

Remote Sensing to support BMP Verification - 2022 Phase 1

Jordan Baker, HRG

Katie Walker, Chesapeake Conservancy

Momentum

- BMP Verification is a long-term need for continued local and Bay water adaptive management
- Incomplete implementation records
- Limited capacity for in-field visits, focus should be on service needs and compliance
- Desire to see next steps, incorporating lessons learned, from Potomac River Basin pilot

Opportunity

- PADEP provided grant funding to Pennsylvania Countywide Action Plan (CAP) counties for BMP verification
- CAPs indicate the need for a remote sensing effort - local stakeholder input
- PA counties have some capacity this year to assist with field verification, further informing the remote sensing approach

Project Goals

- Develop and implement methods for automating the remote identification of previous BMP implementation sites
- Utilize automated remote sensing data to bolster BMP Reporting in CAST
- Reduce human capital needs on verifying previous BMP implementation
- Support data going into long-term water quality monitoring efforts

Project Tasks

- Map/catalogue certain visible BMPs with high resolution imagery and GIS analysis (digitizing and automated methods)
- Field-verify percentage of automated BMP types
- Field-verify all non-automated BMP types that require site-specific information for reporting (e.g. waste management systems, wet ponds/detention basins, barnyard BMPs)
- Report field verified practices through PracticeKeeper (on short term)

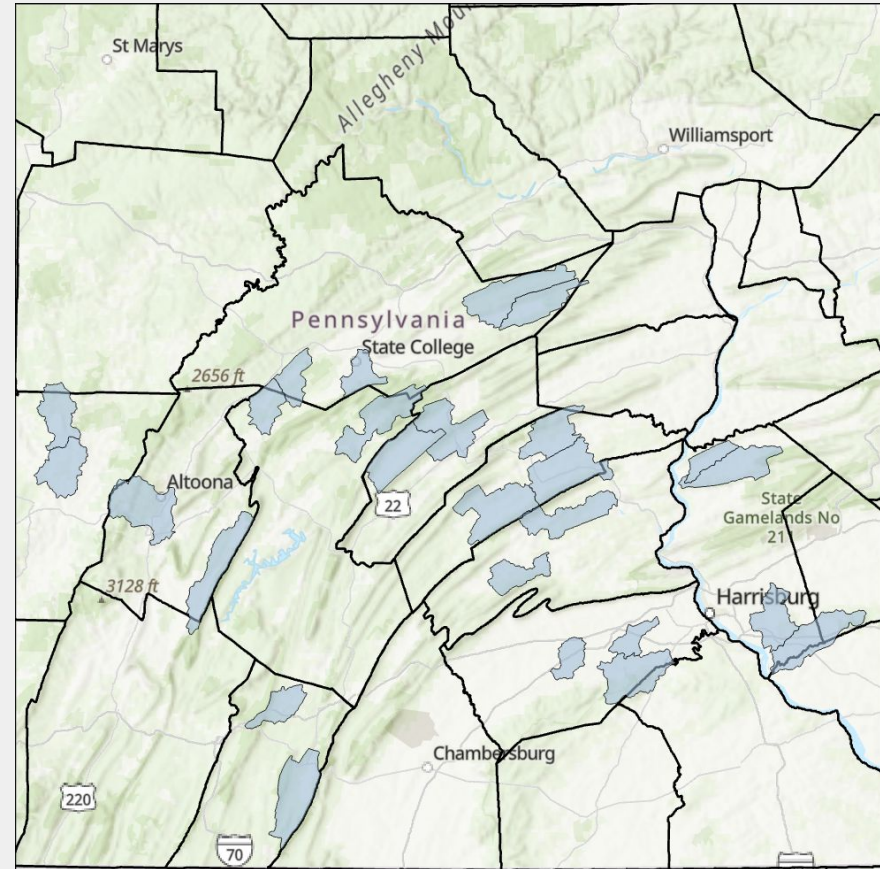
What & Where?

Direct Identification:

- Forested Buffers
- Grassed Waterways
- Streambank Exclusion Fencing
- Wet ponds/detention basins

Indirect (proxy) Identification:

- Barnyard runoff control/loafing lot management
- Animal waste management



County Name	Priority 1 Watershed	HUC-12 Code	Priority 2 Watershed	HUC-12 Code	Priority 3 Watershed	HUC-12 Code	Priority Urban Watershed	HUC-12 Code
Blair	Clover Creek	20503020304					Beaverdam Branch	20503020202
Cambria	Middle Chest Creek	20502010102	Upper Chest Creek	20502010101				
Centre	Elk Creek	20503010201	Pine Creek	20503010202	Halfmoon Creek	20503020402	Slab Cabin Run	20502040102
Cumberland	Middle Yellow Breeches	20503050504	Alexander Spring Creek	20503050402			Hogestown Run	20503050405
Dauphin	Conewago Creek	20503051010	Little Wisconisco Creek	20503010903	Wisconisco Creek	20503010904	Swatara Creek	20503050906
Fulton	Big Cove Creek	20700040302	Wooden Bridge Creek	20503040202				
Huntingdon	Warriors Mark Run	20503020403	Standing Stone Creek - East Branch	20503020702				
Juniata	Lost Creek	20503040802	Tuscarora Creek	20503040907	Juniata River - Raccoon Creek	20503041201		
Mifflin	Kish Creek - Coffee Run	20503040701	Kish Creek	20503040702				
Perry	Shermans Creek - Cisna Run	20503050104	Buffalo Creek	20503041102				

What practices are we considering in Phase 1?

<u>BMP</u>	<u>Measurement</u>	<u>Cataloging Methods</u>	<u>Deliverable</u>
Forest buffers	acres	<ol style="list-style-type: none"> 1. Classify tree canopy coverage within riparian buffer area for 2009 imagery. 2. Identify changes in canopy coverage for 2009-2017. 3. Utilize LiDAR/elevation data to identify additional successional changes that might get lost in full TC classification. 	Shapefile with identified features of possible tree plantings prior to 2017.
Grass waterways	acres	<ol style="list-style-type: none"> 1. Classify grassy vegetation or shrubland within areas of concentrated flow or riparian buffers from 2009 imagery. 2. Utilize high-resolution land use to identify areas of change between agriculture and low vegetation/ shrubland from 2009-2017. 3. Explore use of spectral signatures for classification. 	Shapefile with identifies features of possible planting locations prior to 2017.
Streambank exclusion fencing	Linear feet + acres	<ol style="list-style-type: none"> 1. Digitize fencing through gridded manual review and intersect with associated buffers for highly pasture-agricultural watersheds. 	Shapefile of exclusion fencing Shapefile of associated buffers

What practices are we considering in Phase 1?

<u>BMP</u>	<u>Measurement</u>	<u>Cataloging Methods</u>	<u>Deliverable</u>
Wet ponds/detention basins	square feet	<ol style="list-style-type: none"> 1. Classify water features in urbanized areas from 2009 imagery. Run change analysis for 2009-2017. 2. Identify other likely depressions in sub/urban areas. 3. Explore opportunity to utilize deep learning for feature extraction. 	Shapefile identifying potential implementation
Barnyard runoff control + loafing lot management	acres	<ol style="list-style-type: none"> 1. Identify animal operations by finding likely barn clusters that are close to stream features. 2. Explore opportunity to classify barren patches within pasture. 3. Explore opportunity to utilize deep learning for feature extraction. 	Shapefile identifying farm operations that may be good candidates for field verification.
Animal waste management systems	square feet	<ol style="list-style-type: none"> 1. Identify water features nearby barnyard clusters. 2. Explore opportunity to utilize deep learning for feature extraction. 	Shapefile identifying farm operations that may be good candidates for field verification.

Sample of GIS data



- County Boundaries ...
- Karst Features ...
- Impaired Streams (Integrated List Non-Attaining 2020) ...
- Stream Reaches ...
- HUC12 Boundary + 100 Meter Buffer ...
- Best Management Practice Opportunities (ACPF) ...
- Contour Buffer Strips ...
- Grassed Waterways ...
- Riparian Forest Buffers ...
- 1 ...
- Water and Sediment Control Basins-Embankments ...
- Water and Sediment Control Basins-Basin Areas ...
- Denitrifying Bioreactors ...

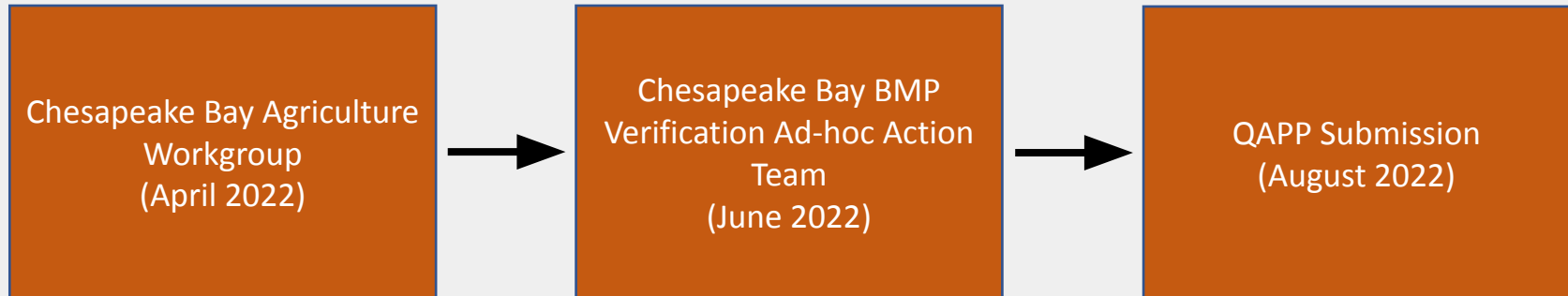
BMP Verification & In-field Support

BMP	Field Verification	Data Submission	Additional Data
Forest Buffers	10% random spot check	10% spot check uploaded to PK, statistical analysis uploaded to Data Warehouse in tabular form	Shapefile with identified features of possible tree plantings prior to 2017 given to CCD
Grassed Waterways	10% random spot check	10% spot check uploaded to PK, statistical analysis uploaded to Data Warehouse in tabular form	Shapefile with identified features of possible tree plantings prior to 2017 given to CCD
Exclusion Fencing	10% random spot check	10% spot check uploaded to PK, statistical analysis uploaded to Data Warehouse in tabular form	Shapefile with identified features of possible tree plantings prior to 2017 given to CCD
Animal Waste Management Systems	Spot Check for every practice	Individual practices uploaded to PK upon completion of spot check	Shapefile identifying location for spot check available to CCD
Barnyard Runoff Controls	Spot Check for every practice	Individual practices uploaded to PK upon completion of spot check	Shapefile identifying location for spot check available to CCD
Wet Ponds and Detention Basins	Spot Check for every practice	Individual practices uploaded to PK upon completion of spot check	Shapefile identifying location for spot check available to CCD

HRG/Chesapeake Conservancy/County BMP Verification Workflow



Approach Support Process (Chesapeake Bay Program)



April – June
Chesapeake
Conservancy will
provide shapefiles
of remotely
sensed BMPs



June – August
Conservation
District Staff,
interns and other
qualified staff will
perform in field
verifications of
BMPs



Field Verification Workflow (Phase 1)



June – September
All field verified BMPs will be entered
into PracticeKeeper by Conservation
Districts and qualified individuals



December
PracticeKeeper BMPs
submitted to EPA

September
Forest buffers, grassed
waterways, and
exclusion fencing will be
statistically analyzed by
Chesapeake
Conservancy and HRG

Conclusion

- Phase 1, will be completed this year. Current application are in the process to start Phase 2 in 2023.
- Future approval for full remote sensing reporting based on results of Phase 1
- Inclusion of additional BMPs including annual practices (Tillage Management and Cover Crops)