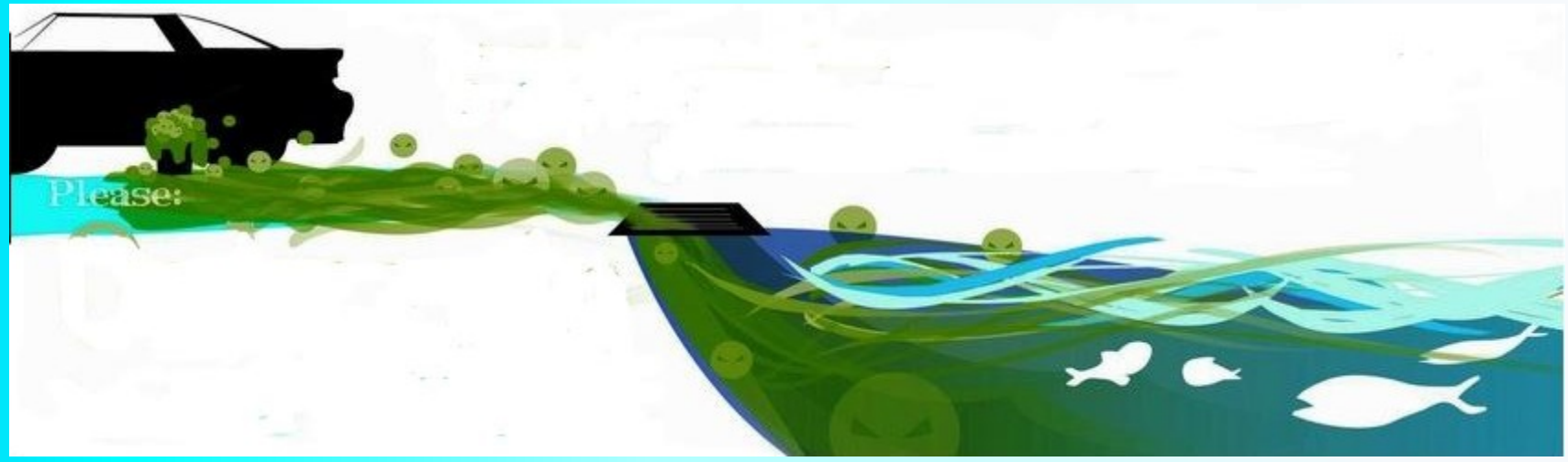
The Evolution of Drainage and Stormwater Assets in Maryland

Kiona Leah, P.E.

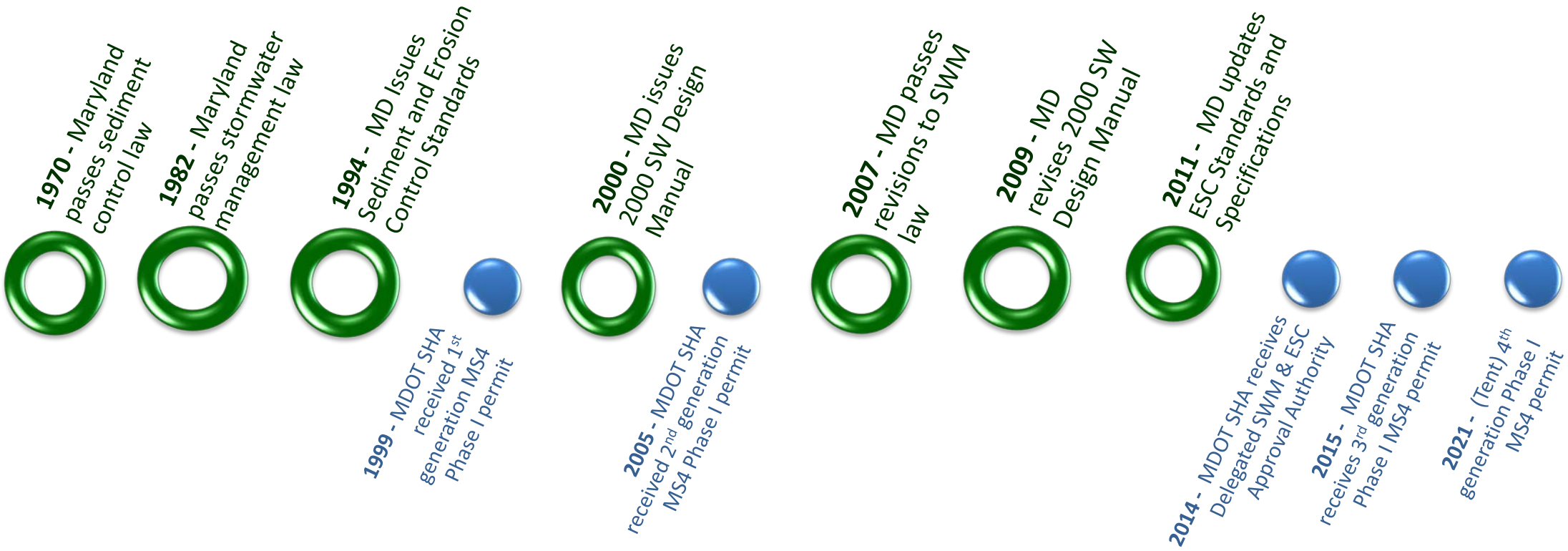


Information development and sharing

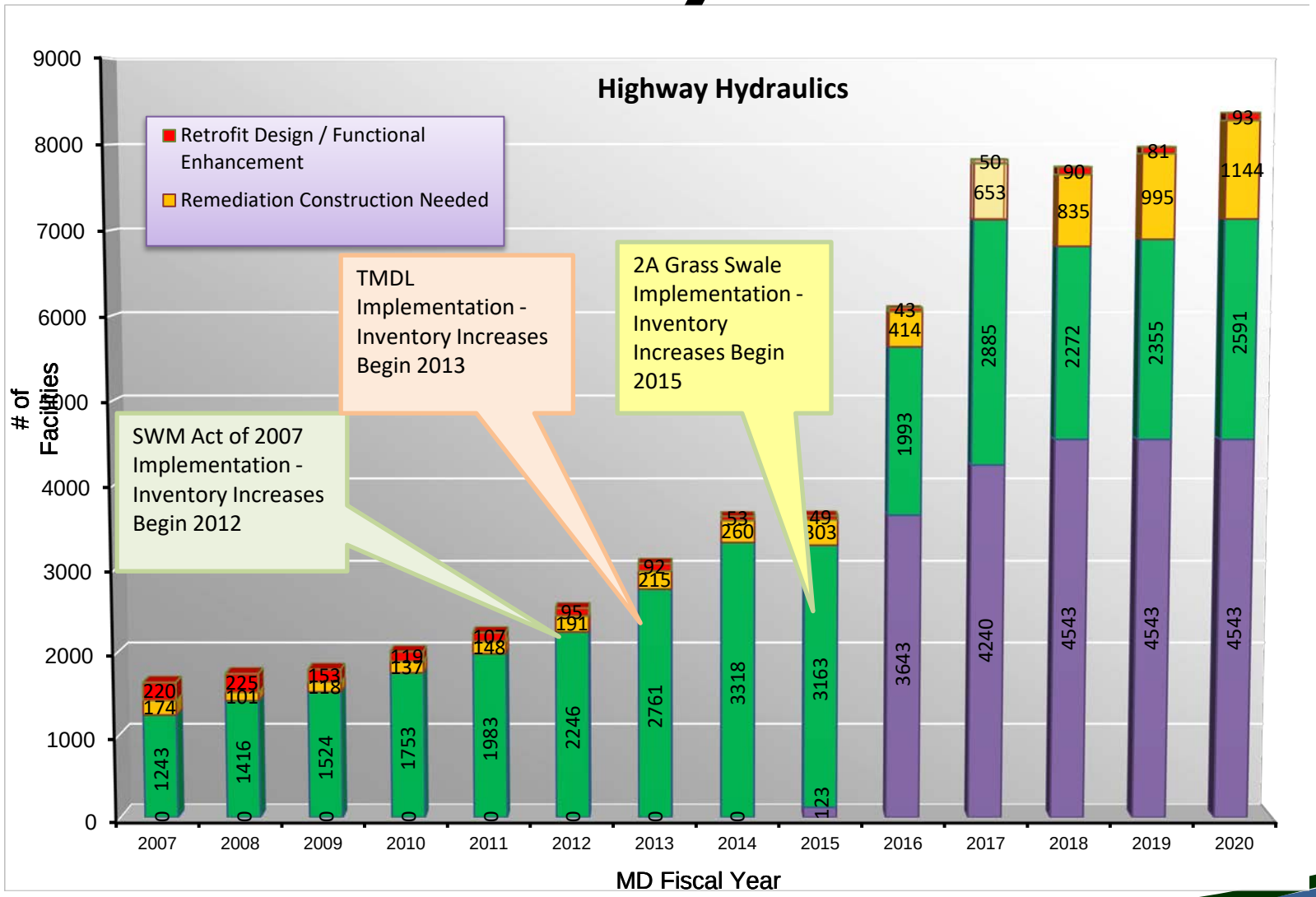
Maryland Department of Transportation
State Highway Administration
MDOT SHA

12/17/2020

Timeline


1970 - Maryland passes sediment control law
1982 - Maryland passes stormwater management law
1994 - MD Issues Sediment and Erosion Control Standards
1999 - MDOT SHA received 1st generation MS4 Phase I permit
2000 - MD issues 2000 SW Design Manual
2005 - MDOT SHA received 2nd generation MS4 Phase I permit
2007 - MD passes revisions to SWM law
2009 - MD revises 2000 SW Design Manual
2011 - MD updates ESC Standards and Specifications
2014 - MDOT SHA receives Delegated SWM & ESC Approval Authority
2015 - MDOT SHA receives 3rd generation Phase I MS4 permit
2021 - (Tent) 4th generation Phase I MS4 permit

Inventory Timeline



Program Structure

Planning

Data Management
Inventory
Inspections & Performance Rating

Engineering

Action Rating
Remediation Work Orders
Retrofit Design

Construction

As-Built Certification
Remediation Verification

Operations

Minor Maintenance
Routine Maintenance Procedures

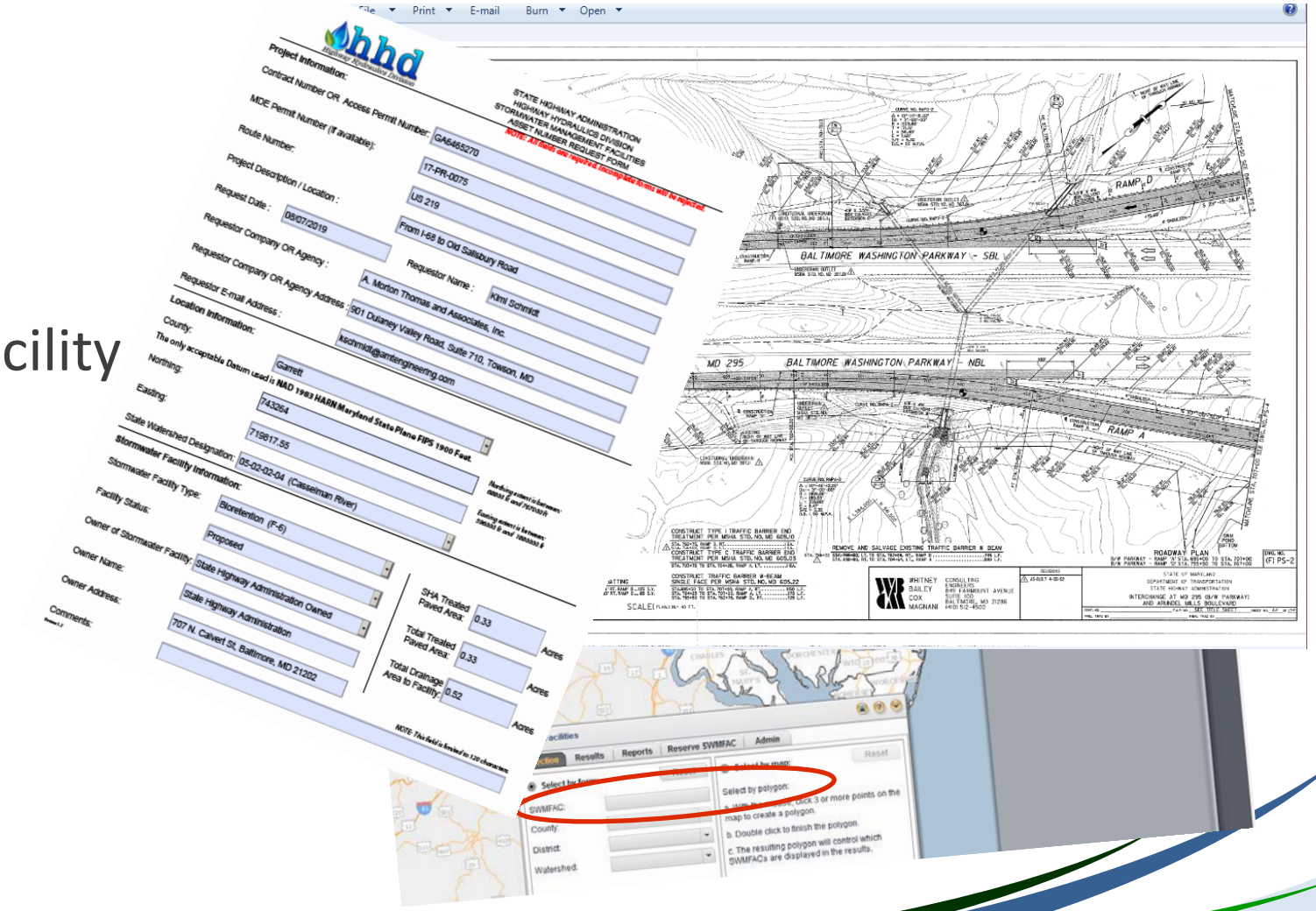
Future Focus

Business Process Improvements
Sharing
Research

Planning

Taking Information and Generating Data – THEN and NOW

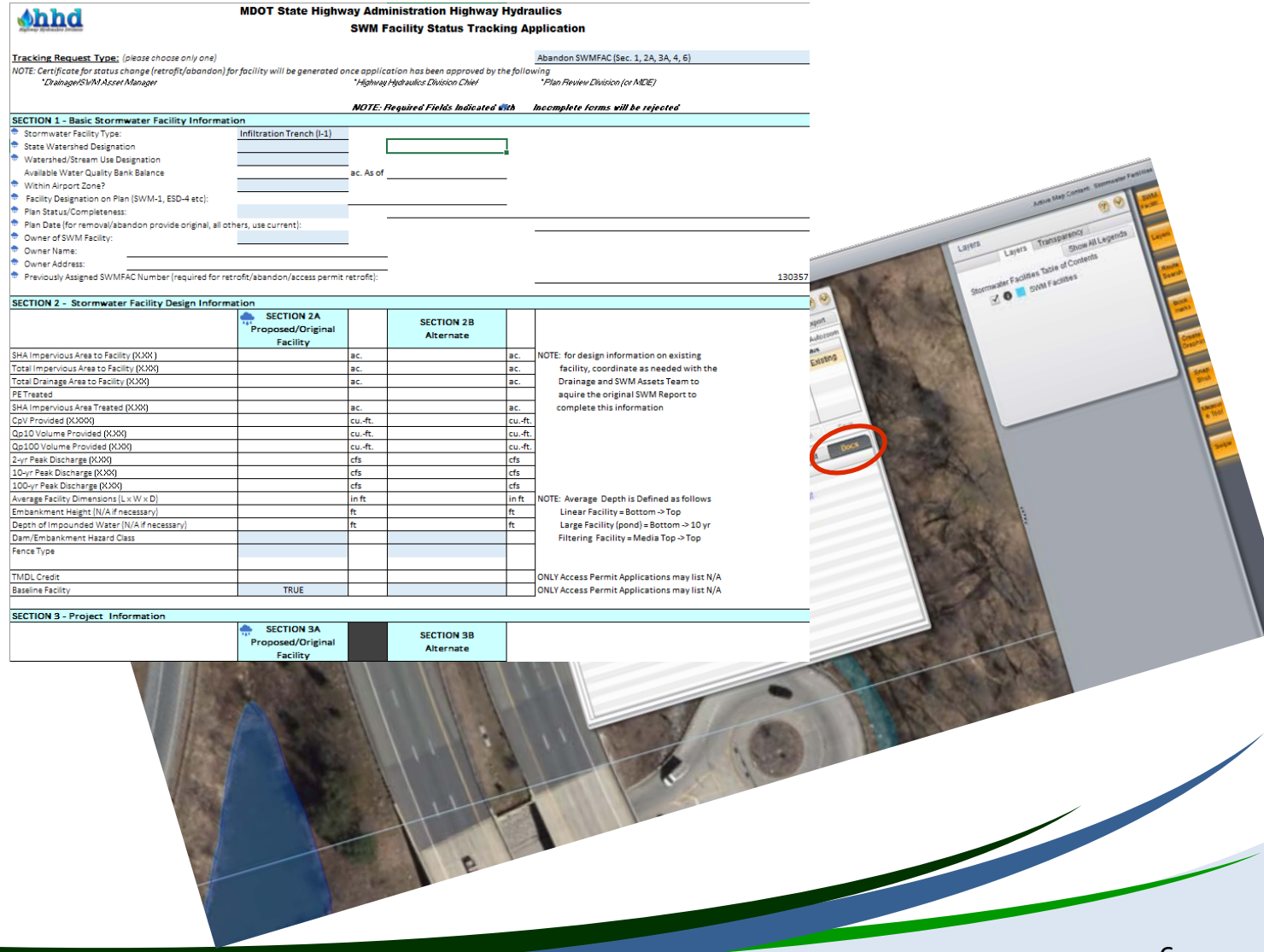
- Initial Information
  - Design Plans
  - Reports
- Turns into Data as a SWM facility number (SWMFAC#)
  - Specifications
  - MOUs
  - Agreements
  - Effectiveness of Treatment
  - Removal Results



Planning

Taking Information and Generating Data – THEN and NOW

- Additional Information
  - Specifications
  - MOUs
  - Agreements
  - Effectiveness of Treatment
  - Removal Results
- Retrofits and Enhancements



MDOT State Highway Administration Highway Hydraulics
SWM Facility Status Tracking Application

Tracking Request Type: *(please choose only one)* Abandon SWMFAC (Sec. 1, 2A, 3A, 4, 6)

NOTE: Certificate for status change (retrofit/abandon) for facility will be generated once application has been approved by the following
**Drainage/SWM Asset Manager* **Highway Hydraulics Division Chief* **Plan Review Division (or MDE)*

NOTE: Required Fields Indicated with ***Incomplete forms will be rejected***

SECTION 1 - Basic Stormwater Facility Information

Stormwater Facility Type:	Infiltration Trench (I-1)
State Watershed Designation	
Watershed/Stream Use Designation	
Available Water Quality Bank Balance	ac. As of
Within Airport Zone?	
Facility Designation on Plan (SWM-1, ESD-4 etc):	
Plan Status/Completeness:	
Plan Date (for removal/abandon provide original, all others, use current):	
Owner of SWM Facility:	
Owner Name:	
Owner Address:	
Previously Assigned SWMFAC Number (required for retrofit/abandon/access permit retrofit):	130357

SECTION 2 - Stormwater Facility Design Information

	SECTION 2A Proposed/Original Facility		SECTION 2B Alternate		
SHA Impervious Area to Facility (X.XX)		ac.		ac.	NOTE: for design information on existing facility, coordinate as needed with the Drainage and SWM Assets Team to aquire the original SWM Report to complete this information
Total Impervious Area to Facility (X.XX)		ac.		ac.	
Total Drainage Area to Facility (X.XX)		ac.		ac.	
PE Treated					
SHA Impervious Area Treated (X.XX)		ac.		ac.	
CpV Provided (X.XXX)		cu.-ft.		cu.-ft.	
Qp10 Volume Provided (X.XX)		cu.-ft.		cu.-ft.	
Qp100 Volume Provided (X.XX)		cu.-ft.		cu.-ft.	
2-yr Peak Discharge (X.XX)		cfs		cfs	
10-yr Peak Discharge (X.XX)		cfs		cfs	
100-yr Peak Discharge (X.XX)		cfs		cfs	
Average Facility Dimensions (L x W x D)		in ft		in ft	NOTE: Average Depth is Defined as follows Linear Facility = Bottom -> Top Large Facility (pond) = Bottom -> 10 yr Filtering Facility = Media Top -> Top
Embankment Height (N/A if necessary)		ft		ft	
Depth of Impounded Water (N/A if necessary)		ft		ft	
Dam/Embankment Hazard Class					
Fence Type					
TMDL Credit					ONLY Access Permit Applications may list N/A
Baseline Facility	TRUE				ONLY Access Permit Applications may list N/A

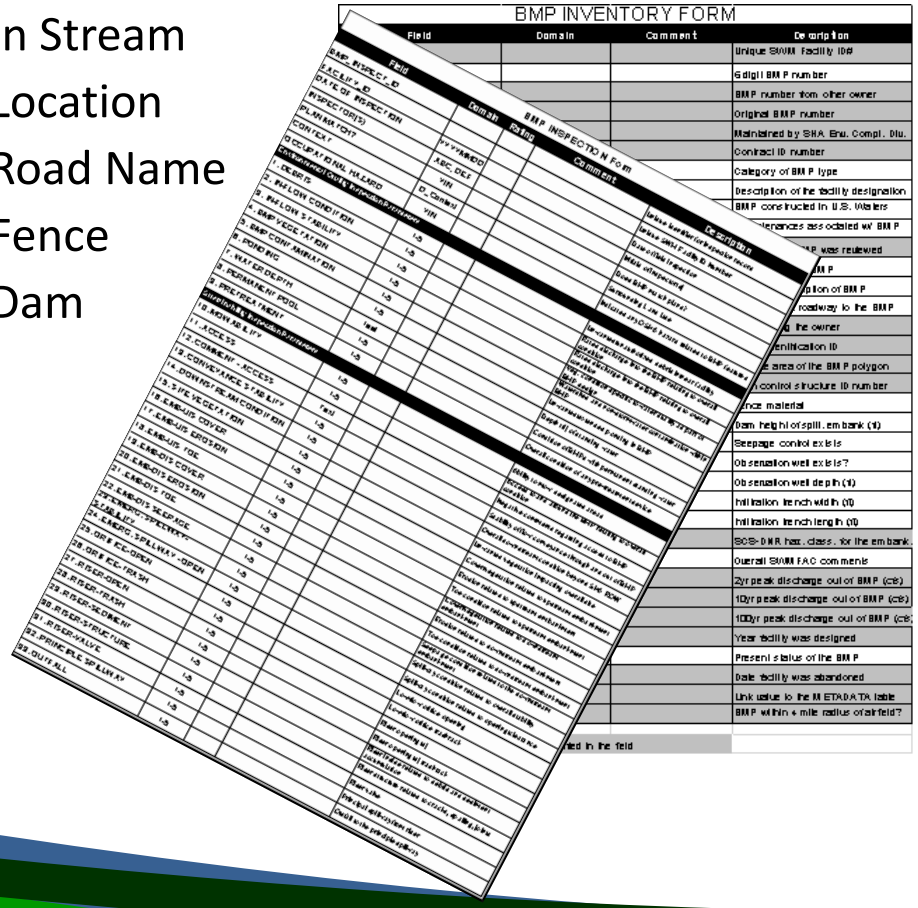
SECTION 3 - Project Information

	SECTION 3A Proposed/Original Facility		SECTION 3B Alternate

Planning

SWM Facility Inventory and Inspections - THEN

- **BMP Inventory**
  - BMP ID Number
  - In Stream
  - Location
  - Road Name
  - Fence
  - Dam

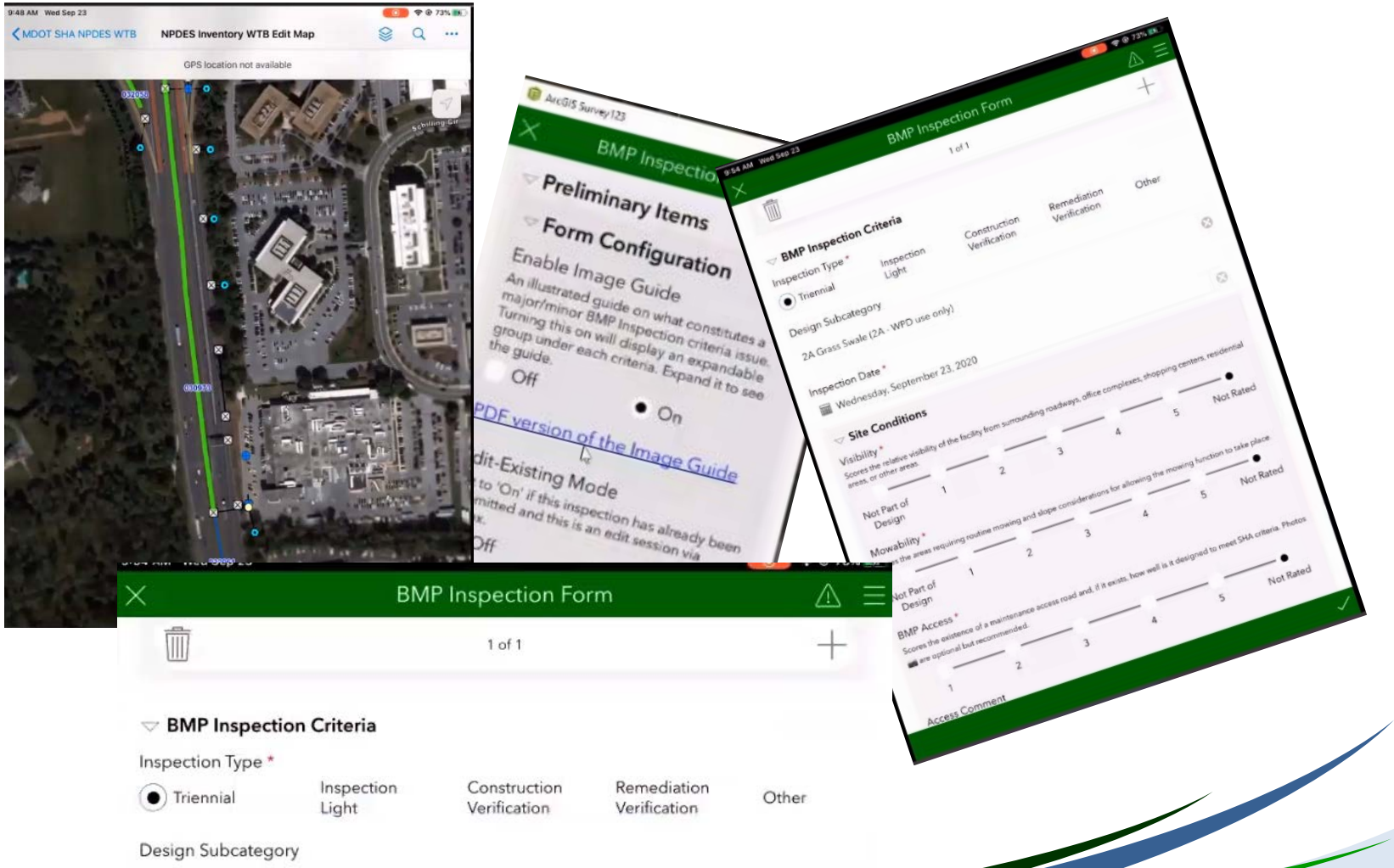


- **BMP Inspection**
  - BMP ID Number
- **33 Inspection Parameters for Triennial**
  - Debris
  - Inflow Conditions
  - Vegetation
  - Ponding
  - Access
  - Mowability
  - Emergency Spillway
  - Orifice
  - Riser
  - Outfall
  - Other inspection protocols for annual, as built and emergency inspections

Planning

SWM Facility Inventory and Inspections – and NOW

- **Technology Now**
  - Customized Off the Shelf Solution
    - Use Tablet Technology
    - Survey 1-2-3, ArcCollector
    - Additional form configuration



Planning

SWM Facility Inventory and Inspections – and NOW

- **Technology Now**
  - New Features
    - Smart Photo Requirements
    - Long Comment Fields
    - Embedded Image Guide
  - **Office tools for data management**

Planning

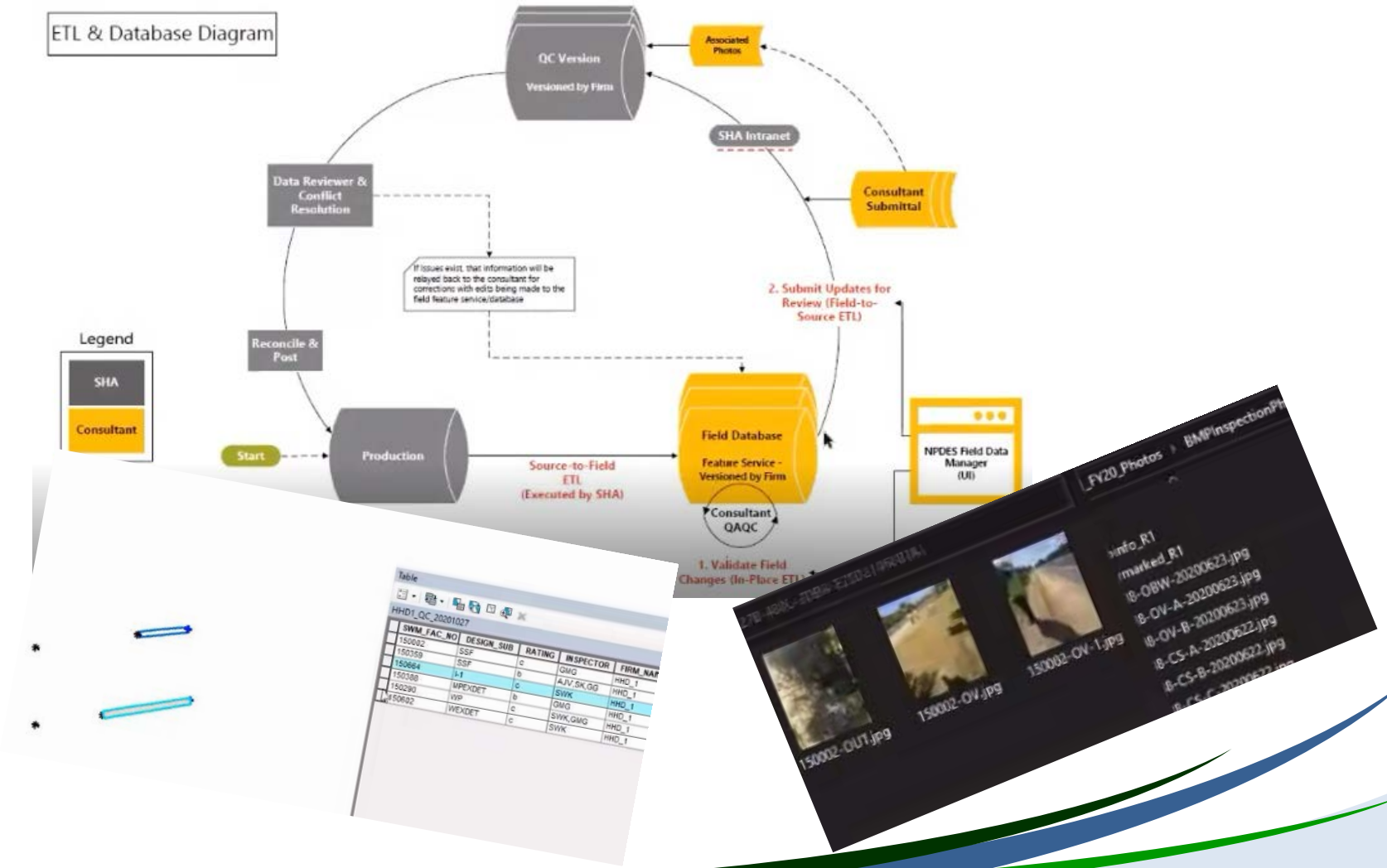
SWM Facility Inventory and Inspections – and NOW

- **Technology Now**
  - Additional Support Data Gathering Tools
    - SWM Inspection Tracker
    - Tracker Dashboard
    - Access Point Tracker

Planning

SWM Facility Inventory and Inspections – and NOW

- **Office tools for data management**
  - Iterative process to verify inspections against parameters
  - Sync Inspections
  - Validate Field Changes
  - Submit for Review
  - Connecting and Watermarking Photos
  - QA/QC



Planning

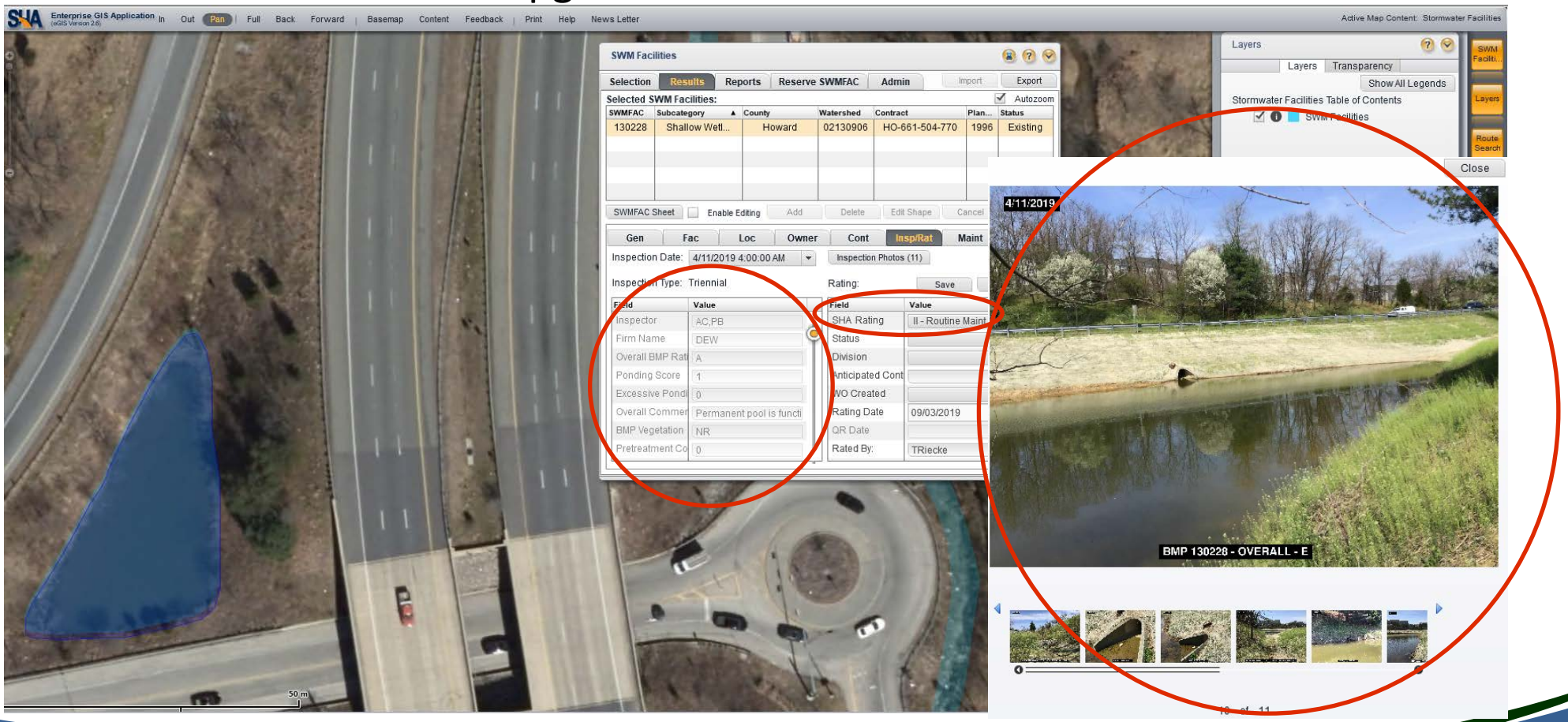
SWM Facility Inventory and Inspections – Training

- **MDOT SHA Staff Take Over**
  - Training Inspectors
    - Classroom
    - Field Experience
  - Training Office Staff
    - Preparation
    - QA/QC and Data Management

Engineering

Action Ratings – THEN and NOW

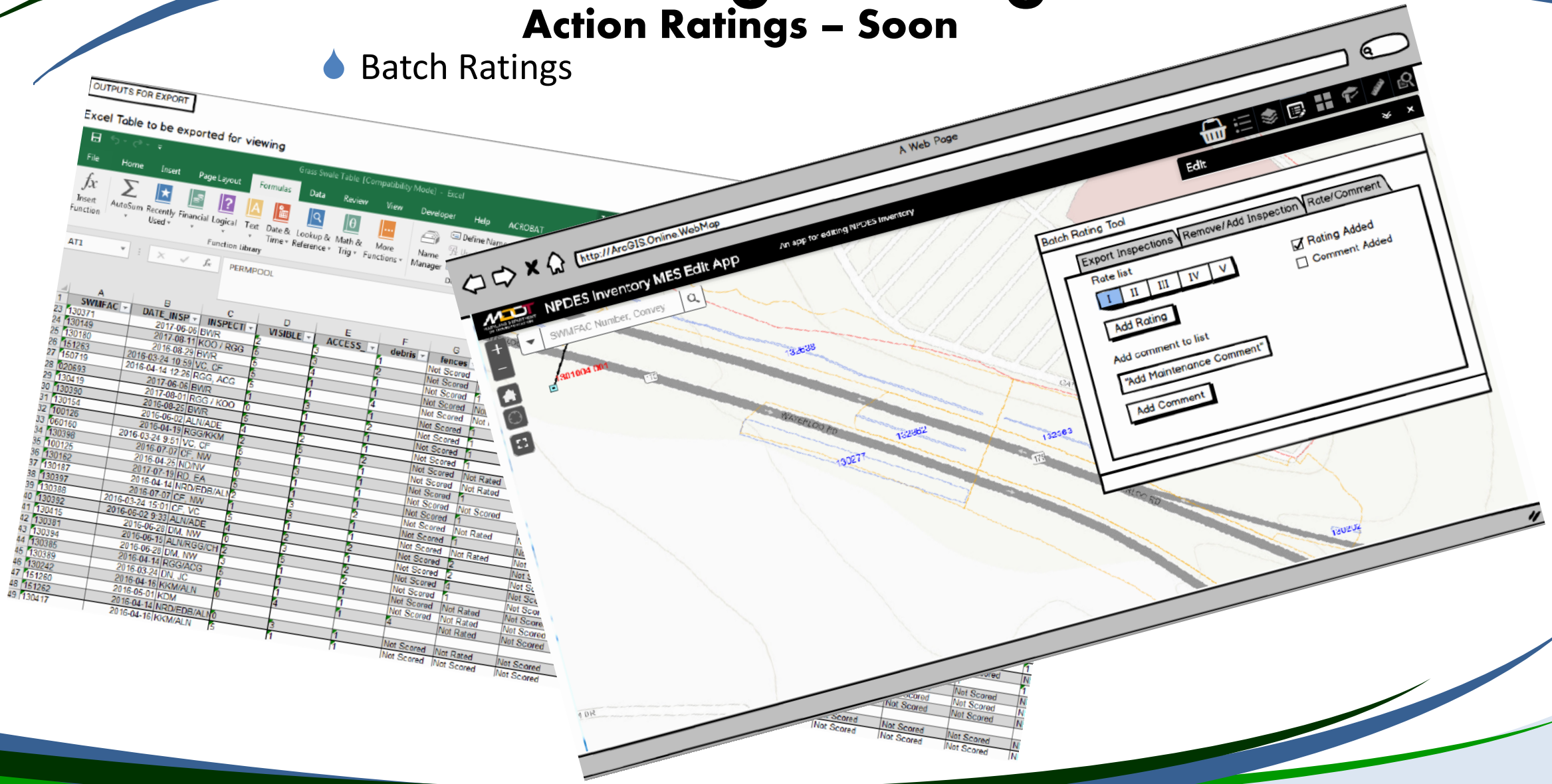
- Inspection Photos and Reports
- eGIS Upgrades



Engineering

Action Ratings – Soon

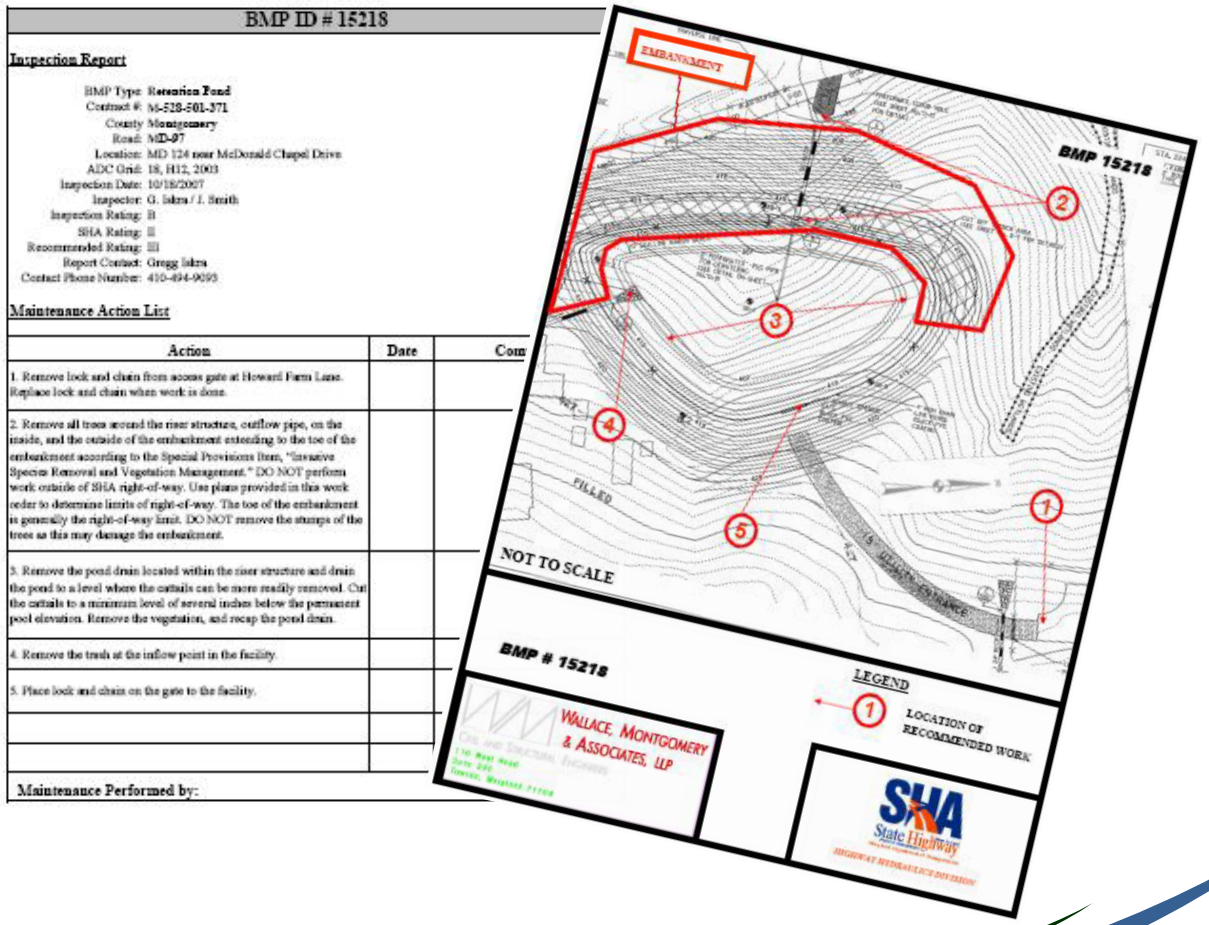
- Batch Ratings



Engineering

Remediation Work Order Design – THEN

- **Traditional Reporting and Needs**
  - BMP Maintenance Report
    - Based on additional field assessment once assigned
    - Location Map
    - Maintenance Work Order
    - Maintenance Plan
    - Cost Estimate
    - As Built Plans and Details
  - Developed in approximately 16 manhours



BMP ID # 15218

Inspection Report

BMP Type: Retention Pond
Contract #: M-528-501-371
County: Montgomery
Road: MD-97
Location: MD 124 near McDonald Chapel Drive
ADC Grid: 18, H12, 2003
Inspection Date: 10/18/2007
Inspector: G. Iskra / J. Smith
Inspection Rating: II
SHA Rating: II
Recommended Rating: III
Report Contact: Gregg Iskra
Contact Phone Number: 410-494-9093

Maintenance Action List

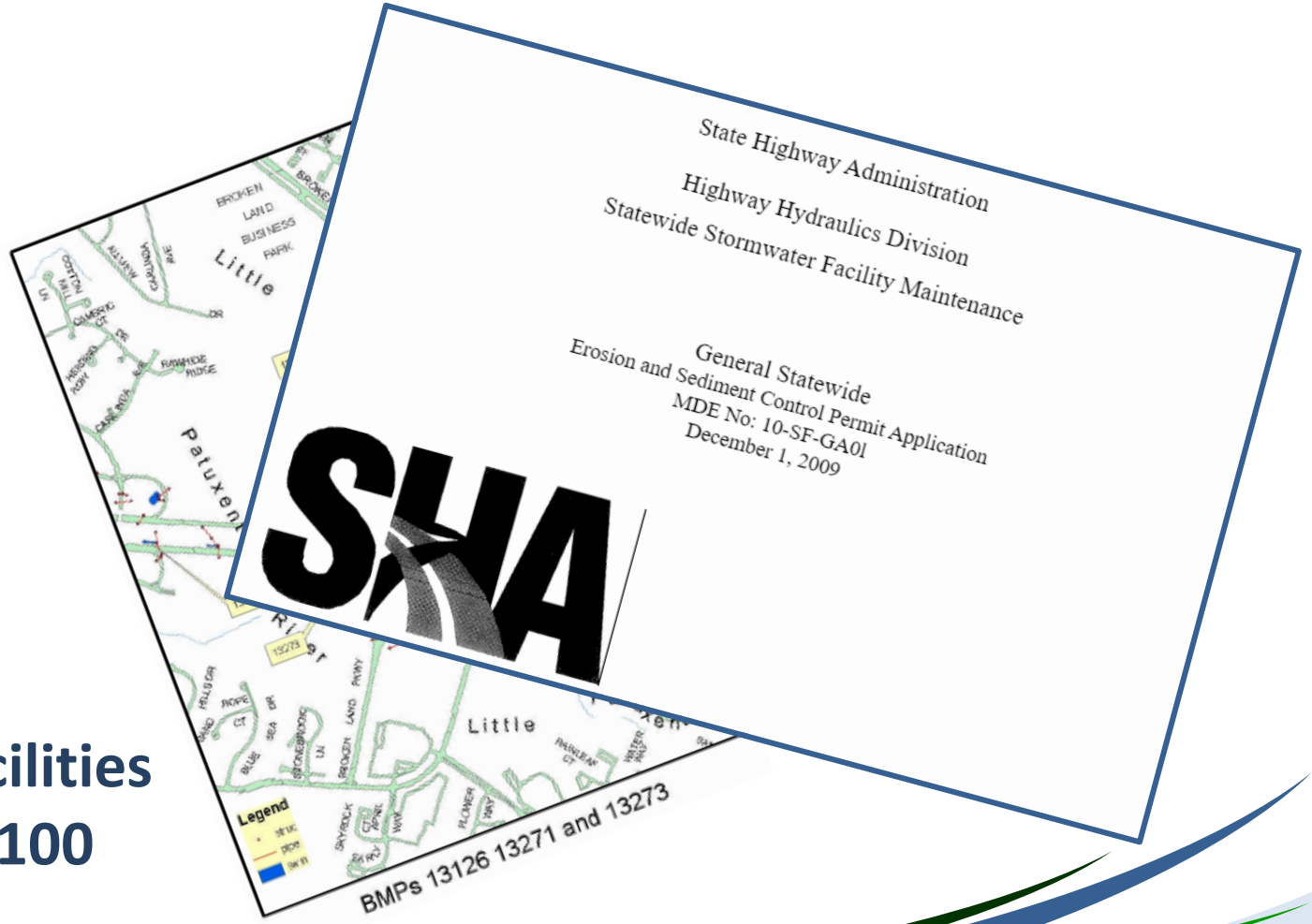
Action	Date	Com
1. Remove lock and chain from access gate at Howard Farm Lane. Replace lock and chain when work is done.		
2. Remove all trees around the riser structure, outflow pipe, on the inside, and the outside of the embankment extending to the toe of the embankment according to the Special Provisions Item, "Invasive Species Removal and Vegetation Management." DO NOT perform work outside of SHA right-of-way. Use plans provided in this work order to determine limits of right-of-way. The toe of the embankment is generally the right-of-way limit. DO NOT remove the stumps of the trees as this may damage the embankment.		
3. Remove the pond drain located within the riser structure and drain the pond to a level where the cattails can be more readily removed. Cut the cattails to a minimum level of several inches below the permanent pool elevation. Remove the vegetation, and recap the pond drain.		
4. Remove the trash at the inflow point in the facility.		
5. Place lock and chain on the gate to the facility.		

Maintenance Performed by:

Engineering

Remediation Work Order Design – THEN

- **Traditional Permit Requirements**
  - MDOT SHA General Permit Allowed
    - Clearing & Grubbing
    - Sediment Removal
    - Slope and Structural Repairs
    - Pipe Cleaning
    - Facility Dredging

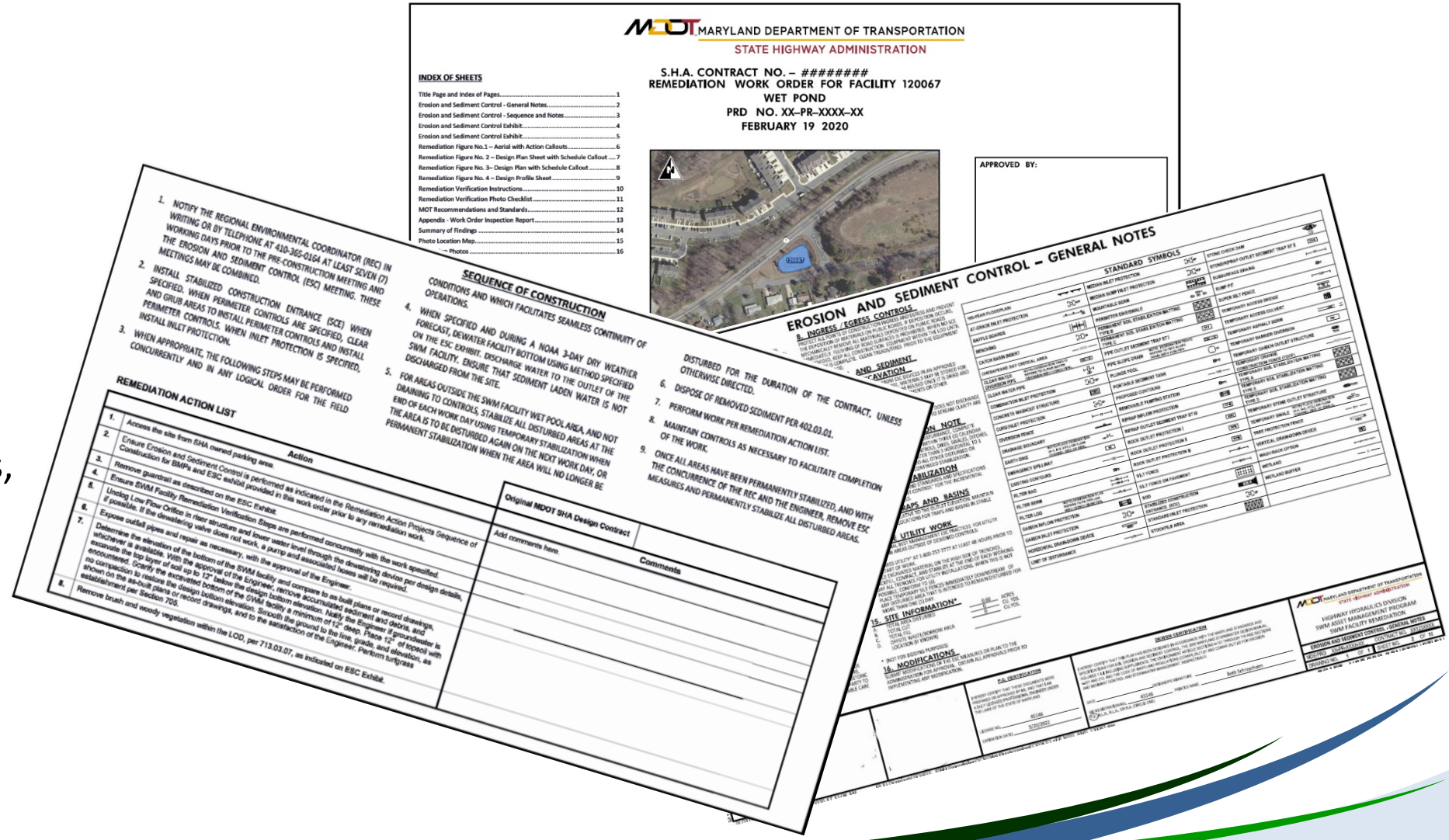


Average Number of Facilities Maintained Annually ~100

Engineering

Remediation Work Order Design –NOW

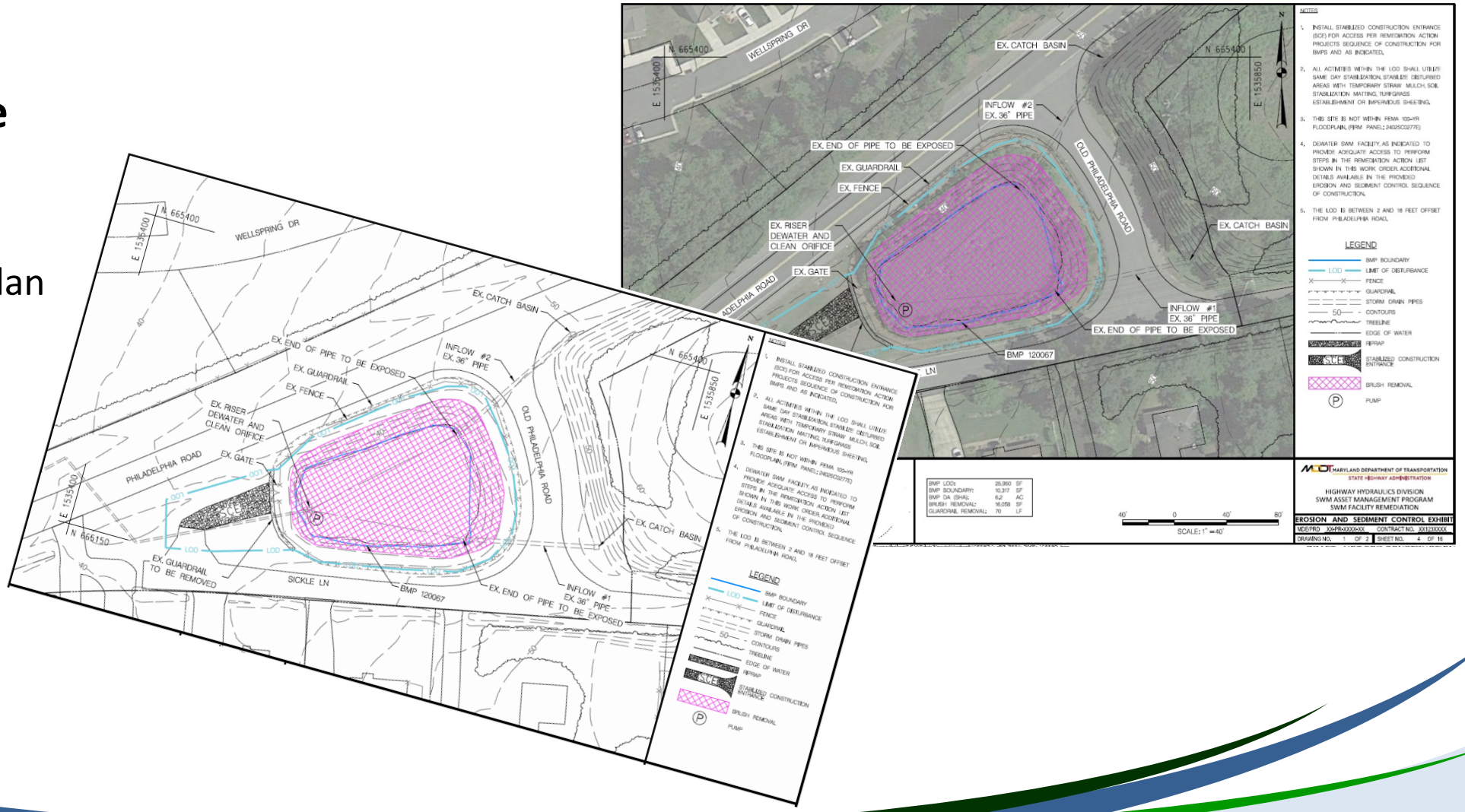
- **Standardized Templates Include**
  - Based on additional field assessment once assigned
  - Location Map
  - Erosion/Sediment Control General Notes, Details, Sequence of Construction
  - Standard language for Sequence of Construction



Engineering

Remediation Work Order Design –NOW

- **Standardized Templates Include**
  - Erosion Sediment Control Exhibits
  - Detailed Design Plan Blow Up



Engineering

Remediation Work Order Design –NOW

- **Standardized Templates Include**
  - Remediation Figures
  - Standard language for Remediation Action Lists

SEQUENCE OF CONSTRUCTION

1. NOTIFY THE REGIONAL ENVIRONMENTAL COORDINATOR (REC) IN WRITING OR BY TELEPHONE AT 410-365-0164 AT LEAST SEVEN (7) WORKING DAYS PRIOR TO THE PRE-CONSTRUCTION MEETING AND THE EROSION AND SEDIMENT CONTROL (ESC) MEETING. THESE MEETINGS MAY BE COMBINED.
2. INSTALL STABILIZED CONSTRUCTION ENTRANCE (SCE) WHEN SPECIFIED. WHEN PERIMETER CONTROLS ARE SPECIFIED, CLEAR AND GRUB AREAS TO INSTALL PERIMETER CONTROLS AND INSTALL PERIMETER CONTROLS. WHEN INLET PROTECTION IS SPECIFIED, INSTALL INLET PROTECTION.
3. WHEN APPROPRIATE, THE FOLLOWING STEPS MAY BE PERFORMED CONCURRENTLY AND IN ANY LOGICAL ORDER FOR THE FIELD CONDITIONS AND WHICH FACILITATES SEAMLESS CONTINU OPERATIONS.
4. WHEN SPECIFIED AND DURING A NOAA 3-DAY DRY WE FORECAST, DEWATER FACILITY BOTTOM USING METHOD SPI ON THE ESC EXHIBIT. DISCHARGE WATER TO THE OUTLET SWM FACILITY. ENSURE THAT SEDIMENT LADEN WATER DISCHARGED FROM THE SITE.
5. FOR AREAS OUTSIDE THE SWM FACILITY WET POOL AREA, AN DRAINING TO CONTROLS, STABILIZE ALL DISTURBED AREAS END OF EACH WORK DAY USING TEMPORARY STABILIZATION THE AREA IS TO BE DISTURBED AGAIN ON THE NEXT WORK D PERMANENT STABILIZATION WHEN THE AREA WILL NO LON

REMEDIATION ACTION LIST

	Action	Original MDOT SHA
1.	Access the site from SHA owned parking area.	Add comments here.
2.	Ensure Erosion and Sediment Control is performed as indicated in the Remediation Action Projects Sequence of Construction for BMPs and ESC exhibit provided in this work order prior to any remediation work.	
3.	Remove guardrail as described on the ESC Exhibit.	
4.	Ensure SWM Facility Remediation Verification Steps are performed concurrently with the work specified.	
5.	Unclog Low Flow Orifice in riser structure and lower water level through the dewatering device per design details, if possible. If the dewatering valve does not work, a pump and associated hoses will be required.	
6.	Expose outfall pipes and repair as necessary, with the approval of the Engineer.	
7.	Determine the elevation of the bottom of the SWM facility and compare to as-built plans or record drawings, whichever is available. With the approval of the Engineer, remove accumulated sediment and debris, and excavate the top layer of soil up to 12" below the design bottom elevation. Notify the Engineer if groundwater is encountered. Scarify the excavated bottom of the SWM facility a minimum of 12" deep. Place 12" of topsoil with no compaction to restore the design bottom elevation. Smooth the ground to the line, grade, and elevation, as shown on the as-built plans or record drawings, and to the satisfaction of the Engineer. Perform turfgrass establishment per Section 705.	
8.	Remove brush and woody vegetation within the LOD, per 713.03.07, as indicated on ESC Exhibit.	

Engineering

Remediation Work Order Design –NOW

- **Standardized Templates Include**
  - Remediation Figures
  - Standard language for Remediation Action Lists

SEQUENCE OF CONSTRUCTION

1. NOTIFY THE REGIONAL ENVIRONMENTAL COORDINATOR (REC) IN WRITING OR BY TELEPHONE AT 410-365-0164 AT LEAST SEVEN (7) WORKING DAYS PRIOR TO THE PRE-CONSTRUCTION MEETING AND THE EROSION AND SEDIMENT CONTROL (ESC) MEETING. THESE MEETINGS MAY BE COMBINED.
2. INSTALL STABILIZED CONSTRUCTION ENTRANCE (SCE) WHEN SPECIFIED. WHEN PERIMETER CONTROLS ARE SPECIFIED, CLEAR AND GRUB AREAS TO INSTALL PERIMETER CONTROLS AND INSTALL PERIMETER CONTROLS. WHEN INLET PROTECTION IS SPECIFIED, INSTALL INLET PROTECTION.
3. WHEN APPROPRIATE, THE FOLLOWING STEPS MAY BE PERFORMED CONCURRENTLY AND IN ANY LOGICAL ORDER FOR THE FIELD CONDITIONS AND WHICH FACILITATES SEAMLESS CONTINU OPERATIONS.
4. WHEN SPECIFIED AND DURING A NOAA 3-DAY DRY WE FORECAST, DEWATER FACILITY BOTTOM USING METHOD SPI ON THE ESC EXHIBIT. DISCHARGE WATER TO THE OUTLET SWM FACILITY. ENSURE THAT SEDIMENT LADEN WATER DISCHARGED FROM THE SITE.
5. FOR AREAS OUTSIDE THE SWM FACILITY WET POOL AREA, AN DRAINING TO CONTROLS, STABILIZE ALL DISTURBED AREAS END OF EACH WORK DAY USING TEMPORARY STABILIZATION THE AREA IS TO BE DISTURBED AGAIN ON THE NEXT WORK D PERMANENT STABILIZATION WHEN THE AREA WILL NO LON

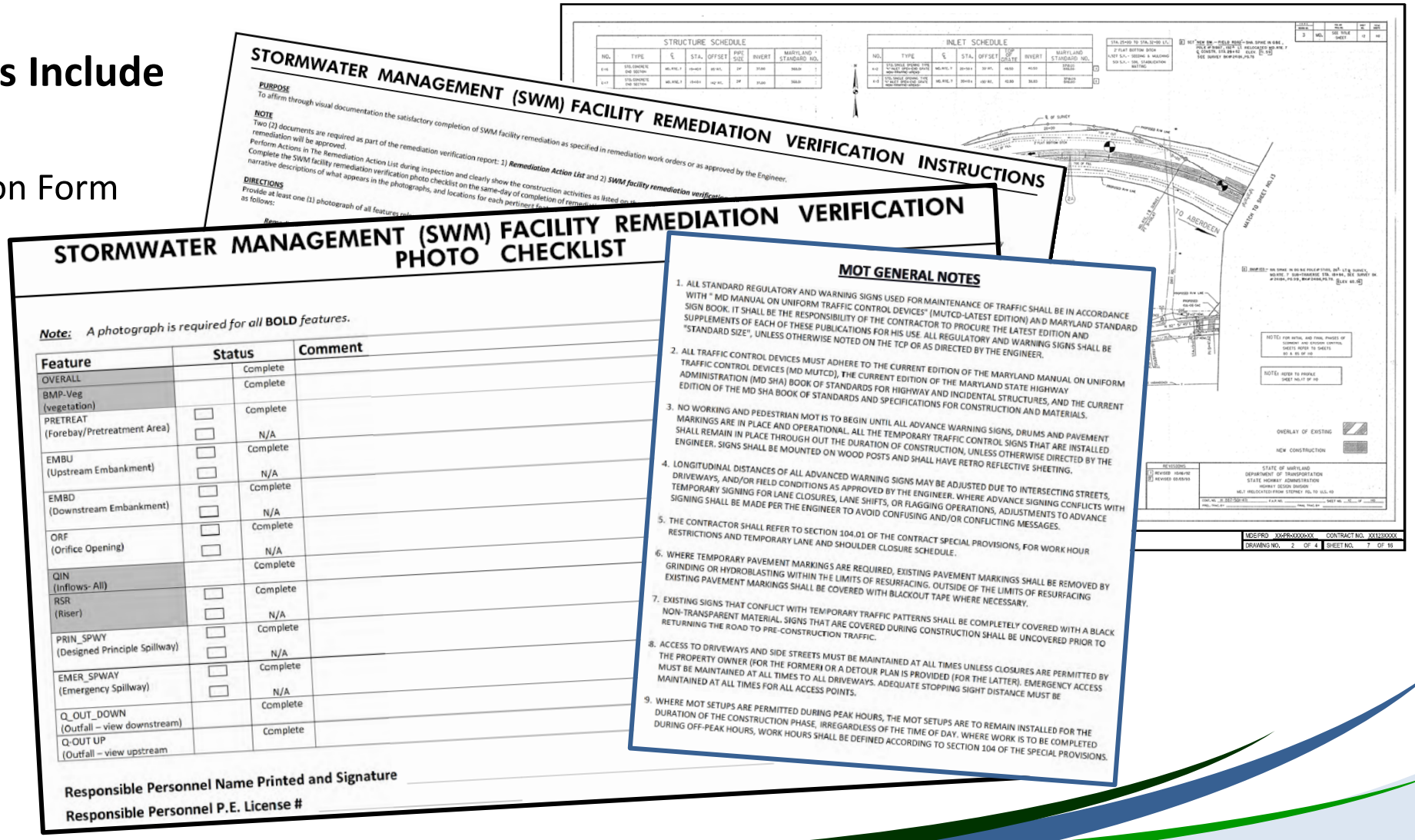
REMEDIATION ACTION LIST

	Action	Original MDOT SHA
1.	Access the site from SHA owned parking area.	Add comments here.
2.	Ensure Erosion and Sediment Control is performed as indicated in the Remediation Action Projects Sequence of Construction for BMPs and ESC exhibit provided in this work order prior to any remediation work.	
3.	Remove guardrail as described on the ESC Exhibit.	
4.	Ensure SWM Facility Remediation Verification Steps are performed concurrently with the work specified.	
5.	Unclog Low Flow Orifice in riser structure and lower water level through the dewatering device per design details, if possible. If the dewatering valve does not work, a pump and associated hoses will be required.	
6.	Expose outfall pipes and repair as necessary, with the approval of the Engineer.	
7.	Determine the elevation of the bottom of the SWM facility and compare to as-built plans or record drawings, whichever is available. With the approval of the Engineer, remove accumulated sediment and debris, and excavate the top layer of soil up to 12" below the design bottom elevation. Notify the Engineer if groundwater is encountered. Scarify the excavated bottom of the SWM facility a minimum of 12" deep. Place 12" of topsoil with no compaction to restore the design bottom elevation. Smooth the ground to the line, grade, and elevation, as shown on the as-built plans or record drawings, and to the satisfaction of the Engineer. Perform turfgrass establishment per Section 705.	
8.	Remove brush and woody vegetation within the LOD, per 713.03.07, as indicated on ESC Exhibit.	

Engineering

Remediation Work Order Design –NOW

- **Standardized Templates Include**
  - As Built Plans
  - Remediation Verification Form
  - Maintenance of Traffic



STORMWATER MANAGEMENT (SWM) FACILITY REMEDIATION VERIFICATION INSTRUCTIONS

PURPOSE
To affirm through visual documentation the satisfactory completion of SWM facility remediation as specified in remediation work orders or as approved by the Engineer.

NOTE
Two (2) documents are required as part of the remediation verification report: 1) **Remediation Action List** and 2) **SWM facility remediation verifica**
remediation will be approved.
Perform Actions in The Remediation Action List during inspection and clearly show the construction activities as listed on a
Complete the SWM facility remediation verification photo checklist on the same-day of completion of remedi
narrative descriptions of what appears in the photographs, and locations for each pertinent fea

DIRECTIONS
Provide at least one (1) photograph of all features
as follows:

STORMWATER MANAGEMENT (SWM) FACILITY REMEDIATION VERIFICATION PHOTO CHECKLIST

Note: *A photograph is required for all* **BOLD** *features.*

Feature		Status	Comment
OVERALL		Complete	
BMP-Veg (vegetation)		Complete	
PRETREAT (Forebay/Pretreatment Area)	☐	Complete	
	☐	N/A	
EMBU (Upstream Embankment)	☐	Complete	
	☐	N/A	
EMBD (Downstream Embankment)	☐	Complete	
	☐	N/A	
ORF (Orifice Opening)	☐	Complete	
	☐	N/A	
QIN (Inflows- All)		Complete	
RSR (Riser)	☐	Complete	
	☐	N/A	
PRIN_SPWY (Designed Principle Spillway)	☐	Complete	
	☐	N/A	
EMER_SPWAY (Emergency Spillway)	☐	Complete	
	☐	N/A	
Q_OUT_DOWN (Outfall – view downstream)		Complete	
Q-OUT UP (Outfall – view upstream		Complete	

Responsible Personnel Name Printed and Signature _____

Responsible Personnel P.E. License # _____

MOT GENERAL NOTES

1. ALL STANDARD REGULATORY AND WARNING SIGNS USED FOR MAINTENANCE OF TRAFFIC SHALL BE IN ACCORDANCE WITH " MD MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD-LATEST EDITION) AND MARYLAND STANDARD SIGN BOOK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROCURE THE LATEST EDITION AND SUPPLEMENTS OF EACH OF THESE PUBLICATIONS FOR HIS USE. ALL REGULATORY AND WARNING SIGNS SHALL BE "STANDARD SIZE", UNLESS OTHERWISE NOTED ON THE TCP OR AS DIRECTED BY THE ENGINEER.
2. ALL TRAFFIC CONTROL DEVICES MUST ADHERE TO THE CURRENT EDITION OF THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MD MUTCD), THE CURRENT EDITION OF THE MARYLAND STATE HIGHWAY ADMINISTRATION (MD SHA) BOOK OF STANDARDS FOR HIGHWAY AND INCIDENTAL STRUCTURES, AND THE CURRENT EDITION OF THE MD SHA BOOK OF STANDARDS AND SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.
3. NO WORKING AND PEDESTRIAN MOT IS TO BEGIN UNTIL ALL ADVANCE WARNING SIGNS, DRUMS AND PAVEMENT MARKINGS ARE IN PLACE AND OPERATIONAL. ALL THE TEMPORARY TRAFFIC CONTROL SIGNS THAT ARE INSTALLED SHALL REMAIN IN PLACE THROUGH OUT THE DURATION OF CONSTRUCTION, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. SIGNS SHALL BE MOUNTED ON WOOD POSTS AND SHALL HAVE RETRO REFLECTIVE SHEETING.
4. LONGITUDINAL DISTANCES OF ALL ADVANCED WARNING SIGNS MAY BE ADJUSTED DUE TO INTERSECTING STREETS, DRIVEWAYS, AND/OR FIELD CONDITIONS AS APPROVED BY THE ENGINEER. WHERE ADVANCE SIGNING CONFLICTS WITH TEMPORARY SIGNING FOR LANE CLOSURES, LANE SHIFTS, OR FLAGGING OPERATIONS, ADJUSTMENTS TO ADVANCE SIGNING SHALL BE MADE PER THE ENGINEER TO AVOID CONFUSING AND/OR CONFLICTING MESSAGES.
5. THE CONTRACTOR SHALL REFER TO SECTION 104.01 OF THE CONTRACT SPECIAL PROVISIONS, FOR WORK HOUR RESTRICTIONS AND TEMPORARY LANE AND SHOULDER CLOSURE SCHEDULE.
6. WHERE TEMPORARY PAVEMENT MARKINGS ARE REQUIRED, EXISTING PAVEMENT MARKINGS SHALL BE REMOVED BY GRINDING OR HYDROBLASTING WITHIN THE LIMITS OF RESURFACING. OUTSIDE OF THE LIMITS OF RESURFACING EXISTING PAVEMENT MARKINGS SHALL BE COVERED WITH BLACKOUT TAPE WHERE NECESSARY.
7. EXISTING SIGNS THAT CONFLICT WITH TEMPORARY TRAFFIC PATTERNS SHALL BE COMPLETELY COVERED WITH A BLACK NON-TRANSPARENT MATERIAL. SIGNS THAT ARE COVERED DURING CONSTRUCTION SHALL BE UNCOVERED PRIOR TO RETURNING THE ROAD TO PRE-CONSTRUCTION TRAFFIC.
8. ACCESS TO DRIVEWAYS AND SIDE STREETS MUST BE MAINTAINED AT ALL TIMES UNLESS CLOSURES ARE PERMITTED BY THE PROPERTY OWNER (FOR THE FORMER) OR A DETOUR PLAN IS PROVIDED (FOR THE LATTER). EMERGENCY ACCESS MUST BE MAINTAINED AT ALL TIMES TO ALL DRIVEWAYS. ADEQUATE STOPPING SIGHT DISTANCE MUST BE MAINTAINED AT ALL TIMES FOR ALL ACCESS POINTS.
9. WHERE MOT SETUPS ARE PERMITTED DURING PEAK HOURS, THE MOT SETUPS ARE TO REMAIN INSTALLED FOR THE DURATION OF THE CONSTRUCTION PHASE, IRREGARDLESS OF THE TIME OF DAY. WHERE WORK IS TO BE COMPLETED DURING OFF-PEAK HOURS, WORK HOURS SHALL BE DEFINED ACCORDING TO SECTION 104 OF THE SPECIAL PROVISIONS.

Engineering

Remediation Work Order Design –NOW

- **Standardized Templates Include**
  - Appendix
    - Inspection Report
    - Photo Location Map
    - Inspection Photos
  - Development Time 64 hours

Inspection Data:
Last Significant Rainfall Date: 10/31/2019 (42")
Rainfall Source: https://www.weather.gov (Annapolis Naval Academy)
Inspection Date: 11/5/2019
Inspection Team: Alicia Peters, Bill Liu, Mike Perrault, Jessie Spruill
Location: Harford County, MD 7 Philadelphia Rd at the intersection with Old Philadelphia Rd.
Function: Wet Pond
SHA Contract #: XXXXX
Previous Inspection Rating: C
BMP Performance Rating: D
SHA Response Rating: III
Assessment Report Contact: EA Engineering, Science, and Technology, Inc., PBC – Beth Schrayshuen
Contact Phone Number: 410-584-7000 Ext. 5153

Site Conditions:
According to the design plans provided by SHA, the west to the facility. The facility are required to rest...

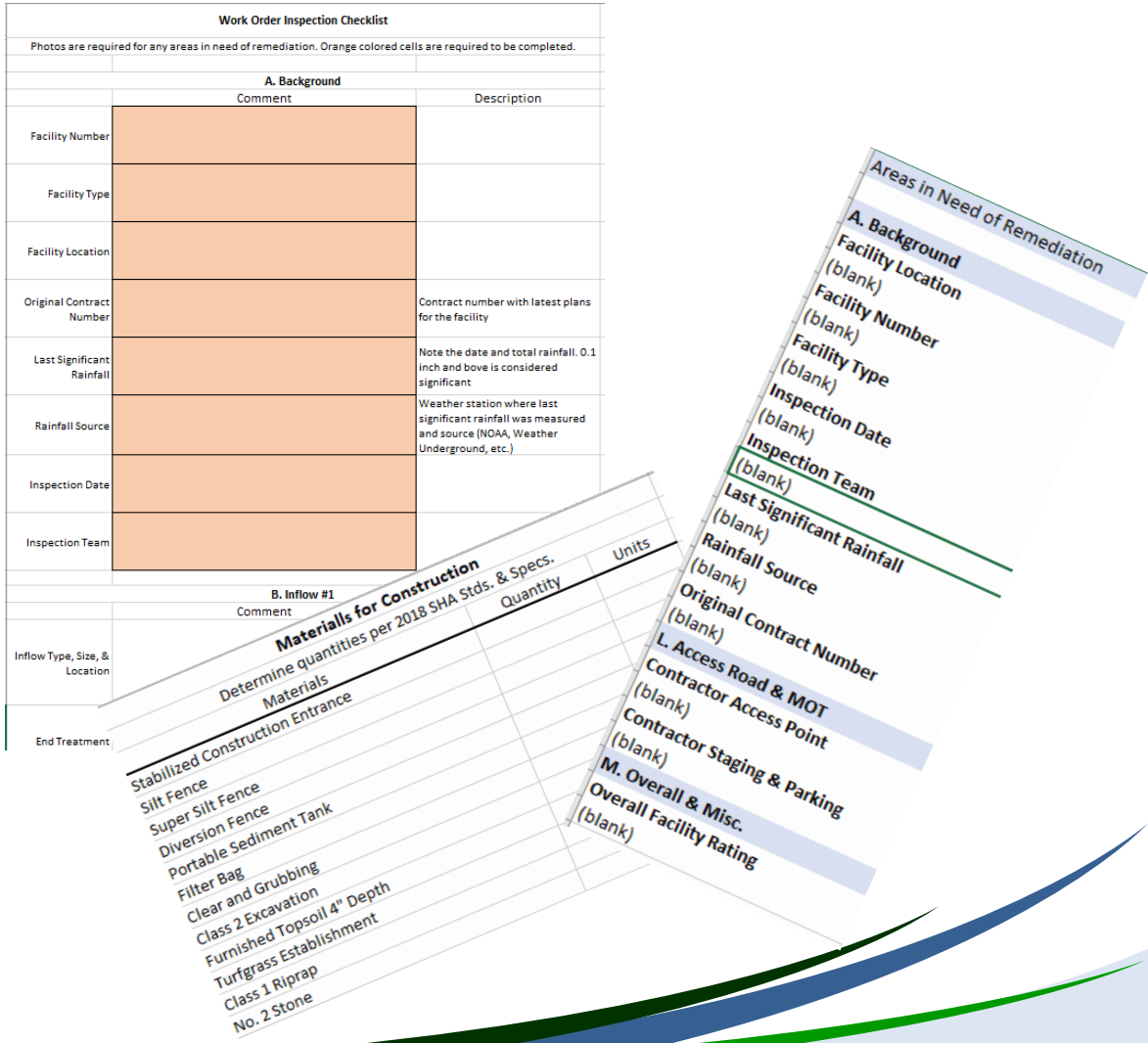
Photo 1: Construction access and gate blocked by guardrail.
Photo 2: Control structure with lots of debris and vegetation, as well as excessive ponding.
Photo 3: Inflow #1, 30" RCP Catch Basin at the intersection of Old Philadelphia Rd and Sickle Ln.
Photo 4: Potential location of where Inflow #1 enters the facility. Could not confirm in field.
Photo 5: Inflow #2, 30" RCP catch basin, deep and could not confirm where it entered the facility. Pipe is either submerged or covered with vegetation.
Photo 6: Overall of pond, requires extensive vegetation and sediment clearing.

FACILITY #: 120067 | DATE OF INSPECTION: 11/5/2019 | WORK ORDER APPENDIX • FACILITY INSPECTION REPORT | INSPECTION PHOTOS

Engineering

Remediation Work Order Design –NOW and SOON

- **Inspection Parameters for Work Orders**
  - Most frequently asked question during first inspection training
    - More in depth – 93 parameters
    - Additional construction information
    - Smart Excel
  - Plans for Additional Survey 123 and ArcCollector surveys



Work Order Inspection Checklist

Photos are required for any areas in need of remediation. Orange colored cells are required to be completed.

A. Background

	Comment	Description
Facility Number		
Facility Type		
Facility Location		
Original Contract Number		Contract number with latest plans for the facility
Last Significant Rainfall		Note the date and total rainfall. 0.1 inch and bove is considered significant
Rainfall Source		Weather station where last significant rainfall was measured and source (NOAA, Weather Underground, etc.)
Inspection Date		
Inspection Team		

B. Inflow #1

	Comment
Inflow Type, Size, & Location	
End Treatment	

Materials for Construction	Quantity	Units
Determine quantities per 2018 SHA Stds. & Specs.		
Materials		
Stabilized Construction Entrance		
Silt Fence		
Super Silt Fence		
Diversion Fence		
Portable Sediment Tank		
Filter Bag		
Clear and Grubbing		
Class 2 Excavation		
Furnished Topsoil 4" Depth		
Turfgrass Establishment		
Class 1 Riprap		
No. 2 Stone		

Areas in Need of Remediation

A. Background	
Facility Location	(blank)
Facility Number	(blank)
Facility Type	(blank)
Inspection Date	(blank)
Inspection Team	(blank)
Last Significant Rainfall	(blank)
Rainfall Source	(blank)
Original Contract Number	(blank)
L. Access Road & MOT	
Contractor Access Point	(blank)
Contractor Staging & Parking	(blank)
M. Overall & Misc.	
Overall Facility Rating	(blank)

Engineering

Remediation/Retrofit Tracking - THEN

- **Current Permit Requirements**
  - MDOT SHA General Permit Pending
    - Brush and Woody Vegetation Clearing only up to 4” DBH allowed
    - Sediment Removal
    - Pipe Cleaning
    - Facility Dredging
  - Additional Permits needed for:
    - JPA
    - Roadside Tree
    - AASCD
    - Critical Area
    - SLOA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
BMP	Facility Type	SHA Rating Date	SHA Rating	RATING_COMMENT	eGIS Change	Date of Maint Request Hainan	Maint. Completed	High Priority - Y/N	MDE General Permit Maint Completed Hainan	SHA Rating Date Sent (HHD - D	Work Order							Ready for Maint. Date (Final	HHD Comments	Work Order Status	JPA Required								EPD Comments	General Permit Type II	PRD Required								PRD Coordination	Project/Work Location	Status
150154	INFTRCH	12/04/2014	III	Major ponding in aboveration well; trim bank vegetation and remove debris																																					
150155		12/04/14	II	Reinspect Facility; should be located behind noise wall																																					
150156		12/04/14	II	Reinspect Facility; should be located behind noise wall																																					
150157	INFTRCH	02/08/2017	I	Fix broken sprinkler valve; remove ordinances in Facility and stabilize shoreline/slope [Maintenance work from work order completed [Bank PG-3,		Jun-16	YES	NO			PG-3	YES		[redacted]	05/28/2016						NO	NO	NO				[redacted]		No permits needed, no resources coming soiled.										BMP_150157_Work Order.pdf	

BMP	BMP Type	Work Order Status	Work Order Consulta	EPD Screening Y/N	Environmental Permits	Resources	CAC	Severn Watershed?	Permitting Authority
020003	Infiltration Basin	PRD aprroval under 17-PR-0194-17	Dewberry	y	RTP	DNR Sensitive species	N	N	SHA PRD
020013	Wet Pond	Submitted to PRD under 17-PR-0194-03	Dewberry	y	JPA	national wetlands inventory (NWI), Forest interior dwelling bird species, FIDS	N	Y	
020036	Infiltration Trench	Exempt from ESC approval, waiting for RTP	RAM	y	RTP	DNR Sensitive species	n	Y	SHA PRD
020083	Infiltration Trench	PRD aprroval under 17-PR-0194-17,	RAM	y	RTP, AASCD	n	n	Y	SHA PRD
020110	Wet Pond	Will be submitted to PRD under 17-PR-0194-04	Dewberry	y	JPA	local protected lands harmans park	n	N	
020112	Bioretention	Comments sent to Dewberry 3/19. Waiting to finalize ESC Sequence to proceed.	Dewberry	y	n	n		N	
020115	Dry Pond	HHD received 11/13/17	WBCM	y	maybe	n	n	N	
020124	Wet Pond	Comments sent to Dewberry 3/19. Waiting to finalize ESC Sequence to proceed.	Dewberry/Suyash	y	maybe	NWI	n	N	
020143	Infiltration Trench	PRD aprroval under 17-PR-0194-17,	RAM	y	RTP	n	n	N	SHA PRD

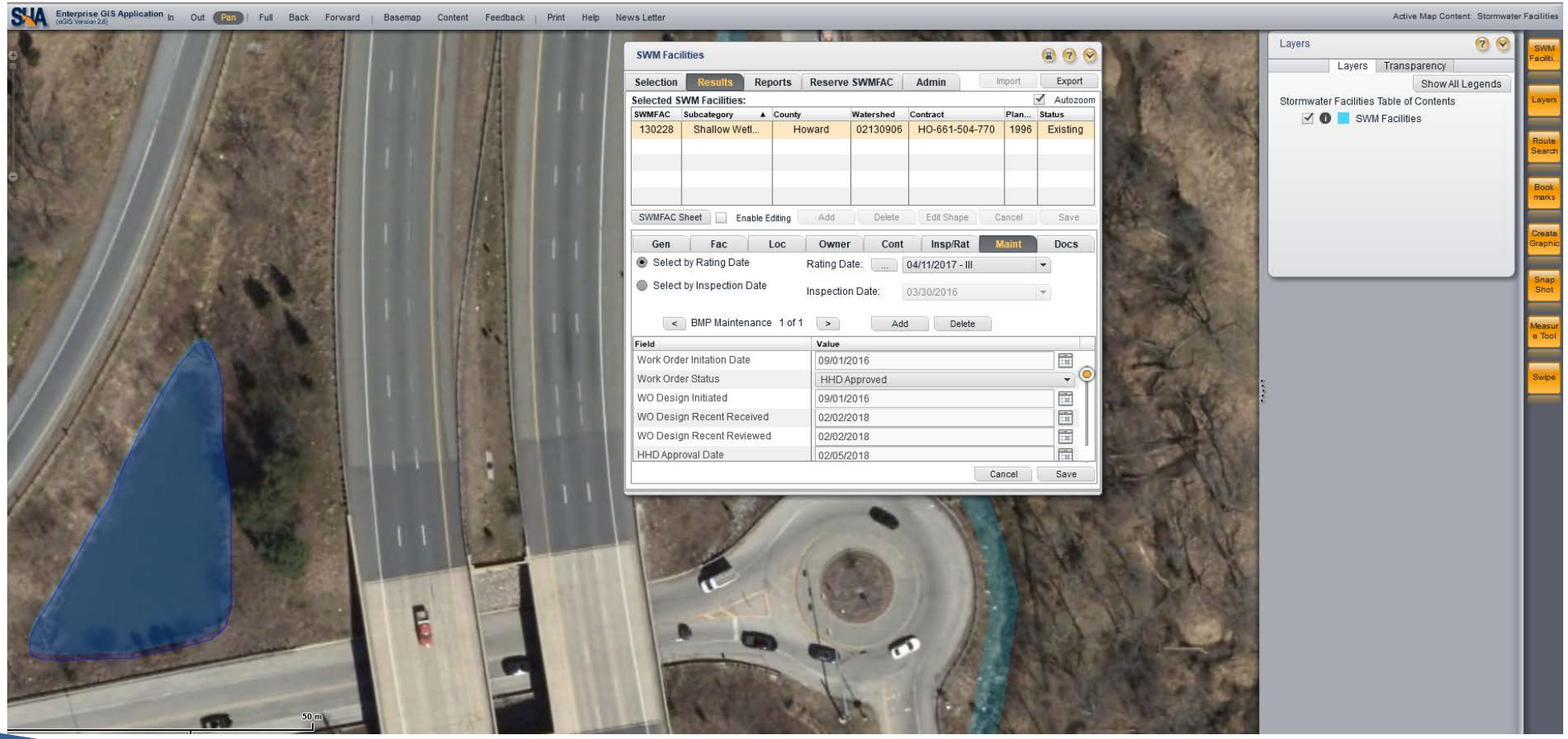
Facilities Maintained

2017	~8
2018	~4
2019	~37
2020	~4

Engineering

Remediation/Retrofit Tracking - NOW

- Updated Permit Tracking for project development



- 46 Parameters
  - Initiation Date
  - Design Status
  - Various Permit Statuses
  - Dates of Construction
  - Contractor
  - Costs
  - As-Built / Remediation Verification Complete
  - Overall Status

Construction

Contract Types – THEN and NOW

- **Historically Many Types of Contracts have been used**
  - Bid-Build
  - Design-Build
  - Memorandum of Understanding
  - Area Wide
    - Time and Materials
    - Bid Item

Operations

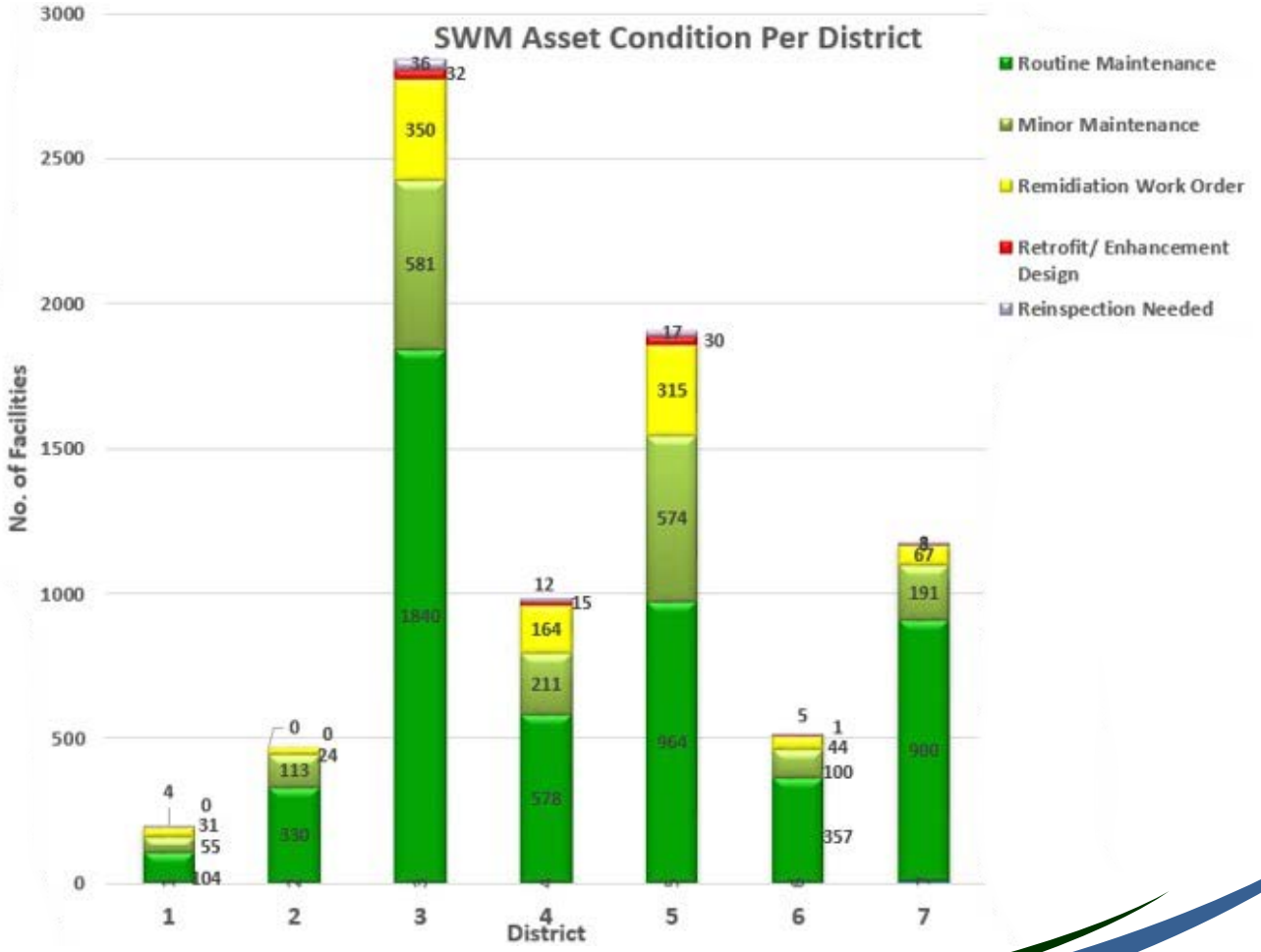
Routine and Minor Maintenance – Then and Now

Data Sharing with Maintenance Staff

- Provides Planning Opportunities
- Budget Decisions

SWM Condition	Totals
Routine Maintenance	5073
Minor Maintenance	1825
Remidiation Work Order	995
Retrofit/ Enhancement Design	81
Reinspection Needed	82

Total 8,056



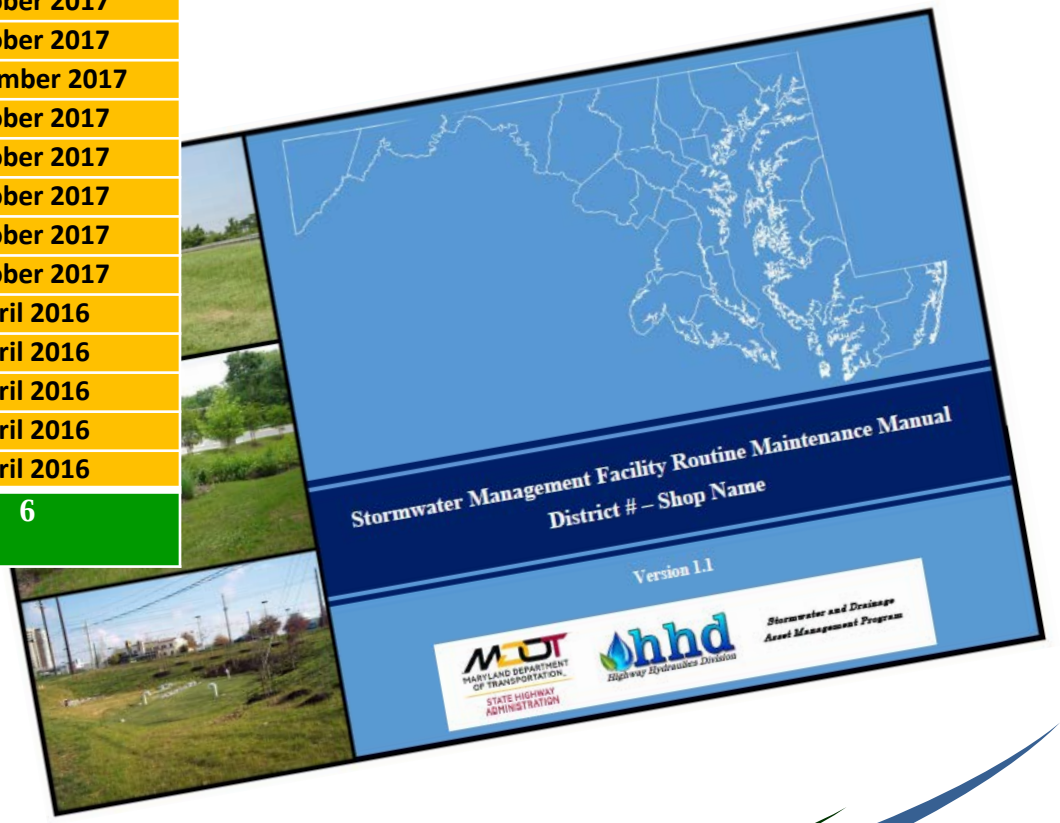
Operations

Routine Maintenance Procedures – THEN and NOW

SWM Facility Routine Maintenance Manuals

- Physical Copies Provided
- PDF and CDs Provided
- Available On-Line

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



Can be Found ON-LINE at:
https://www.roads.maryland.gov/Index.aspx?PageId=363

Operations

Routine Maintenance Procedures – NOW and SOON

Sorting the Information in the Manual

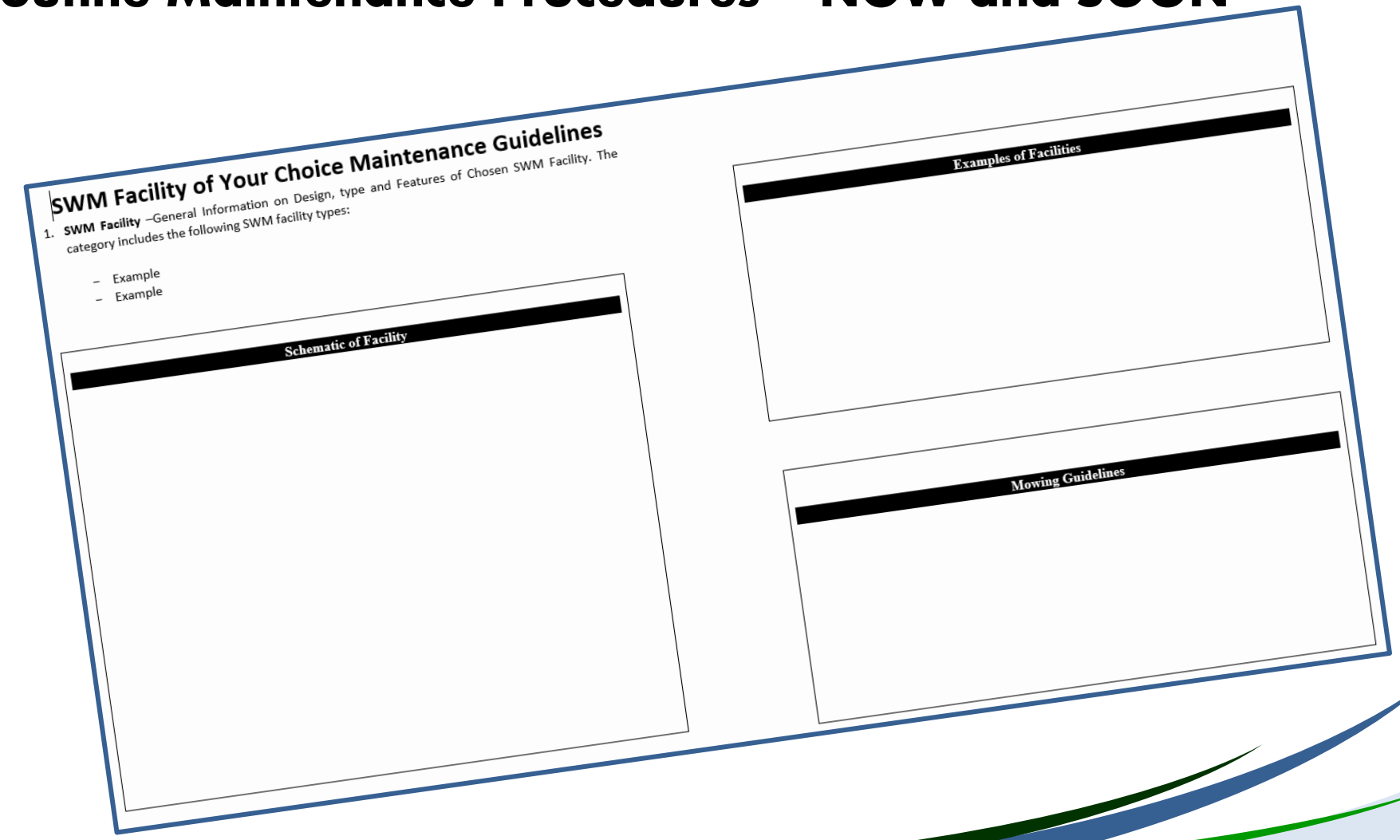
- Types of SWM Facilities
  - Dry Pond
  - Wet Pond
  - Infiltration Facility
  - Filtration Facility
  - Bio-Swale
  - Turfgrass Facility–follow standard turfgrass maintenance guidelines

Operations

Routine Maintenance Procedures – NOW and SOON

Standard Template

- Description
- Schematic
- Example Photos
- Mowing Guidelines
- Schedule



SWM Facility of Your Choice Maintenance Guidelines

1. **SWM Facility** –General Information on Design, type and Features of Chosen SWM Facility. The category includes the following SWM facility types:
   - Example
   - Example

Schematic of Facility

Examples of Facilities

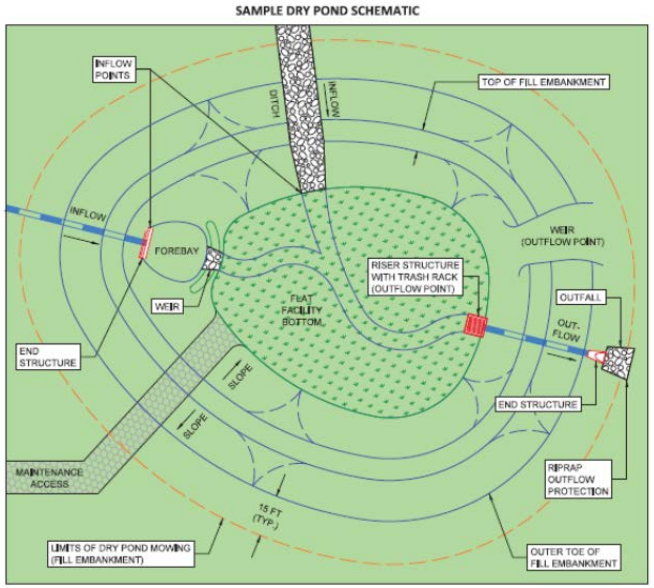
Mowing Guidelines

Operations

Routine Maintenance Procedures – NOW and SOON

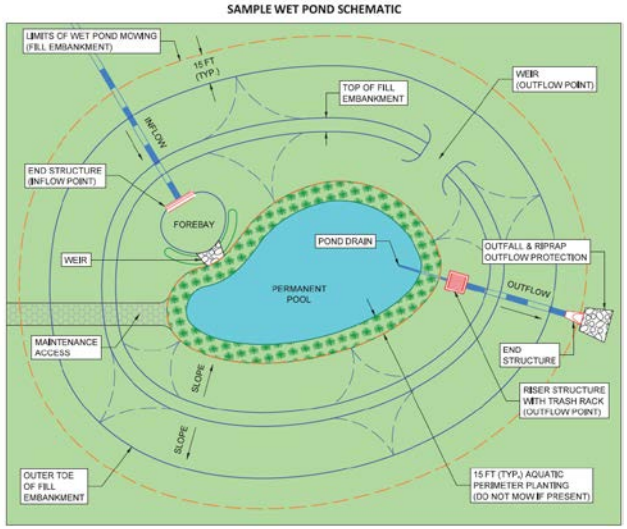
Dry Pond

- Should hold runoff temporarily and release fully. Generally, appears as a grass basin with no permanent pool of water.
- Verify facility is not holding water after 72 hours and report if found



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.
- Verify that pond drain opening in the riser is completely sealed

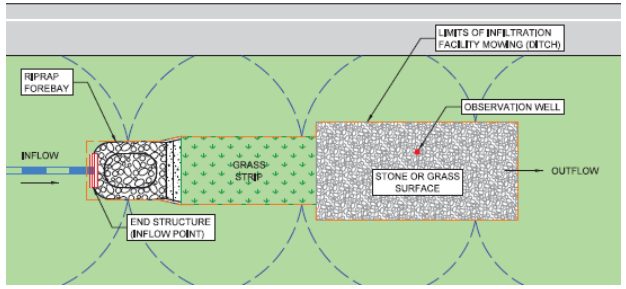


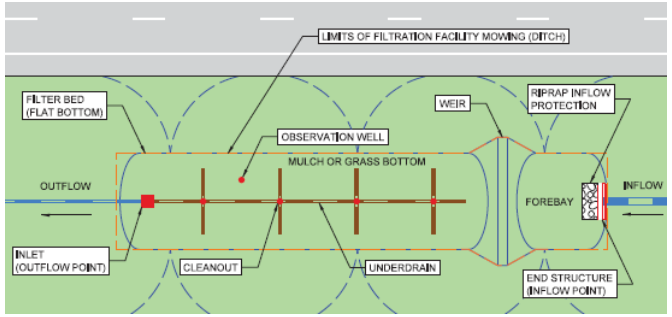
Operations

Routine Maintenance Procedures – NOW and SOON

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



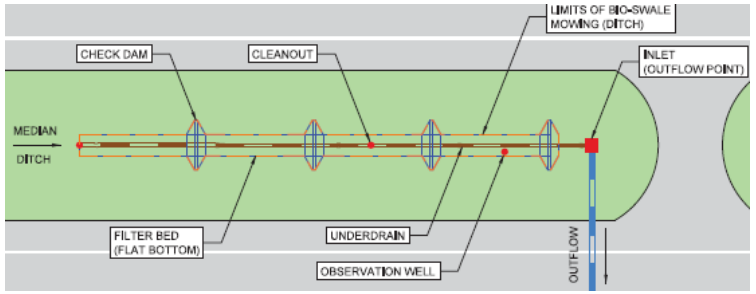


Filtration Facility

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

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

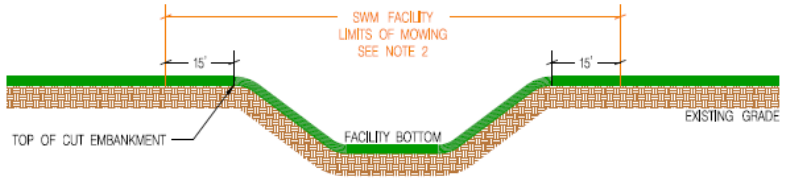


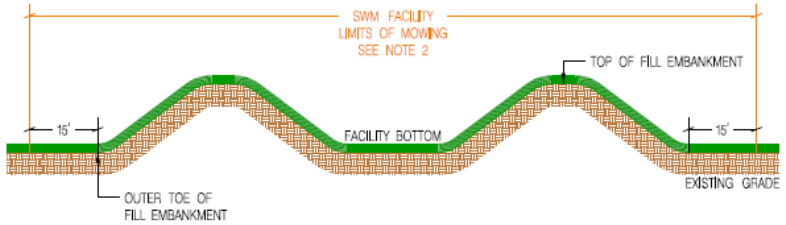
Operations

Routine Maintenance Procedures – NOW and SOON

Dry Facilities

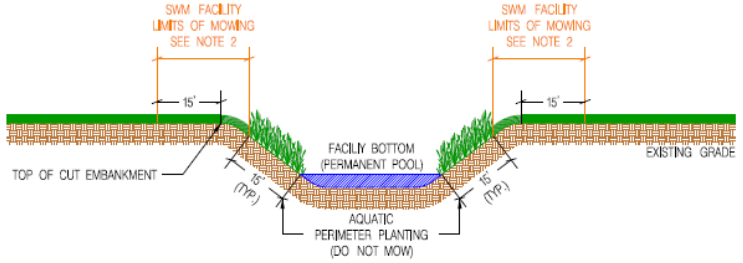
- 6-inch mowing height
- Limits vary

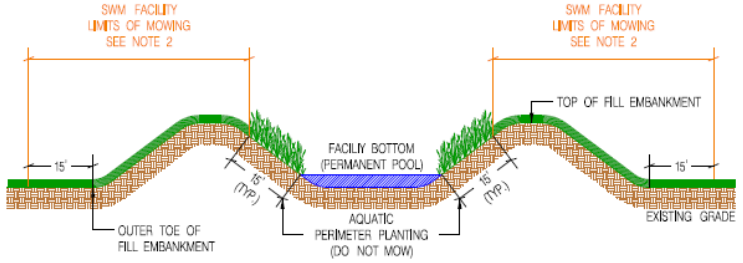




Wet Facilities

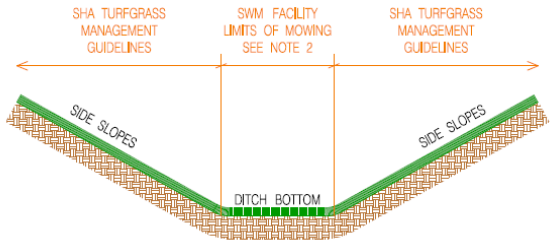
- 6-inch mowing height
- Wet Vegetation Zone





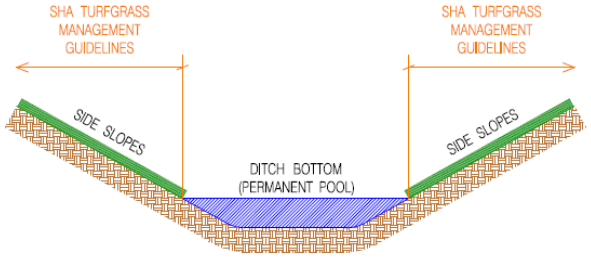
Dry Linear Facilities

- 6-inch mowing height bottom only
- Turfgrass Mowing Zone



Wet Linear Facilities

- No mowing in Aquatic Area
- Turfgrass Mowing Zone



Filtration Facilities – Coming Soon to a Manual Near You

Operations

Routine Maintenance Procedures – NOW and SOON

- **Work Schedule Summaries**
  - Spring Maintenance
    - March 15-May 15
  - Fall Maintenance
    - Sept. 15 – Dec 15
  - Work Description
  - Needed Equipment and Materials
  - Notes and Troubleshooting
  - Common Problem List

Spring Maintenance Work: Once each spring (March 15 – May 15)

Specific Work Items	*Equipment*	*Materials*
1. Install MOT devices as needed	MOT/Safety Equipment	
2. Remove waste including trash, leaves, debris from pond, trash rack, riser and other structures.	Pick-Up Truck Shovel Rake Other Hand Tools	
3. Check for deterioration or damage to structures. Notify Resident Maintenance Engineer if repair work is needed.		
4. If water is still ponding in the facility 72 hours after a storm, check for clogs and clear vegetation that blocks water flow. Report excess ponding to HHD.	Shovel Rake Other Hand Tools String Trimmer	
5. Remove accumulated sediment from the facility. Areas around principle spillway and low flow orifice are most critical.	Pick-Up Truck Shovel Rake Other Hand Tools	
6. Fill animal burrows in embankments by mud-packing 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. Report any soft spots, depressions, or water seepage to HHD.	Shovel Rake Other Hand Tools Bucket Smooth Pipe Section (24" long 6" diam)	Subsoil Cement Furnished Topsoil SHA Turfgrass Seed Mix
7. Remove trees with a diameter at breast height (DBH) under 2 in. (measured approximately 4.5 ft, above highest ground touching the tree) per Landscape Management Guide (LMG). Trees larger than 2 in. require coordination with HHD to flag acceptable locations for removal.	Chain Saw	Herbicide Water
8. Remove brush and control priority invasive weeds per LMG.	Chain Saw Backpack Sprayer	Herbicide Water
9. Mow short meadow (Zone 1) areas per LMG.	Articulated or Side Arm Mower String Trimmer	
10. Transport and dispose waste at approved disposal site.	Pick-Up Truck	
11. Remove MOT devices.		

Fall Maintenance Work: Once each fall (September 15 – December 15)

Specific Work Items	*Equipment*	*Materials*
1. Install MOT devices as needed	MOT/Safety Equipment	
2. Remove waste including trash, leaves, debris from pond, trash rack and other structures.	Pick-Up Truck Shovel Rake Other Hand Tools	
3. Remove trees with a diameter at breast height (DBH) under 2 in. (measured approximately 4.5 ft, above highest ground touching the tree) per LGM. Trees larger than 2 in. require coordination with HHD to flag acceptable locations for removal.	Chain Saw	Herbicide Water
4. Remove brush & control priority invasive weeds per LMG.	Chain Saw Backpack Sprayer	Herbicide Water
5. Mow short meadow (Zone 1) and SWM Facility (Zone 1b) meadow areas per LMG.	Articulated or Side Arm Mower String Trimmer	
6. Remove and reset stone and geotextile in riprap areas, filling in ruts and depressions beneath the geotextile with common borrow to restore smooth grades. Key in geotextile and fill surrounding ruts and depressions using topsoil to restore the ground to the original lines and grades.	Shovel Rake Other Hand Tools	Subsoil Furnished Topsoil SHA Turfgrass Seed Mix Type 'A' Soil Stabilization Matting & Fasteners Class I Riprap
7. Apply seed in bare soil areas and install Type A Soil Stabilization Matting per LMG.	Seed Spreader	SHA Turfgrass Seed Mix Type 'A' Soil Stabilization Matting & Fasteners
8. Transport and dispose waste at approved disposal site.	Pick-Up Truck	
9. Remove MOT devices.		

Notes and Troubleshooting

Do not create ruts or damage soil of facility. Do not drive equipment into wet areas of facility.

Follow guidelines for recommended personal protective equipment. Place signs and other safety devices in accordance with MUTCD and WZTC

Common Problems

1. Erosion
2. Sediment Accumulation
3. Lack of Vegetation
4. Excessive Vegetation
5. Damaged or Deteriorated Structure or Pipe
6. Unstable Embankment
7. Excess Ponding Water

Operations

Routine Maintenance Procedures – NOW and SOON

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

Operations

Routine Maintenance Procedures – NOW and SOON

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

Operations

Routine Maintenance Procedures – NOW and SOON

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 whi as cou

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

Operations

Routine Maintenance Procedures – NOW and SOON

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

Operations

Routine Maintenance Procedures – NOW and SOON

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

Operations

Routine Maintenance Procedures – NOW and SOON

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, re-seed with Turfgrass Seed Mix and Type 'A' Matting
Soft Spots, Depressions, Seepage or Other Problems	Report to HHD

Operations

Routine Maintenance Procedures – NOW and SOON

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

Future Focus

Business Process Improvements

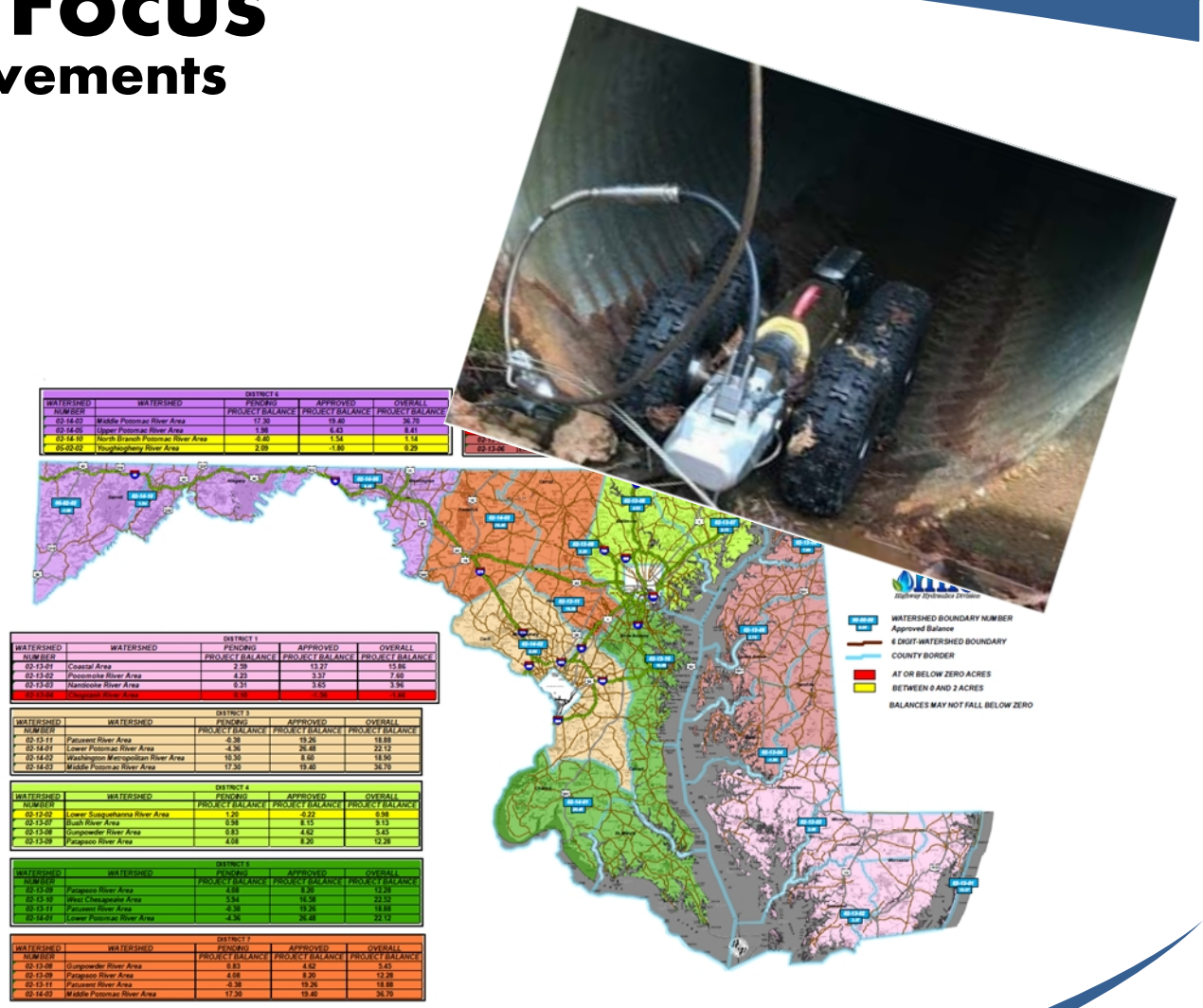
New GIS Applications

- Much more overlaid information
  - Drainage Complaint Data
  - Crash Data from excess water
  - Property Information
  - TMDL Planning from OED
  - Soils Information
  - Watershed Boundaries
  - Roadway Projects
  - Contract Information
  - Sea Level Rise Investigations
  - Tree Conflict Studies

Future Focus

Business Process Improvements

- SWM Facility Inspection Tracker
  - Daily Live Progress Updates
  - Dashboard of Inspection Ratings
- Outfall Inspection Program
- Dam Inspection Program
- Video Pipe Inspection for Drainage Inspection
  - CMP Pipes are Aging and Failing and Disrupting our Roadway System.
  - A Proactive and Less Reactive Approach
- Water Quality Bank Tracking
  - Tracks amount of amounts of impervious managed or treated for WQ in acres



DISTRICT 6

WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-14-03	Middle Potomac River Area	17.30	19.40	36.70
02-14-06	Upper Potomac River Area	1.58	6.43	8.01
02-14-10	North Branch Potomac River Area	-0.40	1.54	1.14
05-02-02	Youghiogheny River Area	2.09	-1.80	0.29

DISTRICT 1

WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-13-01	Coastal Area	2.59	13.27	15.86
02-13-02	Pocomoke River Area	4.23	3.37	7.60
02-13-03	Nanticoke River Area	0.31	3.65	3.96
02-13-04	Choptank River Area	5.50	-5.36	0.14

DISTRICT 3

WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-13-11	Patuxent River Area	-0.38	19.26	18.88
02-14-01	Lower Potomac River Area	-4.36	26.48	22.12
02-14-02	Washington Metropolitan River Area	10.30	8.60	18.90
02-14-03	Middle Potomac River Area	17.30	19.40	36.70

DISTRICT 4

WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-12-02	Lower Susquehanna River Area	1.20	-0.22	0.98
02-13-07	Bush River Area	0.98	8.15	9.13
02-13-08	Gunpowder River Area	0.83	4.62	5.45
02-13-09	Patapsco River Area	4.08	8.20	12.28

DISTRICT 5

WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-13-09	Patapsco River Area	4.08	8.20	12.28
02-13-10	West Chesapeake Area	5.54	16.98	22.52
02-13-11	Patuxent River Area	-0.38	19.26	18.88
02-14-01	Lower Potomac River Area	-4.36	26.48	22.12

DISTRICT 7

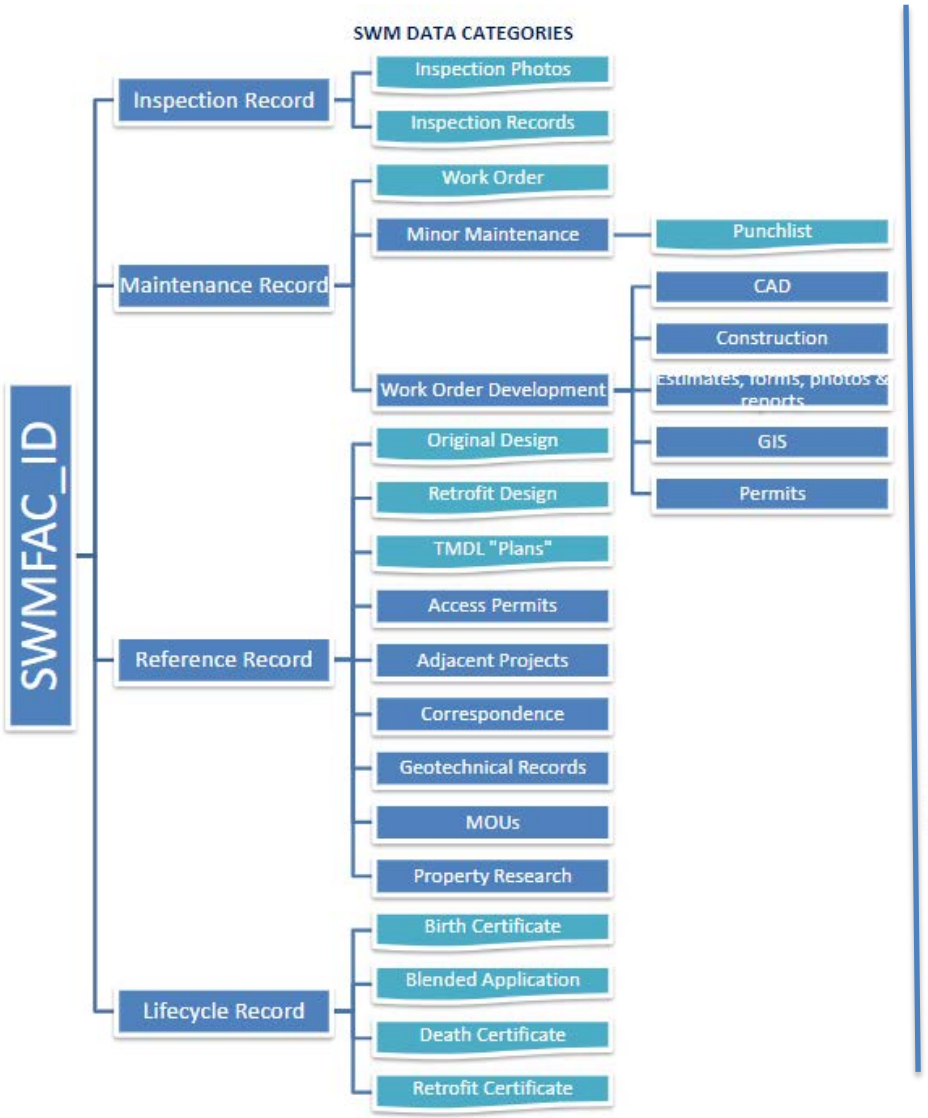
WATERSHED NUMBER	WATERSHED	PENDING PROJECT BALANCE	APPROVED PROJECT BALANCE	OVERALL PROJECT BALANCE
02-13-08	Gunpowder River Area	0.83	4.62	5.45
02-13-09	Patapsco River Area	4.08	8.20	12.28
02-13-11	Patuxent River Area	-0.38	19.26	18.88
02-14-03	Middle Potomac River Area	17.30	19.40	36.70

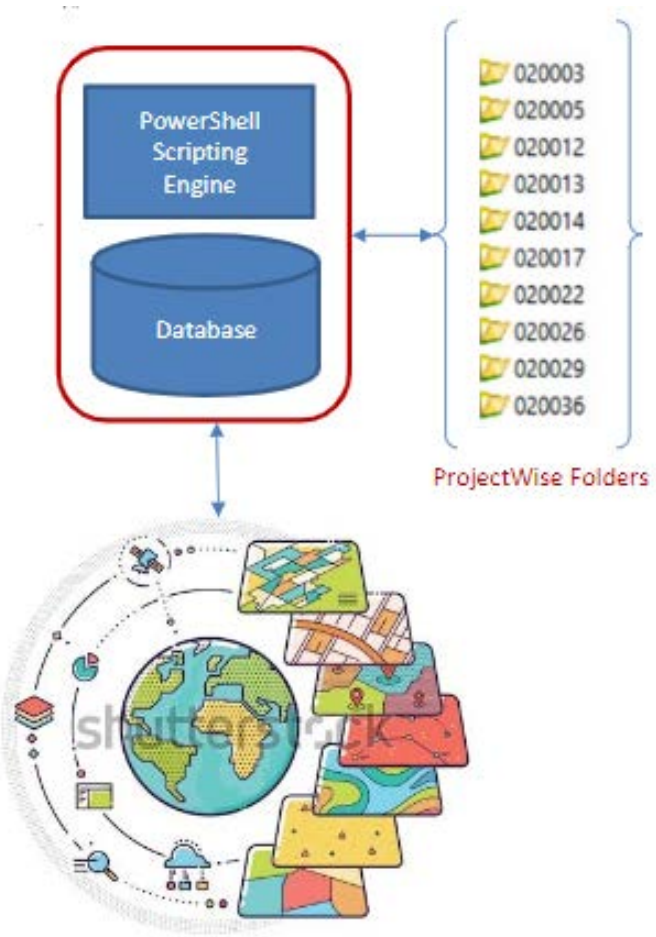
Future Focus

Sharing

More than JUST the Database

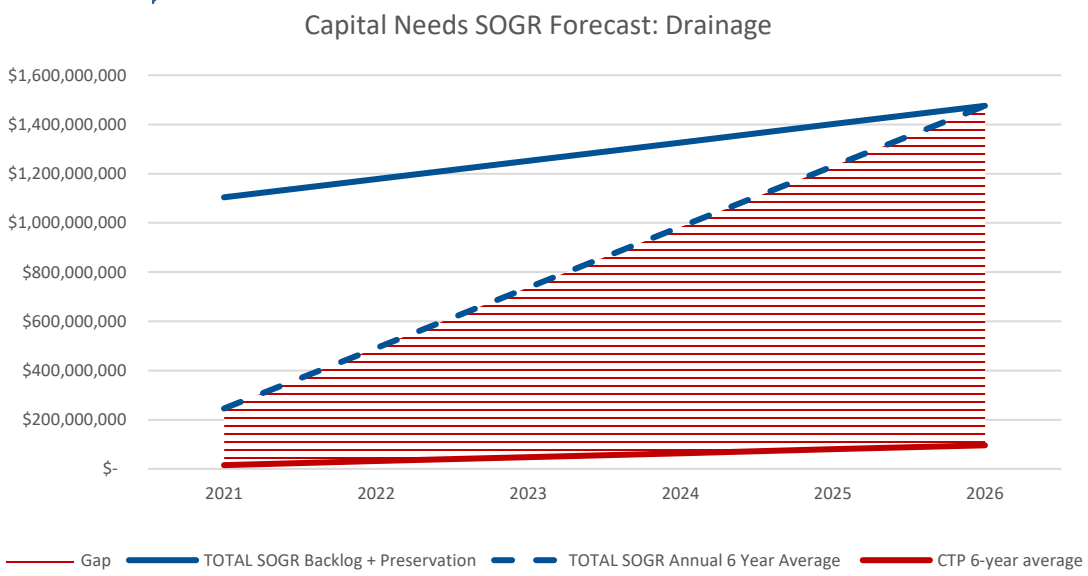
- New File Organization
  - Search Tools
  - Database Sharing Tools thru On-Line Platforms

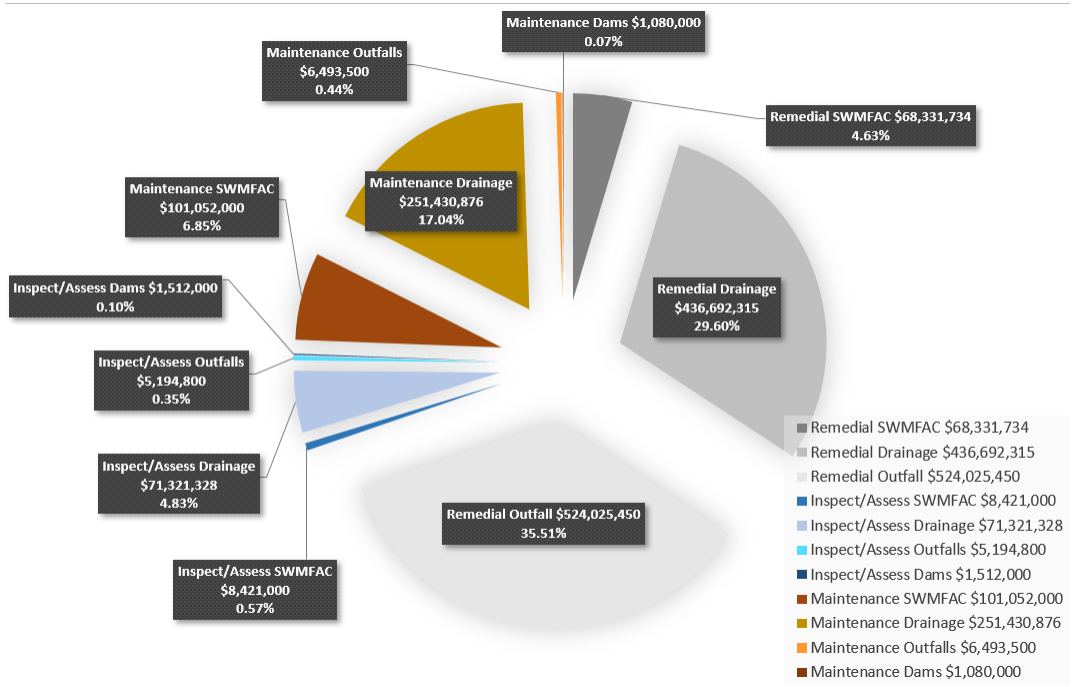




Future Focus

Asset Management Expertise





Data strengths/gaps vary per sub-category

a. *SWMFAC* - Strong with few gaps and updated daily
b. *Drainage* – Medium with major gaps and updated annually
c. *Outfalls* – Medium with major gaps updated quarterly
d. *Dams* - Strong with few gaps and updated annually

All aspects require better maintenance tracking and operations training materials.

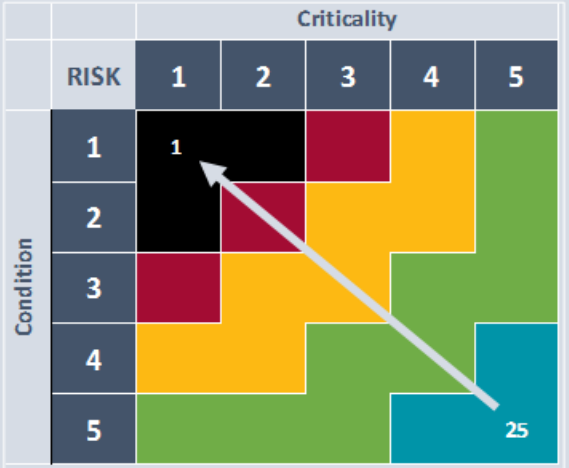
Future Focus

Asset Management Expertise

Condition x **Criticality** = **Risk Score**

Physical / Visual
Functional
- Capacity
- Safety / Regulatory
- Obsolescence
- Level of Service
- Resources
- Resiliency

Safety
Level of Service
Regulatory
Environmental
Operations & Maintenance
Financial / Economic



- Renew
- Replace
- Operations & Maintenance
- Redesign / Enhance

Failure Modes Analysis

Effects Analysis / Maintenance Planning

Service Level Impacts / Critical Failures

Intervention Strategy

Outcomes

- **Drive Proactive Maintenance and Risk Strategy**
- **Extend Life and Deliver Level of Service**
- **Maximize Reliability Focused on Critical Assets**

Contact Me

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