

Year One in Review: Building an Inspection and Maintenance Program in Coastal Virginia

June 14, 2018



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City of Virginia Beach SWMF
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Introduction

Introduction

MS4 Permit

Stormwater Infrastructure Management

The permittee shall continue implementing programs to maintain the permittee's stormwater infrastructure and to update the accuracy and inventory of the storm sewer system

For stormwater management (SWM) facilities and infrastructure maintained by the permittee including residential properties where SWM facilities and Storm Drainage Systems qualify for permittee maintenance (excluding apartments and mobile home parks), the following apply:

- a) The permittee shall provide for adequate long-term operation and maintenance of SWM facilities owned or operated by the permittee in accordance with written inspection and maintenance procedures included in the MS4 Program Plan.
- b) The permittee shall, at a minimum, inspect annually all SWM facilities owned or operated by the permittee.
- c) The permittee shall conduct maintenance on SWM facilities owned or operated by the permittee as necessary.

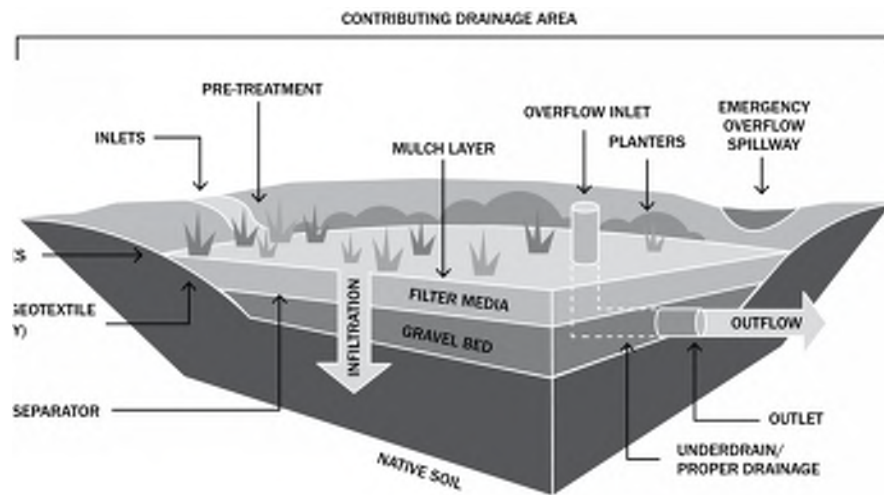


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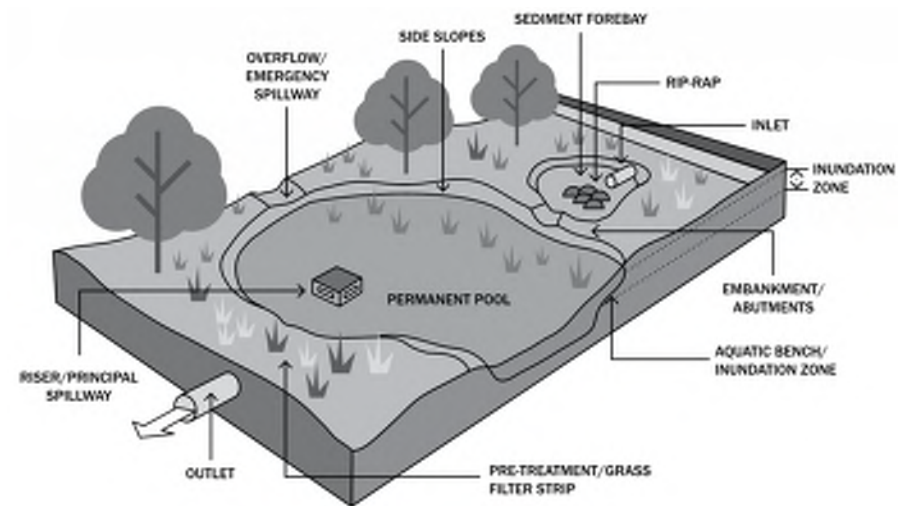


SWMF Facility Overview

Non-Proprietary Stormwater Management Facilities



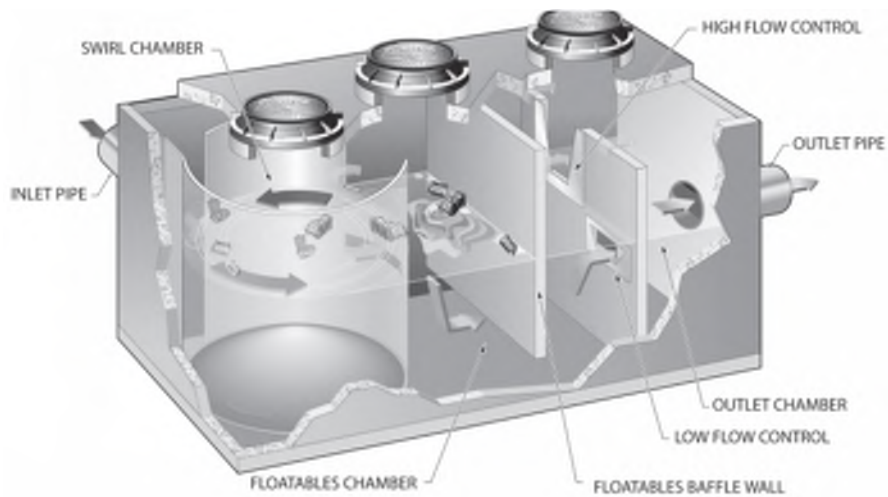
Bioretention



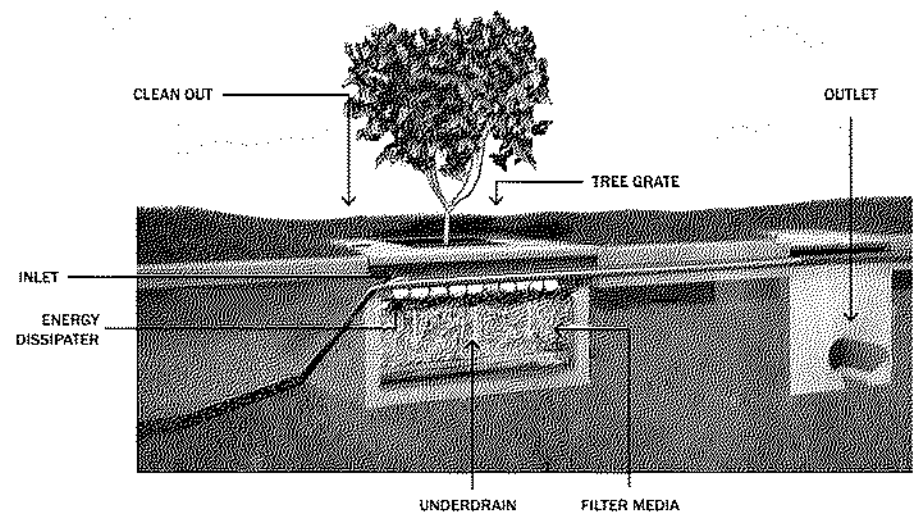
Wet Pond

SWMF Facility Overview

Proprietary Stormwater Management Facilities



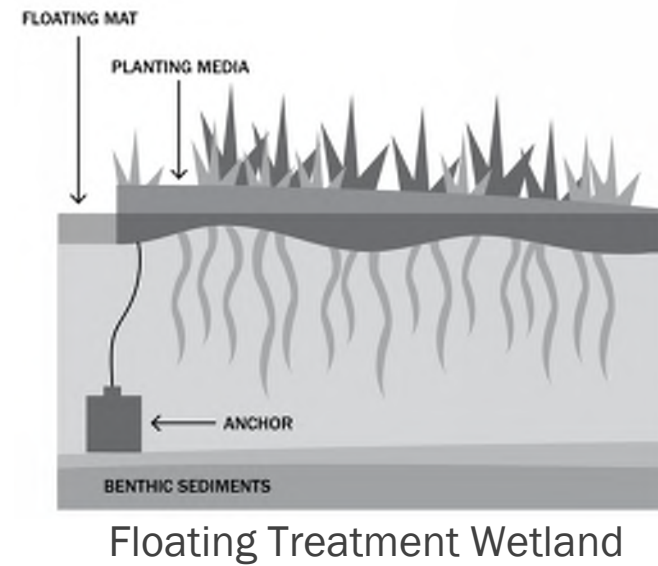
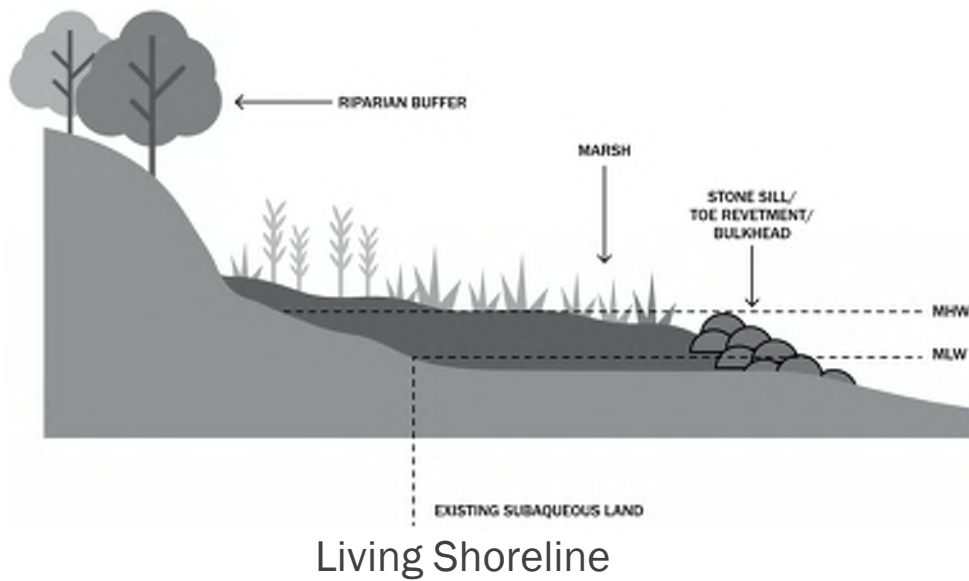
Vortechs System



Filtera Bioretention System

SWMF Facility Overview

Expert Panel Stormwater Management Facilities





City of Virginia Beach SWMF Inspection and Maintenance Program

SWMF Inspection and Maintenance Overview

SWMF Inspection and Maintenance Manual

The SWMF inspection and maintenance manual includes procedures leading up to, during and after an inspection:

I. Inspection Procedures

- Field Preparation
- SWMF Inspection
- Documentation and Recordkeeping

II. SWMF Inspection Forms

- Non-Proprietary
- Proprietary
- Expert Panel

III. SWMF Maintenance

- Non-Proprietary
- Proprietary
- Expert Panel

Prepared for City of Virginia Beach, Virginia
Public Works Engineering
Surface Water Regulatory Compliance Division

JUNE 2017

Stormwater Management Facility Inspection and Maintenance Manual



Stream Restoration

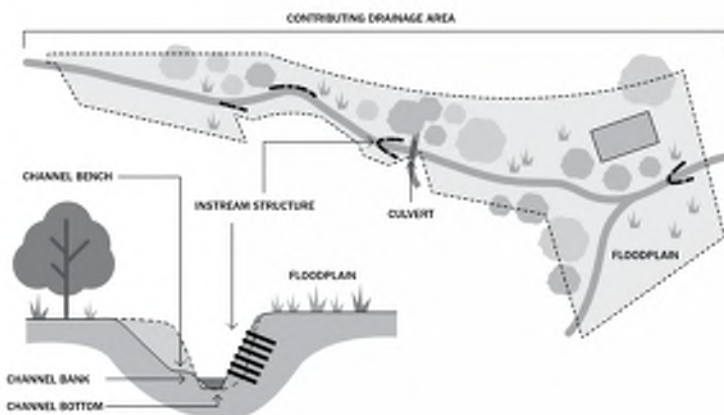
INSPECTOR _____

DATE _____ TIME _____

SWMF ID# _____

SWMF NAME _____

WEATHER _____

LAST RAINFALL: > 48 HRS < 48 HRS _____ IN.INSPECTION TYPE: SCHEDULED FOLLOW-UPOWNERSHIP TYPE: PUBLIC PRIVATE

GENERAL COMMENTS

SWMF Inspection and Maintenance Overview

SWMF Inspections

The objective of any SWMF Inspection program is to ensure that each facility is adequately operated and maintained throughout the life of each facility.

The three primary goals of the Inspector for every inspection are as follows:

- Evaluate the condition of the SWMFs
- Determine if routine maintenance is recommended
- Determine if the SWMF needs repairs

To determine each, the inspector will decide the overall condition of the facility. Facilities that don't require repairs or need routine maintenance will be considered to be adequately operating.

SWMF Inspection and Maintenance Overview

Standard Operating Procedures

The Inspector will inspect each component of a SWMF for the following operational issues (as applicable):

- Trash/Debris
- Erosion
- Sedimentation
- Vegetation
- Pest Control
- Structural Integrity
- Pollutants

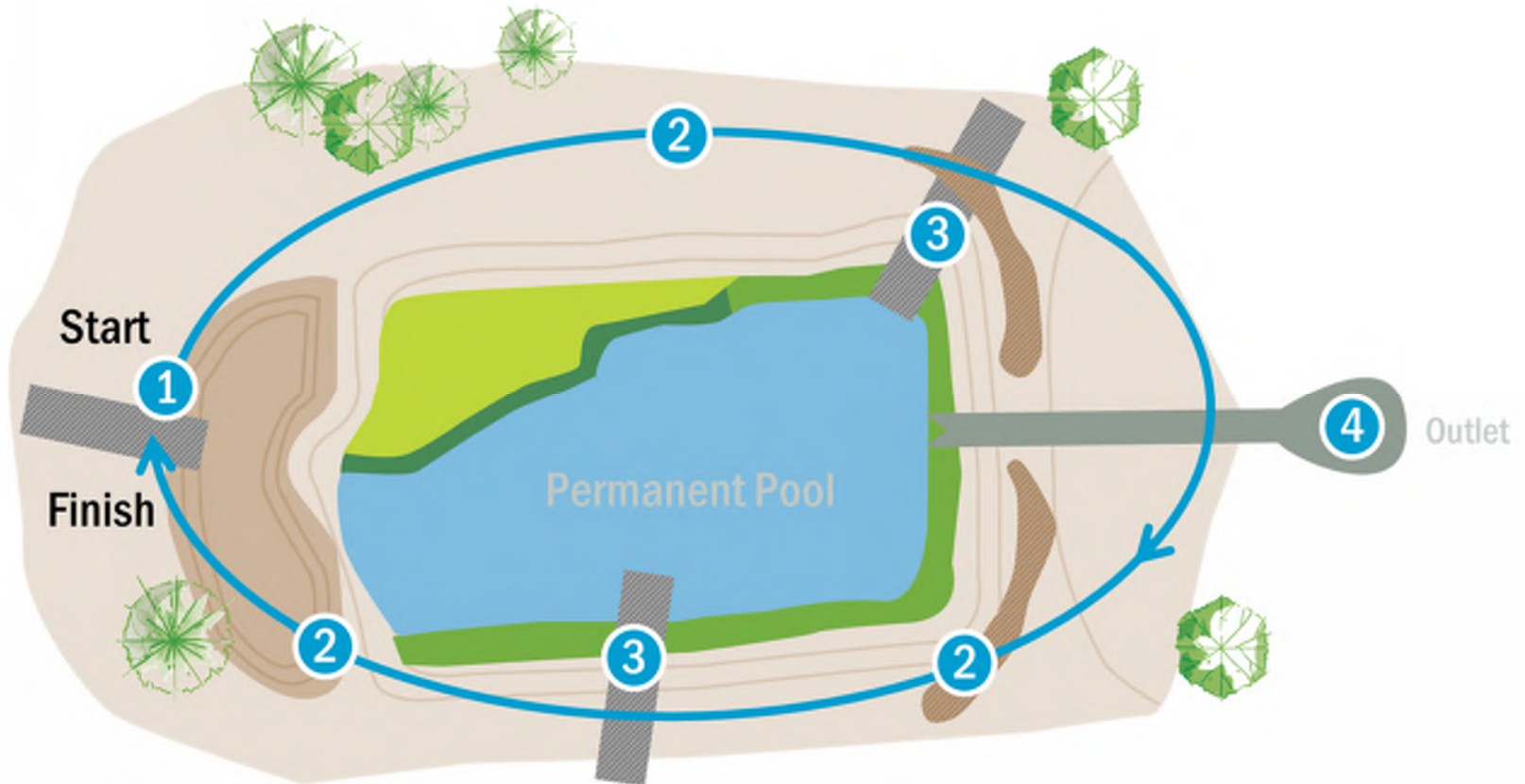
The Inspector will record:

- SWMF Identification #
- Work Order #
- SWMF Facility Type
- Weather
- Last Rainfall
- Inspection Date and Time
- Inspector Name
- Stormwater Inspector Number
- Type of Inspection
- SWMF Maintenance Status



SWMF Inspection and Maintenance Overview

Visually Based Inspections



SWMF Inspection and Maintenance Overview

Visually Based Inspections



SWMF Inspection and Maintenance Overview


SWMF Maintenance

The objective of a SWMF Inspection program is to ensure that each facility is adequately operated and maintained throughout the life of each facility.

Proper maintenance of any SWMF is important for ensuring the performance of the facility and to prevent failures that could damage or degrade the surrounding environment.

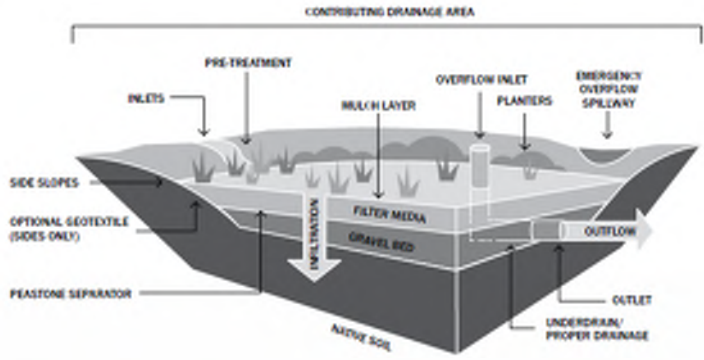
All maintenance needs that are observed and recorded during an inspection will be completed in a reasonable timeframe.

LONG-TERM MAINTENANCE | BIORETENTION



Bioretention

SWMF ID# _____
 OWNER _____



Maintenance

Bioretention consists of a shallow land-depression that temporarily ponds water and filters, through the soil, solids and other pollutants deposited during storms. When designed and maintained properly, bioretention can have numerous pollutant removal methods to protect the surrounding environment. Maintenance is needed so bioretention practices operate as intended over a long term basis. Routine maintenance, such as mowing and removing debris and trash, is needed annually. Inspection and repair of critical structure features (i.e., underdrains and outlets) should be performed by a qualified professional who has experience in the inspection, construction, and repair of these features.

Routine maintenance will take place on an annual or biennial schedule. The table below lists the frequency of maintenance, the specific actions that will take place during the routine maintenance, and which routine maintenance items will be addressed at that time.

FREQUENCY	ROUTINE MAINTENANCE GOAL	ROUTINE MAINTENANCE ACTIVITY
Annual	Trash and Debris Removal	<ul style="list-style-type: none"> • Remove trash and debris, including the removal of leaves and woody debris
	Invasive Species Management	<ul style="list-style-type: none"> • Control, reduce, or eliminate establishment and growth of invasive species
	Tree Management	<ul style="list-style-type: none"> • Prune damaged tree limbs by cutting back to next lateral branch or permanent stem • Control brush or woody vegetation to maintain a clear channel
Biennial	Rodent and Pest Management	<ul style="list-style-type: none"> • Examine any burrows that may be problematic
	Side-Slope Protection / Stabilization	<ul style="list-style-type: none"> • Replenish and amend soil where carbonic and heavily eroded areas have developed along side-slopes • Re-seed and mulch areas with soil exposed (add soil where more than two inches of soil loss is observed)
	Vegetation Management	<ul style="list-style-type: none"> • Mow and control weeds • Monitor and replace dead or dying plants • Prevent large-root systems from impacting structural components

SWMF Inspection and Maintenance Overview

Routine Maintenance

Routine maintenance will take place on an annual or biennial schedule. The table below lists the frequency of maintenance, the specific actions that will take place during the routine maintenance, and which routine maintenance items will be addressed at that time.

FREQUENCY	ROUTINE MAINTENANCE GOAL	ROUTINE MAINTENANCE ACTIVITY
Annual	Trash and Debris Removal	<ul style="list-style-type: none">Remove trash and debris, including the removal of leaves and woody debris
Biennial	Invasive Species Management	<ul style="list-style-type: none">Control, reduce, or eliminate establishment and growth of invasive species
	Tree Management	<ul style="list-style-type: none">Prune damaged tree limbs by cutting back to next lateral branch or parent stemControl brush or woody vegetation to maintain a clear channel
	Rodent and Pest Management	<ul style="list-style-type: none">Backfill any burrows that may be problematic
	Side-Slope Protection / Stabilization	<ul style="list-style-type: none">Replenish and amend soil where cavities and heavily eroded areas have developed along side-slopesRe-seed and mulch areas with soil exposed (add soil where more than two inches of soil loss is observed)
	Vegetation Management	<ul style="list-style-type: none">Mow and control weedsMonitor and replant dead or dying plantsPrevent large root systems from impacting structural components

Routine maintenance includes but is not limited to the following:

- Bank protection and stabilization
- Vegetation control
- Invasive species control
- Trash and debris removal
- Tree management
- Rodent and pest control

SWMF Inspection and Maintenance Overview

Repair Maintenance

Proper maintenance of any SWMF is important for ensuring the performance of the facility and to prevent failures that could damage or degrade the surrounding environment.



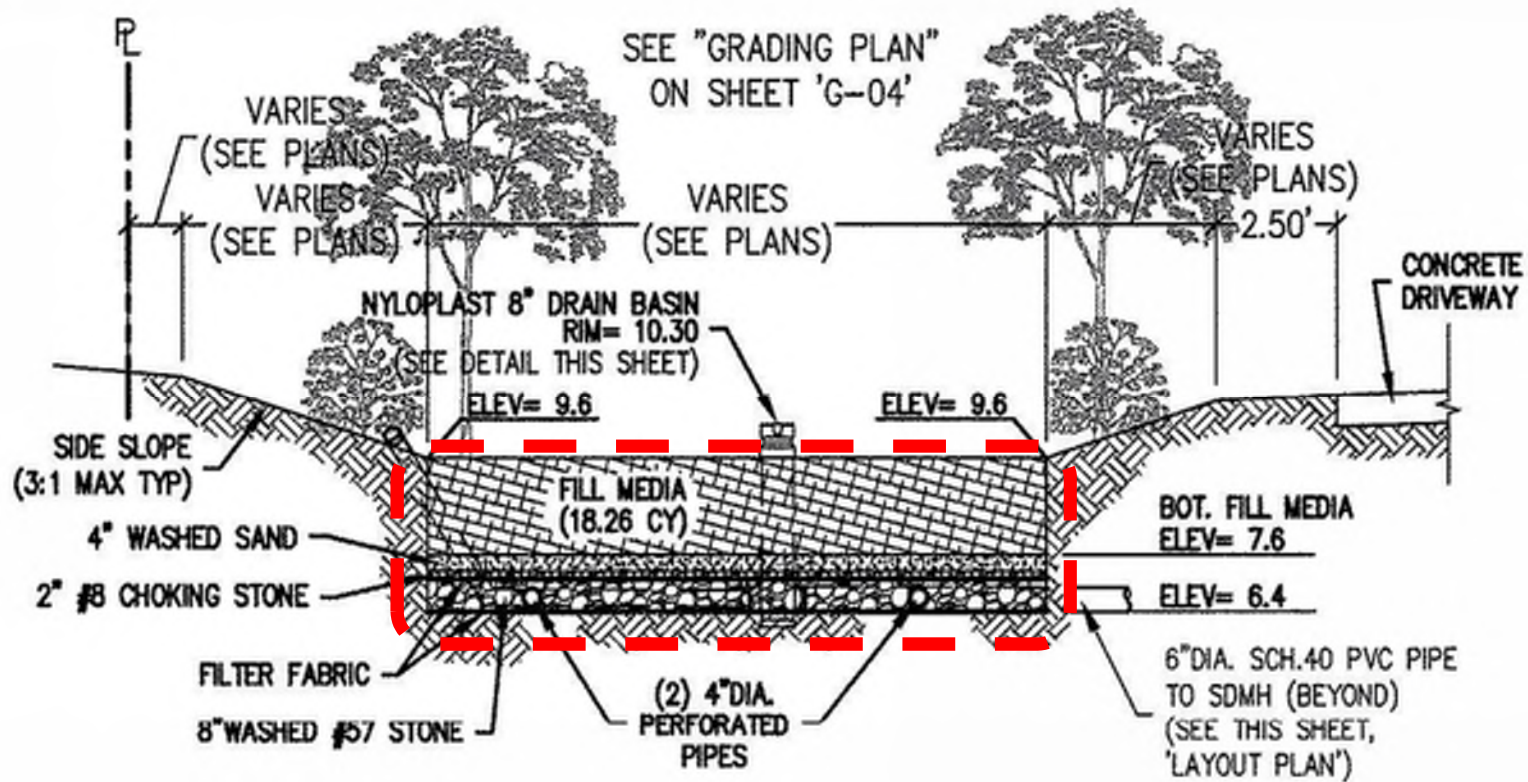
Repair maintenance is needed when an issue not associated with routine maintenance occurs that affects both the short- and long-term function of the SWMF to meet water quality benefits.

For private SWMFs, when repair maintenance is directed, follow up inspections will be conducted after the repair is completed.

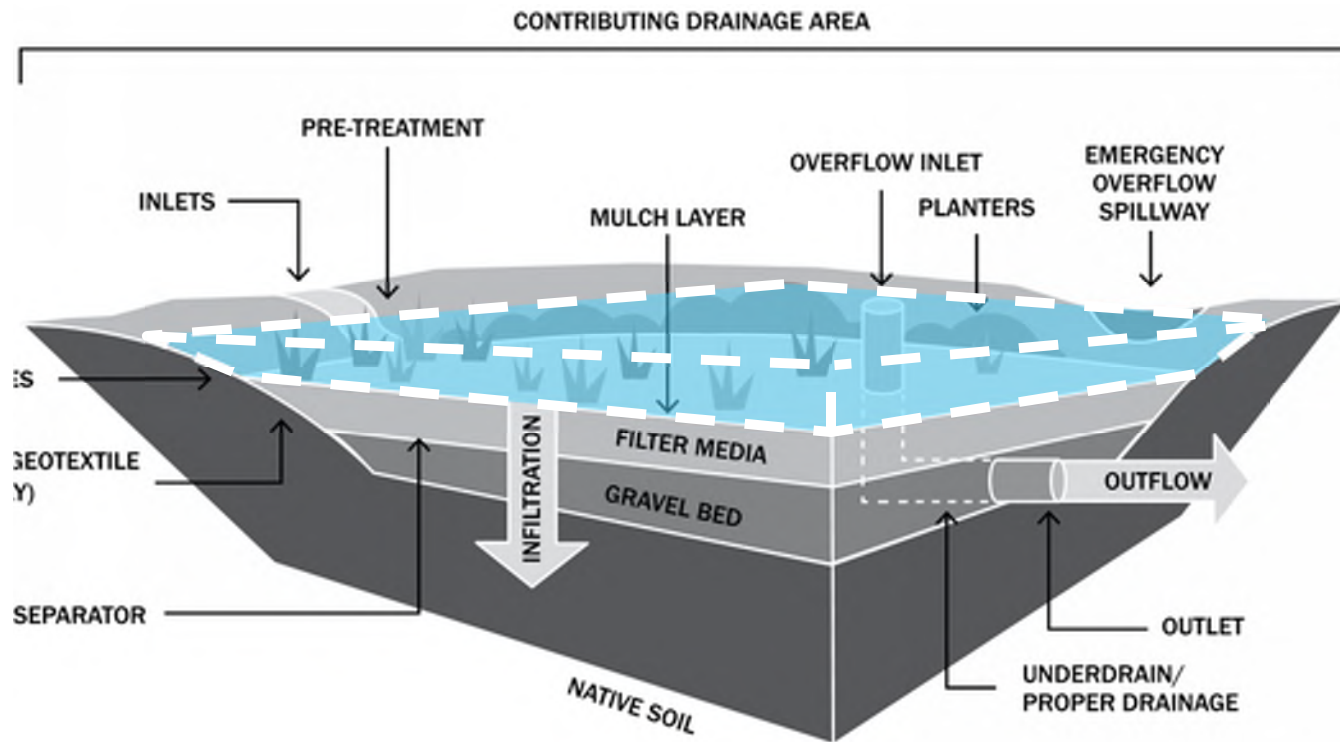


Alternative Inspection Methods

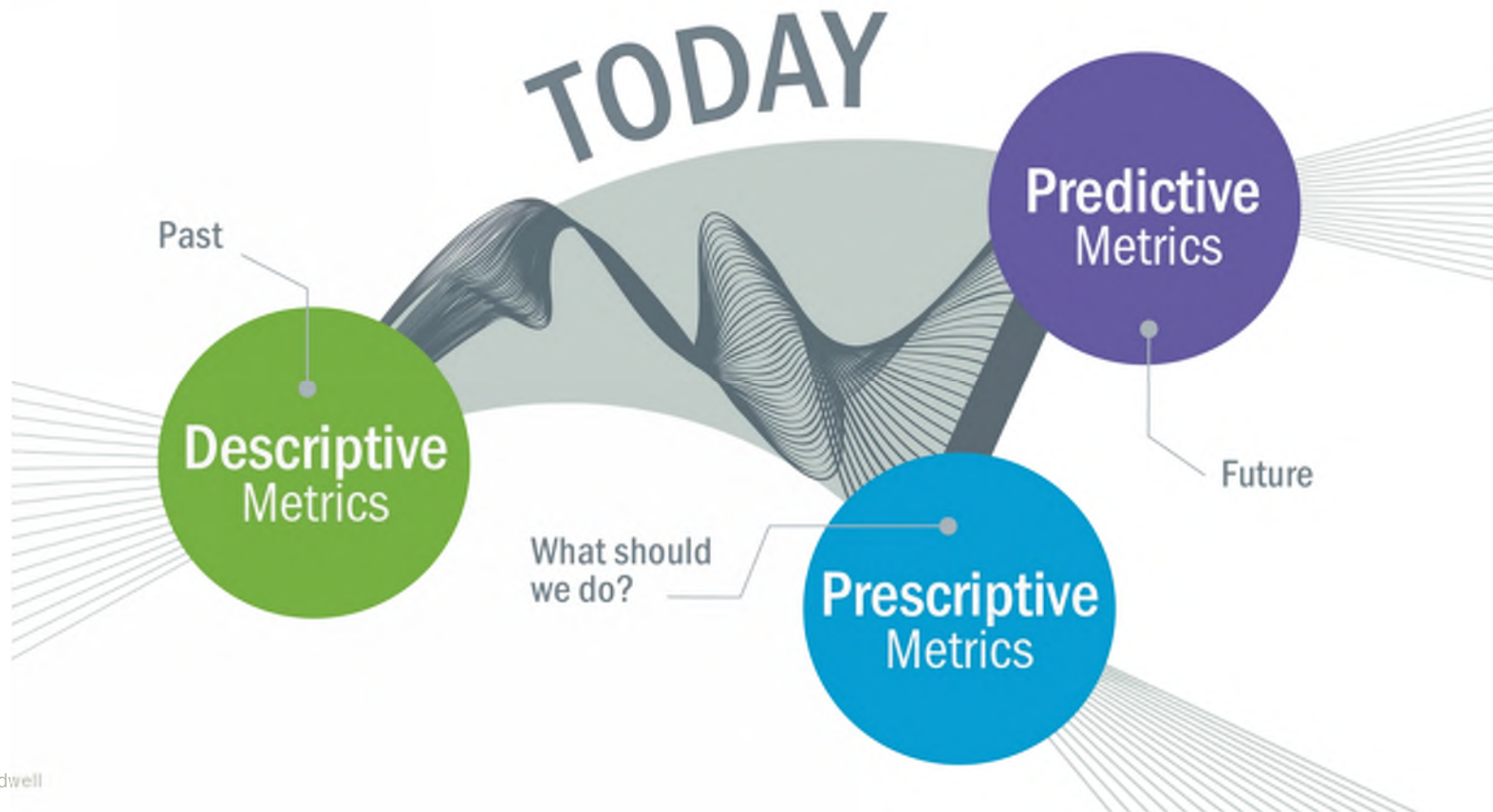
Visually Based Inspections



Re-defining Performance



Moving towards Prescriptive and Predictive



Example Metrics

Prescriptive Metrics

- Total Ponding Events
 - At what storm recurrence does this occur?
- Average Drawdown Time
- Average Infiltration Rate
 - Over a year or quarter (i.e. season)
- Overflow Events
 - What is the minimum rainfall intensity?

Predictive Metrics

- Routine Maintenance Impact
 - When does routine maintenance provided the greatest benefit?
- Degradation
 - What is average monthly decline in performance?
- Risk of Failure
 - At what point will a facility fail?



Next Steps

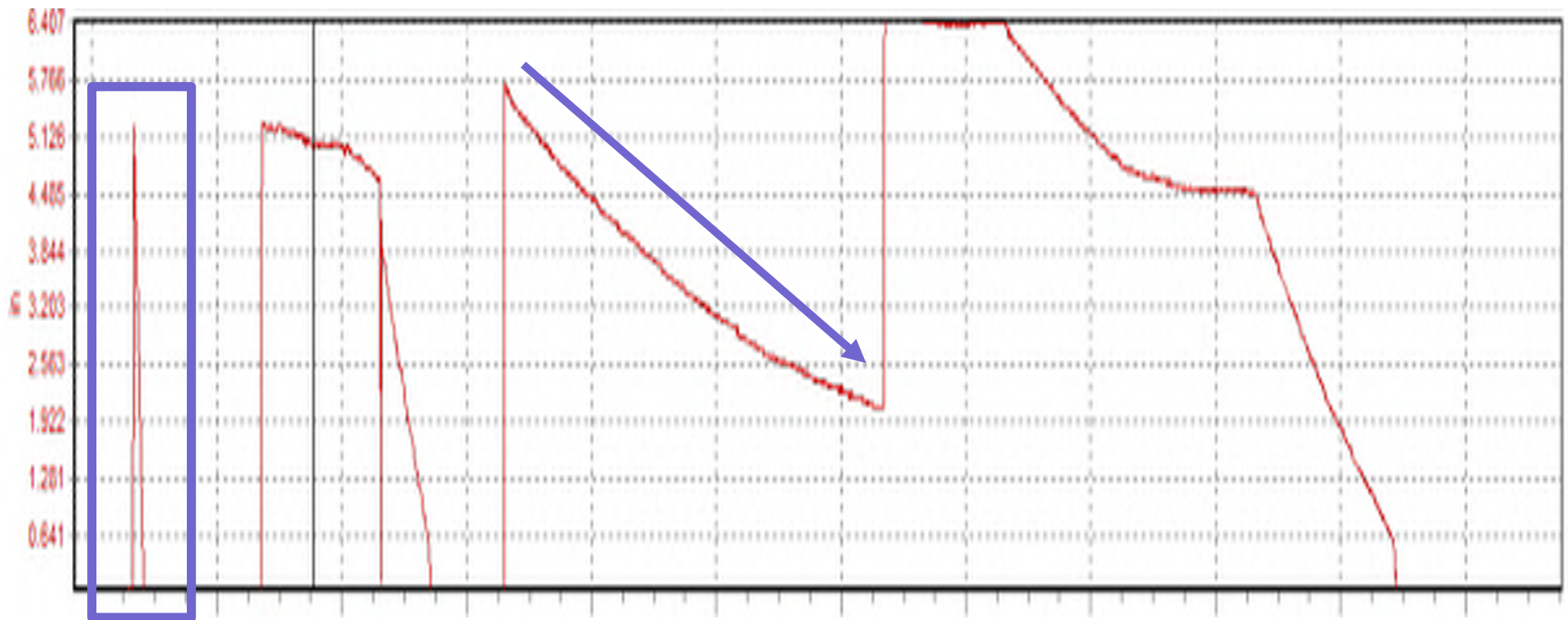
Next Steps

Testing Alternative Inspection Methods



Next Steps

Initial Lab Results



Next Steps

Prepping for a Field Trial



To be continued...



