# CASE STUDIES FOCUSED ON LONG TERM INSPECTION AND MAINTENANCE OF POST-CONSTRUCTION BMP'S IN HAMILTON COUNTY

Hamilton County Planning + Development

Stormwater + Infrastructure Division

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DRAINS TO WATERWAYS

# POST CONSTRUCTION BMP's

1. Long Term Performance
2. Maintenance
3. Enforcement

# HISTORY
# HAMILTON COUNTY
# STORM WATER REGULATIONS

1. Hamilton County Storm Water Drainage System Regulations
   - Water Quantity Requirements

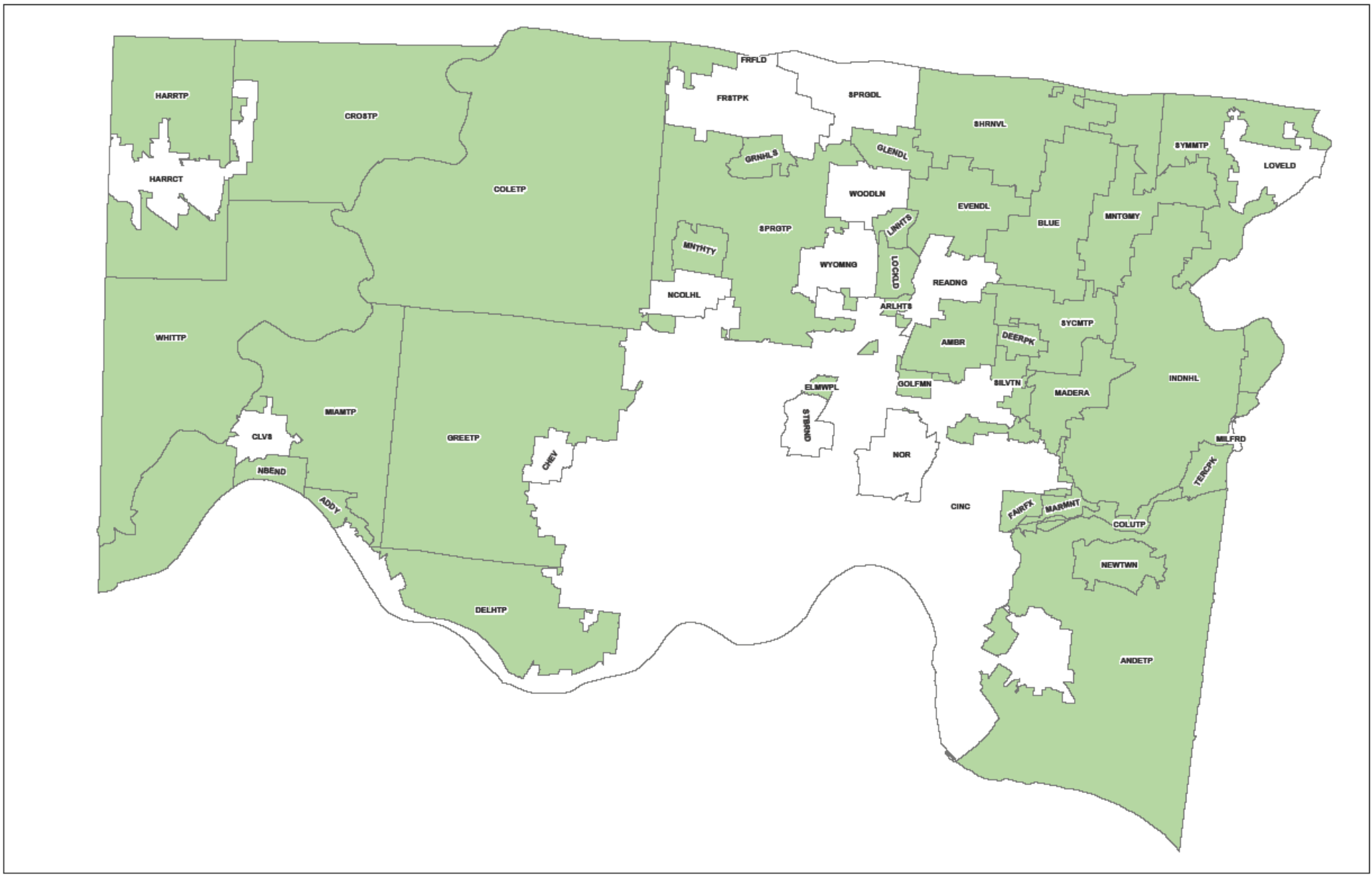
2. Post Construction Water Quality Regulations.

3. Stream Corridor Regulations

# Major Elements of Hamilton County Storm Water Drainage System "SDS" Regulations

1. Detention required on all development redevelopment
2. Design requirements for both minor and major systems (i.e.. Flood routing)
3. Regulations apply to both public and private drainage systems.

# TOWNSHIPS AND MUNICIPALITIES



# Responsibilities

Plan Review/Approval:

- ODOT - Highways
- HCE - County Roads
- P&D - All Others

Operation & Maintenance:

- ODOT - Highways
- HCE - County Roads
- P&D & Townships split systems on township roads.
- Private - Owner

# What does each Permit Require for Post Construction?

## Regulated Township/City/Village

### Quality

**Post Construction BMP Regulations**

- Applicable when >1 ac is disturbed
- Stormwater Pollution Prevention Plan (SWP3)
- BMP design/calculations to treat Water Quality Volume
- O&M Plan to Ensure Long Term functionality of BMP
- Structural or Non-Structural BMPs allowed
- Innovative BMPs allowed when compliant with OEPA's CGP
- Inspection of BMPs during and after construction

### Quantity

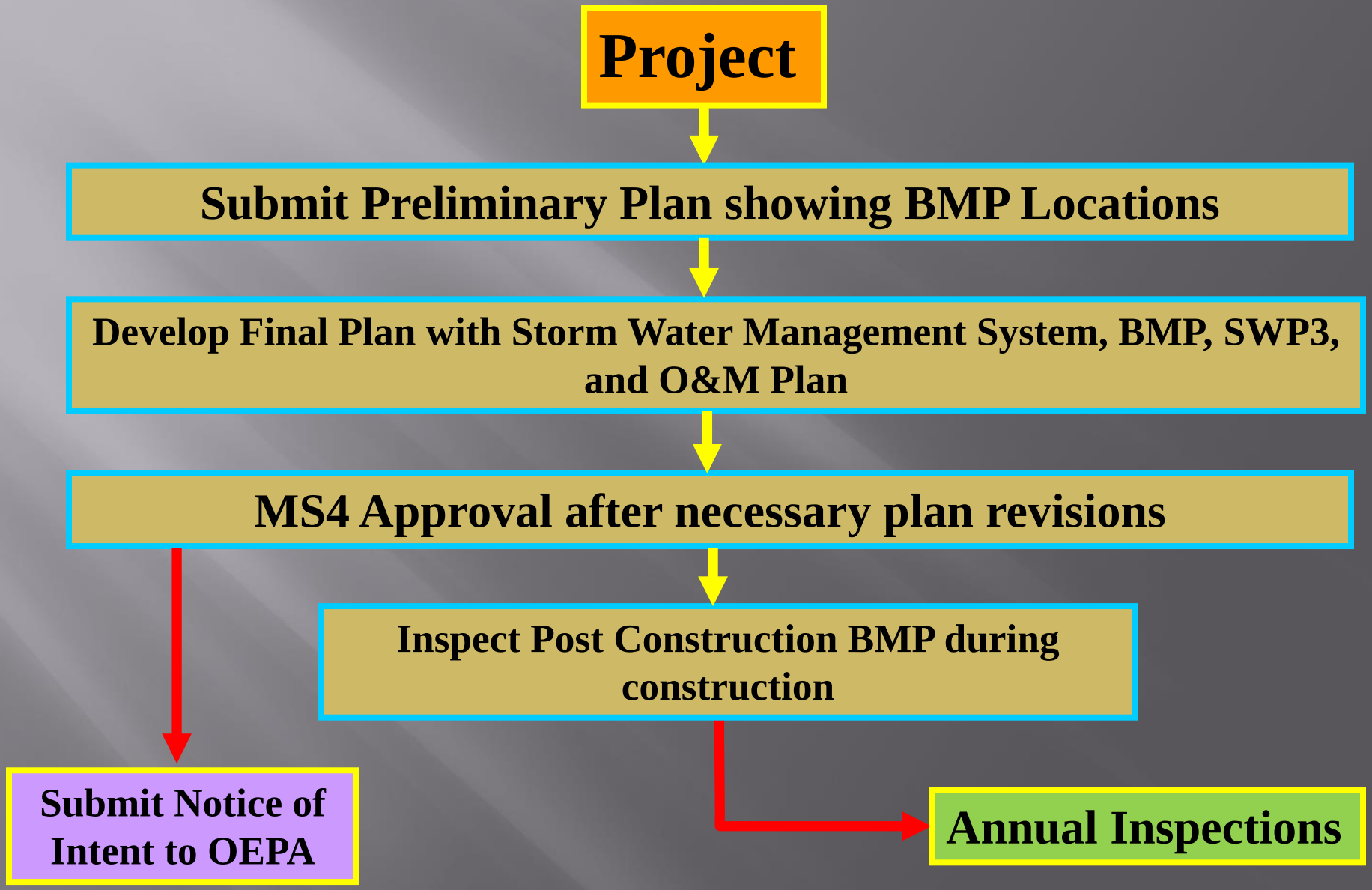
**Hamilton County SDS Regulations**

- Detailed Storm System Drawings
- Detention/Retention Basin design and calculations
- Storm Sewer design and calculations
- Inspections of Storm System during construction for compliance with Approved Plans.

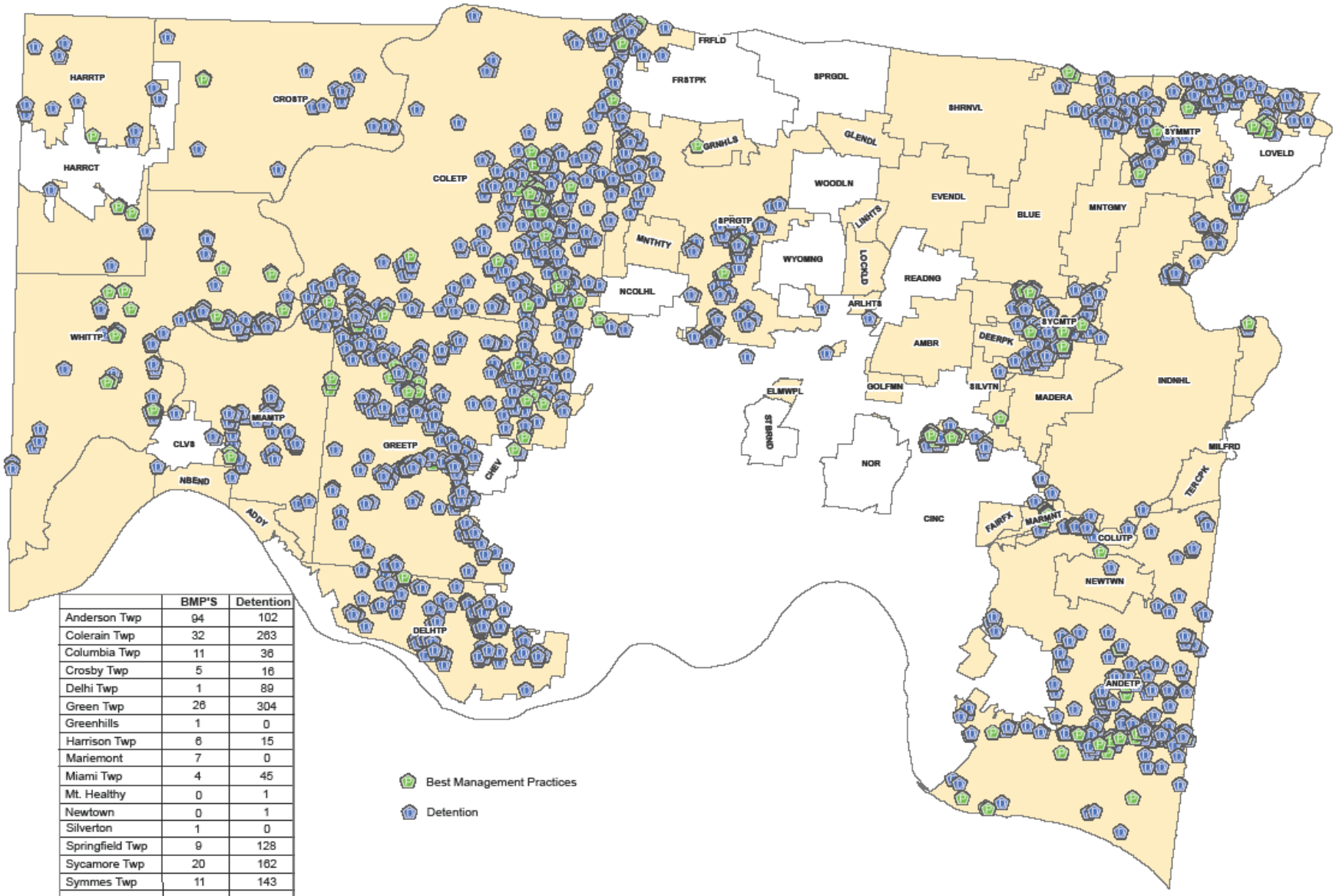
## Commonalities

- Inspections during construction
- Post-Construction BMP Inspections
- Allow retention/detention and infiltration systems
- Encourage wet ponds for extended detention

# Permit Flowchart



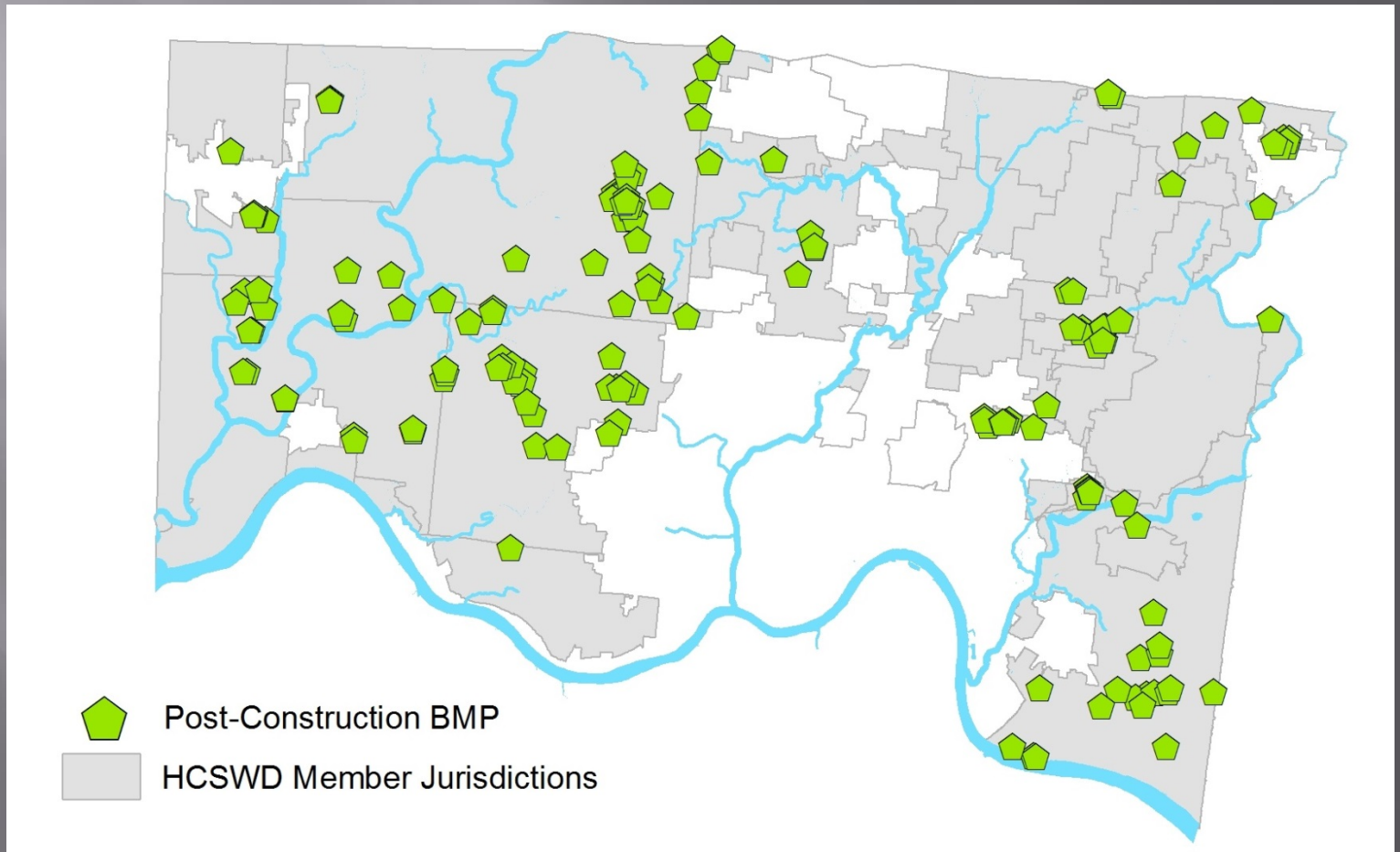
# DETENTION BASINS AND POST CONSTRUCTION BMPS IN HAMILTON COUNTY




| | BMP'S | Detention |
|---|---|---|
| Anderson Twp | 94 | 102 |
| Colerain Twp | 32 | 263 |
| Columbia Twp | 11 | 36 |
| Crosby Twp | 5 | 16 |
| Delhi Twp | 1 | 89 |
| Green Twp | 26 | 304 |
| Greenhills | 1 | 0 |
| Harrison Twp | 6 | 15 |
| Mariemont | 7 | 0 |
| Miami Twp | 4 | 45 |
| Mt. Healthy | 0 | 1 |
| Newtown | 0 | 1 |
| Silverton | 1 | 0 |
| Springfield Twp | 9 | 128 |
| Sycamore Twp | 20 | 162 |
| Symmes Twp | 11 | 143 |
| Whitewater Twp | 15 | 64 |
| Total | 243 | 1369 |

# TYPES OF POST CONSTRUCTION BMPS APPROVED

65 – Dry Extended Detention
48 – Underground Detention
16 – Dry Wells
15 – Inlet Filters (4 sites)
6 – Wet Extended Detention
6 – Raingarden/Bioretentions
4 – Infiltration Basin/Trench
4 – Pervious Pavement
3 – Hydrodynamic Separators
1 – Rainwater Cistern



# POST-CONSTRUCTION STRUCTURAL BEST MANAGEMENT PRACTICES

*Raingarden*

*Retention Pond*

**Example Post-Construction BMP's**

# Structural Post Construction BMPs

## Pervious Pavement

### Background Information

- Temporarily store runoff, allowing pollutant filtration and groundwater infiltration.
- Discharge water through infiltration or underdrain.
- Can be used independently, for runoff reduction, or in conjunction with other BMPs

# Structural Post Construction BMPs

## Infiltration Practices

**Background Information**

- Treat storm water through a filtering substrate (sand, gravel or soil).
- Discharges into the ground water.
- Requires appropriate soils and geology to ensure success.


Infiltration Trench Area

# Structural Post Construction BMP's

## Dry Extended Detention Basin

**Background Information**

- Detains and releases run-off WQv slowly over 48 hours
- Two methods are available:
  - Above ground – Preferred method when feasible.
  - Below ground – Useful in urban/specific situations.

# Structural Post Construction BMP's

## Wet Extended Detention Basin (Retention)

**Background Information**

- Capture and release 100% of the WQv slowly over 24 hours (outlet control required)
- Provides permanent storage for at least 100% of the WQv.
- The full storage depth ranges from 3-6 feet .

# Structural Post Construction BMP's

## Bioretention

**Background Information**

- Treats storm water via specific soils.
- Uses a perforated underdrain or catch basin as an outlet.
- Specially selected plant species utilized to maximize treatment/infiltration and provide the appearance of normal landscaping.
- Designed to store 100% of the WQv prior to filtration.
- Total filtration should occur within 48 hours.

# Post Construction BMP Inspection

- Compile report of all BMPs using GIS database.
- Generate inspection sheet for each BMP.
- Inspection performed and pictures taken.
- Inspection results added to existing database.
- Letters sent to owners of BMPs that need maintenance.

- BMP scored on a scale 0-3 in 13 categories
- 0 – Good Condition
- 1 – Acceptable, monitor for future issues
- 2 – Needs maintenance
- 3 – Immediate maintenance/repair needed
- Comments section provided to record details for each inspection category.

# BMP Inspection Scoresheet

## Storm Water Post-Construction BMPs INSPECTION CHECKLIST

**Hamilton County Department of Planning & Development**

| | | | | | |
|---|---|---|---|---|---|
| PWSD Number: | | | Post-Construction BMP | | Score: |
| Project Name: | | | No Post-Construction BMP | | N/A = Not Applicable |
| Inspection Date: | | | | | 0 = In Compliance (No Issues) - Good Condition |
| Inspector: | | | | | 1 = Monitor For Future Problems - Acceptable Condition |
| Address: | | | | | 2 = Routine Maintenance – Need Improvement |
| | | | | | 3 = Immediate Maint. Or Repair Needed – Bad Condition |

Structure Type(s):

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dry Basin | | | Device-Contech Type Product | | | Rain Garden | | | Media Filter | |
| | Wet Basin | | | Underdrain | | | Infiltration Basin | | | Biofilter | |
| | Inline Pipe | | | Drywell | | | Pervious Pavement | | | Constructed Wetland | |
| | Stormtech System | | | Inlet Filters | | | Swale/Strip BMP | | | Other | |

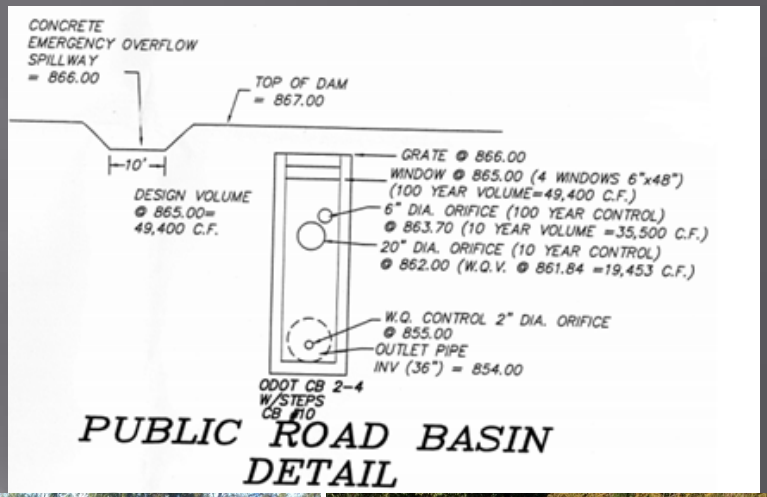
| Item No | | Control Structure | Comments |
|---|---|---|---|
| | Type: | | |
| | Description: | | |
| 1 | Trash Present: | | |
| 2 | Any Erosion: | | |
| 3 | Grass/Ground Cover Condition: | | |
| 4 | Standing Water (More than 3 days in pond): | | |
| 5 | Displaced Rip Rap: | | |
| 6 | Grease/Oil Present | | |
| 7 | Emerg. Spillway Clear of Debris: | | |
| 8 | Inlet Clear of Debris: | | |
| 9 | Outfall Clear of Debris: | | |
| 10 | Low Flow Orif. Clear of Debris or Clogged: | | |
| 11 | Structure Sumps Greater Than 50% Full of Sediment: | | |
| 12 | Underdrain/Dewatering System Functioning: | | |
| 13 | Post-Constr. Standpipe Clean/Functioning: | | |
| 14 | Other (Specify in Comments): | | |
| | Total Score: | | |

# Mercy West Hospital

- Dry Detention Pond & Underground Detention
- Dry basin built in 2011
- Underground basin converted from dry basin in 2016
- Treat 11 acre and 20 acre drainage areas

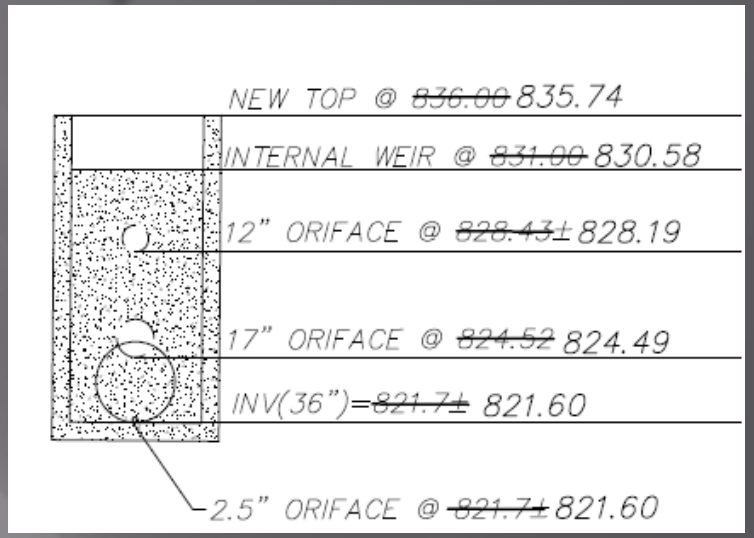
# Mercy West Hospital – Dry Basin

- Total Volume = 49,400 cf
- WQv = 19,453 cf
- Inspection Scores:
  - 2015 – 6
  - 2017 – 6
  - 2018 – 12
- Inlet/Outlet clogging and sediment issues ongoing.
- Trash, erosion, and ground cover issues in 2017 & 2018.
- 2" orifice in face of Outlet Control Structure (OCS).




# Mercy West Hospital – Underground System

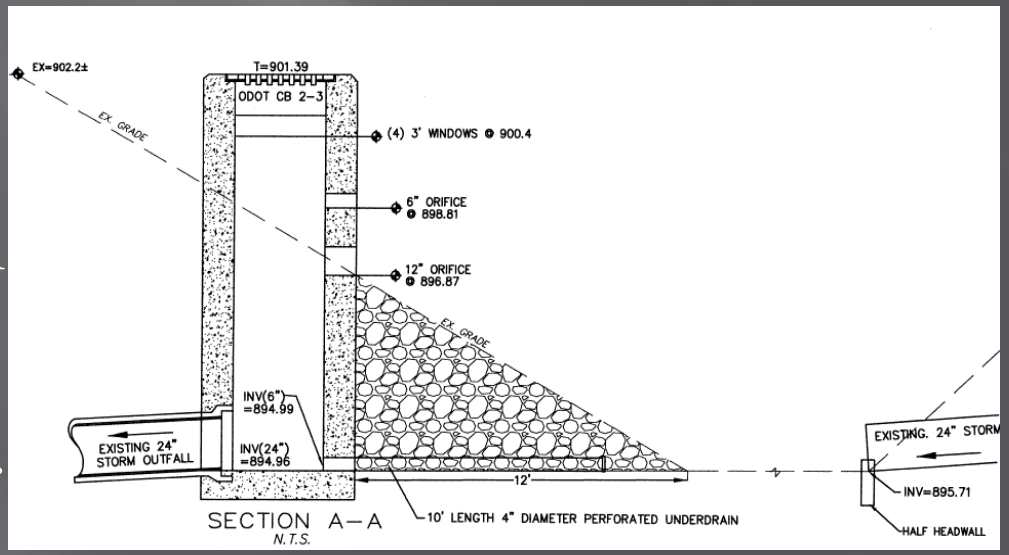
- Converted from dry basin in 2016 to add additional parking
- Total Volume = 131,432 cf
- WQv = 35,283 cf
- Inspection Scores:
  - 2018 – 0
- Largest underground detention system in Hamilton County
- No maintenance issues.
- 2.5” orifice in internal weir wall of OCS.




# Mercy West Hospital – Underground System


# Artis Senior Living

- Dry detention basin installed in 2015.
- Total Volume = 24,113 cf
- WQv = 8,471 cf
- Inspection Scores:
  - 2017 – 12
  - 2018 – 6
- Erosion, overgrown vegetation, sedimentation, inlets & outlets clogged.
- Control structure condition improved 2017-2018.
- 4" perforated pipe under washed gravel WQ control.



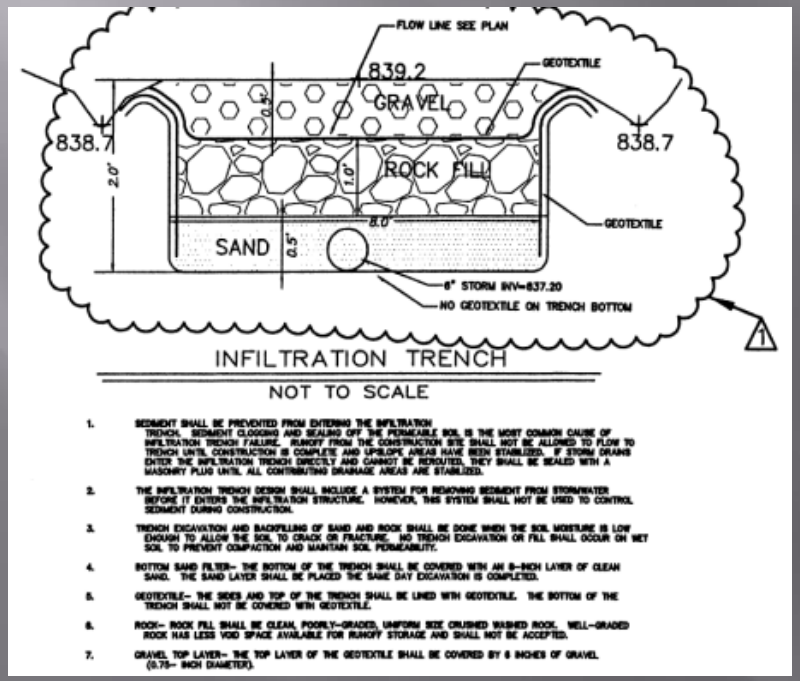
# Artis Senior Living

*October 2016*

*October 2018*

# Blue Ash Self Storage

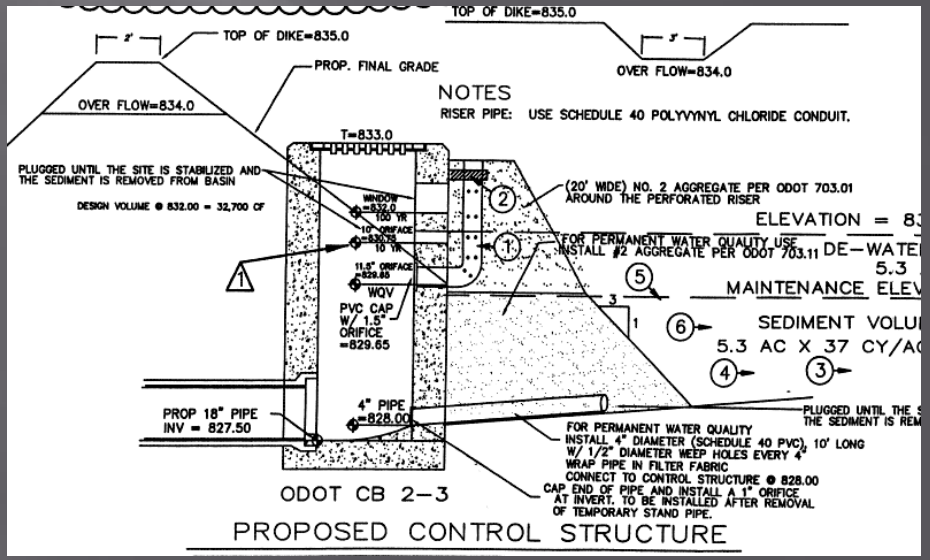
- 1 Dry Detention Basin and 1 Infiltration Trench installed in 2013.
- Treat an 8 acre site




1. SEDIMENT SHALL BE PREVENTED FROM ENTERING THE INFILTRATION TRENCH. SEDIMENT CLOGGING AND SEALING OFF THE PERMEABLE SOIL IS THE MOST COMMON CAUSE OF INFILTRATION TRENCH FAILURE. RUNOFF FROM THE CONSTRUCTION SITE SHALL NOT BE ALLOWED TO FLOW TO TRENCH UNTIL CONSTRUCTION IS COMPLETE AND UPSLOPE AREAS HAVE BEEN STABILIZED. IF STORM DRAINS ENTER THE INFILTRATION TRENCH DIRECTLY AND CANNOT BE REROUTED, THEY SHALL BE SEALED WITH A MASONRY PLUG UNTIL ALL CONTRIBUTING DRAINAGE AREAS ARE STABILIZED.
2. THE INFILTRATION TRENCH DESIGN SHALL INCLUDE A SYSTEM FOR REMOVING SEDIMENT FROM STORMWATER BEFORE IT ENTERS THE INFILTRATION STRUCTURE. HOWEVER, THIS SYSTEM SHALL NOT BE USED TO CONTROL SEDIMENT DURING CONSTRUCTION.
3. TRENCH EXCAVATION AND BACKFILLING OF SAND AND ROCK SHALL BE DONE WHEN THE SOIL MOISTURE IS LOW ENOUGH TO ALLOW THE SOIL TO CRACK OR FRACTURE. NO TRENCH EXCAVATION OR FILL SHALL OCCUR ON WET SOIL TO PREVENT COMPACTION AND MAINTAIN SOIL PERMEABILITY.
4. BOTTOM SAND FILTER– THE BOTTOM OF THE TRENCH SHALL BE COVERED WITH AN 8–INCH LAYER OF CLEAN SAND. THE SAND LAYER SHALL BE PLACED THE SAME DAY EXCAVATION IS COMPLETED.
5. GEOTEXTILE– THE SIDES AND TOP OF THE TRENCH SHALL BE LINED WITH GEOTEXTILE. THE BOTTOM OF THE TRENCH SHALL NOT BE COVERED WITH GEOTEXTILE.
6. ROCK– ROCK FILL SHALL BE CLEAN, POORLY–GRADED, UNIFORM SIZE CRUSHED WASHED ROCK. WELL–GRADED ROCK HAS LESS VOID SPACE AVAILABLE FOR RUNOFF STORAGE AND SHALL NOT BE ACCEPTED.
7. GRAVEL TOP LAYER– THE TOP LAYER OF THE GEOTEXTILE SHALL BE COVERED BY 6 INCHES OF GRAVEL (0.75– INCH DIAMETER).

# Blue Ash Storage – Dry Basin

- Total Volume = 25,591 cf
- WQv = 6,400 cf
- Inspection Scores:
  - 2015 – 8
  - 2017 – 25
  - 2019 – 23
- Sediment Basin standpipe was never switched to Post Construction Water Quality Control.
  - Prevented the basin from functioning as a dry basin
  - Oversight/miscommunication between agencies/inspectors.
- Inlets clogged, outlet clogged, trash, and overgrown vegetation are ongoing issues.



# Blue Ash Storage – Dry Basin

*October 2015*

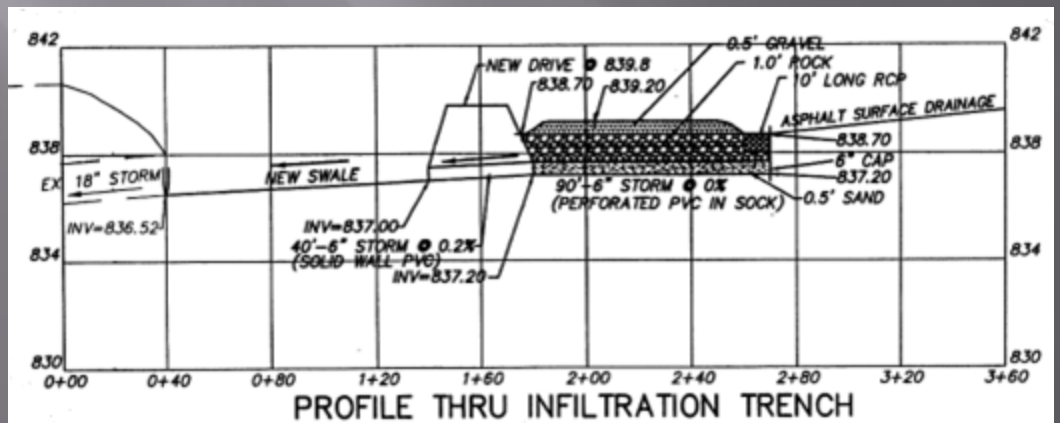
*March 2018*

# Blue Ash Storage – Infiltration Trench

- Redeveloped WQv treated = 288 cf
- 6″ underdrain outlet
- Inspection Scores:
  - 2015 – 0
  - 2018 – 1
- 2018 - Minor sediment deposits in gravel

*October 2015*

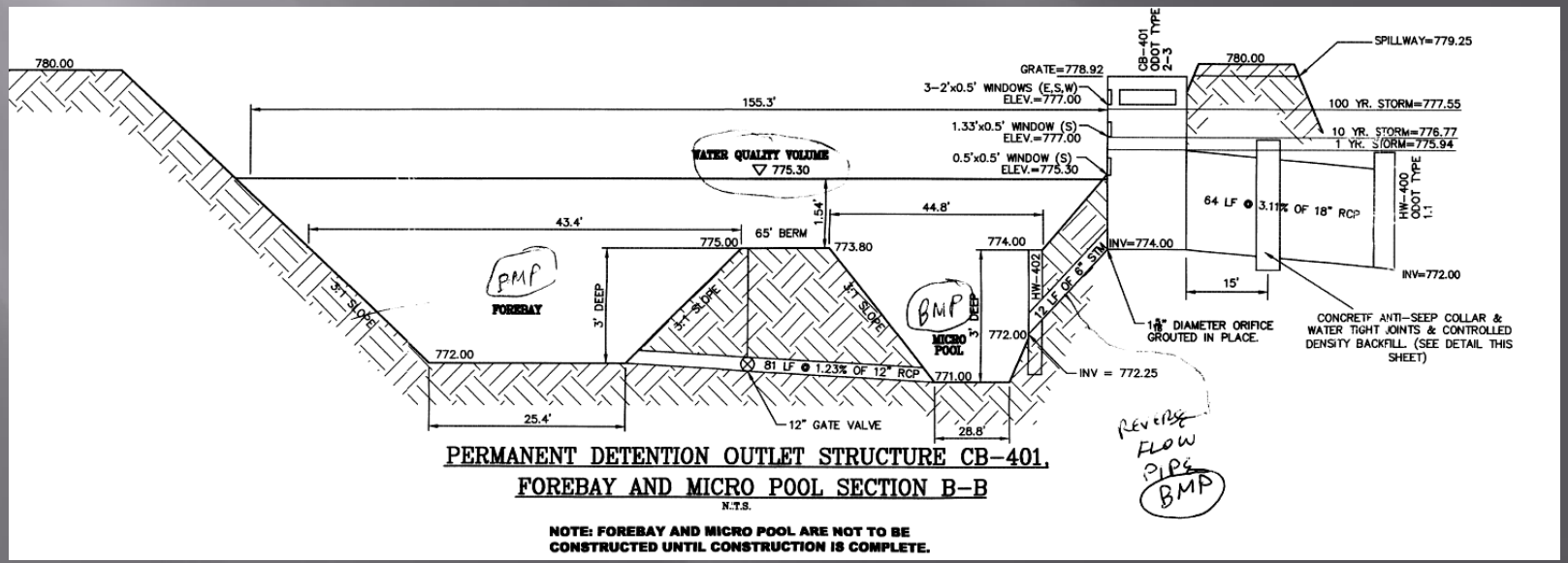
*December 2018*



# Alois Alzheimer Center

- 1 Dry Detention Basin installed in 2010.
- 8.11 ac drainage area
- Total Volume = 15,390
- WQv = 4,792

- Inspection Scores:
  - 2015 – 12
  - 2017 – 13
  - 2018 – 19
- Erosion, ground cover, WQ control and standing water are ongoing issues.



# Alois Alzheimer Center

*October 2015*

*December 2018*

# Crossroads Church

- 1 Wet Basin, 1 Dry Basin
- Installed in 2016
- Both basins treating roughly 3 acres.
- WQ controls are 1.65” and 1” orifice in the face of the OCS.

# Crossroads Church – Wet Basin

- Inspection Score:
  - 2018 – 0
- No issues, in great condition.

*September 2016*

*October 2018*

*Outlet Pipe installation – August 2016*

# Crossroads Church – Dry Basin

- Inspection Scores:
  - 2017 – 4
  - 2018 – 2

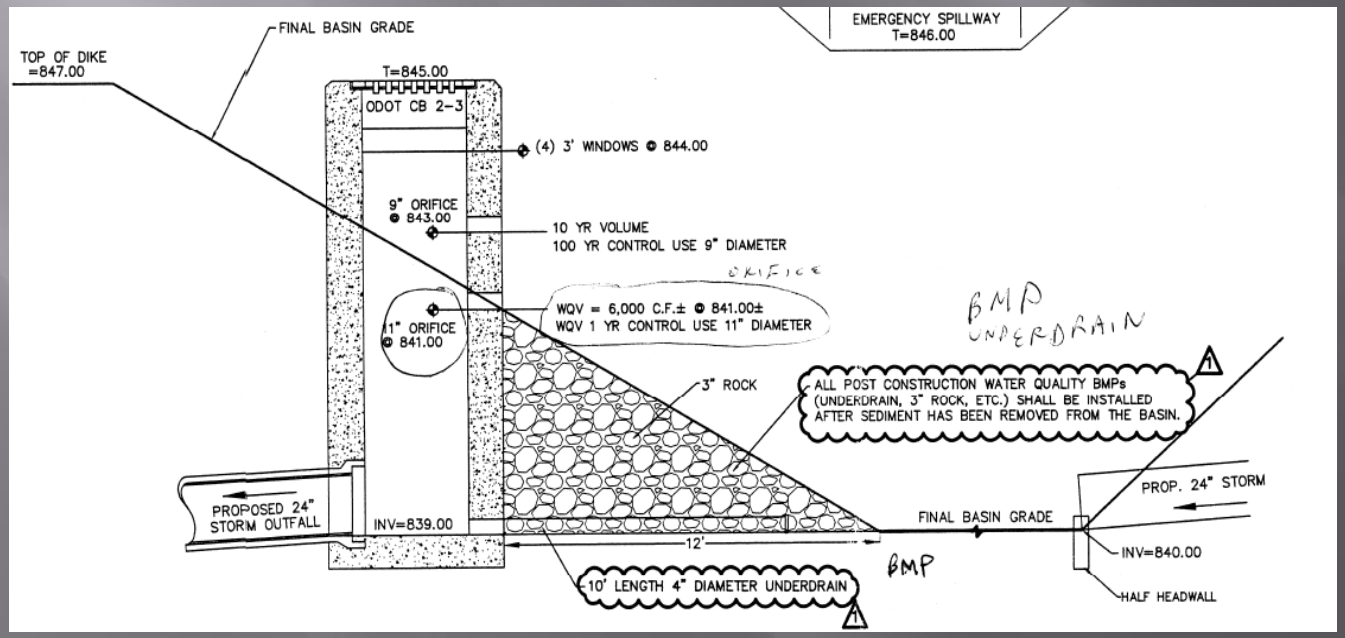
*March 2017 (after heavy rain)*

- Erosion and overgrown vegetation issues in 2017.
- Vegetation only issue in 2018.

*October 2018*

# Liberty Nursing

- Dry Detention Basin installed in 2014
- 6.5 ac drainage area
- Total Voume = 15,000 cf
- WQv = 5,875 cf
- 4” perforated pipe under washed gravel
- Inlet/Outlet/WQ Control clogged, erosion, vegetation, sediment, and standing water issues all 3 years.




Inspection Scores:

- 2015 – 12
- 2017 – 22
- 2018 – 23

# Liberty Nursing

*October 2015*

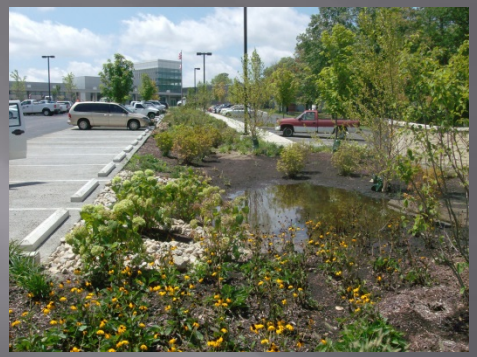
*December 2018*

# Diamond Oaks

- Rain Garden with Pervious Pavement
- Rainwater Collection System
- Both Installed in 2011
- 2.23 acre drainage area to rain garden
- Rainwater collected from 0.13 acres of roof used for irrigation.

# Diamond Oaks – Rain Garden

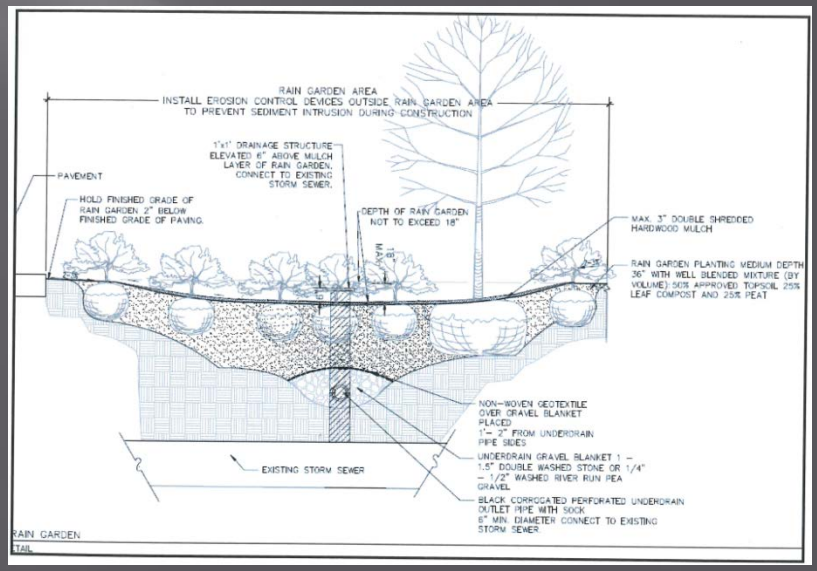
- Inspection Scores:
  - 2015 – 0
  - 2017 – 0
  - 2018 – 0
- Pervious pavement drains into rain garden.
- Rain garden drains through underdrain and catch basin 6″ above grade.



*2011*

*2018*

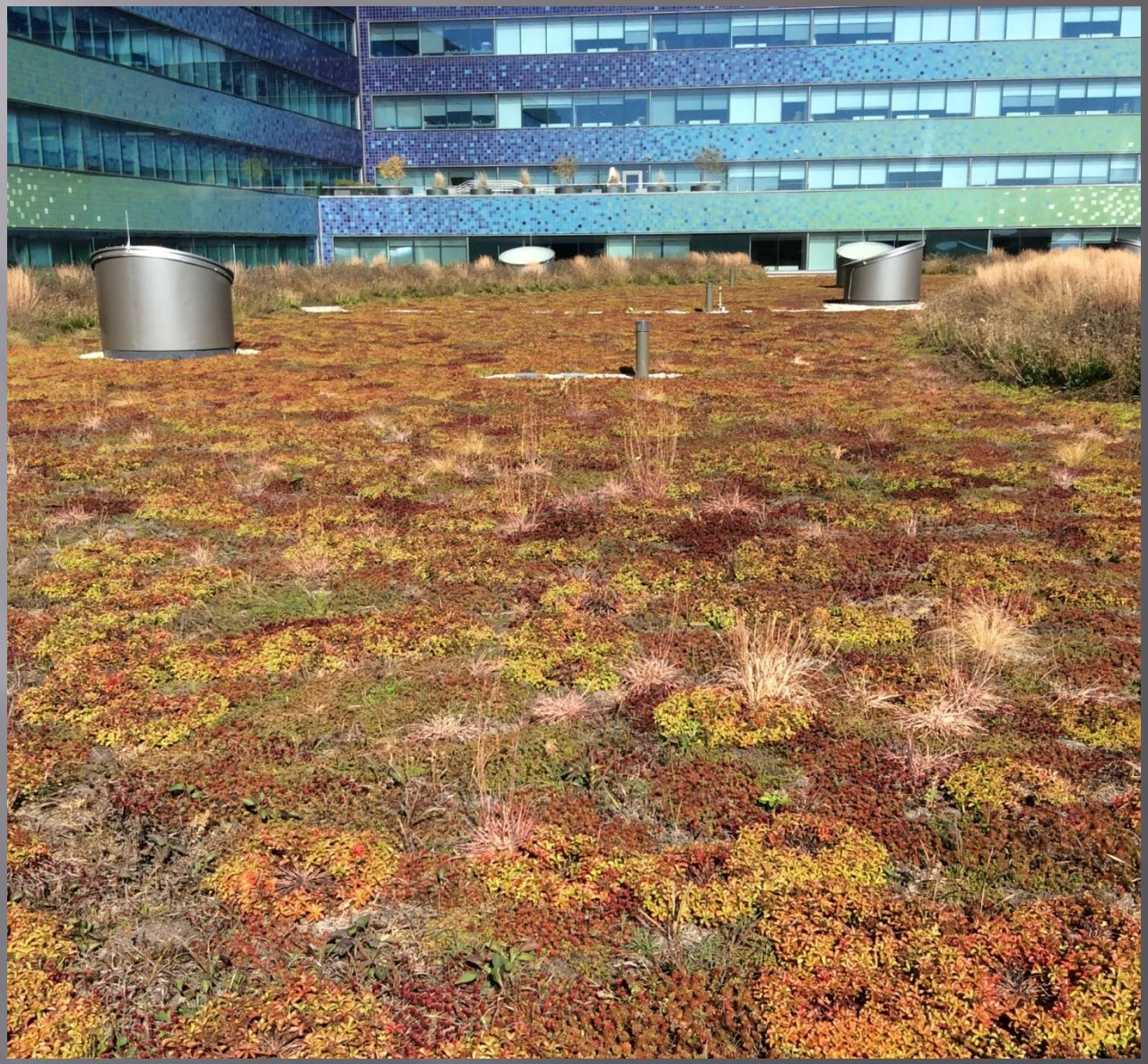
*Underdrain Installation*



# Rainwater Cistern

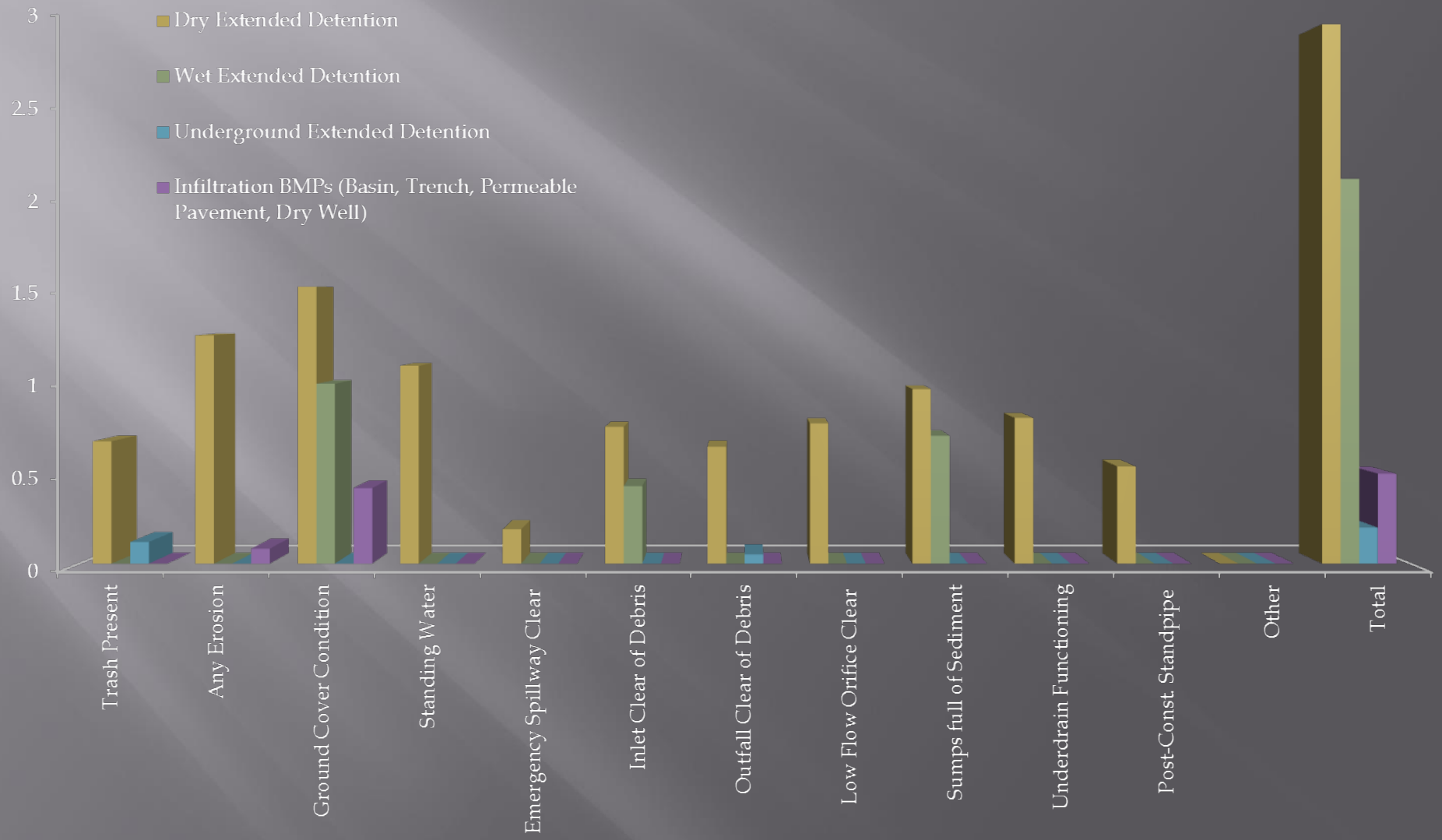
- Collects all downspout runoff from a 5,600 sf building addition.
- School uses rainwater for irrigation.

# Roof Garden

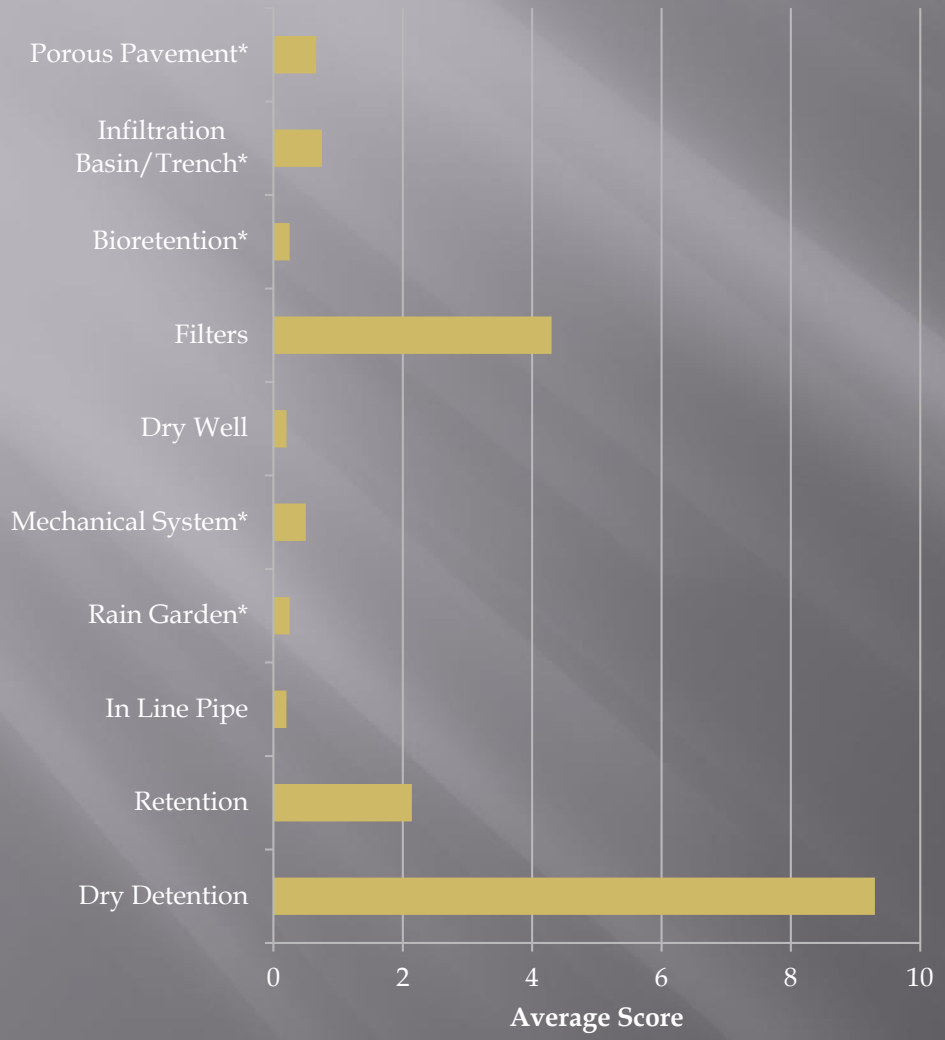


# 2018 Inspection Results

## Score by Category

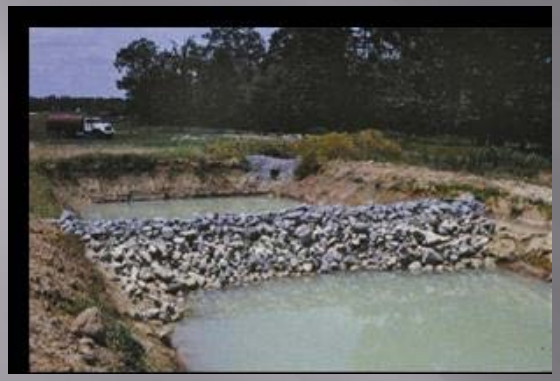


# 2018 Inspection Results




*Denotes 5 or less inspected

- Dry detention problems generally caused my lack of basic maintenance and small WQ/Low-flow orifices.
- Wet detention basins fare much better than dry basins.
- Inlet filters (no longer acceptable with 2018 CGP) were all removed or completely clogged.



# Questions and Answers