

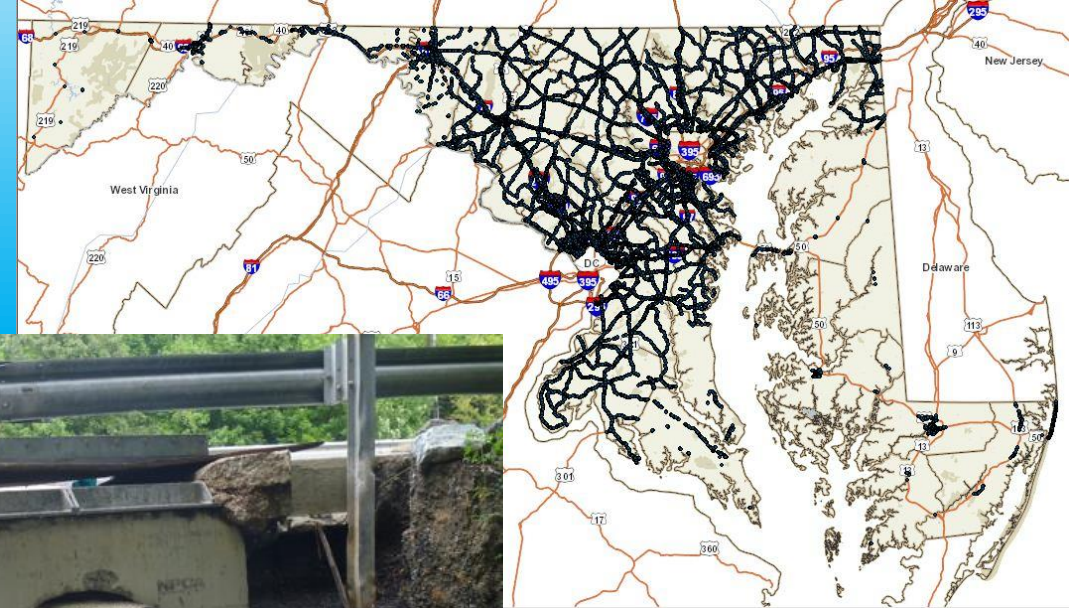
Drainage and SWM Maintenance of Today and Tomorrow



HIDDEN THREATS TO THE ROADS

Storm drains have been a part of the roadway plans since roadways were designed, at MDOT SHA prior to 1980 they helped get water off the roads and control flooding.

- As of June 30 2018 nearly 168,500 hydraulic structures and over 141,000 conveyance features (over 9 million LF)
- Inventory of all structures and conveyances has been completed but requires consistent updates.



HIDDEN THREATS TO THE ROADS

How are structures degrading over time?

- 💧 Poor Joints in concrete pipes
- 💧 Widespread use of CMP's in corrosive soils or abrasive environment
- 💧 Drainage on interstates and major road expansions built in the 1950's and 1960's are now reaching past their life cycles
- 💧 Drainage Infrastructure Design Life is generally 50 to 100Years



THE FUTURE IS COMING

For the Hidden Threats to the Roads

- 💧 Structure location information available for ArcGIS thru KML files.
- 💧 ArcGIS On Line account information coming SOON to access LIVE DATA
- 💧 In Development
 - 💧 General Permit for Ditch Trimming and Dredging
 - 💧 Standard Plans for ESC activities
 - 💧 Operations Manual Section on Repairing Minor Drainage Structures
 - 💧 Operations Manual Section on Repairing Pipe and/or Box Culverts
 - 💧 Operations Manual Section on Ditching with Excavator or Grader
 - 💧 Operations Manual Section on Hand Cleaning Ditches



LIVING MDOT SHA FACILITIES

SWM facilities have been designed and constructed by MDOT SHA since 1982 to control water quantity and quality of the roadway runoff.

- As of June 2018 nearly 8,500 permanent stormwater management/ESD facilities

Dry Swale



Infiltration

Bio-Retention



Ponds Retention/
Extended Detention

LIVING MDOT SHA FACILITIES

The Drainage and Stormwater Asset Management Program was developed in 1999 just prior to the 2000 regulations that took effect for stricter water quality requirements. It was developed to:

- 💧 Sustain and enhance SWM Facilities Performance
- 💧 Comply with NPDES Permit
 - 💧 Inventory, inspect, evaluate all SWM facilities
 - 💧 Perform routine maintenance annually
 - 💧 Identify and perform required repair work
 - 💧 Reinspect every 3 years
 - 💧 Improve water quality of highway runoff
 - 💧 Protect sensitive water resources.

Annual Report

October 9, 2018

National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System
Permit No. 11-DP-3313 MD0068276
Permit Term
October 2015 to October 2020

Submitted to:
Sediment, Stormwater, and Dam Safety Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Submitted by:
Maryland Department of Transportation
State Highway Administration
Office Of Environmental Design
707 North Calvert Street, C-303
Baltimore, MD 21202

MDOT
MARYLAND DEPARTMENT
OF TRANSPORTATION
STATE HIGHWAY
ADMINISTRATION

LIVING MDOT SHA FACILITIES

Tri-Annual BMP Inspection

- 💧 When We're In Your neighborhood
- 💧 Focus on Preventative Maintenance
- 💧 2019 record year with nearly 6,000 inspections



Keep THIS....



From Becoming THIS....

LIVING MDOT SHA FACILITIES

Tri-Annual BMP Inspection Issues

💧 We may need your help



Standard Resettable Combination
Lock set to District Combo



Can't Get there from Here



No Access Full of Water
Pumping Needed

LIVING MDOT SHA FACILITIES

Once Inspections are Complete, Action Ratings are Assigned

💧 I – Routine Maintenance

- 💧 schedule for annual maintenance in next cycle
- 💧 Mowing
- 💧 Trash and debris removal
- 💧 Vegetation management/ clearing
- 💧 Fencing and Access Repairs



💧 II - Minor Maintenance Activities Coordination

- 💧 **attention needed** to sustain BMP performance- vegetation management, mowing, trash removal, minor sediment removal, wildlife control (beaver issues)
- 💧 Invasive species, brush and tree removal
- 💧 Stabilization of eroded areas with matting & seeding or stone
- 💧 Inlet and pipe cleaning
- 💧 Patching
- 💧 Sediment Removal

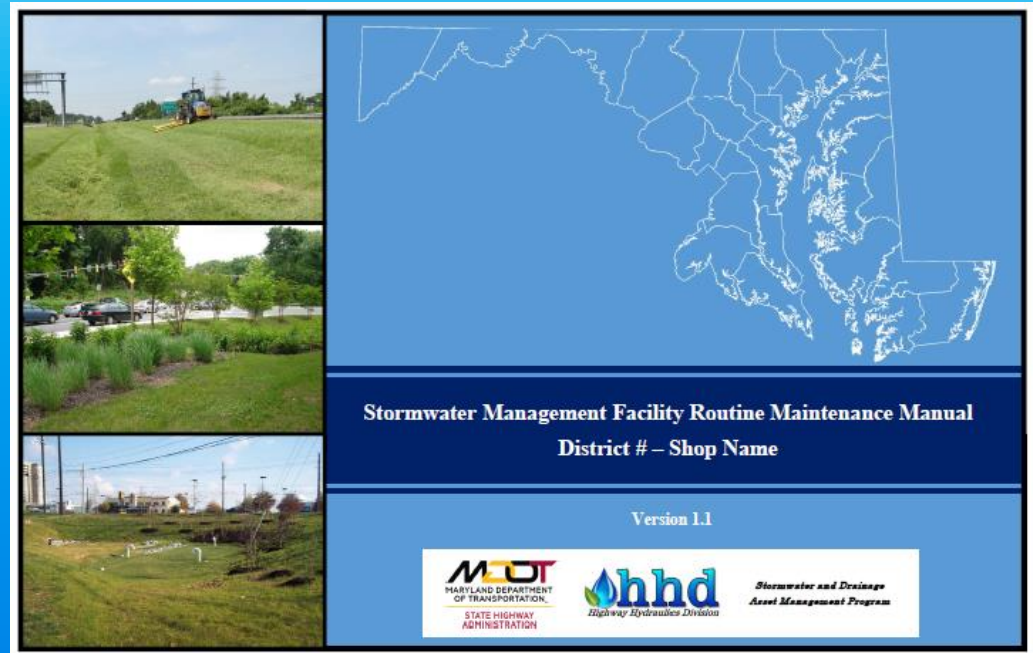
MAKING YOUR JOBS EASIER...WE HOPE

SWM Facility Routine Maintenance Manuals are Available

- Provide Feedback for your shop and your crews abilities

- Types of SWM Facilities

- Dry Pond
- Wet Pond
- Infiltration Facility
- Filtration Facility
- Bio-Swale
- Turfgrass Facility – follow standard turfgrass maintenance guidelines



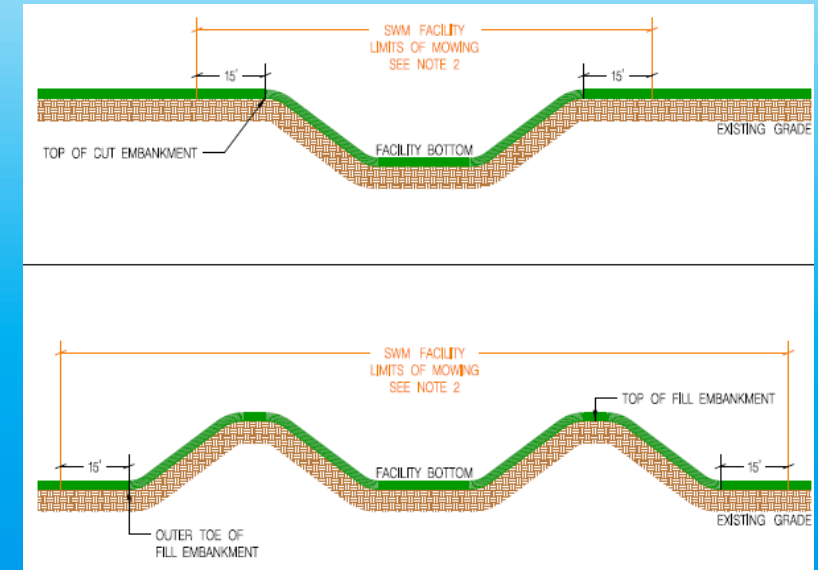
Can be Found ON-LINE at:

<https://www.roads.maryland.gov/Index.aspx?PageId=363>

THE DETAILS OF SWM MAINTENANCE

Dry Pond

- Should hold runoff temporarily and release fully. Generally appears as a grass basin with no permanent pool of water.
- Spring Maintenance
 - Check for deterioration to structures and report any as needed.
 - Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures
 - Remove accumulated sediment
 - Check embankments and eliminate any burrows or holes; seed bare spots and install matting; and report any soft spots or seepage
- Fall Maintenance
 - Mow herbaceous vegetation within 15-feet of the facility embankment limits to a height of 6-inches
 - Seed bare spots and install matting
 - Fill eroded areas with topsoil to restore. If an area adjacent to existing rip rap shows degradation, stabilize with additional rip rap.
 - Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures
- Verify facility is not holding water after 72 hours and report if found



THE DETAILS OF SWM MAINTENANCE

Wet Pond

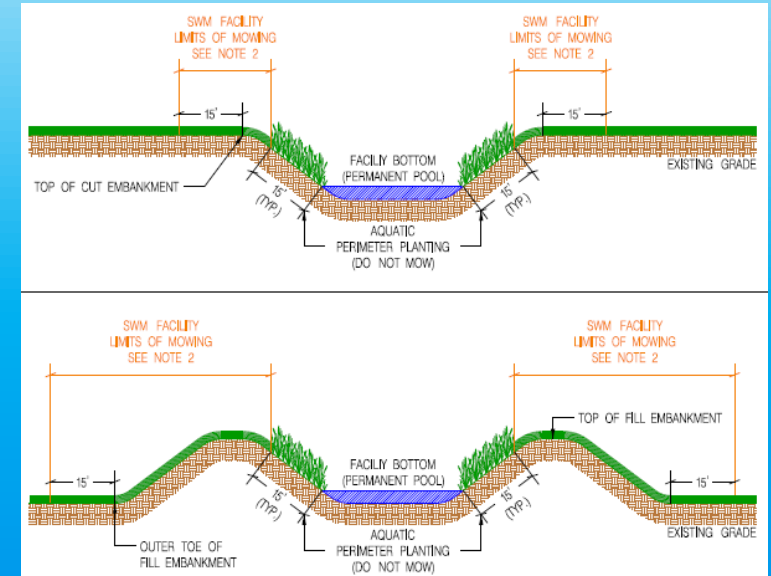
- Should hold a certain amount of runoff permanently. Generally includes a grass embankment and unmowed 15-foot aquatic perimeter around a pool of water.

Spring Maintenance

- Check for deterioration to structures and report any as needed.
- Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures
- Remove accumulated sediment
- Check embankments and eliminate any burrows or holes; seed bare spots and install matting; and report any soft spots or seepage

Fall Maintenance

- Mow herbaceous vegetation within 15-feet of the facility embankment limits to a height of 6-inches
 - Seed bare spots and install matting
 - Fill eroded areas with topsoil to restore. If an area adjacent to existing rip rap shows degradation, stabilize with additional rip rap
 - Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures
- Verify that pond drain opening in the riser is completely sealed



THE DETAILS OF SWM MAINTENANCE

Infiltration Facility

- Should release runoff thru media in order to soak into the ground directly. These may be ditches or basins and have grass or stone bottoms with an observation well.

Spring Maintenance

- Check for clogs then clear vegetation, trash and debris from facility and associated structures
- Replenish stone if necessary
- Check for deterioration and damage to structures and report, replace any broken/missing observation well caps
- Remove accumulated sediment
- Check embankments and eliminate any burrows or holes; seed bare spots and install matting; and report any soft spots or seepage

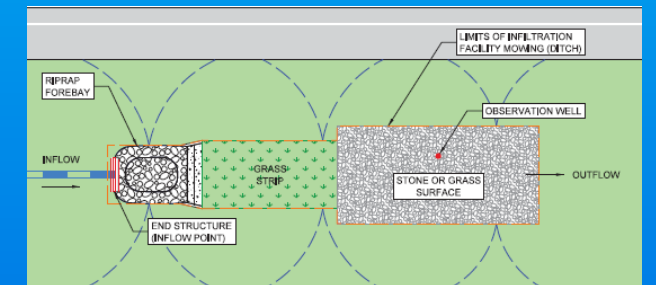
Fall Maintenance

- Mow herbaceous vegetation within 15-feet of the facility embankment limits to a height of 6-inches
- Seed bare spots and install matting
- Fill eroded areas with topsoil to restore. If an area adjacent to existing rip rap shows degradation, stabilize with additional rip rap
- Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures

- Facility type very prone to clogs at outflows and leaf/sediment/debris build up at bottom



Infiltration Trench



THE DETAILS OF SWM MAINTENANCE

Filtration Facility

- Should release runoff thru a filter bed in order to be carried away by underdrains. Generally include cleanouts above the surface and may be fully vegetated or mulched

Spring Maintenance

- Check for clogs then clear vegetation, trash and debris from facility and associated structures
- Replenish mulch if present
- Check for deterioration and damage to structures and report, replace any broken/missing cleanout caps
- Remove accumulated sediment
- Check embankments and eliminate any burrows or holes; seed bare spots and install matting; and report any soft spots or seepage

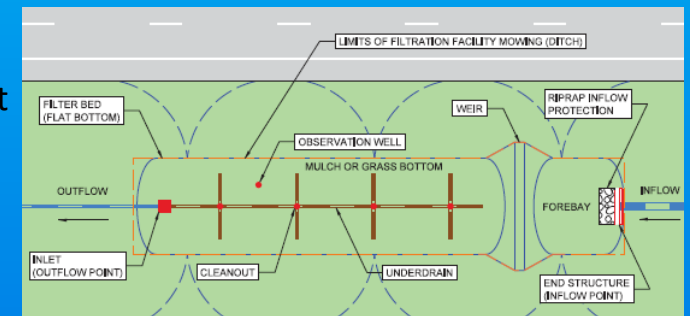
Fall Maintenance

- Mow herbaceous vegetation within 15-feet of the facility embankment limits to a height of 6-inches. Do NOT mow over filter bed limits (bottom of the facility)
- Seed bare spots and install matting
- Fill eroded areas with topsoil to restore. If an area adjacent to existing rip rap shows degradation, stabilize with additional rip rap
- Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures

- Facility type very prone to clogs at outflows or underdrains and leaf/sediment/debris build up at bottom.



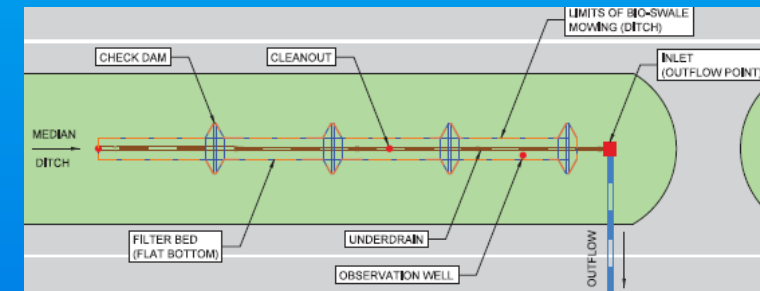
Bioretention Facility



THE DETAILS OF SWM MAINTENANCE

Bio-Swale

- Specific type of filtration facility located in a ditch. Generally includes check dams along the length to create temporary ponding. Functionally similar to Dry Swales.
- Spring Maintenance
 - Check for clogs then clear vegetation, trash and debris from facility and associated structures
 - Check for deterioration and damage to structures and report, replace any broken/missing cleanout caps
 - Remove accumulated sediment
- Fall Maintenance
 - Mow herbaceous vegetation within the facility to a height of 6-inches. Do NOT mow over filter bed limits (bottom of the facility.) Side slopes above facility should follow standard MDOT SHA Turfgrass Guidelines.
 - Seed bare spots and install matting
 - Fill eroded areas with topsoil to restore. If an area adjacent to existing rip rap shows degradation, stabilize with additional rip rap
 - Check for clogs then clear vegetation, trash and debris from pond, trash rack, riser and other structures
- Facility type very prone to clogs at outflows or underdrains and leaf/sediment/debris build up at bottom.



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems - Erosion

- Very common problem especially along ditches or embankments. Can occur when soils are not properly compacted or vegetation doesn't establish. Small problems can become large if not treated quickly.

Problem	Solution
Minor Erosion	Fill eroded area with Furnished Topsoil as necessary to restore the original ground surface. If it is adjacent to existing rip rap, stabilize with Class I. Otherwise, re-seed with Turfgrass Seed Mix and Type 'A' Matting.
Major Erosion	Report to HHD



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Sediment Accumulation

- ◆ Sediment accumulation can be a major problem because it slows infiltration and other functions. If found sediment should be removed from forebays, outfalls and other areas around SWMFACs

Problem	Solution
Minor Sediment Accumulation	Remove minor sediment accumulated with a shovel. If necessary, re-seed the area with Turfgrass Seed Mix and Type 'A' Matting
Major Sediment Accumulation	Report to HHD

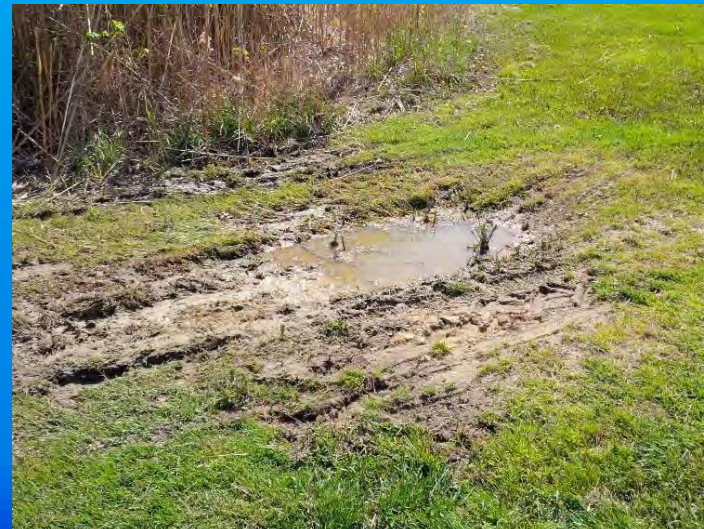


THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Lack of Vegetation

- Most commonly identified by areas of bare soil and is a problem because it leads to erosion which leads to sediment accumulation. Small areas are common and easily remedied, large areas could be a larger issue.

Problem	Solution
Small Area of Bare Soil	Re-seed the bare area with Turfgrass Seed Mix and Type 'A' Matting
Large Area of Bare Soil	Report to HHD



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Excess Vegetation

- Excess vegetation causes major issues of blocking pipes, structures and weirs; interfering with filter media; interfering with inspection routes and access; and decreasing available storage volume.

Problem	Solution
Excess Vegetation	Clear the vegetation with a weed Trimmer



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Structure Damage

- Large debris, ice, soil settlement or other issues can cause damage to end structures, pipes, observation wells. Structure and pipe maintenance is important to ensure proper water collection and conveyance.

Problem	Solution
Damaged or deteriorated structure or pipe	Report to Resident Maintenance Engineer to determine how to repair



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Unstable Embankment

- Failure of an embankment which holds water in the facility can result in water escaping in problematic ways and not managing flooding as needed. Identifying potential problems such as soft spots, depressions, seepage, erosion and holes is very important.

Problem	Solution
Animal Burrows or Other Holes	Mud-pack using 9 parts subsoil and 1 part cement in a mud-like slurry. Place a 24-inch long 6-in. diameter smooth pipe vertically into the hole with a tight fit. Pour slurry until full, then remove pipe. Tamp opening with subsoil and compact. Cover tamped area with 2 in. topsoil and permanently stabilize.
Minor Erosion	Fill eroded area with Furnished Topsoil as necessary to restore the original ground surface. If it is adjacent to existing rip rap, stabilize with Class I. Otherwise, reseed with Turfgrass Seed Mix and Type 'A' Matting
Soft Spots, Depressions, Seepage or Other Problems	Report to HDD



THE DETAILS OF SWM MAINTENANCE

Identify and Solve Common Problems – Excess Ponding

- Except Wet Ponds, all other facilities should not have water visible 72 hours after a rain event. Ponding shows that outflow structures may be clogged; sediment or debris has clogged filter materials or underdrains are blocked. Even once resolved these issues should be reported to HHD.

Problem	Solution
Outflow Points are Clogged	Clear clogs in or obstruction to the outflow point(s)
Leaves/Sediment/Debris has Accumulated in Facility Bottom	Remove minor leaf/sediment/debris buildup from the bottom of the facility. Report major buildup to HHD.
Underdrain is Blocked	Clean out the underdrain with a vacuum truck
Filter Media is Clogged or Compacted or Other Problem	Report to HHD



PHYSICAL COPIES DISTRIBUTION

District	Shop Name	Date Manual Received/Anticipated
1	Cambridge	October 2017
1	Princess Anne	October 2017
1	Salisbury	September 2017
1	Snow Hill	October 2017
2	Centerville	October 2017
2	Chestertown	October 2017
2	Denton	October 2017
2	Easton	October 2017
2	Elkton	April 2016
3	Fairland	April 2016
3	Gaithersburg	April 2016
3	Laurel	April 2016
3	Marlboro	April 2016
Total Distributed to date		6

District	Shop Name	Date Manual Received/Anticipated
4	Churchville	April 2016
4	Golden Ring	April 2016
4	Hereford	April 2016
4	Owings Mills	April 2016
5	Annapolis	April 2016
5	Glen Burnie	April 2016
5	La Plata	April 2016
5	Leonardtown	October 2017
5	Prince Frederick	July 2017
6	Hagerstown	April 2016
6	Keyzers Ridge	October 2017
6	La Vale	October 2017
7	Dayton	April 2016
7	Frederick	April 2016
7	Westminster	April 2016
Total Distributed to date		12

💧 **CDs for EVERYONE were distributed**

💧 **All manuals were distributed**

Can be Found ON-LINE at:

<https://www.roads.maryland.gov/Index.aspx?PageId=363>

PERMIT REMINDERS FOR MAINTENANCE

Permit not Required:

- ◆ Mowing
- ◆ Trash and debris removal
- ◆ Vegetation trimming and tree felling
- ◆ Manual Invasive species removal
- ◆ Earth grading < 5000 SQ Ft. and <100 CY
- ◆ Stabilization of eroded areas with matting & seeding or stone – no grading
- ◆ Inlet and pipe cleaning
- ◆ Patching

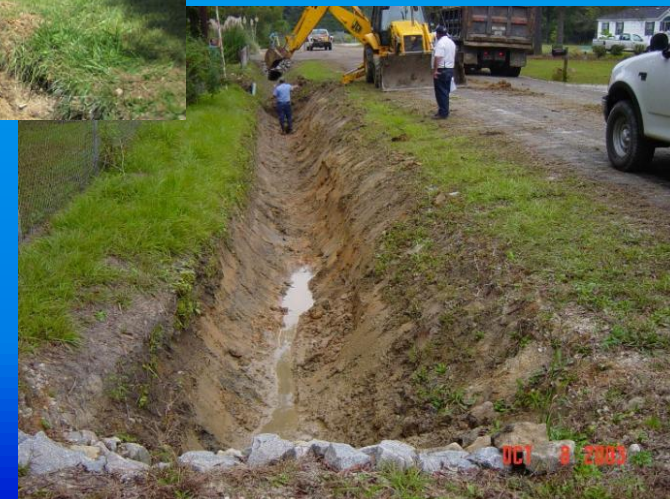
But many of these activities often still require an ESC plan approved by HDD.



PERMIT REMINDERS FOR MAINTENANCE

Earth disturbance of 5,000 sq.ft. or more or 100 c.y. or more of earth movement

- 💧 Dredging
- 💧 Grading / Re-grading
- 💧 Flow Diversion
- 💧 Dewatering/Pumping
- 💧 Slope Stabilization
- 💧 Landscaping
- 💧 Culvert Replacement
- 💧 Structural Repairs
- 💧 Outfalls Repairs
- 💧 Access Road Construction



PERMIT REMINDERS FOR MAINTENANCE JOINT PERMIT APPLICATION (JPA)

Impacts to jurisdictional waters (streams), wetlands, or FEMA floodplain

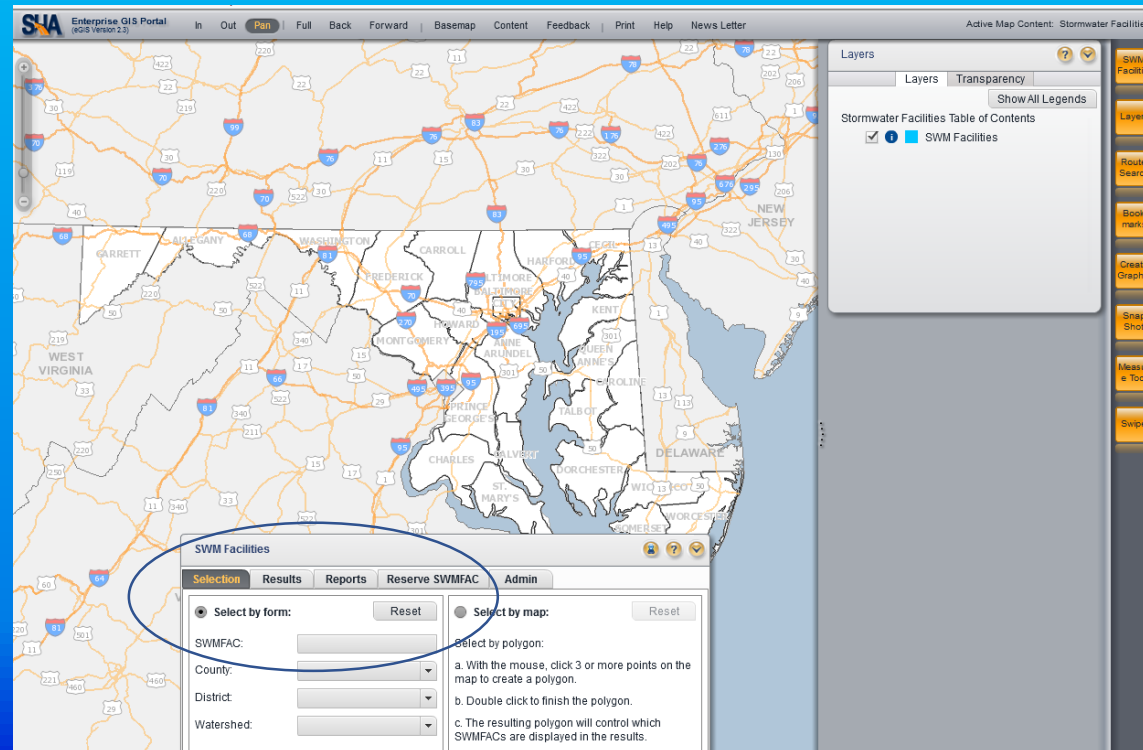
- Stream slope stabilization
- Outfall repair
- Outfall channel stabilization
- Dewatering/ flow diversion
- Drainage systems installation
- Culvert replacement / lining
- Herbicide use at 'wet' facilities (TMP)



WHERE IN THE WORLD IS THAT SWMFAC?

eGIS

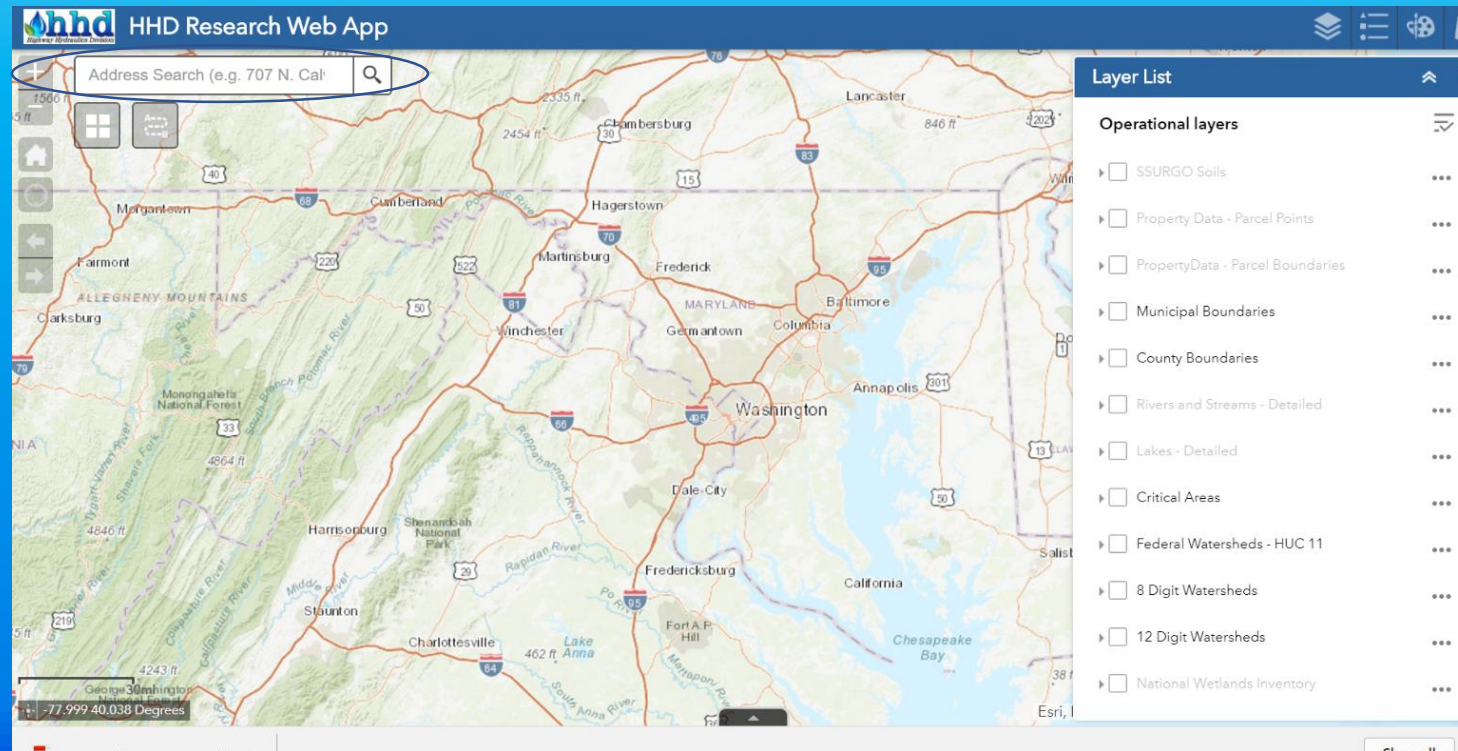
- 🟢 Old Standard Tried and True available from the MDOT SHA network
- 🟢 Use the SWMFAC Content and imagery is also often helpful
- 🟢 Scheduled for replacement with ArcGIS On Line platform



WHERE IN THE WORLD IS THAT SWMFAC?

HHD Web Research App

- 💧 New and Hip!
- 💧 <http://bit.ly/HHD-Research>



WHERE IN THE WORLD IS THAT SWMFAC?

The screenshot displays an aerial map of a highway interchange with several data overlays. A red circle highlights a specific location on the map, and a purple circle highlights a wet pond. A pop-up window provides details for the wet pond:

This Wet pond's Facility No. is 020809. It is in Anne Arundel County in the Patapsco River Area watershed. This facility's plan date is 2000 and its status is listed as Existing.

Facility Number: 020809
Type: Wet pond
Plan Date: 2000
Status: Existing
County: Anne Arundel
Watershed: Patapsco River Area

The legend on the right side of the map includes the following items:

- NPDES - Structures
- NPDES - Conveyance
- NPDES - SWMFAC
- NPDES - Structure Drainage Area
- NPDES - SWMFAC Drainage Area
- SSURGO Soils
- OHD Roadway Projects
- TMDL - Stream Restoration
- TMDL - Stream Site Selection
- TMDL - Grass Swale Planning
- TMDL - Landuse Change BMP
- TMDL - Pavement Removal Site Selection
- TMDL - Stormwater
- TMDL - Stormwater Planning
- Drainage Investigation Locations
- Fund 74 Projects
- High Hazard Dams
- Accidents on Wet Pavement Curves Heat Map
- Property Data - Parcel Points
- PropertyData - Parcel Boundaries

HHD Web Research App

- ▶ Much more overlaid information including
 - ▶ Planned Retrofits and Highway Projects
 - ▶ Drainage Complaint Data
 - ▶ Crash Data because of excess water

WHERE IN THE WORLD IS THAT SWMFAC?

Helping Find BMPs by putting up signs

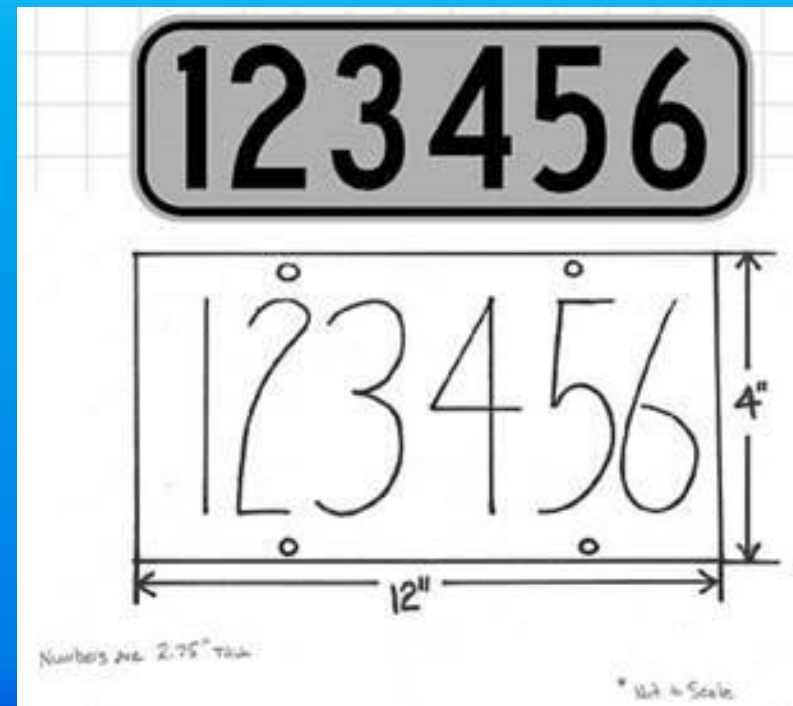
- 💧 Helping you find where you are
- 💧 On the Fence
- 💧 On the Control Structure
- 💧 On a low post



WHERE IN THE WORLD IS THAT SWMFAC?

Sign Design Tips

- The Sign Shop Can Help! Just ask like D1.
- Current Spec 12" x 4" with 2 ¾" Lettering of the 6 digit SWMFAC Number
- Holes will need to be drilled by installer on location



WHERE IN THE WORLD IS THAT SWMFAC?

ArcGIS

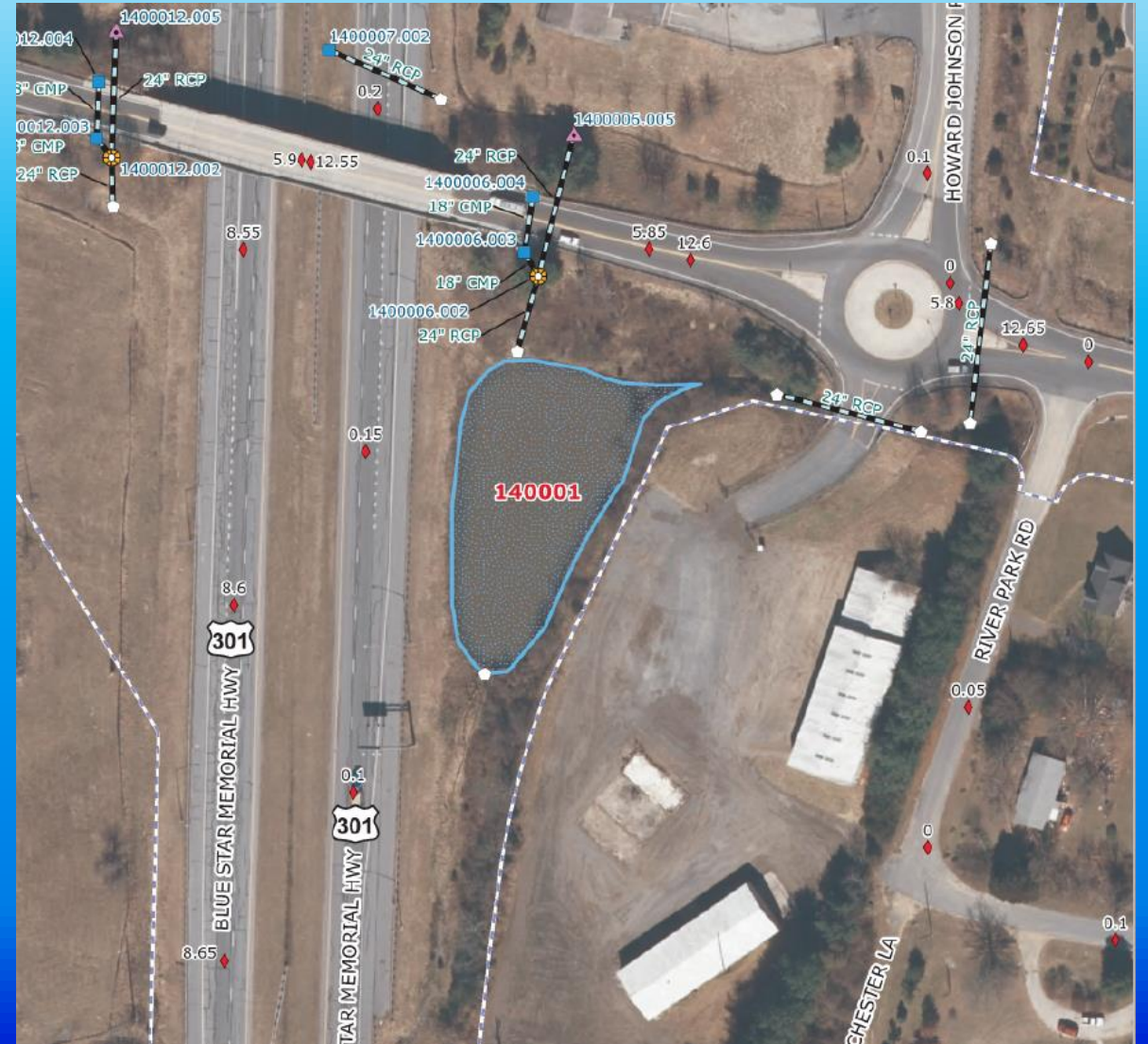
- Very flexible
- Oracle basis
- Transformational

Google Earth

- KMLs have been distributed to RMEs and District Operation Engineers – **IPAD compatible**
- Google Earth provide an alternative to eGIS for spatial information

ArcGIS On Line

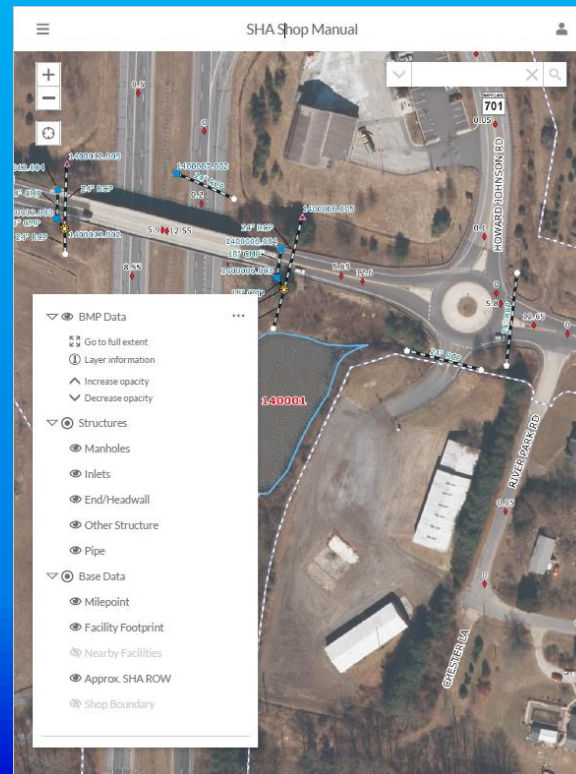
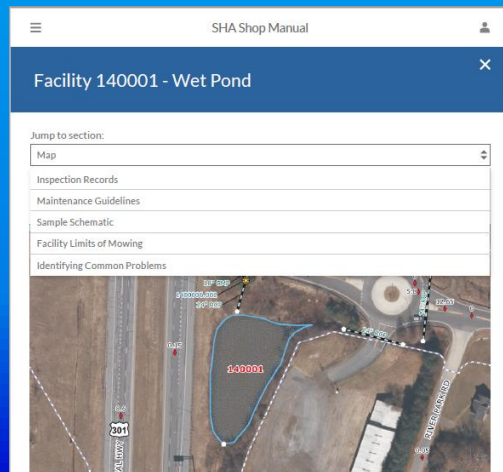
- Expanded Views of Drainage Data
- User Groups will allow access to internal ratings, inspections and MORE
- Contact me for more details and an account



THE FUTURE IS COMING

Ipad App Development Plans

- Find the SWMFAC and Structures via live GPS Data fully searchable.
- Ability to layer map data and select views and overall maps with facility details
- Menus for the following included per facility
 - Inspection Records
 - Maintenance Guidelines
 - Sample Schematic
 - Facility Mowing Limits Schematic
 - Common Problems



THE FUTURE IS COMING

Ipad App Development Plans

- 🟢 Data at your finger tips in the field
- 🟢 Will leverage current AGOL platforms already supported



Inspection Record

▼ 11/13/2014

Last Inspection: 7/24/2014

Latest Rating Record: 11/13/2014

Comments: Eutrophication, vegetate/stabilize downstream embankment, remove debris at outfall.



> 7/24/2014

> 7/15/2013

Maintenance Guidelines

Description and Purpose: Aesthetic and structural maintenance of Wet Ponds.

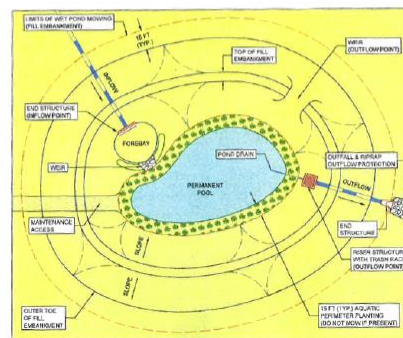
Scheduling: Once each spring (March 15 - May 15) and fall (September 15 - November 15).

Overview Staff / Materials Spring Maintenance Fall Maintenance Troubleshooting

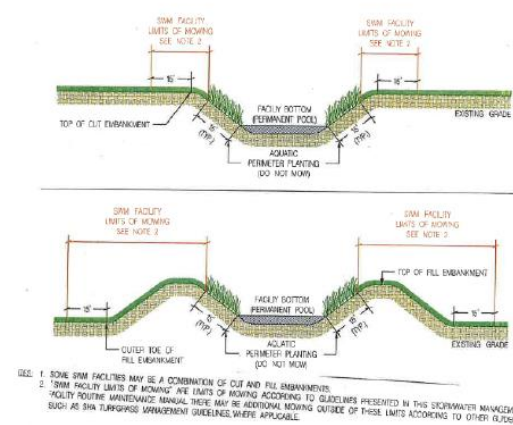
Wet Pond
Similar to a Dry Pond, a Wet Pond is a SWM facility that is designed to hold stormwater runoff then release the runoff over a period of time, with the purpose of removing pollutants and sediment from water and providing flood protection. Unlike a Dry Pond, however, a Wet Pond is designed to permanently hold some volume of water at all times. A Wet Pond generally includes a grassed embankment and aquatic perimeter planting around a pool of water. Wet Ponds should be maintained by following the Wet Pond Routine Maintenance Guidelines.

[Back to Top](#)

Sample Schematic



SWM Facility Limits of Mowing



Identifying and Solving Common Problems

While major issues with SWM facilities are the responsibility of, and should be reported to HHD, minor issues are typically handled by Shop maintenance personnel. The following defines common issues that may be observed at SWM facilities, along with their solutions. Portions of this Section V were adapted from Chapter 7, "Best Management Practice Assessment Guidelines for maintenance and Remediation," of the "Stormwater NPDES Program Standard Procedures Manual" produced by SHA.

Jump to section:

Lack of Vegetation

Lack of Vegetation

Lack of vegetation is most commonly identified by areas of visible bare soil, and is a problem because the bare soil is vulnerable to erosion. While small areas of bare soil are not uncommon in the life-cycle of a SWM facility, large areas of bare soil may indicate that permanent or recurring conditions are not favorable for plant growth. In such cases, the condition should be reported to HHD so that HHD can assess the facility and determine whether there is an underlying issue causing the lack of vegetation.

THE FUTURE IS COMING

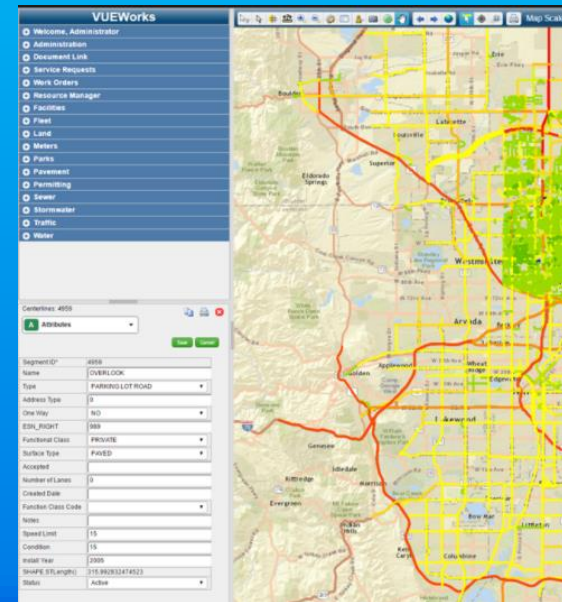
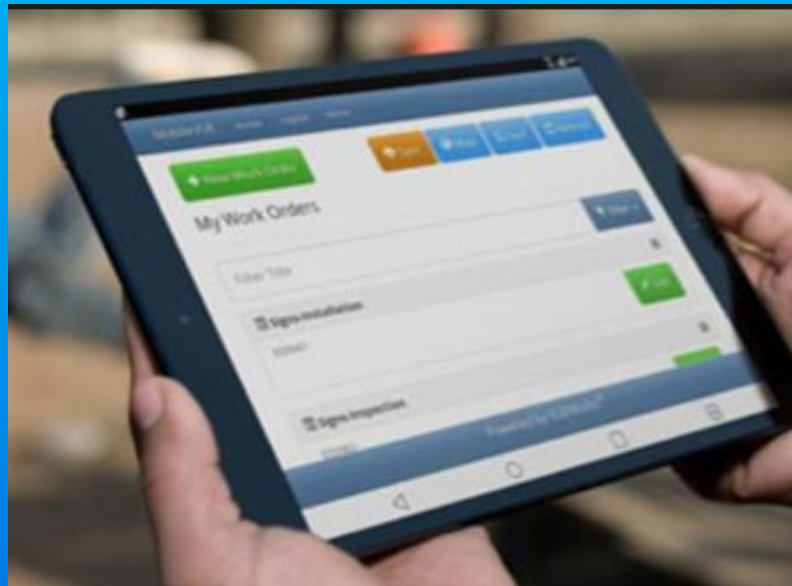
Ipad App Development Plans

- 💧 District 7 Kickoff Jan 2019
- 💧 Get Involved and Add to the List!
 - 💧 The ability to work on line and off line to some degree
 - 💧 Drainage Areas for ponds to aid in diagnosing discharge points (possibly contours)
 - 💧 Outfall locations/ Points of Discharge
 - 💧 All inspection records on a facility visible for historic data that shows how a facility should look when fully functional.
 - 💧 Design Documents that include
 - 💧 Linear feet of constructed pipe
 - 💧 Cross sections of pipes and ditches
 - 💧 Access Mapping from public roadway to facility (may be an ongoing effort to add after launch)
 - 💧 Pipe Inspection data (also may be ongoing to add after launch)
 - 💧 Drainage investigation locations, response reports and any actions taken by HDD

THE FUTURE IS COMING

Upgrades in Technology and Coordination

- Continued Cooperation and Coordination Encouraged
- VUEWorks
 - Current Roll out planned July 2019 thru OOM in Guard Rail and Lighting programs
 - Drainage and SWM Asset Program anticipated in 1-2 years



QUESTIONS



Presented by: Kiona Leah, P.E – Program Manager
410-545-8044 [kleah@shat.state.md.us](mailto:k Leah@shat.state.md.us)