Lifecycle of a Detention Pond: From Construction to Long-Term Maintenance

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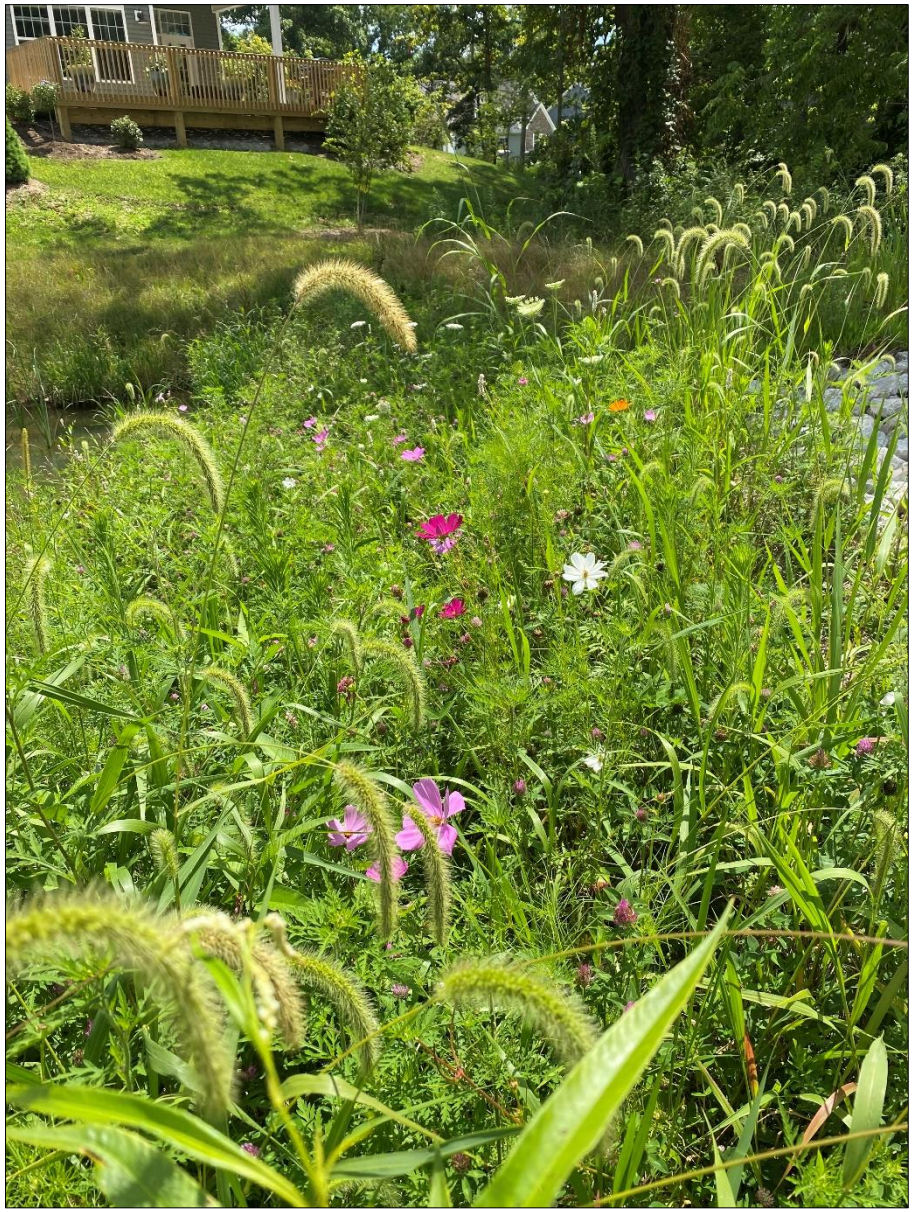
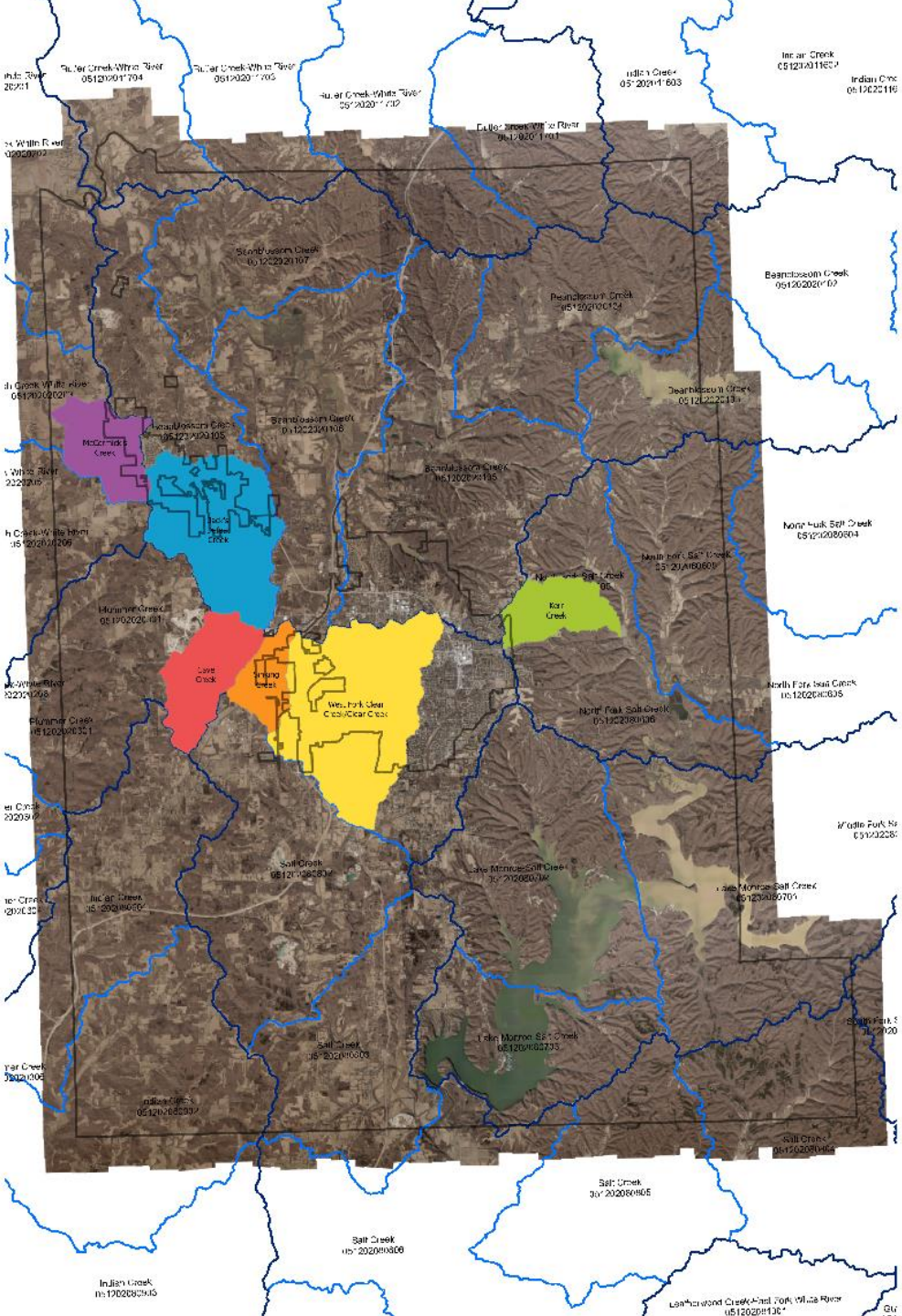
STORMWATER SERVICES

MONROE COUNTY HIGHWAY DEPARTMENT

Agenda

1. Monroe County Watersheds
2. Stormwater Management
3. Defining Detention Ponds/Basins
4. Life-cycle Phases
    a) Pre-Construction & Active Construction
        a) Inspection Expectations
    b) Post-Construction
        a) Inspection Expectations
    c) Long-Term Maintenance
        a) Inspection Expectations
5. Questions?



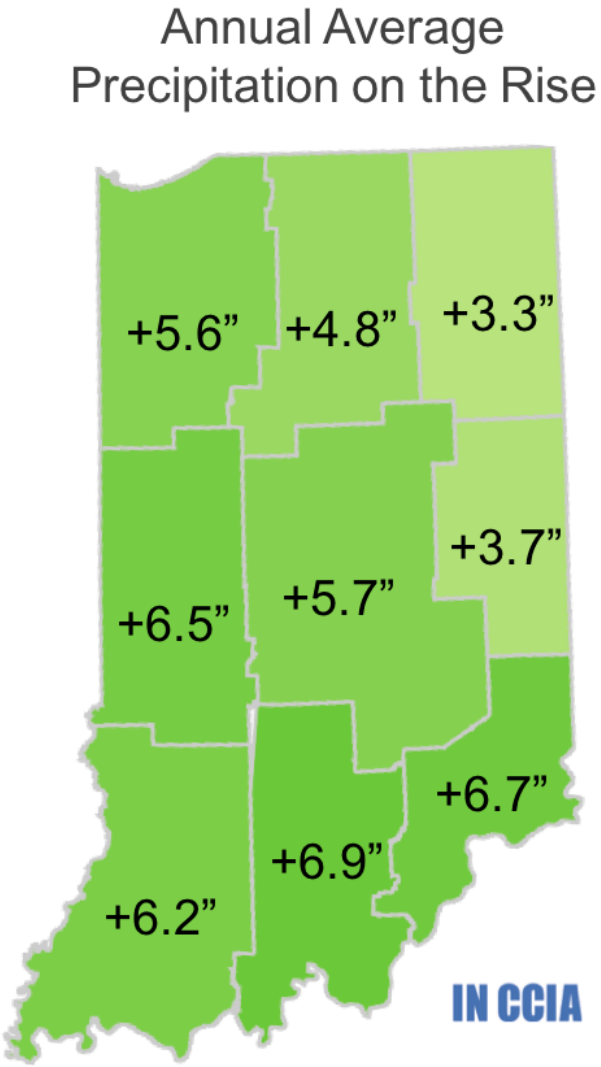


Monroe County Watersheds

with Critical Drainage Areas

Changes in Precipitation Patterns

- From 1895 to 1959, the state gained 0.32 inches of precipitation per decade.
- Since then, the rate of precipitation change has increased to 1.33 additional inches per decade, a fourfold increase.
- The **southern and west-central** regions of the state observed the largest increases, while the east-central and northeast observed the smallest.



Change in annual average precipitation based on linear trend between 1895 to 2016

https://ag.purdue.edu/indianaclimate/indiana-climate-report/#precipitation

Stormwater Management

- State Regulations
  - IDEM
- County Regulations
  - Zoning
  - Grading
  - Stormwater
- Guiding Documents
  - Monroe County Urbanizing Area Plan (2014)
  - Monroe County Comprehensive Plan (2012, updates this year)
  - Monroe County Stormwater Long Range Stormwater Plan (Feb. 2016)

What is a Detention Pond/Basin?

- As defined in Ch 761: A facility constructed or modified to restrict the flow of stormwater to a prescribed maximum rate, and to detain concurrently the excess waters that accumulate behind the outlet.

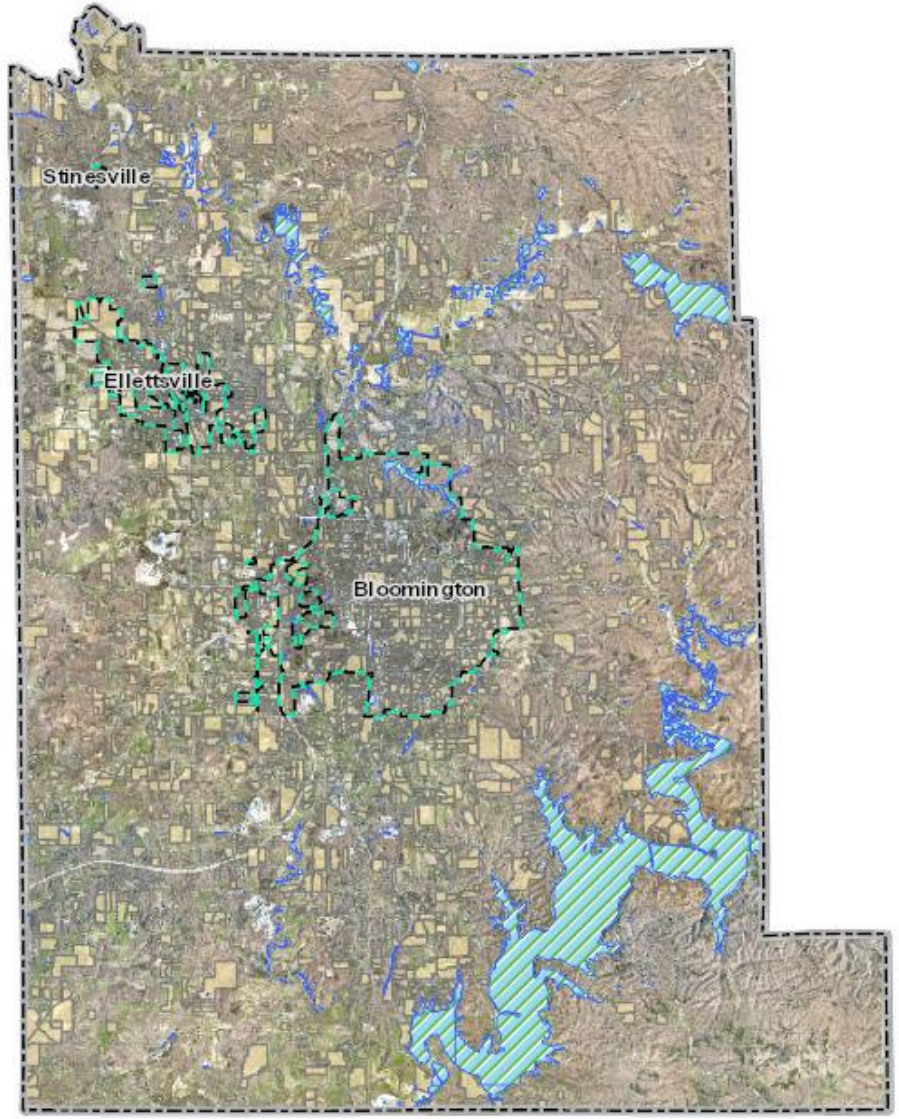
- As defined in CH 8 IDEM Stormwater Manual: constructed basins that collect, temporarily hold, and gradually release excess storm water from storm events.

What's the Difference Between Detention & Retention Ponds?

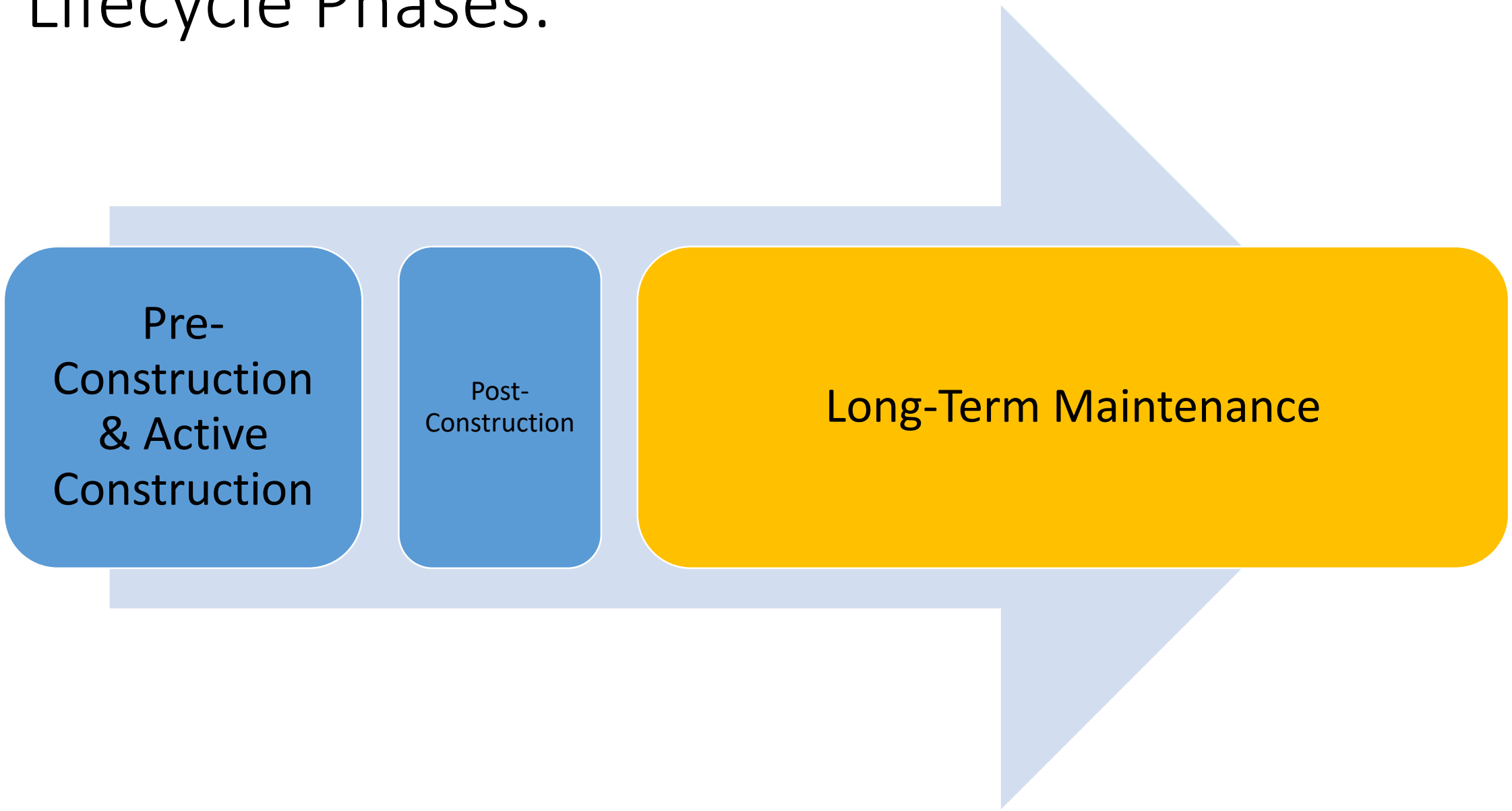
- Water Retention!

How Many Does Monroe County Have?

- Estimated 450+ basins
  - Both residential & commercial developments
  - Based on records from 2005-present
    - Why 2005?
- 2021 BMP Inventory
  - Catching up on what's already there.
  - Track new basins as they are built.



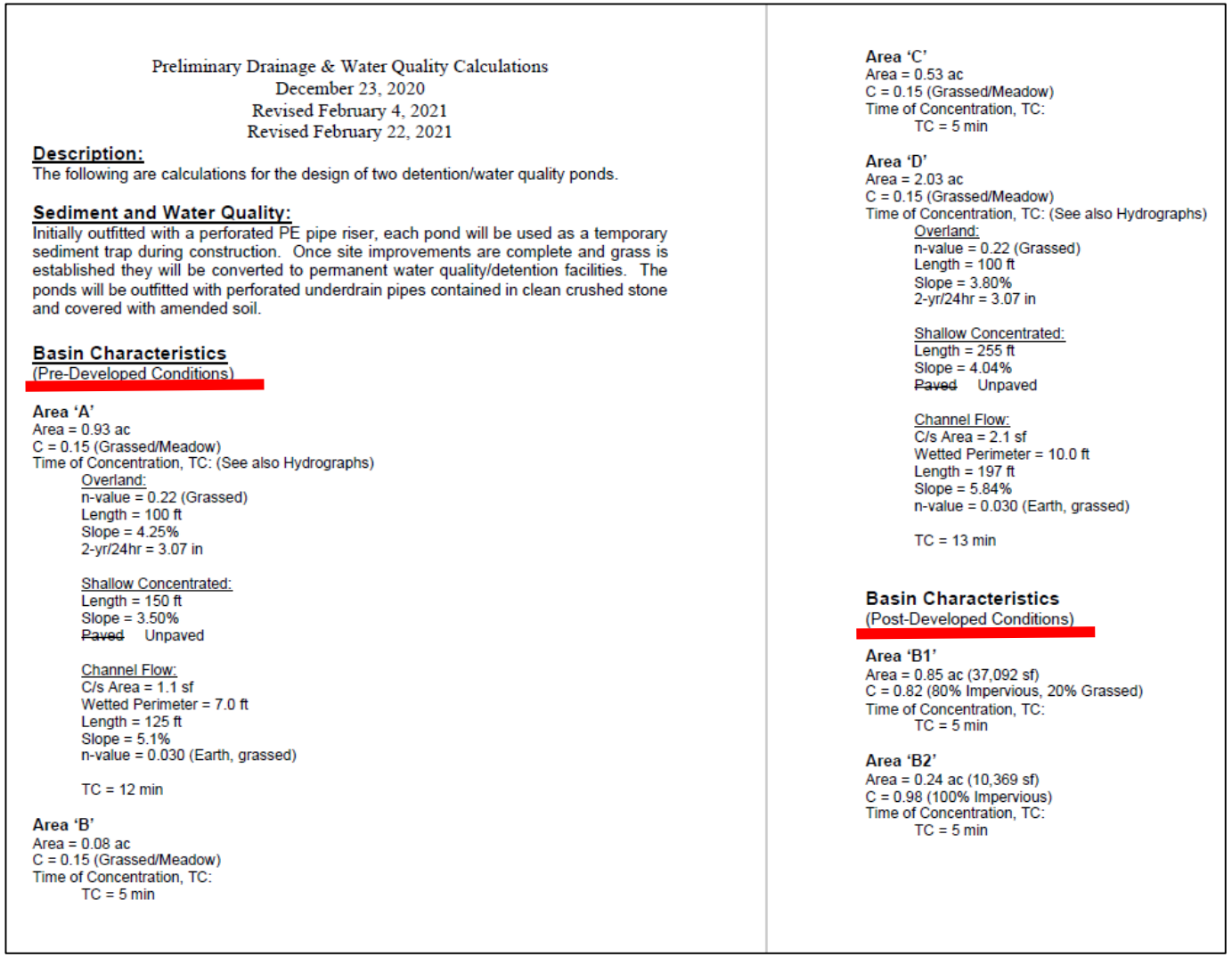
Lifecycle Phases:



Phase 1: Pre-Construction & Active Construction

- Pre-Construction
  - Design
  - Drainage Reports →
  - Hydrograph Modeling
  - Construction Permits
  - O&M Manual Draft

- Pre-Construction Meeting
  - Review SW Concerns
  - Set Expectations



Preliminary Drainage & Water Quality Calculations
December 23, 2020
Revised February 4, 2021
Revised February 22, 2021

Description:
The following are calculations for the design of two detention/water quality ponds.

Sediment and Water Quality:
Initially outfitted with a perforated PE pipe riser, each pond will be used as a temporary sediment trap during construction. Once site improvements are complete and grass is established they will be converted to permanent water quality/detention facilities. The ponds will be outfitted with perforated underdrain pipes contained in clean crushed stone and covered with amended soil.

Basin Characteristics
(Pre-Developed Conditions)

Area 'A'
Area = 0.93 ac
C = 0.15 (Grassed/Meadow)
Time of Concentration, TC: (See also Hydrographs)
Overland:
n-value = 0.22 (Grassed)
Length = 100 ft
Slope = 4.25%
2-yr/24hr = 3.07 in

Shallow Concentrated:
Length = 150 ft
Slope = 3.50%
~~Paved~~ Unpaved

Channel Flow:
C/s Area = 1.1 sf
Wetted Perimeter = 7.0 ft
Length = 125 ft
Slope = 5.1%
n-value = 0.030 (Earth, grassed)

TC = 12 min

Area 'B'
Area = 0.08 ac
C = 0.15 (Grassed/Meadow)
Time of Concentration, TC:
TC = 5 min

Area 'C'
Area = 0.53 ac
C = 0.15 (Grassed/Meadow)
Time of Concentration, TC:
TC = 5 min

Area 'D'
Area = 2.03 ac
C = 0.15 (Grassed/Meadow)
Time of Concentration, TC: (See also Hydrographs)
Overland:
n-value = 0.22 (Grassed)
Length = 100 ft
Slope = 3.80%
2-yr/24hr = 3.07 in

Shallow Concentrated:
Length = 255 ft
Slope = 4.04%
~~Paved~~ Unpaved

Channel Flow:
C/s Area = 2.1 sf
Wetted Perimeter = 10.0 ft
Length = 197 ft
Slope = 5.84%
n-value = 0.030 (Earth, grassed)

TC = 13 min

Basin Characteristics
(Post-Developed Conditions)

Area 'B1'
Area = 0.85 ac (37,092 sf)
C = 0.82 (80% Impervious, 20% Grassed)
Time of Concentration, TC:
TC = 5 min

Area 'B2'
Area = 0.24 ac (10,369 sf)
C = 0.98 (100% Impervious)
Time of Concentration, TC:
TC = 5 min

Drainage Reports

Contain pond calculations that dictate design needs, for example, the capture and retention requirements and outlet orifice elevation.

Pond No. 1 Calculations:

Water Quality

Onsite Contributing Area = 47,461 sf (From B1 & B2)

Total Storage Required = (0.50 in / 12 in/ft) x 47,461 sf = 1,978 cf

Capture and retain 1,978 cf in for water quality storage

Pond 1 Stage/Storage:

Elevation (ft)	Contour Area (sf)	Total Storage (cf)	
827	1030	0	
828	1522	1276	Water Quality Storage Elev. = 828.36
829	2394	3234	Set lowest orifice invert at 828.36
830	3360	6111	

Overflow Design

The pond riser will be an INDOT Type E inlet with an East Jordan Iron Works 6610 casting. Emergency overflow spillway calculations:

$Q_{100\ year\ design}$ = 1.25 x 9.7 = 12.1 cfs

Required Weir Length (w/ depth of flow = 0.50') L = Q / 3.33 x $H^{1.5}$

L = 10.3 feet; say 12 feet

Pond No. 2 Calculations:

Water Quality

Onsite Contributing Area = 108,202 sf (From C only)

Total Storage Required = (0.50 in / 12 in/ft) x 108,202 sf = 4,509 cf

Capture and retain 4,509 cf in for water quality storage

Pond 1 Stage/Storage:

Elevation (ft)	Contour Area (sf)	Total Storage (cf)	
823	4713	0	
824	5555	5134	Water Quality Storage Elev. = 823.87
825	7049	11436	Set lowest orifice invert at 823.87
826	8751	19336	

Overflow Design

The pond riser will be an INDOT Type E inlet with an East Jordan Iron Works 6610 casting. Emergency overflow spillway calculations:

$Q_{100\ year\ design}$ = 1.25 x 10.4 = 13 cfs

Required Weir Length (w/ depth of flow = 0.50') L = Q / 3.33 x $H^{1.5}$

L = 11 feet; say 15 feet

Phase 1: Pre-Construction & Active Construction

- Active Construction
  - Construction Sequencing
    - Rule 5 - SWPP
  - Basin Installation Sequencing

Principal Spillway Installation

Install the spillway barrel (pipe) and riser on a firm, even foundation. Place at least one watertight anti-seep collar (1.5 foot minimum projection) around the barrel if it is eight inches or larger in diameter.

Place a four-inch layer of moist, clayey, soil around the lower part of the barrel and compact it by hand to at least the density of the soil foundation, taking care **not to** raise the barrel from the foundation when compacting under the barrel haunches. (Do not use soil materials such as sand, aggregate or silt.)

Perforate the riser pipe with one-half inch holes spaced three inches apart or use a manufactured perforated riser pipe.

Connect the riser pipe to the barrel.

Embed the riser pipe in at least 12 inches of concrete (the concrete serves as an anti-flotation block).

Wrap perforated riser with hardware cloth or wire mesh.

Place an aggregate filter pack around the perforated riser. [The filter pack should consist of 12 inches of INDOT Uniform A or B riprap or INDOT CA No. 2 aggregate placed around the riser and then covered with a minimum of 12 inches of INDOT CA No. 5 aggregate (for filtration)].

Install a trash guard (bars two to three inches apart) on the top of the riser pipe.

Maintenance

Inspect within 24 hours of a rain event and at least once every seven calendar days.

Remove and properly dispose of sediment when it accumulates to one-half the design volume.

Periodically check embankment, emergency spillway, and outlet for erosion damage, piping , settling, seepage, or slumping along the toe or around the barrel; repair immediately.

Remove trash and other debris from riser, emergency spillway, and pool area.

Clean or replace aggregate around the riser if the sediment pool does not dewater (drain) within 48 to 72 hours following a storm water runoff event.

EROSION CONTROL SEQUENCE

1. CONTACT CONNIE GRIFFIN, MS4 ASSTANT COORDINATOR AT: (812)349-2960 FOR A PRE-CONSTRUCTION MEETING. AT THIS MEETING THE CONTRACTOR IS TO PROVIDE CONNIE WITH ONE CERTIFIED SET OF SITE CONSTRUCTION PLANS.

2. POST PERMITS ON PERMIT BOARD IN PUBLIC ACCESSIBLE LOCATION. PERMIT BOARD SHALL INCLUDE: CONTACT PHONE NUMBERS OF CONTRACTOR AND PROPERTY OWNER, APPROVED PERMITS, IDEM SPILL LINE EMERGENCY NUMBERS, PRINTED PLAN SET LOCATION, SPILL KIT LOCATION, SELF MONITORING LOG BOOK LOCATION AND CONTRACTOR TRAINING INFORMATION.

NOTE: EROSION CONTROL MEASURES ARE TO BE INSTALLED WELL IN ADVANCE OF ANY GRADING ACTIVITY.

3. INSTALL CONSTRUCTION ENTRANCES AS SHOWN ON PLANS

4. PRIOR TO ANY EARTH MOVING PLACE SILT FENCE ALONG THE DOWNSTREAM SIDE OF ALL GRADING ACTIVITY AND MAINTAIN DURING CONSTRUCTION.

5. CONSTRUCT THE TEMPORARY COMPONENTS OF THE DETENTION/WATER QUALITY PONDS AS DETAILED ON SHEET C504.

6. INSTALL SILT FENCE AROUND TEMPORARY TOPSOIL STOCKPILE AREAS SHOWN. STRIP TOP SOIL FROM AREAS TO BE DISTURBED BY CONSTRUCTION ONLY AND LOCATE TO THE TEMPORARY TOPSOIL STOCKPILE AREAS. SEED ALL DISTURBED AREAS PER THE TEMPORARY SEEDING SPECIFICATIONS ON SHEET C603.

7. PERFORM CONSTRUCTION ACTIVITIES AS SHOWN ON THE PLANS. DO NOT DISTURB TURF AREAS OUTSIDE OF CONSTRUCTION LIMITS SO THAT TURF ACTS AS A VEGETATIVE FILTER STRIP. GRADING AROUND THE BUILDING PAD SHOULD DIRECT RUNOFF AWAY AND TO THE EROSION CONTROL MEASURES AROUND THE SITE.

9. FINISH GRADE STEEP SLOPES THAT ARE CALLED TO RECEIVE EROSION CONTROL BLANKET AND INSTALL SAID BLANKET TO STABILIZE.

10. ALL EROSION CONTROL STRUCTURES SHALL BE KEPT IN WORKING ORDER AND INSPECTED UPON COMPLETION OF EVERY RAIN EVENT. ADD ADDITIONAL MEASURES WHEN NECESSARY.

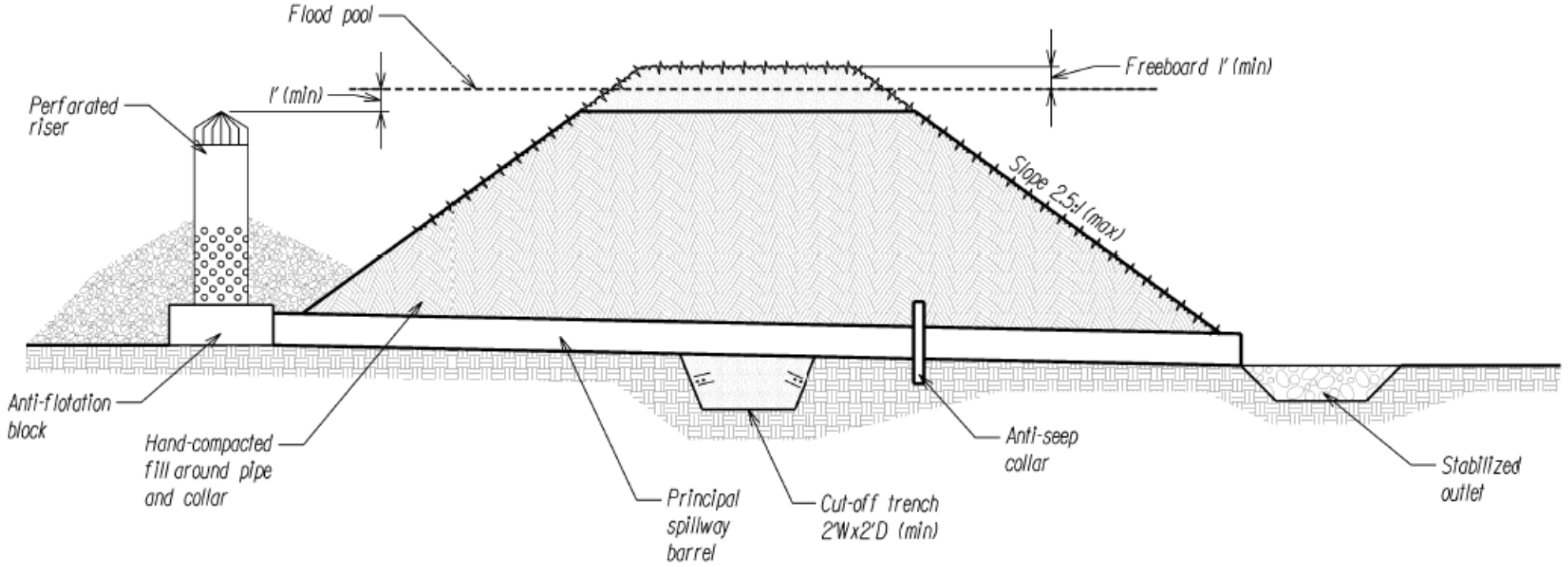
11. UPON COMPLETION OF CONSTRUCTION OF ALL IMPROVEMENTS REDISTRIBUTE TOP SOIL TO ALL PROPOSED GRASSED AREAS.

12. MULCH SEED PROPOSED GRASS AREAS IMMEDIATELY UPON COMPLETION OF ALL EARTHMOVING AND UNDERGROUND UTILITY WORK IN ACCORDANCE WITH INDOT SS-621 SEED MIXTURE TYPE U.

13. WATER SEEDED AREAS UNTIL MATURE TURF IS ESTABLISHED. FERTILIZER MAY BE USED ONLY IF SOIL TESTING INDICATES THE NEED FOR FERTILIZER.

Phase 1: Pre-Construction & Active Construction

- Typical Plan Set Detail



TEMPORARY SEDIMENT BASIN

NO SCALE

Phase 1: Pre-Construction & Active Construction

Phase 1: Pre-Construction & Active Construction

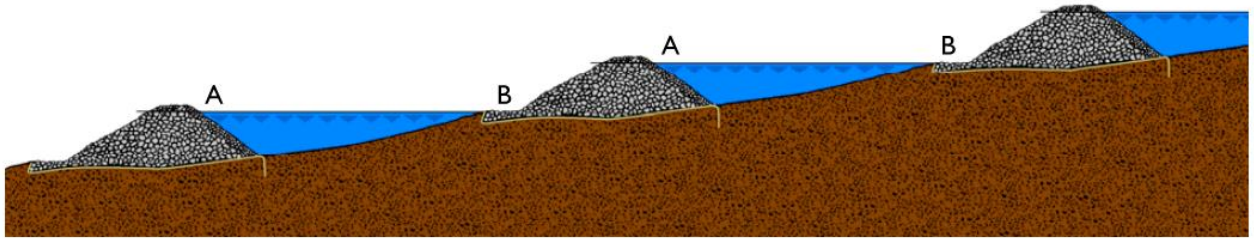
- What will basin inspections be looking for?
  - Reference the SWPPP!
  - ✓Protected street inlets & other points of basin in-flow
  - ✓Outlet control structure protection
  - ✓Stabilized basin walls
  - ✓Stabilized out-flow

Phase 1: Pre-Construction & Active Construction

Phase 1: Pre-Construction & Active Construction

Temporary rock check dams should be repaired as needed.

Allow water to slow and sediment to settle out.



Phase 2: Post-Construction

- Phase 2 begins when all other site activities involving soil disturbance have completed and basin is no longer acting as a sediment trap.
  - Other permanent stabilization is established or being installed.
- Submit site as-builts
- Basin finalization can begin!
  - ❑ Remove accumulated sediment.
  - ❑ Re-stabilize basin walls.
  - ❑ Remove temporary basin protections.
  - ❑ Install underdrain.
  - ❑ Apply amended soils & bioretention landscaping.
  - ❑ Stabilize in-flows & out-flows.

Phase 2: Post-Construction

- Final Inspections:
  - ✓Street inlets are clear of sediment.
  - ✓Basin in-flows are stable.
  - ✓Basin walls do not have gullying.

Phase 2: Post-Construction

Basin in-flows are stable.

Phase 2: Post-Construction

- Final Inspections:
  - ✓Outlet control structure is clear of debris.
  - ✓Basin out-flows are stable.
  - ✓Underdrain clean-out is accessible.
    - Trimmed to 8-12” above basin bottom.

Phase 2: Post-Construction

- Basin outflow stabilization missing

What if the project site has multiple phases?

- If basins are anticipated to be in Active Construction for an extended period, or will have periods of no construction between build-out of different phases:
  - Regular inspections are still expected.
  - Regular maintenance should occur.
    - Mowing to prevent unwanted vegetation growth.
    - Clear debris
- Remember, you still have an active Construction Stormwater Permit.

Phase 2: Post-Construction

- If the project lasts for several years, vegetation management can become an issue.

- Establish regular mowing or vegetation control schedule early to avoid growth of unwanted vegetation.

Phase 2: Post-Construction

- Vegetation management
- Underdrain stub protections
- Sediment accumulation at in-flow points
- Outlet control structure protections

Phase 3: Long-Term Maintenance

- Begins when all construction is complete, basin is fully stabilized, and NOT has been filed.
- Developer/contractor hands basin ownership over to HOA or property owner.
  - O&M Manual is updated to reflect final conditions and is provided to HOA/Property Owner
    - Representatives sign, date, notarize & record
    - O&M Manual is legally attached to the property so basin can be maintained in perpetuity

What Makes a Good O&M Manual?

- See Technical Standards Manual for O&M Manual requirements.
- Adequately describes BMP location or has an easy to read map.
- Properly describes BMP as it was installed.
  - As-built plans
- Maintenance is specific to BMP.
- Inspection form is specific to BMP.

I. INSPECTION AND MAINTENANCE REQUIREMENTS

Subsequent to successful installation of Post-construction BMPs, they need to be inspected and maintained regularly in accordance with the Operation and Maintenance Manual required to be prepared for each BMP. An operations and maintenance (O&M) manual for all private infrastructure, including but not limited to pipes, ponds, ditches, and BMPs (when required), shall be submitted for the final plan approval and permit process. The manual will become a maintenance guide for the drainage infrastructure once development is complete. The final O&M manual will be provided to the County in both hard copy and digital formats. The O&M manual maintenance agreement along with a site map showing the BMP locations shall be recorded with the final plat. The O&M manual will include the following:

1. name, address, business phone number, home phone number, email address, cellular phone number, pager number;
2. Site drawings (8½" by 11" or 11" by 17"), showing both plan and cross-section views, showing the infrastructure and applicable features, including dimensions, easements, outlet works, forebays, signage, etc., as well as an overall site map of the development showing all structures;
3. Guidance on owner-required periodic inspections;
4. Requirement of owner to perform maintenance specified by County inspection, if any;
5. Guidance on routine maintenance, including mowing, litter removal, woody growth removal, signage, etc.;
6. Guidance on remedial maintenance; such as inlet replacement, outlet works maintenance, etc.;
7. Guidance on sediment and trash removal, both narrative and graphical, describing when sediment removal should occur in order to ensure that BMPs and other infrastructure remain effective as water quality and/or quantity control devices;
8. A statement that the County's representatives have the right to enter the property to inspect the infrastructure;
9. A tabular schedule showing inspection and maintenance requirements; and

Phase 3: Long-Term Maintenance

- Common issues:
  - Mowing frequency or infrequency
  - Invasive species
  - Trees
  - Debris blockages
  - Underdrain failure

Phase 3: Long-Term Maintenance

Phase 3: Long-Term Maintenance

Upcoming Efforts from Monroe County Stormwater Program:

- Detention Pond Inventory
  - Score each pond – prioritize for more in-depth inspections
- Official Inspections
  - Historical investigation
  - Send report with maintenance needs
- Detention Pond 101 workshops

Questions, Comments, Concerns??

Contact Info:

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