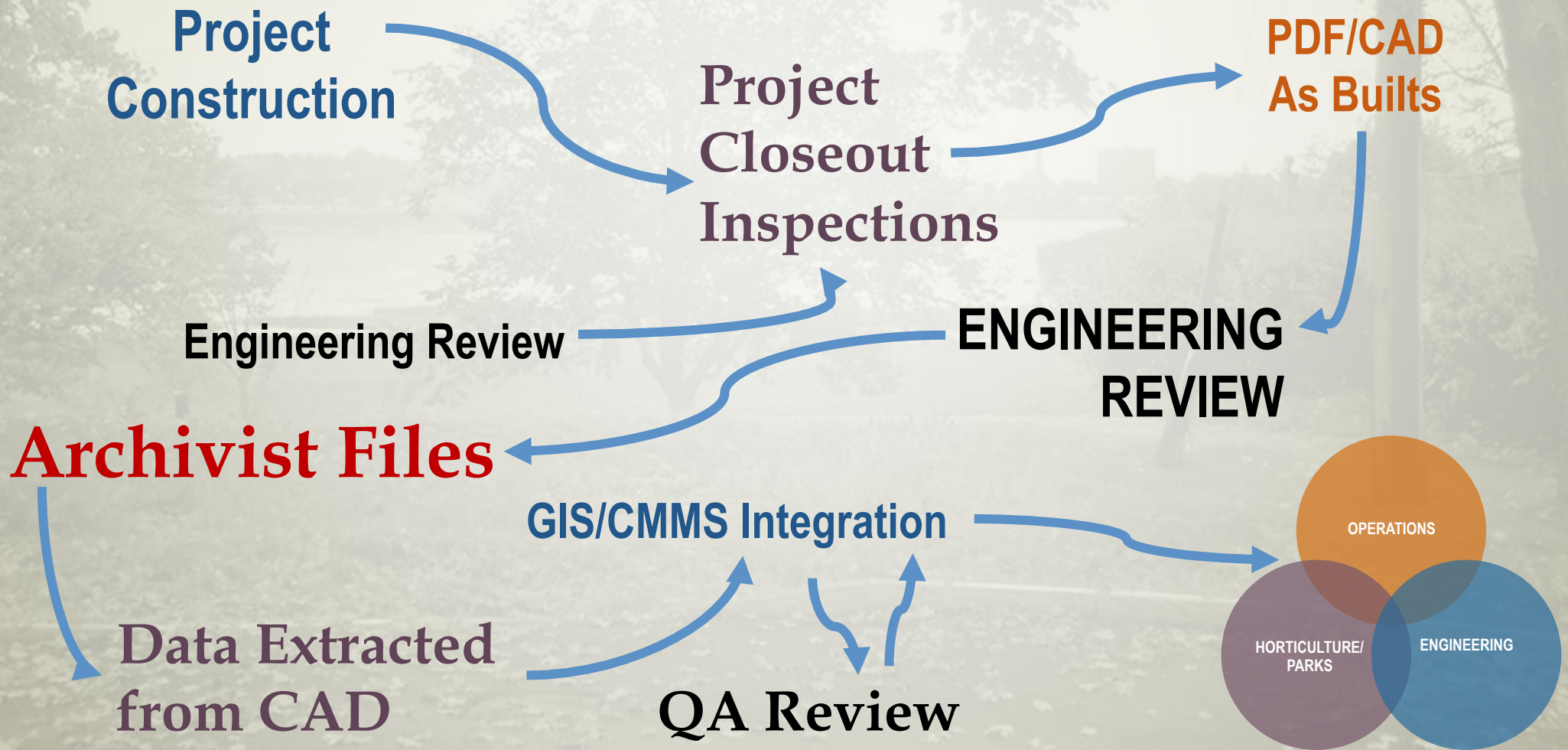
*Mellen Street - Fall 2008*



*Out of Sight, Out of Mind...*

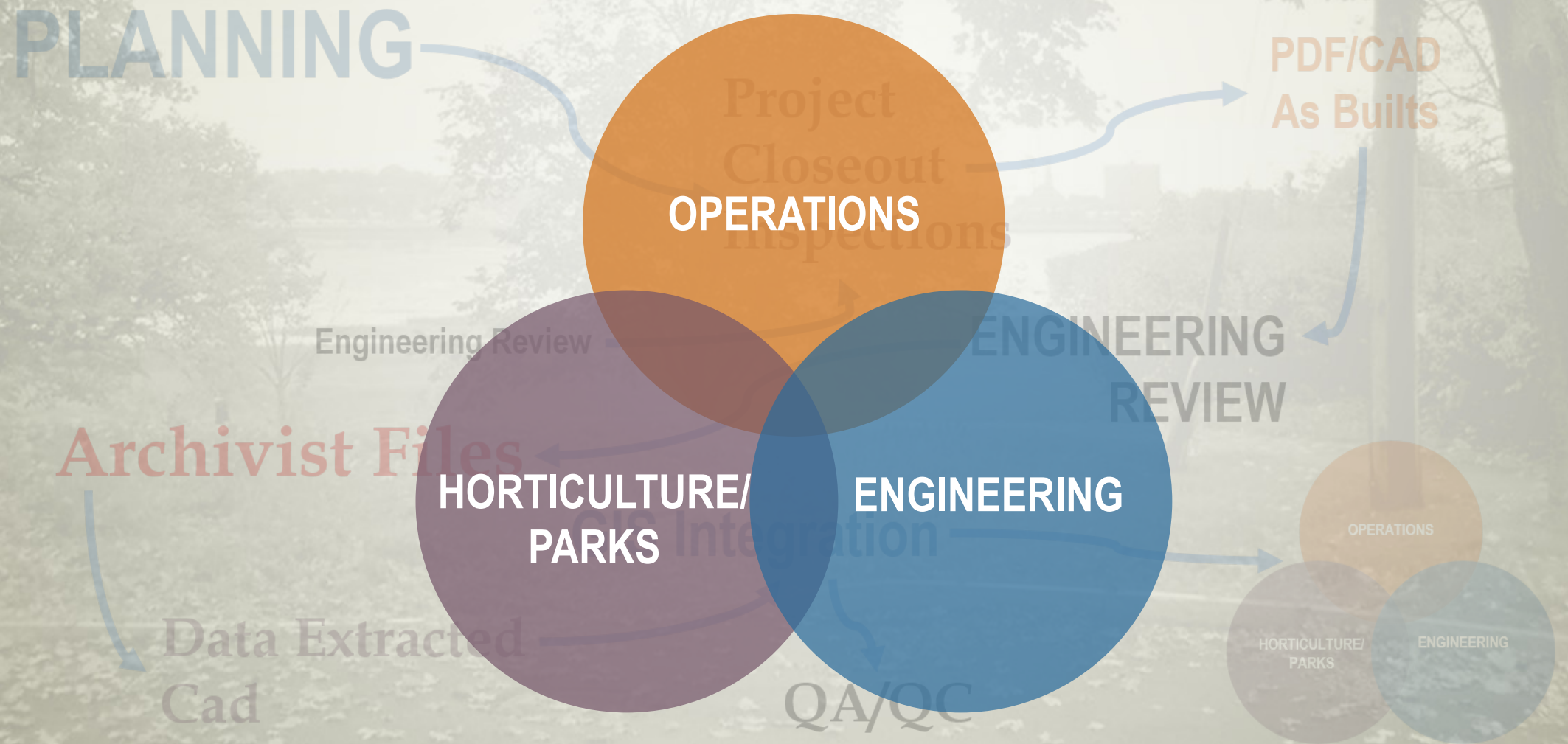


# Lessons Learned & Challenges to Maintenance: Where Are They?





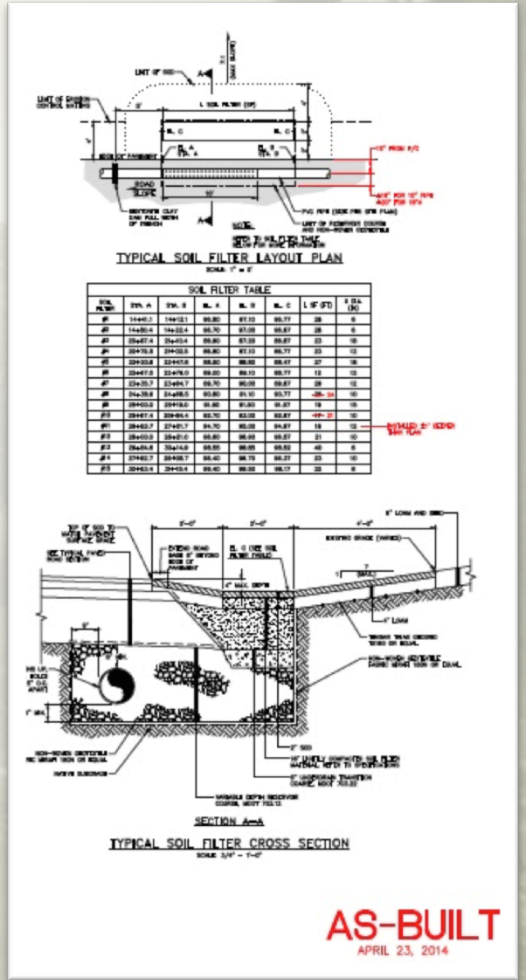
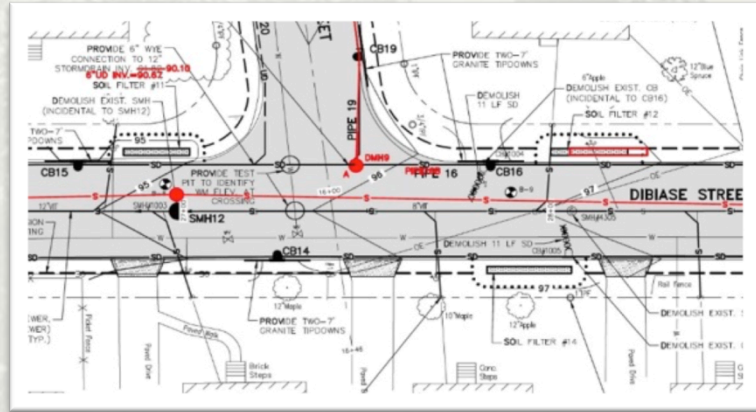
# Lessons Learned & Challenges to Maintenance: Where Are They?





# Lessons Learned & Challenges to Maintenance: Where Are They?

- 37 site plans/record drawings obtained
  - Plans reviewed and systems identified
  - Georectified and brought into GIS
- 117 individual treatment units determined to be owned by the municipality





# Lessons Learned & Challenges to Maintenance: Level of Effort?

- System Types

- 80 Filtration Systems (Gravel Wetland, Bioretention)
- 2 Wet Pond
- 6 Infiltration Systems (inc. Pervious Pavements)
- 1 Buffer
- 27 Sediment Separators
- 1 Green Roof

- Strategic inspection of a sample of the above to:

1. Assess condition (meet MS4 Permit requirements)
2. Evaluate level of service needed (Inspection Labor Hours, Maintenance Labor Hours, Key Activities, Maintenance Frequency, Tools/Skills Required)



Stormwater Treatment System Subtype*	Estimated Labor-Hours for Inspections	Estimated Crew-Hours for Maintenance	Activities	Recommended Maintenance Frequency	Tools/ Equipment Required
Filter	30-45 Minutes	2-8 Hours	<p>Check for Erosion</p> <p>Remove Sediment/Debris</p> <p>Check Filter Media Quality and Replace Surface Mulch</p> <p>Perform Landscaping (Weed, Trim, etc.)</p> <p>Check for Clogging/Blockages</p>	Spring & Fall	Tymco 210, fuel, rakes, shovels, hook, trash bags, mulch, dry disposal container
Wet Pond	15-30 Minutes	3-4 Hours	<p>Check Embankment Conditions for Damage from Erosion and/or Rodents</p> <p>Remove Sediment/Debris</p> <p>Check for Clogging/Blockages</p> <p>Check Vegetation/Mow Embankments/</p>	May, July/August, & October	Pickup and trailer, fuel, mower, line trimmer, blowers, rakes, shovels, hook, trash bags, dry disposal container
Infiltration	20-30 Minutes	1 Hour	<p>Check for Joint Separation/Blockages in Porous Pavements</p> <p>Vacuum Sweep</p> <p>Conduct Infiltrometer Test if Failure is Observed</p>	2x/Year	Tymco 210, fuel, rakes, shovels, hook, trash bags, mulch, dry disposal container
Buffer	30 Minutes	2 Hours	Typical Landscaping	2x/Year	Pickup and trailer, fuel, mower, line trimmer, blowers, rakes, shovels, hook, trash bags, dry disposal container
Sediment Separator	15-30 Minutes	2-8 Hours	<p>Check Surface Conditions (signs of erosion/settling)</p> <p>Skim Floatables</p> <p>Remove Sediment</p>	Inspections will ultimately dictate schedule. Late Fall (after leaf-fall and before snowfall)	Pole mounted camera or video, jet-vacuum truck, fuel, wet disposal solution, absorbents, stadia rod



# Lessons Learned & Challenges to Maintenance: Level of Effort?

- Probable Annual Costs
  - Inspection Frequency
  - Maintenance Frequency
  - Labor Hours Per Unit by Type
  - Mobilization
  - Contingency
  - Contractor Hourly Rate
- Projected Annual Inspection Costs: \$16,000
- Projected Annual Maintenance Costs: \$220,000





# CLEAN WATER equals CLEAN GROWTH

## Summary

- Green Infrastructure and Conventional Stormwater Treatment Infrastructure is a **standard part of Portland's municipal infrastructure design**
- Stormwater Treatment Infrastructure **requires** Inspection and Maintenance (like any other infrastructure)
- Level of Effort and Costs are **Real and Increasing**
- **Standards, Standard Operating Procedures and Employee Training** are Crucial

*"It is not just a Department, it takes a City"*  
– Doug Roncarati,  
Portland's Stormwater Program Coordinator







# Questions?

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