



# CSO Reduction and Green Infrastructure

A Happy Marriage

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# Presentation Outline

## **Fore Street/Eastern Promenade Sewer Separation Project**

- ▶ Background
- ▶ Objectives
- ▶ Challenges
- ▶ Solutions
- ▶ Operations Considerations

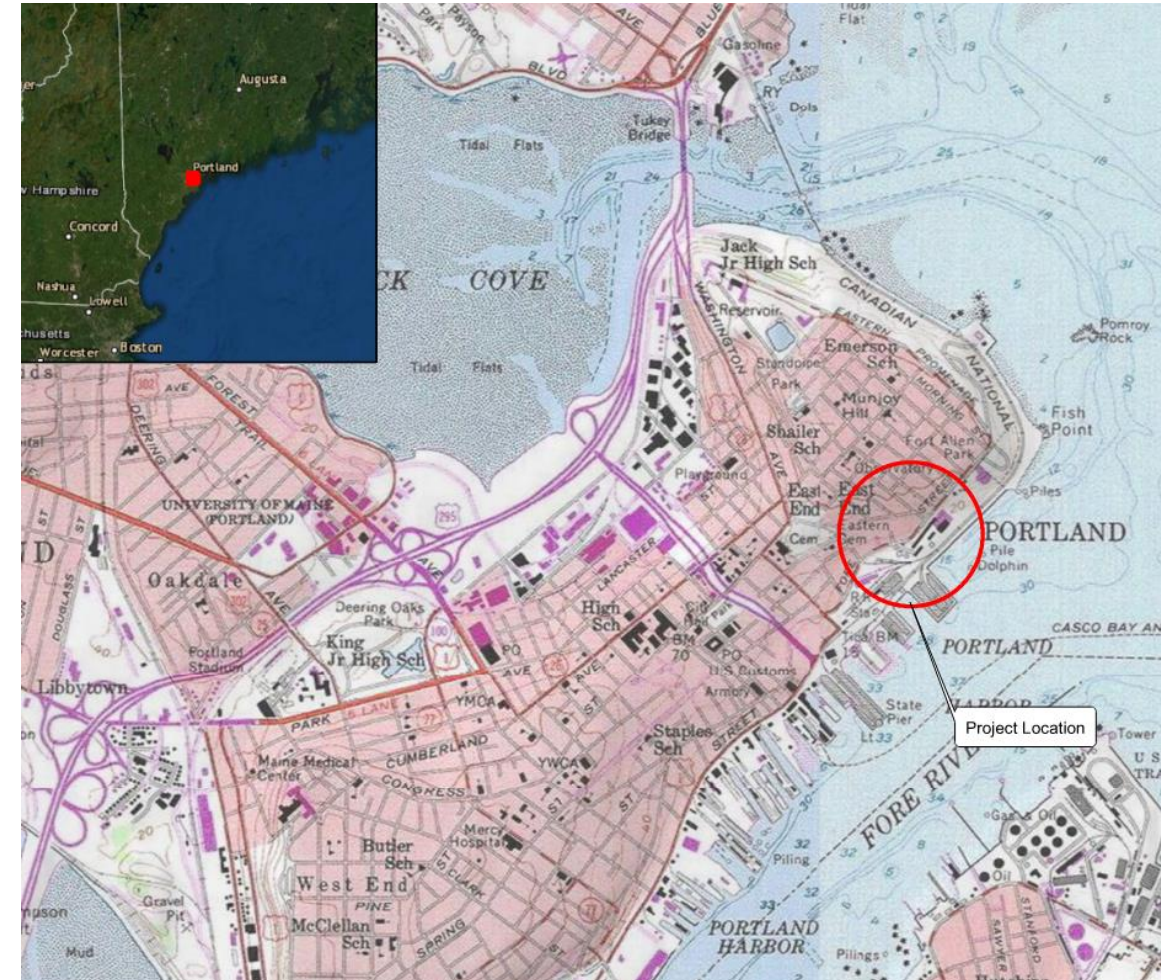




# Background

## City of Portland, ME

- ▶ 28 Active CSOs (down from 42)
  - Part of major ongoing effort to reduce CSO volume and event frequency
  - Project part of EPA CSO Consent Decree LTCP compliance (Currently in Tier III of LTCP)
- ▶ 125 City-managed GI BMPs
  - Bio Retention Cells
  - Soil Filters
  - Tree Box Filters
  - Pervious Pavement/Filter Systems
  - Wet Ponds
  - Gravel Wetlands



# Portland CSO Reduction Progress



**173 million dollars** invested to reduce/eliminate CSO's since 1993.



**Portland LTCP Goals:**  
Reduce Annual CSO Volume from **719 MG to 87 MG** through combination of CSO storage and Separation.  
Average Annual Discharge  
**2016-2020: 229 MG**



**Brighton Avenue  
Sewer Separation  
Manhole Installation**  
Summer of 2021



**Back Cove South 3.5 MG  
Storage Facility**  
Construction Summer of 2021





# PORTLAND CSO REDUCTION



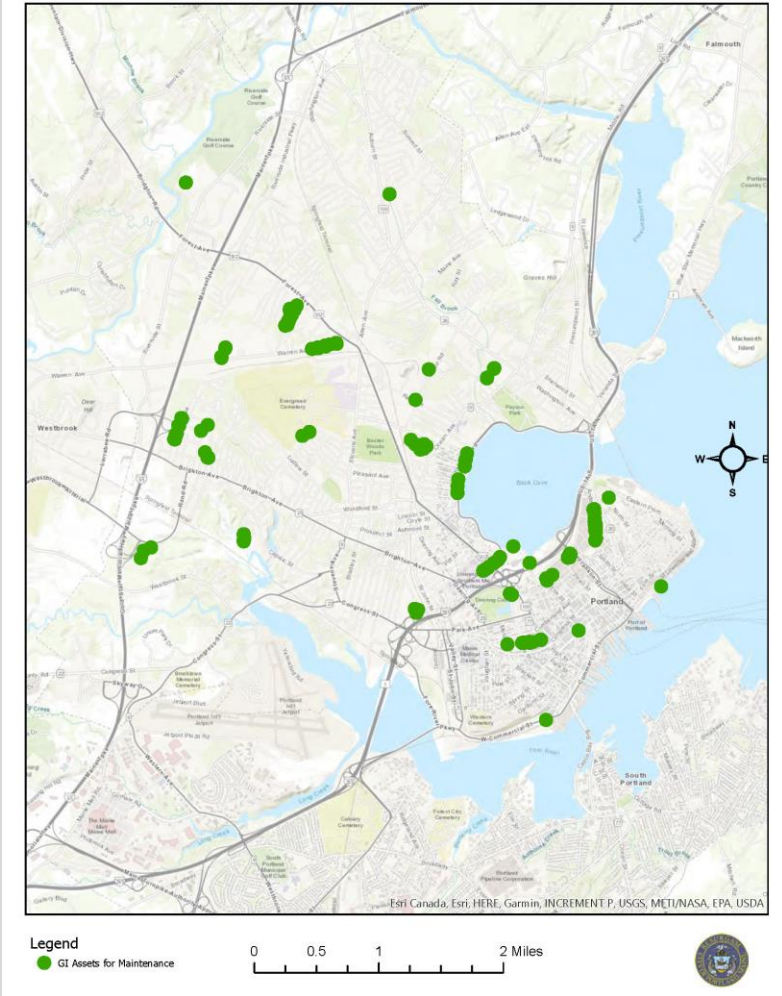


# Portland G.I. Implementation to Date

- ▶ 125 G.I. Treatment Units Installed and managed by City since 2008.
- ▶ Separated Stormwater Pollution Reduction.
- ▶ Maintenance is Critical.



## Portland 2020 GI Overview





# Portland Green Infrastructure Examples



Deering Corner Roundabout Bio Retention Cells



Baxter Blvd Bio Retention Cells





# Project Overview: Fore Street/Eastern Promenade Sewer Separation

- ▶ Sewer Separation for Southeast Side of Munjoy Hill (Portland East End).
- ▶ Project not originally identified in CSO LTCP
- ▶ Project required installation of new 60" storm drain outfall into Portland Harbor.
- ▶ Hired W&C to design project in 2019.
- ▶ Project successfully bid in 2021 and currently under construction.
- ▶ Contract Value: \$4,000,000.00





# Project Motivation

Water Quality in two parts:

- ▶ Reduce CSOs
- ▶ Provide stormwater treatment

Contaminants of interest:

- Bacteria
- Trash
- Nitrogen





# Receiving Water

## Casco Bay

- Marine environment
- Nitrogen is of great concern



Photograph by Deb Dawson

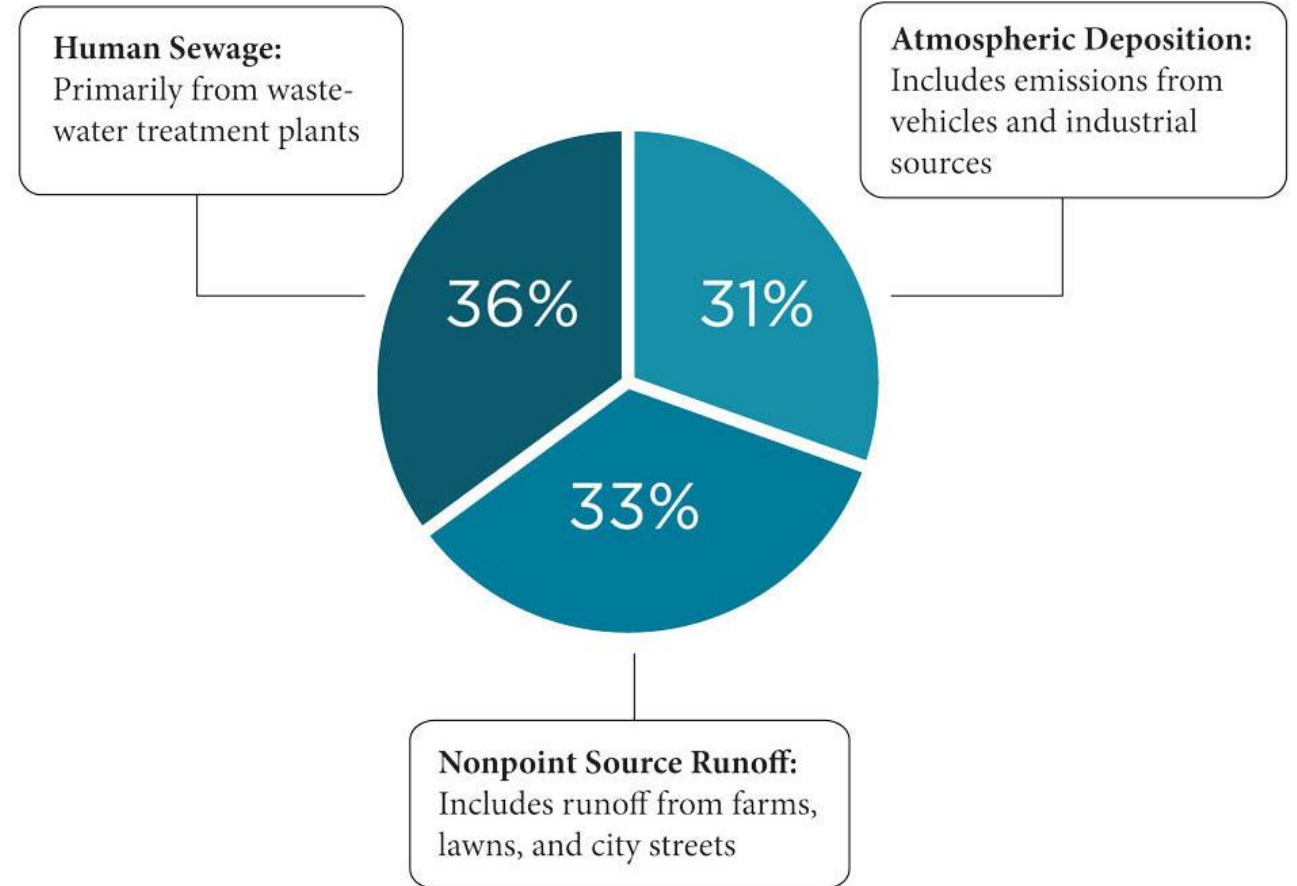




# Casco Bay Pollutant of Concern: Nitrogen

## Water Quality Problems Associated with Nitrogen:

- Nuisance algal blooms
- Harmful algal blooms which lead to shellfish closures
- Coastal acidification
- Reduced Water Clarity
- Degraded Water Quality



Source: Friends of Casco Bay, Casco Baykeeper  
Further Information: <https://www.cascobay.org/our-work/baykeeping/nitrogen/>





# CSO Reduction-Sewer Separation

Installation of 1,800 LF of separated storm drain

- ▶ This phase separates 21 acres, 31 catch basins
- ▶ Opportunity for separation of additional 28 acres
- ▶ Reduce CSO's at location #23 into Portland Harbor.
- ▶ Recent Modeling Indicates project will reduce Annual CSO Discharge Volume by 50% (2010-2020 Average Annual Discharge CSO # 23= 12 MG)





# Stormwater Treatment

- ▶ Not required by regulation
- ▶ 9 locations for GI Identified
  - Focusing on impervious area in ROW
  - Heavily used street parking area
  - Objective is to maximize treatment value





# Green Infrastructure - Challenges

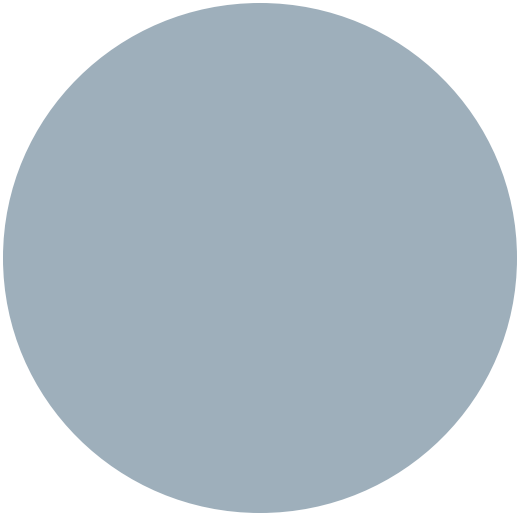
- ▶ Narrow ROW
- ▶ Steep slopes
- ▶ Historic neighborhood
- ▶ Esplanade grading



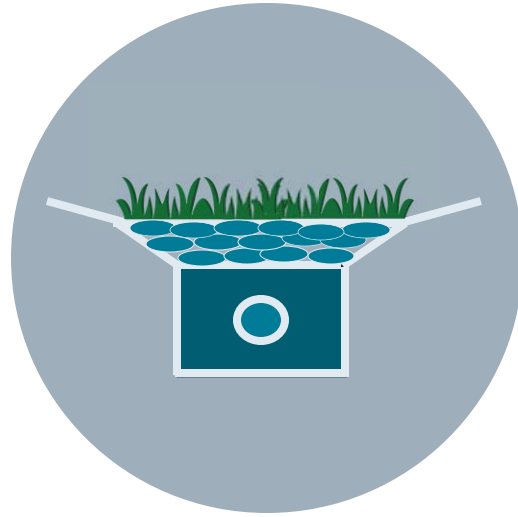




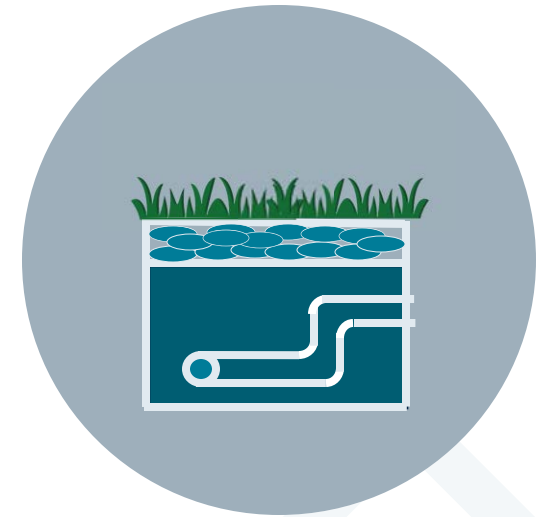
# Treatment Alternatives



**Prefabricated  
Tree/Box Filters**



**Traditional Underdrained  
Surface/Subsurface  
Soil Filters**



**Upflow Soil Filtration  
Media**

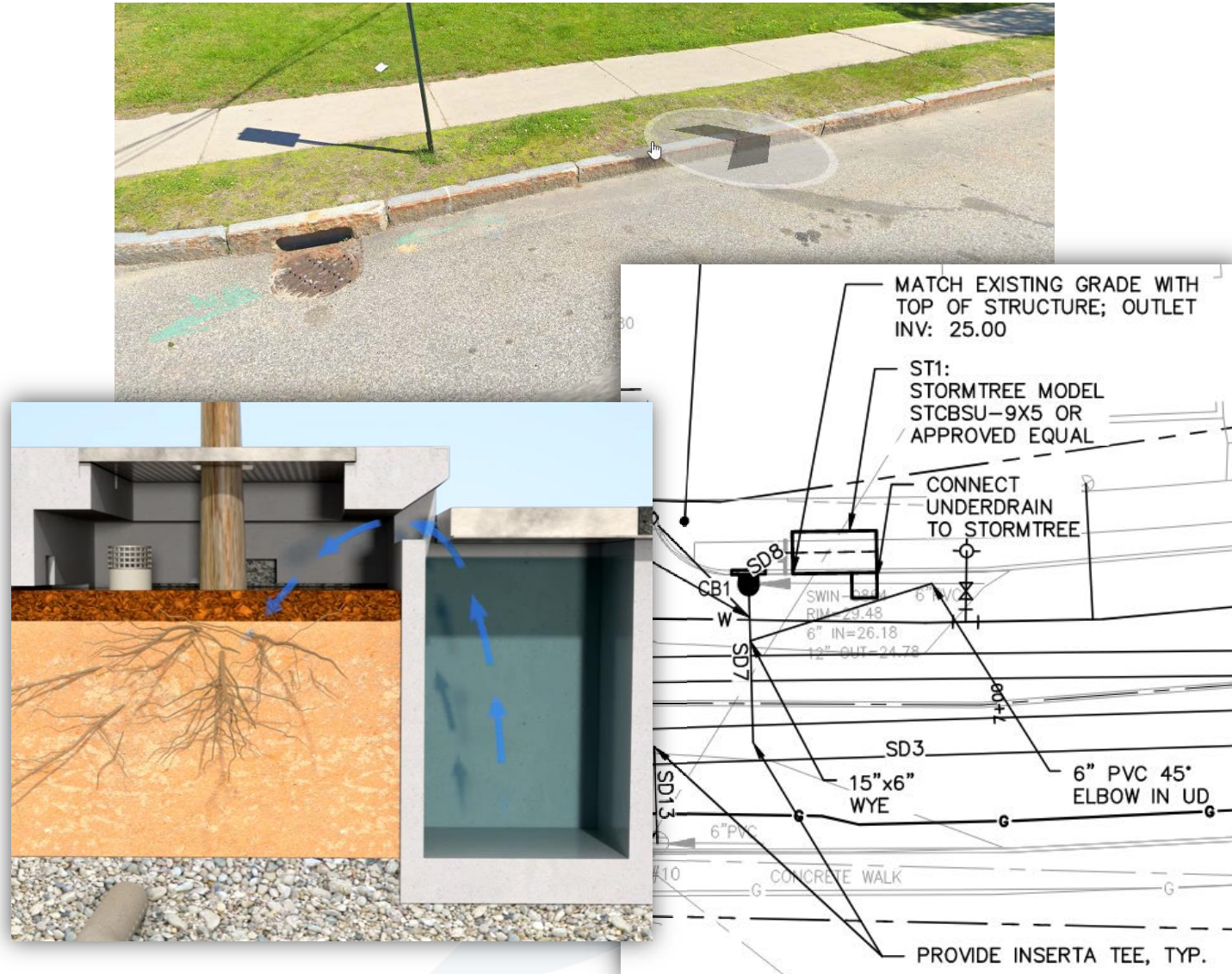




# Treebox Filters

## StormTree® units

- ▶ Located in esplanade
- ▶ Upstream sump/catch basin with overflow weir
- ▶ Open-bottom & sides
- ▶ High-flow filtration media
- ▶ Overflow piped connection to storm drain
- ▶ Treatment performance
  - 85% TSS removal
  - 85% Oil & grease removal
  - 48% TN removal
  - 48% TP removal
  - 60% Total metals removal

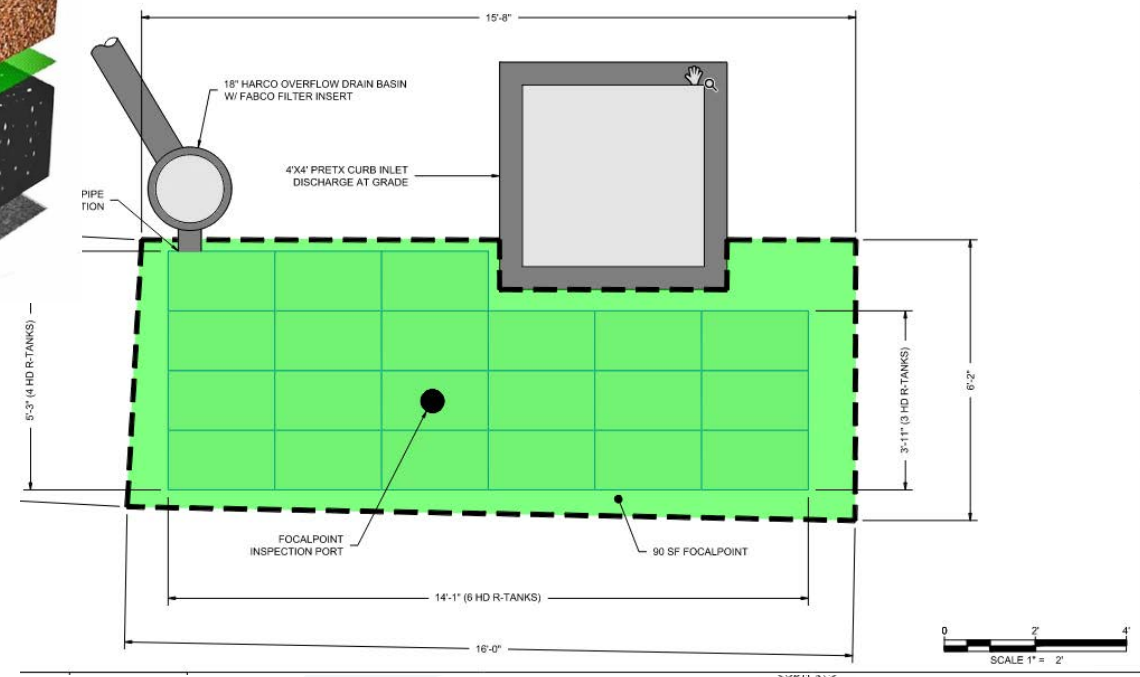
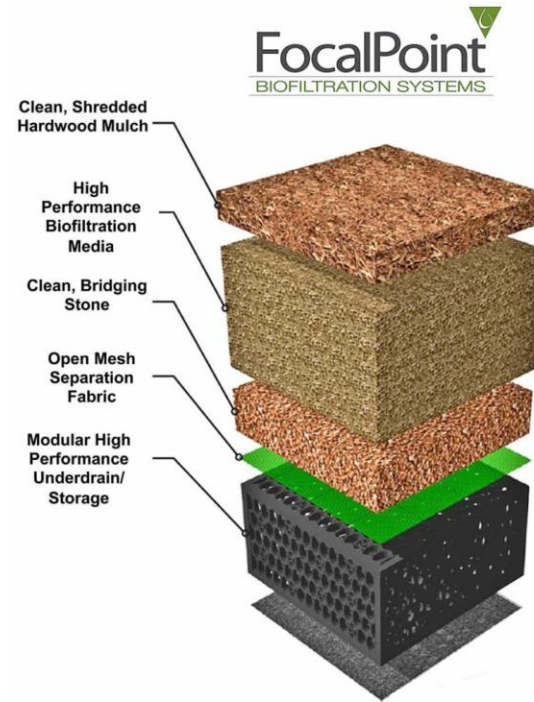




# Biofiltration System

## FocalPoint® unit

- ▶ Located in esplanade
- ▶ Upstream PreTx™ unit with overflow weir
- ▶ Vegetated
- ▶ High-flow filtration media
- ▶ Treatment performance
  - 80% TSS removal
  - 48% TN removal
  - 60% TP removal
  - 50% Indicator bacteria

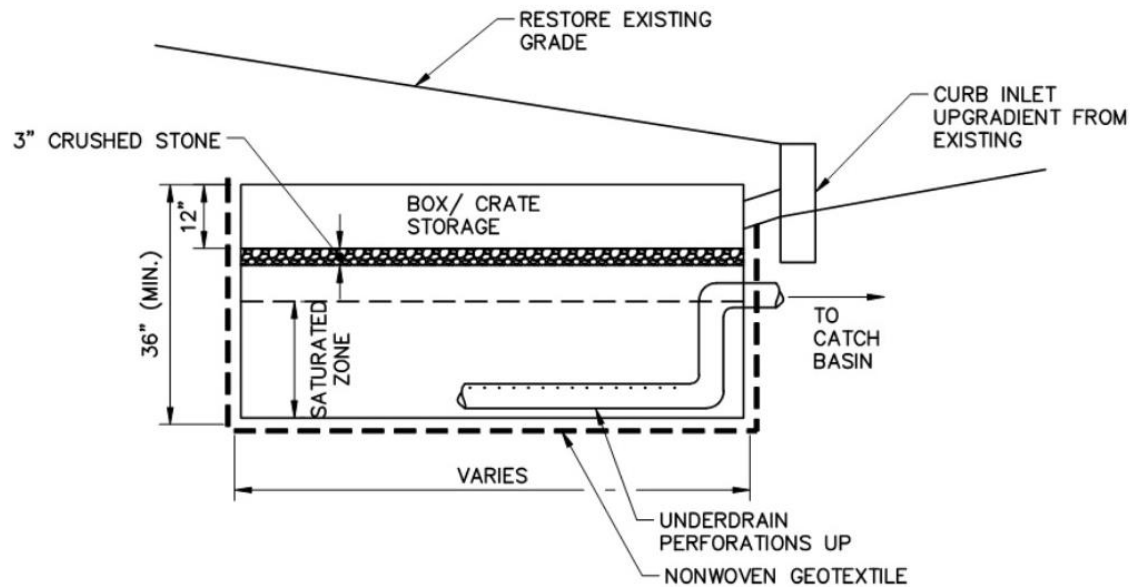




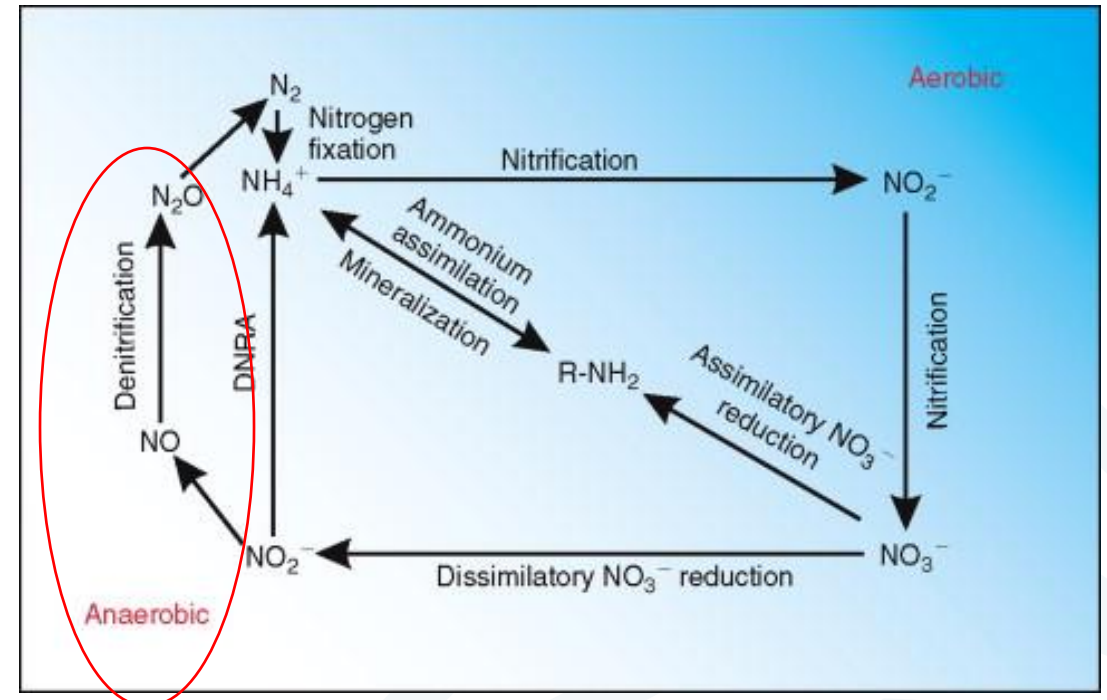
# Upflow Filtration – Brief Explanation

Increased Nitrogen Removal:

- ▶ Saturated zone promotes denitrification
- ▶ Particulate removal through filtration



SECTION 2  
N.T.S.





# Bold & Gold® Upflow Filtration

## Bold & Gold® unit

- ▶ Located in esplanade
- ▶ Upstream PreTx™ unit with overflow weir
- ▶ No vegetation (except existing grass)
- ▶ Cleanout ports only at surface
- ▶ High-flow filtration media

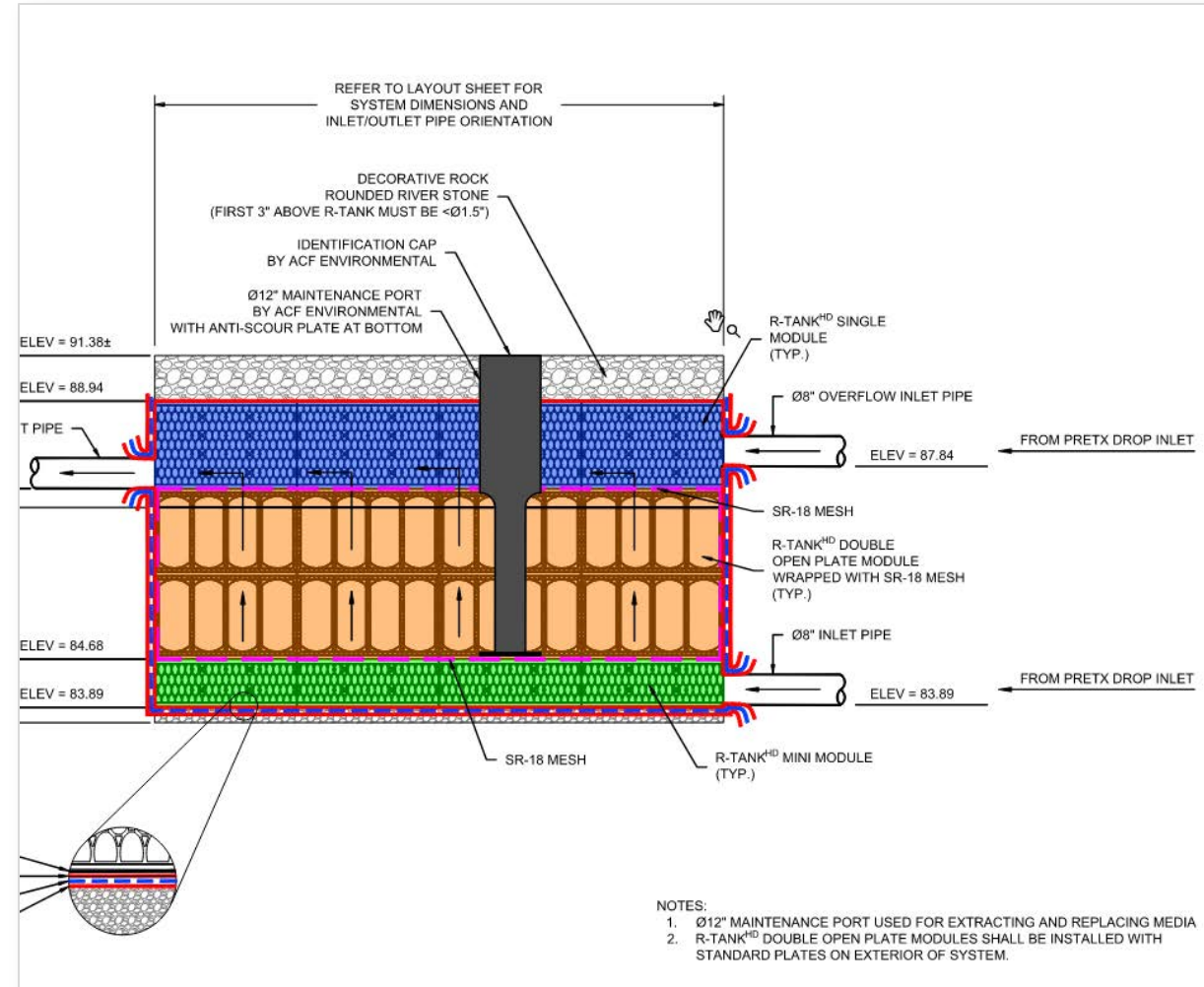




# Bold & Gold® Upflow Filtration

## Bold & Gold® unit

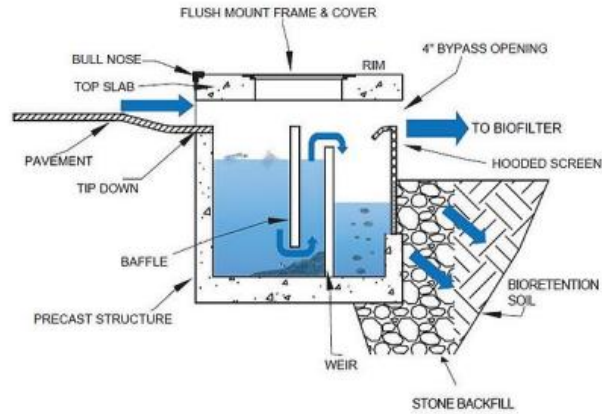
- ▶ Requires 3-6" of driving head for upflow
- ▶ Maintenance ports for media replacement/regeneration
- ▶ Treatment performance
  - 70-95% TSS removal
  - 55-75% TN removal
  - 65-95% TP removal



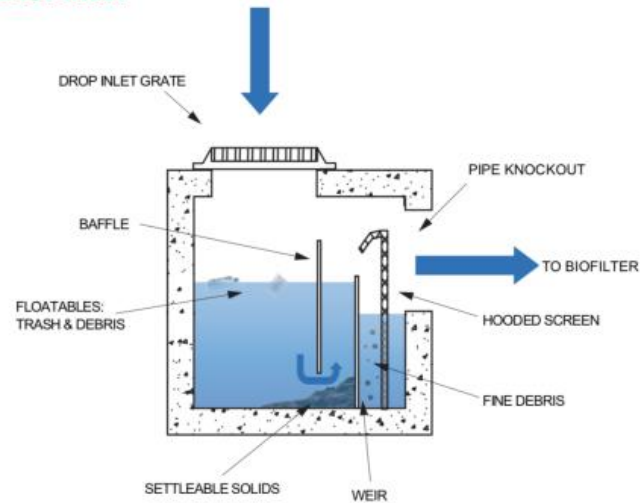


# Pretreatment

## PRETX - CURB INLET



## PRETX - DROP INLET



## PreTx® Unit (multiple configurations)

- Provides settling, screening, and floatable removal
- Protects BMP and downstream infrastructure
- Easily accessible cleanout





# Project Breakdown

Measure	Value
Total area treated	2.03 acres
Approximate Project Area (ROW)	3.88 acres
Percent Treated	52%
Estimated Annual Stormwater Volume Treated	2.2 MG
Approximate Treatment Cost/acre	\$180,000/acre
Total Area Separated	21 acres
Estimated Annual CSO Reduction	50% (12 MG)
Approximate Separation Cost/acre	\$125,000/acre



**One Project – Many Benefits!**





# Looking Ahead – Maintenance & Monitoring

## Maintenance

- ▶ Wealth of City experience
- ▶ Upstream catch basin/sumps
- ▶ Access/maintenance ports

## Monitoring

- ▶ Pilot post-construction program in development
- ▶ Seasonal sampling
  - Nutrients
  - Metals
  - TSS





# Thank you for joining!

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