Detention vs Retention

REGFORM Water Seminar, July 2025

Understanding Options & Picking the Right Tool

Introductions

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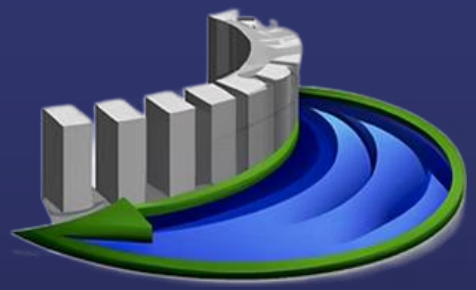


The Choice Matters

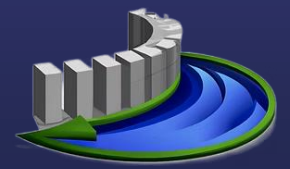
Why Does This Matter?

Improving Management, Effectiveness, & Compliance

Detention/retention decisions affect:

- Compliance with NPDES
- Long-term maintenance liabilities
- Flooding, erosion, and stream impairment

Regulatory inspections now emphasize performance, not just installation



What's the Difference?

Detention (Dry basin)

- Temporary Storage
  - Dry Between Storms
- Controls Peak Discharge
  - MS4/NPDES

Municipal Separate Storm Sewer System

National Pollutant Discharge Elimination System (NPDES)

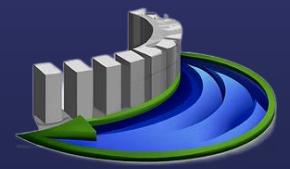
Retention (Wet basin/ pond)

- Permanent Pool
  - Buffers & Slow Release
- Enhances Water Quality
  - TMDL

Total Maximum Daily Load

At A Glance

	Detention Basin	Retention Pond
Water Presence	Temporary	Persistent
Primary Purpose	Peak Flow Reduction	Water Quality & Flow Control
Water Quality Treatment	Limited	Enhanced
Maintenance	Low to Moderate	Moderate to High
Aesthetic/Recreational Value	Low	High
Vector/Mosquito Risk	Low	Moderate – High
Land Required	Less	More
Suitable for Dense Urban Sites	Yes	Rarely




FOREBAY


CLAYCO

When Detention is the Better Fit

- **Better For:**
  - Flood Control
  - Limited Space
  - Groundwater Recharge is not Needed
  - Vector or Aesthetic Limitations
  - Limited Maintenance
- **Typical Applications:**
  - Industrial or Commercial
  - Parking Lots
  - Urban Infill
  - Streams Requiring Peak Flow Management

When Retention Adds Strategic Value

- **Better For**:
  - Water Quality Treatment and Nutrient Removal
  - Adding Aesthetic or Recreational Value
  - Promoting Infiltration and Groundwater Recharge
  - High-Volume Runoff Lower Permeability Soils

- **Typical Applications:**
  - Residential Subdivisions and Campuses
  - Commercial Sites with Open Land
  - Industrial Sites Needing Quality Improvement
  - Sites targeting ESG or green infrastructure goals

How Do I Choose?

The Basics

- Consider Each Watershed Separately
- Issues You Need/Want to Address
  - Possible Mutual Benefits
- How Much Space
  - Needed
  - Available
  - Think 3-D
- New or Retrofit
- Regulatory & Community Status
- Budget Constraints

You Have Options

- Hybrid Basins – a little of both
- Subsurface Basins
  - Space Utilization
  - Design & Approval Considerations
  - Maintenance Considerations
- Zero or Indirect Discharge
  - Evaporative Basins
  - Infiltration Basins
  - Land Application Basins

Some of Both

Hybrid Basins

Hybrid Basins

Examples:

- Detention with internal forebay (pretreatment)
- Extended detention + wet pool
- Step-wise system (bioretention -> vault -> basin)
- Underground chambers with vegetation above

More on Hybrid Basins

Multi-stage, integrated stormwater system
that blends natural features with
engineered controls.

Some sites take advantage of their existing topography, soil types, and natural drainage patterns to design a more integrated or hybridized stormwater control system.

Rather than relying on a single detention or retention basin, these sites may create a series of interconnected BMPs, each with a specific treatment role.

Engineering and Construction Fundamentals

Key Design and Code-Based Requirements

- See local municipal guides (Some are too prescriptive)

Important Examples

- Drainage Flow: Inlet and outlet pipes should be sized for 2-, 10-, and 100-year storm
- Freeboard & Overflow: Minimum 1–3-foot freeboard above 100-year storm level; emergency spillways must be armored or reinforced
- Residence Time: Typical retention pond design targets 24–72 hours to promote sedimentation and nutrient reduction

Engineering - Liners

Why & When Liners Are Needed

- Groundwater contamination risk
- Prevent infiltration near critical infrastructure
- Required for Superfund, Brownfields, and regulated pollutants
- Persistent bypasses
- Local TMDL development (upstream users can impact you)

Engineering - Liners

Liner Type	Material	Best Use Cases	Pros	Cons
Compacted Clay	Natural clay soil	Rural sites, low-cost retrofits	Low cost, natural materials	Requires 12–24" thickness, prone to drying/cracks
Geosynthetic Clay Liner (GCL)	Bentonite + geotextile	Sites with limited space, consistent permeability	Thin profile, easy to install, self-healing	Costlier than native clay, not good on steep slopes
HDPE Geomembrane	High-density polyethylene	Industrial sites, high-risk pollutant containment	Highly impermeable, chemical-resistant	Requires anchoring, vulnerable to punctures
PVC Geomembrane	Flexible vinyl	Small basins with complex shapes	Flexible, conforms to irregular geometry	UV degradation risk, less chemical resistance
Concrete	Poured-in-place or precast	Industrial/facility-adjacent basins needing durability	Extremely durable, minimal maintenance	Very high cost, needs structural support
Spray-on Liner (Polyurea or EPDM)	Polymer-based coating	Retrofitting old basins, irregular surfaces	Seamless, adaptable to shapes	Surface prep critical, shorter lifespan

Engineering - Liners

The liner you choose sets physical and regulatory boundaries for what your basin can do, and sometimes it's the first clue to what kind of basin you really need.

Challenges

Cramped for Space

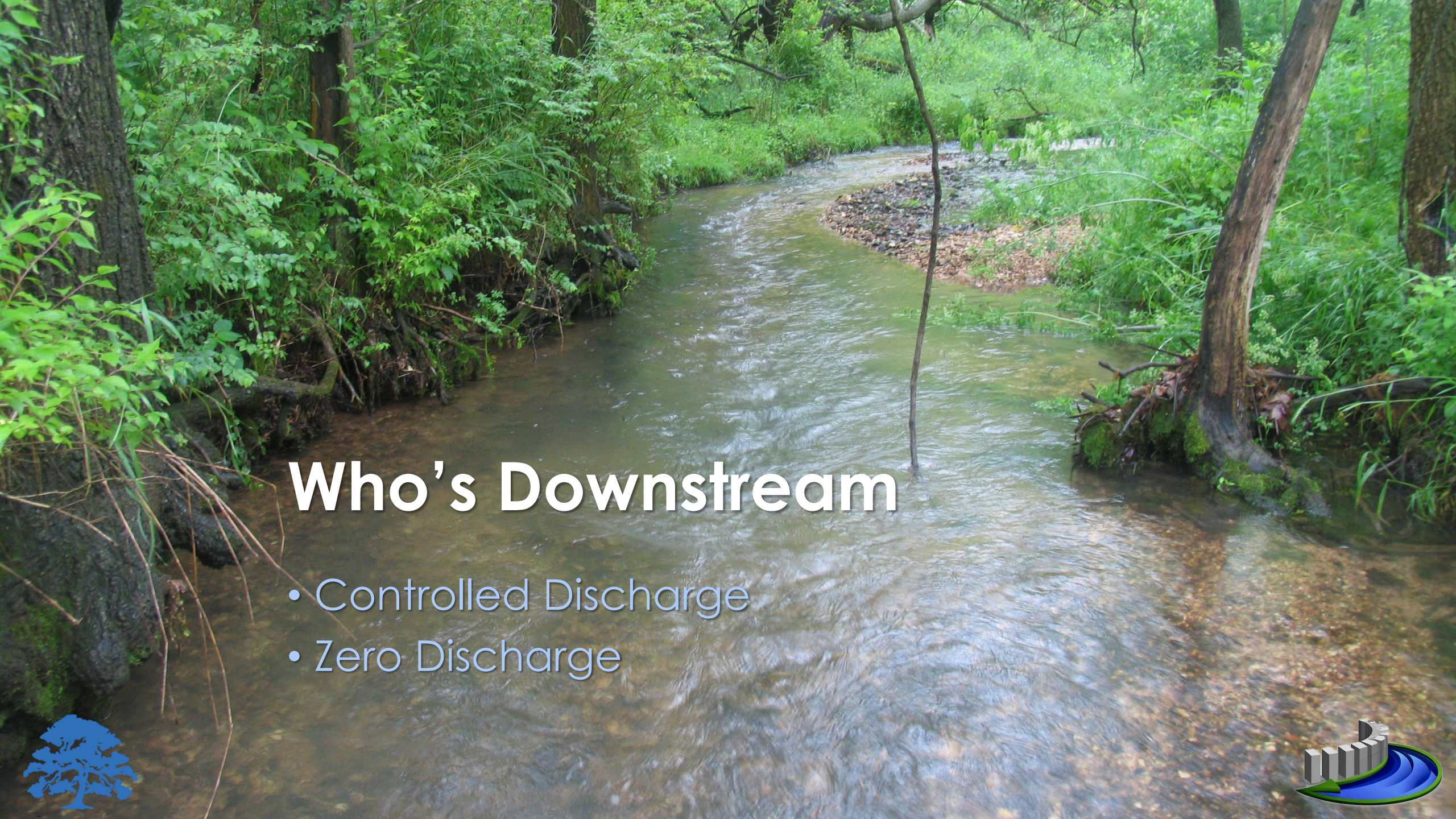
- 3-D Solutions
  - Optimize Space
  - Operation & Maintenance

Neighbors

- What's Upgradient
- Shared Basins

What's Below

- Soil
- Groundwater
- Liners



Who's Downstream

- Controlled Discharge
- Zero Discharge

Maintenance & Compliance

Maintenance

200%-500% mark-up on mobilized repair services

Why Maintenance Is Non-Negotiable

Poor or infrequent maintenance is a top violation trigger under NPDES.
Maintenance failure leads to:

Sediment accumulation → lost storage volume

Vegetation overgrowth → obstructions → mask, burrows, permanent root intrusion into underdrains , clogs, erosion, structural damage and blowouts

Algae blooms → benchmark exceedance

Trash/debris blockages → flooding & infrastructure damage

Maintenance

Why Maintenance Is Non-Negotiable

MoDNR - 10 CSR 20-6.200
BMP expectations

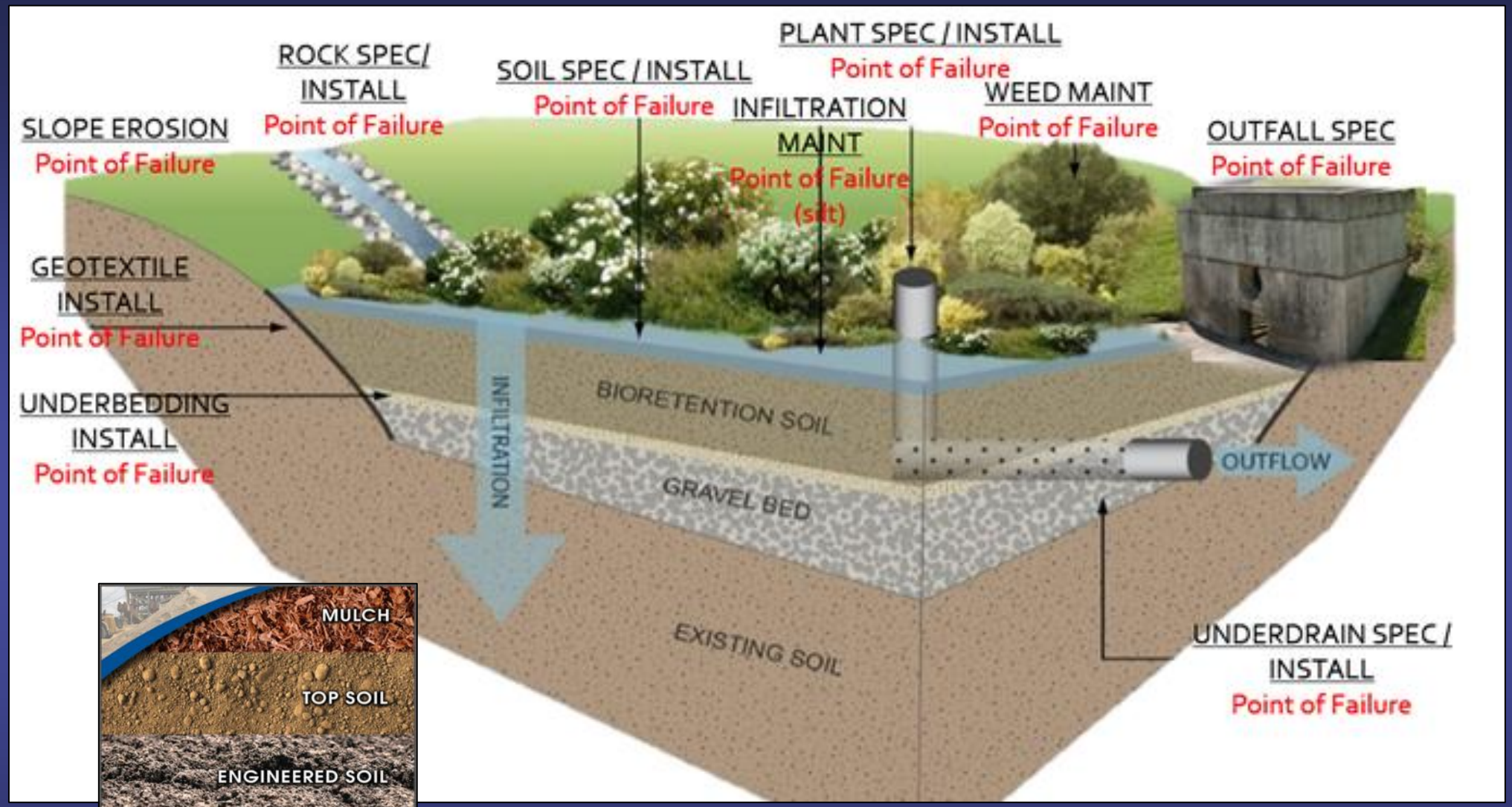
Regular forebay and basin sediment removal, even maintenance. Failure = violation

Maintenance

Quick case study

**“We thought it was just a grass ditch until it backed up and flooded the building/impacted adjacent property.
It cost more to fix than it did to build.”**

— Facility Operations Manager


PLANT SPEC / INSTALL
Point of Failure
ROCK SPEC/
INSTALL
Point of Failure
SOIL SPEC / INSTALL
Point of Failure
INFILTRATION
MAINT
Point of Failure
(silt)
WEED MAINT
Point of Failure
OUTFALL SPEC
Point of Failure
SLOPE EROSION
Point of Failure
GEOTEXTILE
INSTALL
Point of Failure
UNDERBEDDING
INSTALL
Point of Failure
INFILTRATION
BIORETENTION SOIL
GRAVEL BED
OUTFLOW
EXISTING SOIL
UNDERDRAIN SPEC /
INSTALL
Point of Failure
MULCH
TOP SOIL
ENGINEERED SOIL
FILL DIRT
AGGREGATES

Plans Required

What Are the Minimums?

1. Stormwater Pollution Prevention Plan (SWPPP)
2. Outfall Identification Map
3. Facility Site Map with Flow Arrows
4. Engineering As-Built or Design Drawings
5. Maintenance Plan / BMP O&M Schedule
6. Inspection Checklists & Logs
7. Algae Control or Vegetation Management Plan
8. Shared Use Agreement or Maintenance Easement

Activities Required

What might you really need to do?

1. Visual Inspection of Basin
2. Trash & Debris Removal (Inlets & Outlets)
3. Sediment Depth Monitoring
4. Sediment Removal (Dredging)
5. Vegetation Maintenance (Trimming, Mowing)
6. Native Plant Management

Activities Required

What might you really need to do?

7. Inlet/Outlet Structure Inspection
8. Emergency Spillway Inspection
9. Algae Monitoring and Treatment
10. Mosquito Prevention (Stagnant Water Control)
11. Outfall Inspection & Cleaning
12. Check Dam Inspection
13. Recordkeeping & Log Entry

Documentation, data storage and recall,?

Mapping a Strategy

Options & Design

- Ongoing Obligations
- Living Infrastructure
- What is the Facility's Future
- Is Retrofit Needed?

Planning & Implementation

- Start Early
- Consider Your Objectives
- Consider Your Setting
- Integrate Solutions

Contact Us

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