Rappahannock River Comprehensive Watershed Evaluation (Programmatic Document)

Provided to the Rappahannock-Rapidan Regional Commission
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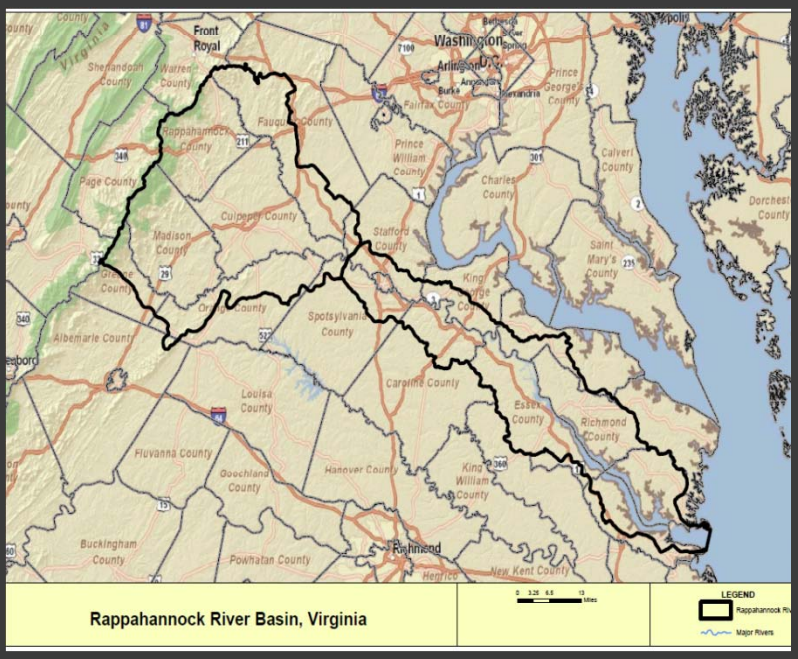
"Planning Smart, Building Strong"

Agenda

Introductions & Background
Water Resources Problems, Needs & Opportunities
Authorization & Appropriation
What This Is
What This Is Not
Presentation (Including an Example)
Questions
Follow-Up Actions ("BY WHO & BY WHEN")
Conclusion



Under the Chesapeake Bay TMDL…

localities develop and implement Watershed Implementation Plans (WIPs)

…to reduce their annual discharges of Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS or 'sediment') to prescribed limits.

These pollutants contribute to water quality problems (like algal blooms, dissolved oxygen depletion, fish lesions and mahogany tides) in the Bay.

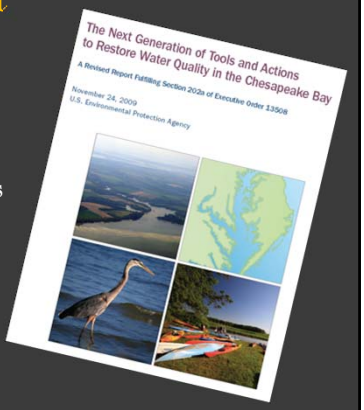
Putting a WIP Together

Photo Credits:

(Top) ***Ulcerative Dermatitis Syndrome (UDS)*** MD Department of Natural Resources, Fisheries Service, and University of Maryland, Center for Environmental Science, Horn Point Laboratory

(Bottom) ***Harmful Algal Blooms (HABs)*** Sarah Dinh, Ph.D.

The WIP identifies Best Management Practices (BMPs) that can be implemented to reach the goals.



Typical BMPs include:

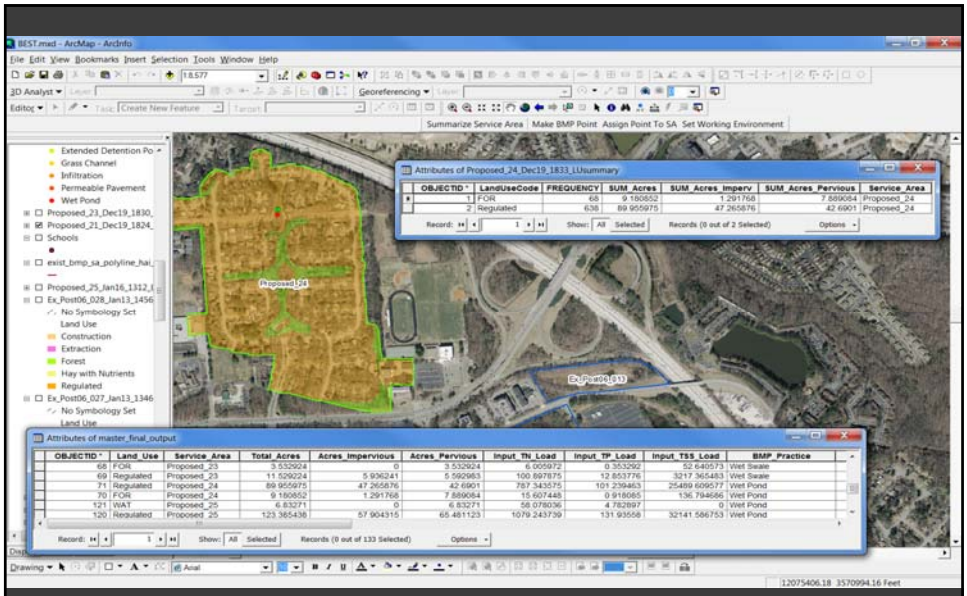
- Erosion & Sediment Control Practices
- Street Sweeping
- Detention ('Dry) Ponds
- Retention ('Wet') Ponds
- Nutrient Management Plans
- Restrictions on the Use of Fertilizer
- Creation of Wetlands
- Bioretention
- Infiltration Practices
- Urban Filtering Practices

Putting a WIP Together

The challenge is to select BMPs that can meet the regulated pollutant reduction levels set by the Chesapeake Bay TMDL at a reasonable cost.

So…How can that be done?

Putting a WIP Together



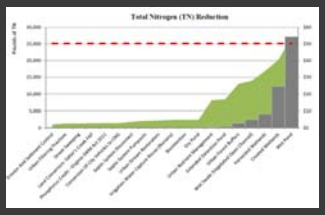
Here's an example of a planning analysis to site a wet pond. Pollutant removals are computed and tallied towards the TMDL goals.

Putting a WIP Together

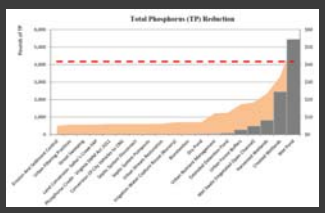
Most BMPs serve to reduce some amount of *all three* pollutants. For example, a wet pond removes TN, TP *and* TSS from stormwater discharges.

Localities need to select a toolbox of cost-effective BMPs that when implemented collectively can meet the prescribed pollutant reduction levels.

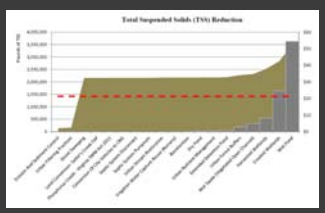
TN



TP



TSS

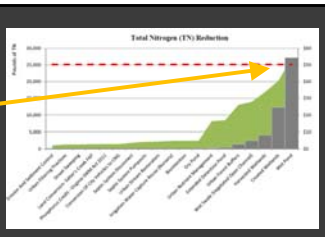


Putting a WIP Together

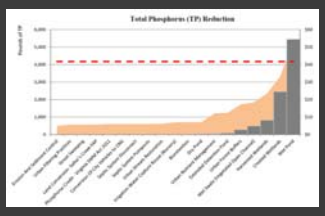
Typically, one of the three pollutants will prove to be the most difficult for a locality to remove…

…and the WIP is only compliant when *all three* pollutant reductions meet or exceed their prescribed target.

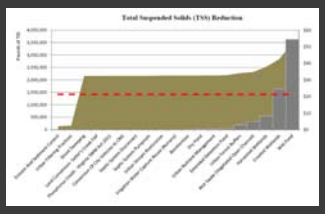
TN



TP



TSS



Putting a WIP Together

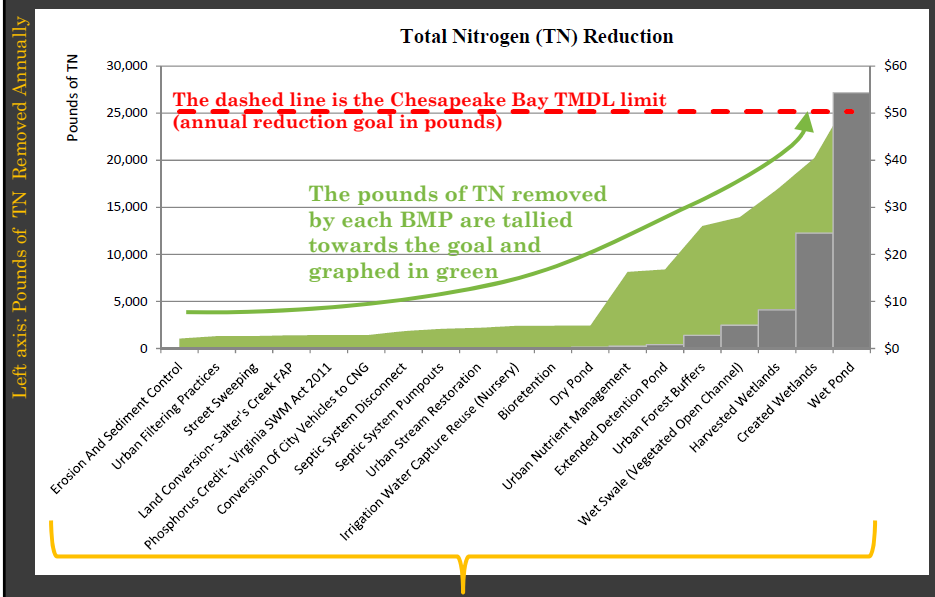
General Steps to Develop a WIP

1. Make sure you are working with the correct data and reduction targets.
2. Estimate which types of BMPs will work, and are 'affordable'. The list becomes the locality's BMP Toolbox.
3. Through planning analyses, determine how much implementation is appropriate for each BMP…
4. …taking into consideration
   - *actual* implementation costs
   - feasibility to implement at specific sites
   - contingencies (they won't all pan out)

Putting a WIP Together

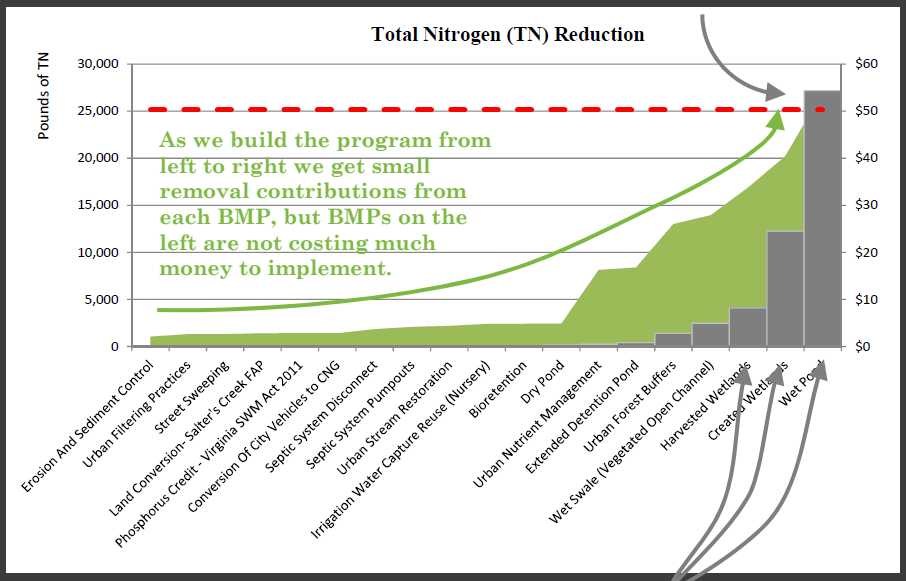
Let's look at an actual WIP, with estimated costs, in chart form.

Putting a WIP Together



These BMPs comprise the locality's "BMP Toolbox"
(Quantities and costs were determined by planning analyses)

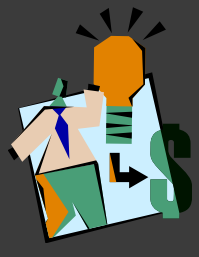
Plan to exceed the goal because not all BMPs can be successfully implemented.



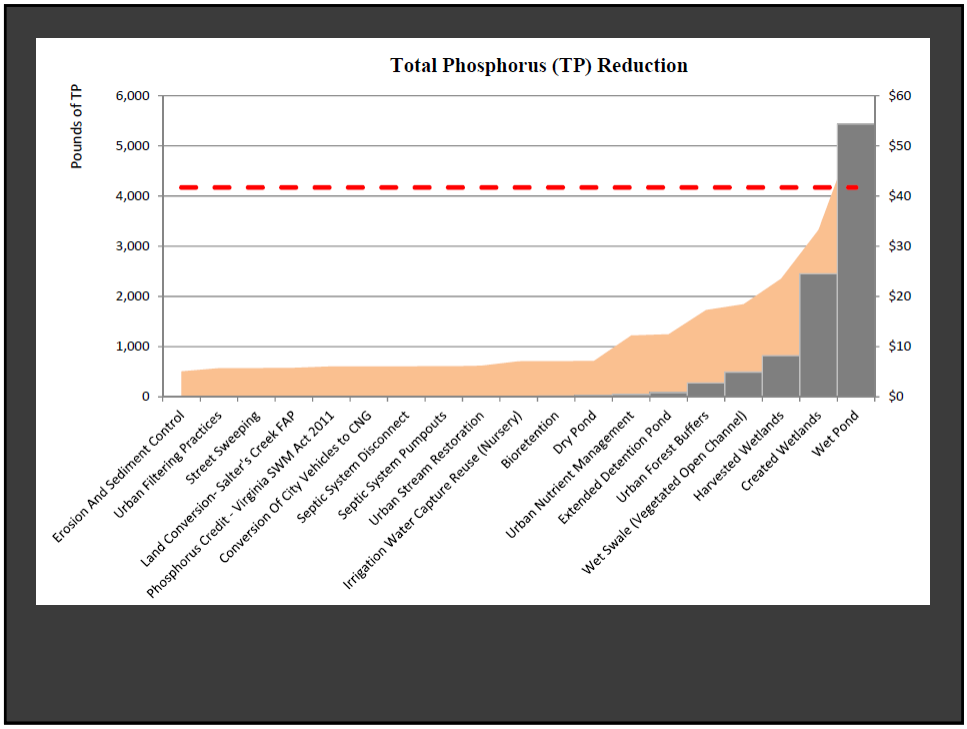
These BMPs begin to cost significantly. They represent the largest capital outlays, but are needed to reach the pollutant reduction goal.

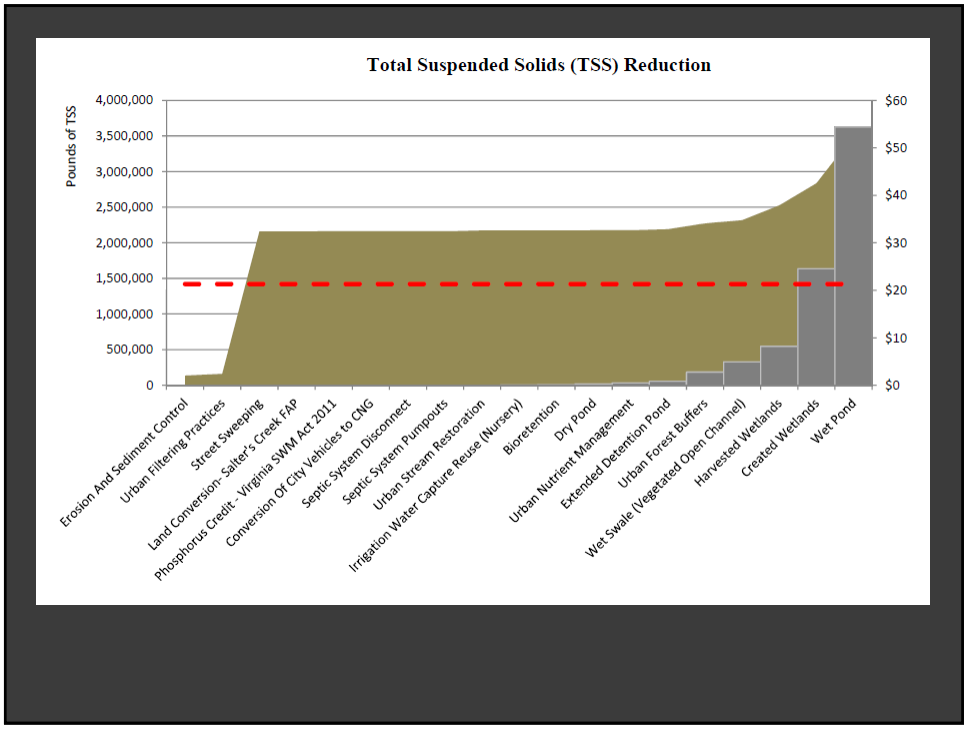
For this locality TN was the most difficult target to meet.

The other pollutant removals for this WIP program are shown on the following charts.



Putting a WIP Together


Total Phosphorus (TP) Reduction
Pounds of TP
6,000
5,000
4,000
3,000
2,000
1,000
0
$60
$50
$40
$30
$20
$10
$0
Erosion And Sediment Control
Urban Filtering Practices
Street Sweeping
Land Conversion- Salter's Creek FAP
Phosphorus Credit - Virginia SWM Act 2011
Conversion Of City Vehicles to CNG
Septic System Disconnect
Septic System Pumpouts
Urban Stream Restoration
Irrigation Water Capture Reuse (Nursery)
Bioretention
Dry Pond
Urban Nutrient Management
Extended Detention Pond
Urban Forest Buffers
Wet Swale (Vegetated Open Channel)
Harvested Wetlands
Created Wetlands
Wet Pond


Total Suspended Solids (TSS) Reduction
Pounds of TSS
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
$60
$50
$40
$30
$20
$10
$0
Erosion And Sediment Control
Urban Filtering Practices
Street Sweeping
Land Conversion- Salter's Creek FAP
Phosphorus Credit - Virginia SWM Act 2011
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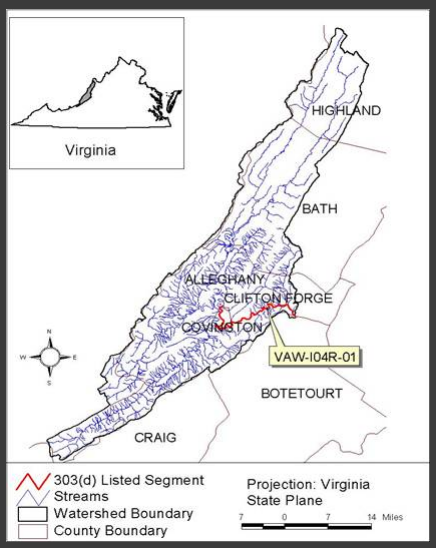
Harvested Wetlands
Created Wetlands
Wet Pond

JACKSON RIVER FACTS
(CREDIT TO JASON HILL AND TOM BOTKINS)

- Impaired 25 miles due to aquatic life use designation not being met
- Greatest stress to aquatic life is from elevated nutrient levels that lead to excessive benthic periphyton
- Flow pulses that mimic natural flow variability being evaluated to improve conditions

JACKSON RIVER LISTED SEGMENT

- Segment VAW-I04R-01
  - Listed on the 1996, 1998, 2002, 2004 Section 303(d) Lists of Impaired Waters (VADEQ)
- Upstream Limit:
  - Immediately below the Covington City Water Treatment Plant intake
  - 24.21 River Mile
- Downstream Limit
  - Confluence of the Jackson and Cowpasture Rivers
  - 00.00 River Mile



BENTHIC IMPAIRMENT

- Based on Biological Monitoring
  - Assessments indicate the benthic community is impaired.
  - Therefore, the listed segment does not meet the Aquatic Life Use support goal.

The General Water Quality Standard: "All state waters shall be free from substances […] which are harmful to human, animal, plant or aquatic life." (9 VAC 25-260-20).

STRESSOR IDENTIFICATION SUMMARY

- The common endpoint stressor is the excessive periphyton growth causing the benthic impairment
- This excessive periphyton growth is mainly caused by the excessive phosphorus in the river
- Consequently, the periphyton issue in the Jackson River may be addressed through a reduction in phosphorus loadings and a flow pulsing scenario based on natural variability

ENDPOINT DETERMINATION APPROACH

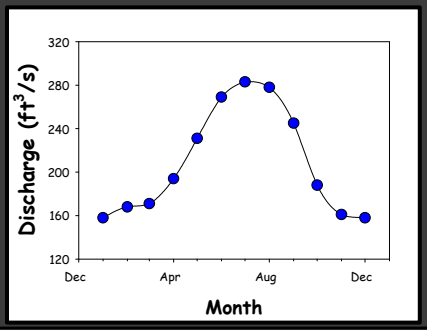
Identify acceptable Periphyton Benthic Chlorophyll *a* levels

Develop statistical relationships; establish correlations linking periphyton and nutrients

Are there strong relationships between stream periphyton and nutrients in the Jackson River?

Use the derived relationship between periphyton and nutrient to develop the nutrient endpoint using the *acceptable level of periphyton*

- More algal biomass downstream of the Mill and up to 30km downstream relative to the reference site (Filtration Plant).
- Highest concentrations between Mill and about 6km downstream
- Historically, algal biomass peaks in the fall.
- Reduction in effluent P in 2005-06 may have reduced algal growth and biomass.
- Algal accrual may be exacerbated by Gathright Dam discharge pattern
  - regulates high flows
  - augments low flows
  - reduces natural scour events.



Question to Consider:

- Did the USACE 2006 dam release scour and remove periphyton biomass from the Jackson River?

JACKSON RIVER OBSERVATIONS (DRAWN FROM A PRELIMINARY DATASET)

- Biomass in 2006 is lower compared to some sampling periods in previous years in the reach between Mill Bridge and Industrial Park.
- Suspended particulates and chlorophyll-*a* concentrations were highest on the leading edge of the 1,100 cfs pulse.
- The effects of the1,100 cfs pulse varied among sites. Playground and Industrial Park showed a significant reduction in algal biomass.
- The 6k pulse scoured a significant amount of periphyton from almost all locations.

JACKSON RIVER OBSERVATIONS (DRAWN FROM A PRELIMINARY DATASET)

- Pulses between 1,100 and 6,000 cfs appear to be effective in removing algal biomass in the Jackson River.
- The amplitude of the pulse maybe more important for scouring algae than pulse duration.
- Pulsing may be necessary to meet TMDL goals for aquatic life use and keep dissolved oxygen levels up in stressful years