Maryland Sediment TMDL Development

A Chesapeake Bay Partnership

Managing Sediments in the Watershed: Bringing Dredged Material and Watershed Managers Together
August 29-31, 2006, Portland, OR

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Maryland Department of the Environment

Components in TMDL Development

- Identify problem
- Source analysis
- Develop numeric targets
- Link targets and sources
- Allocate loads
- Reasonable assurance of implementation

Adapted from “Protocols for Developing Sediment TMDLs”. USEPA (1999)

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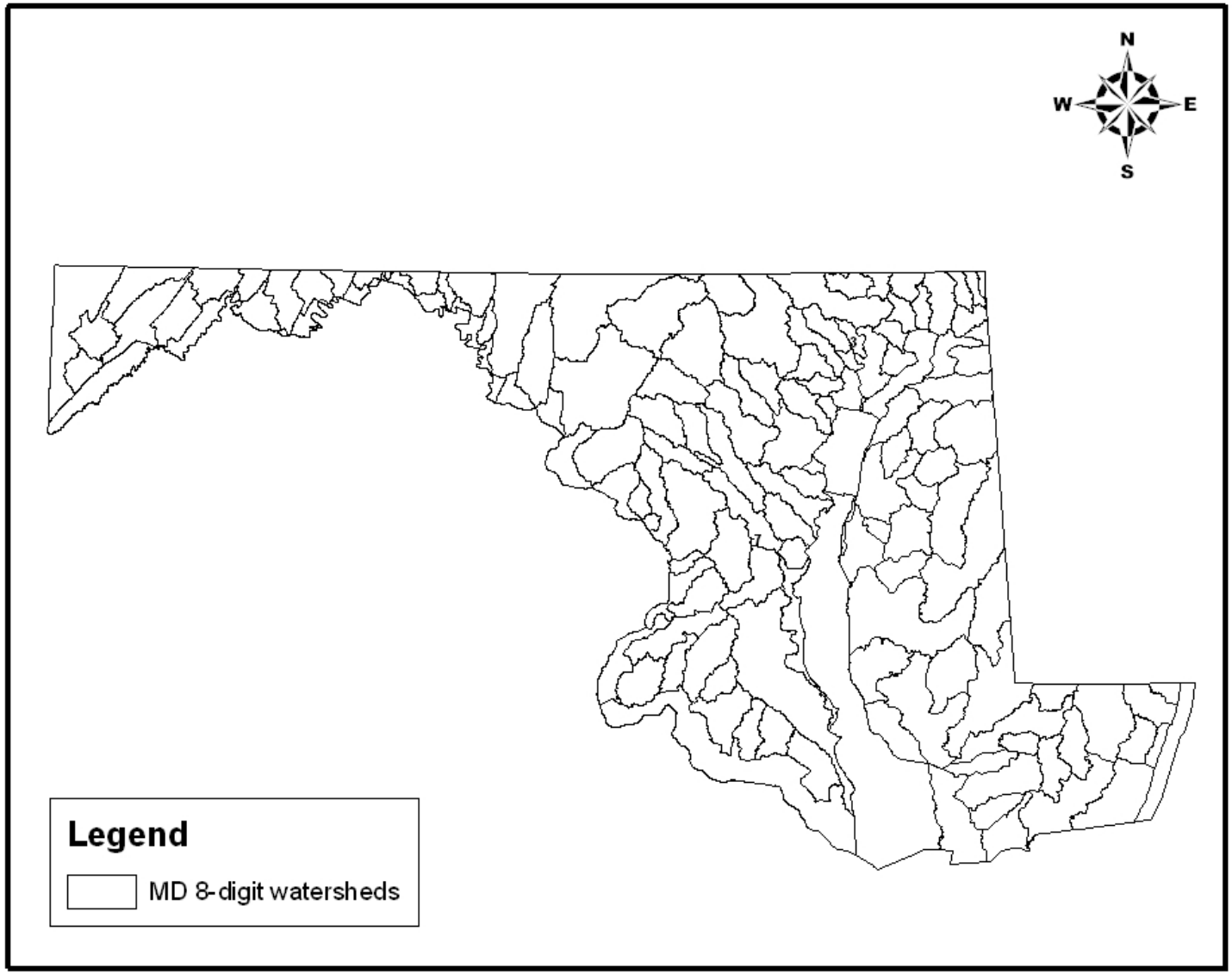
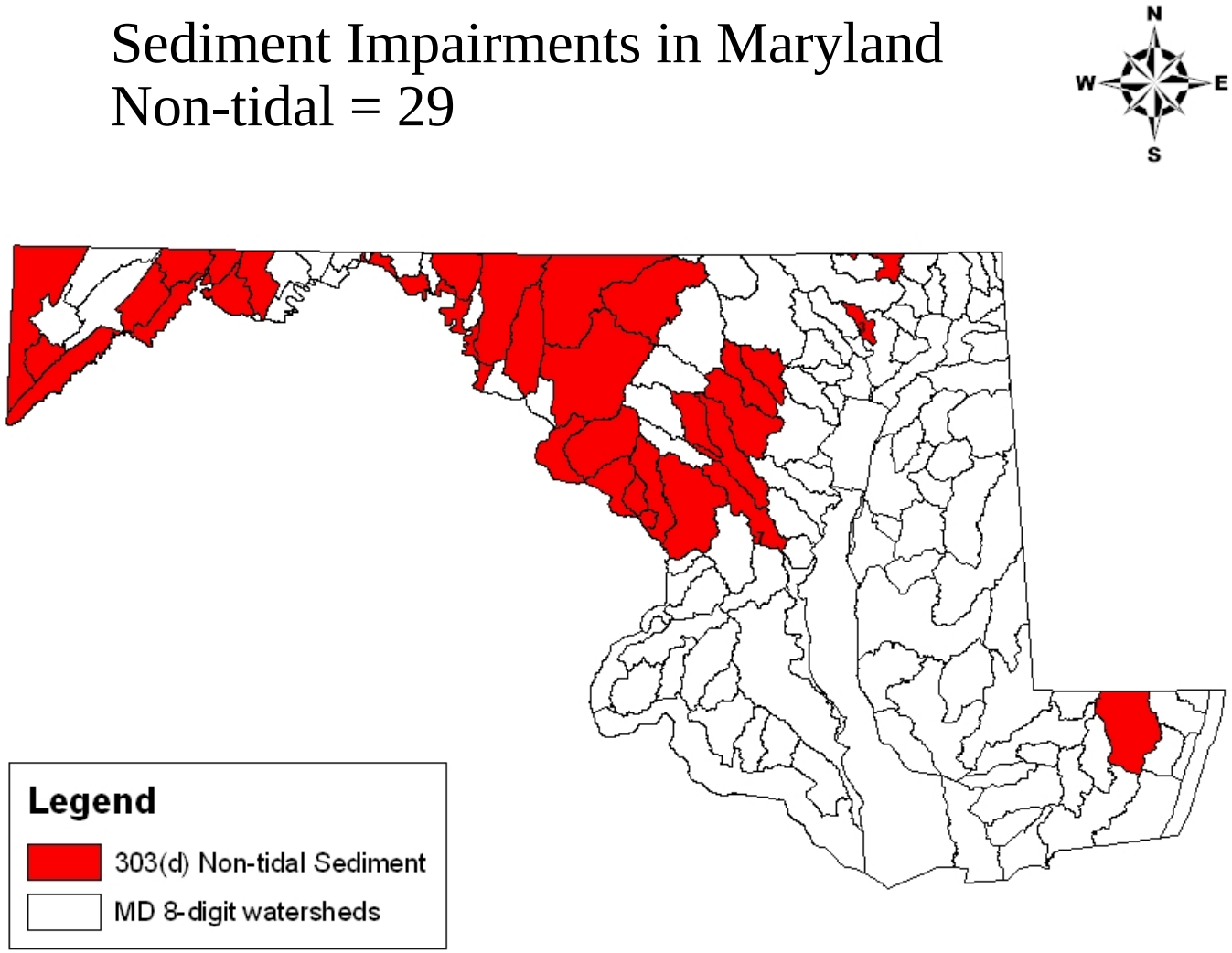
Identify Problem



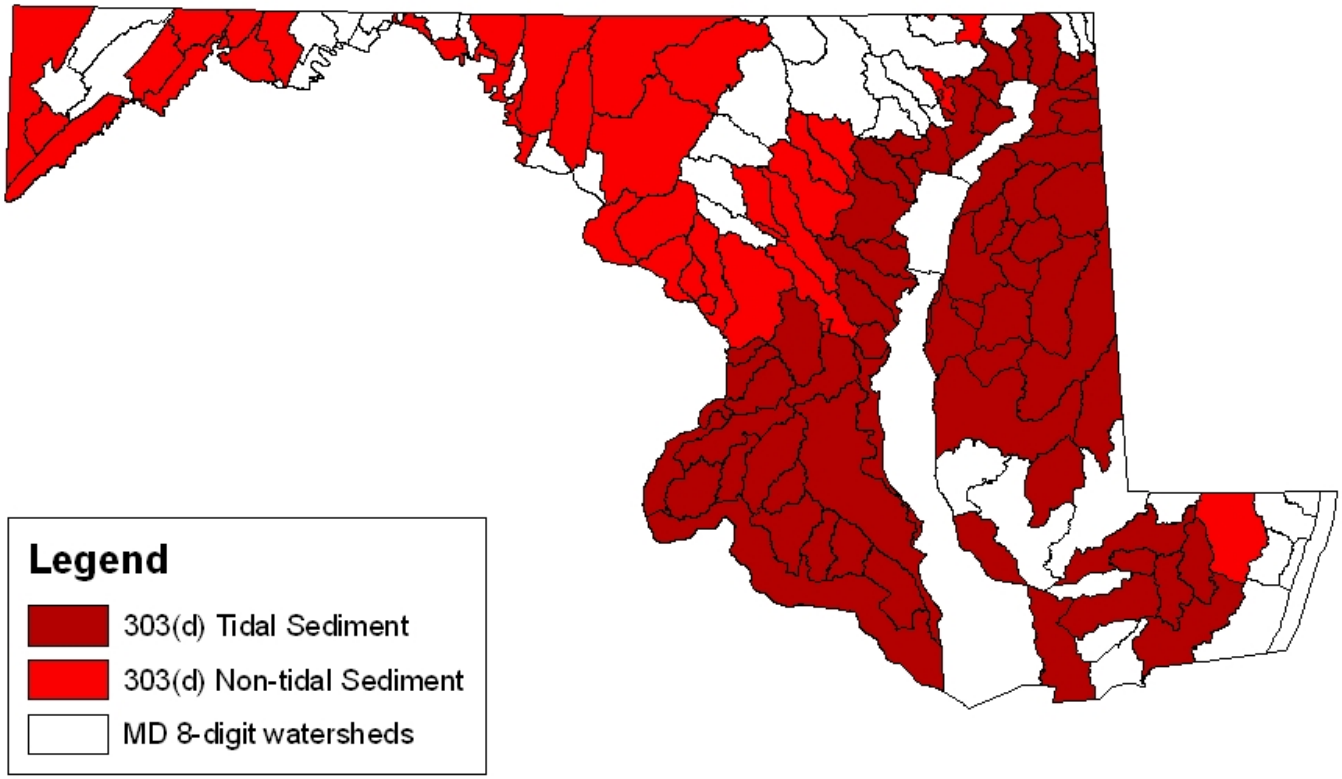
Identify Problem

Sediment Impairments in Maryland
Non-tidal = 29



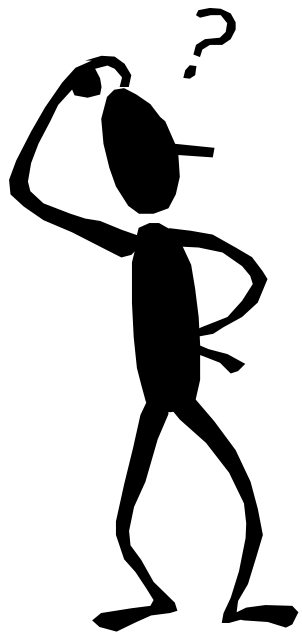
Identify Problem

Sediment Impairments in Maryland
Non-tidal = 29
Tidal = 65



MD's TMDL Challenge

- Address 94 Sediment impairments
  - Differing waterbody types and standards
  - Complex processes
  - Multi-jurisdictional issues
  - Multiple sources
- Maintain consistency and equity



Partnerships in TMDL Development

The Key to Success!

- Maryland Department of the Environment
- USEPA Chesapeake Bay Program
- Maryland Department of Natural Resources
- USGS
- Interstate Commission on the Potomac River Basin
- Maryland Geological Society
- Army Corps of Engineers
- Local Governments

MD Sediment TMDL Overview

- Source analysis
  - Multi-jurisdictional community model
- Develop numeric targets
  - Non-tidal
    - Total suspended solids $\Rightarrow$ in-stream aquatic health
  - Tidal
    - Total suspended solids $\Rightarrow$ clarity $\Rightarrow$ SAV
- Link targets and sources
  - TSS $\Leftrightarrow$ community model $\Leftrightarrow$ sources

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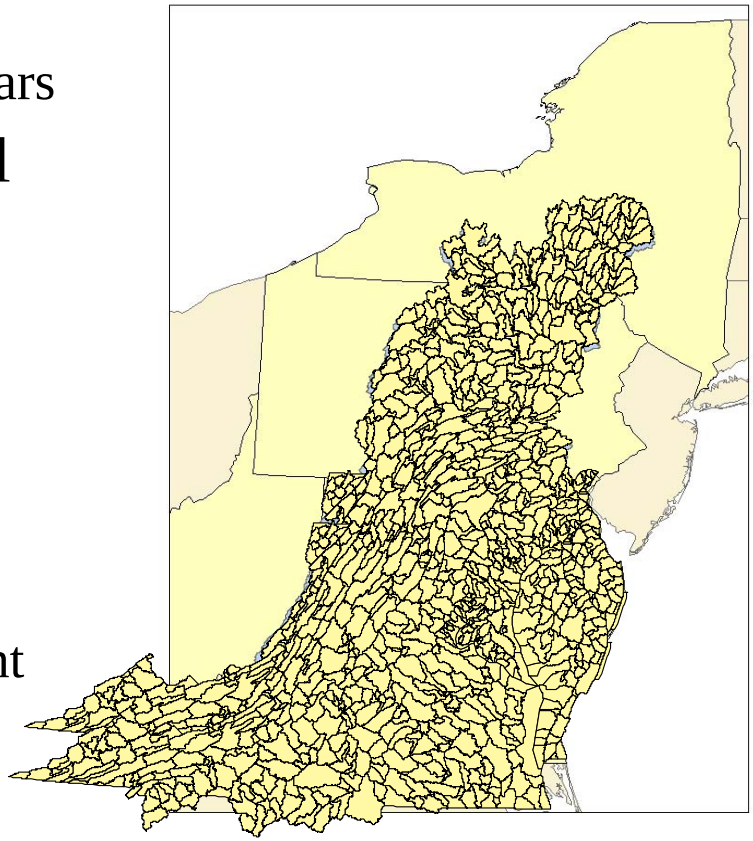
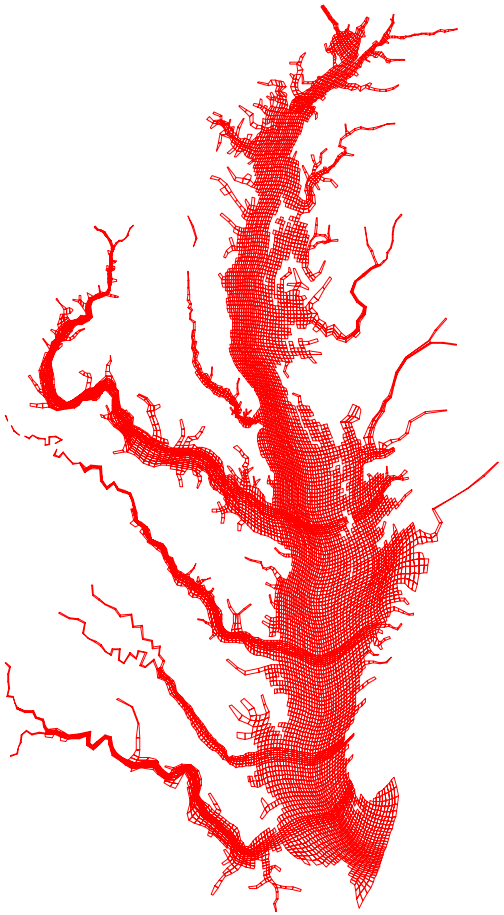
Source Analysis: CBP Community Model Overview

- General
  - 18 simulation years
- Watershed Model
  - 899 segments
  - 24 land uses
  - 296 calibration stations
- Estuary Model
  - 54,000 cells
  - Detailed sediment input
  - Wave model for resuspension



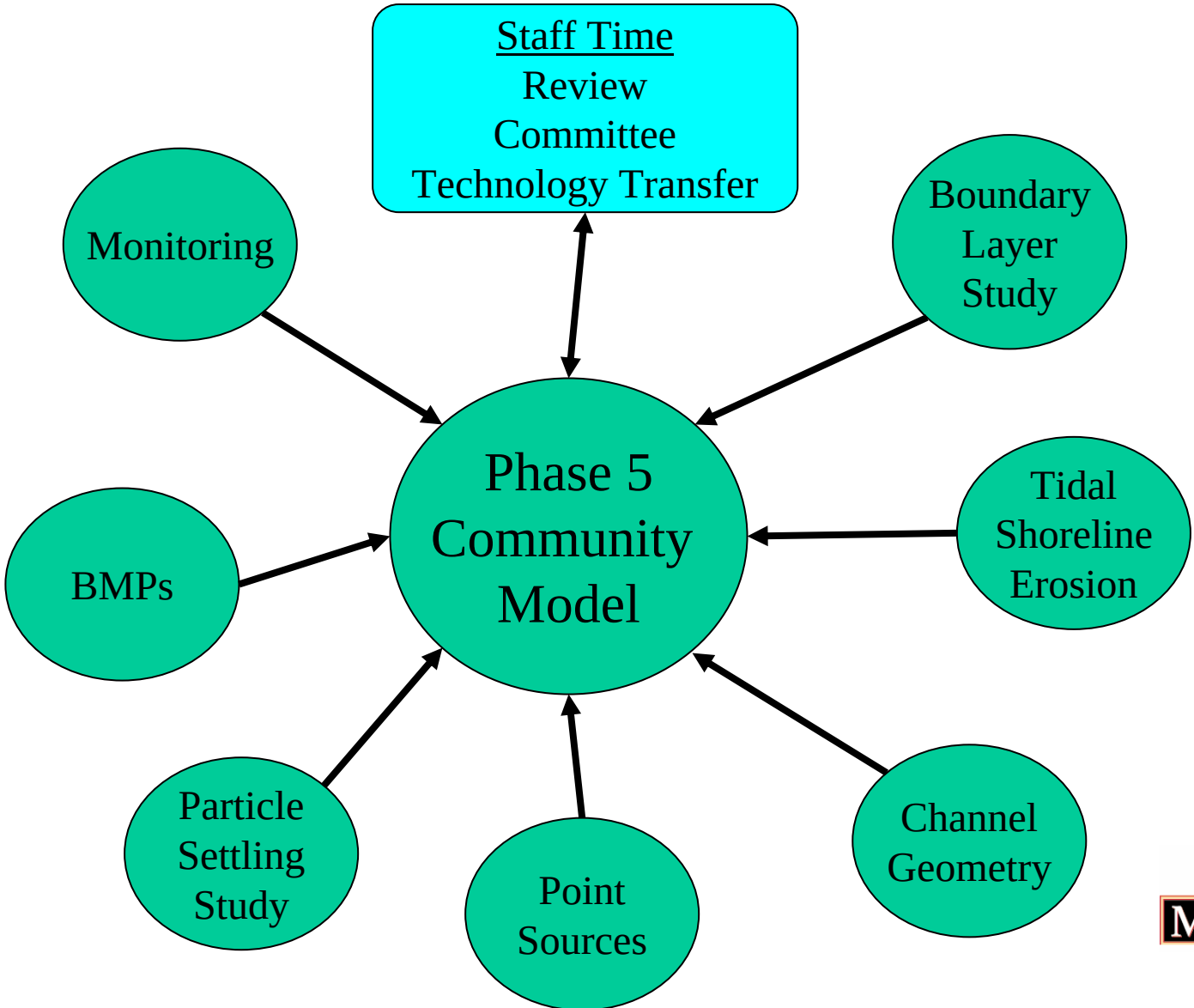
Phase 5 Watershed Model



Chesapeake Bay Estuary Model

Figures courtesy of CBP

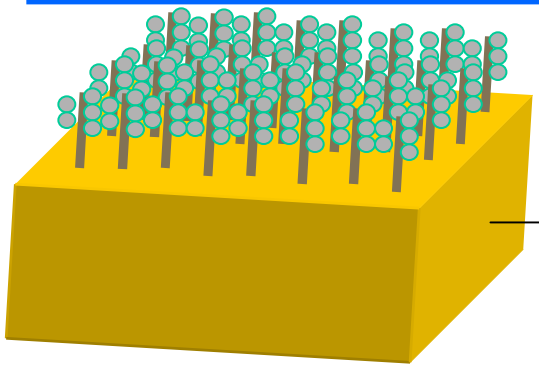
MDE's Participation in the Sediment Model Development



Estimating Sediment Sources

- Watershed
  - Terrestrial
  - Channel
- Bay
  - Tidal erosion
  - Resuspension
- Oceanic Input

Watershed Sediment Simulation



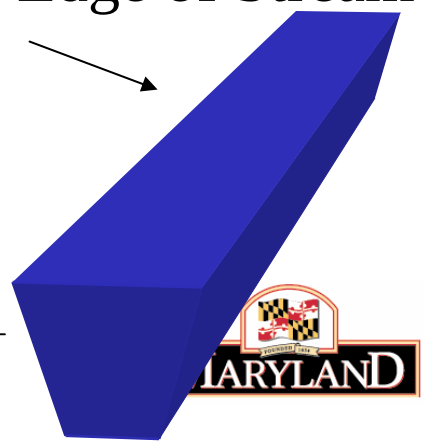
Edge of Field

BMP

Land Use Acre

Sediment Delivery

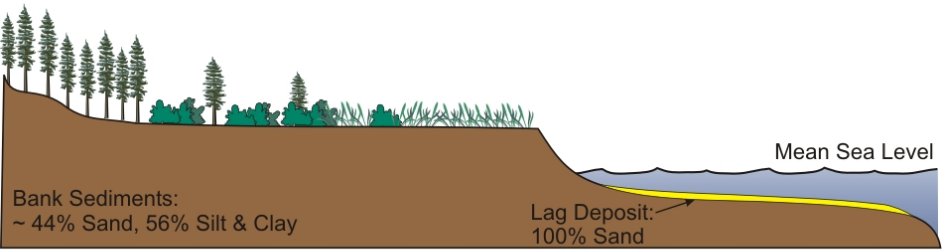
Edge of Stream

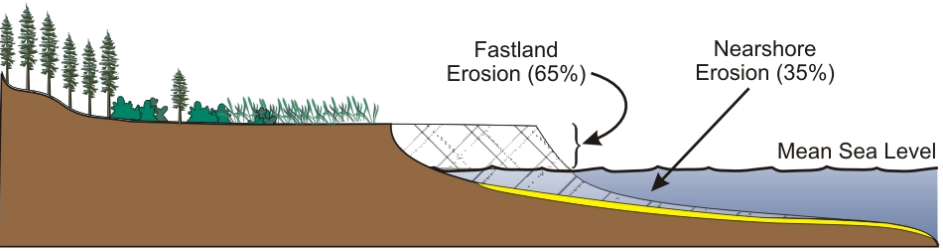


In Stream Concentrations

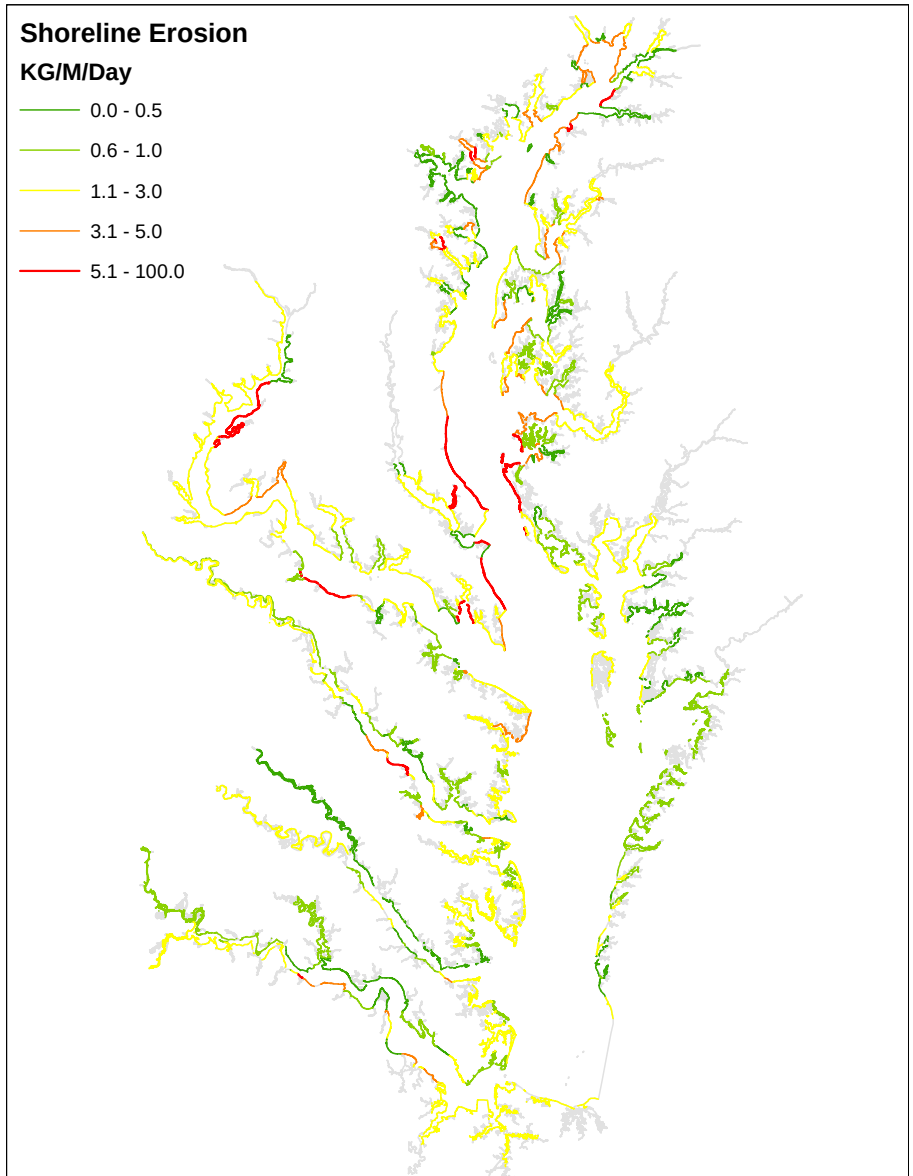
Schematic adapted from Shenk (CBP)

Tidal Erosion Estimates





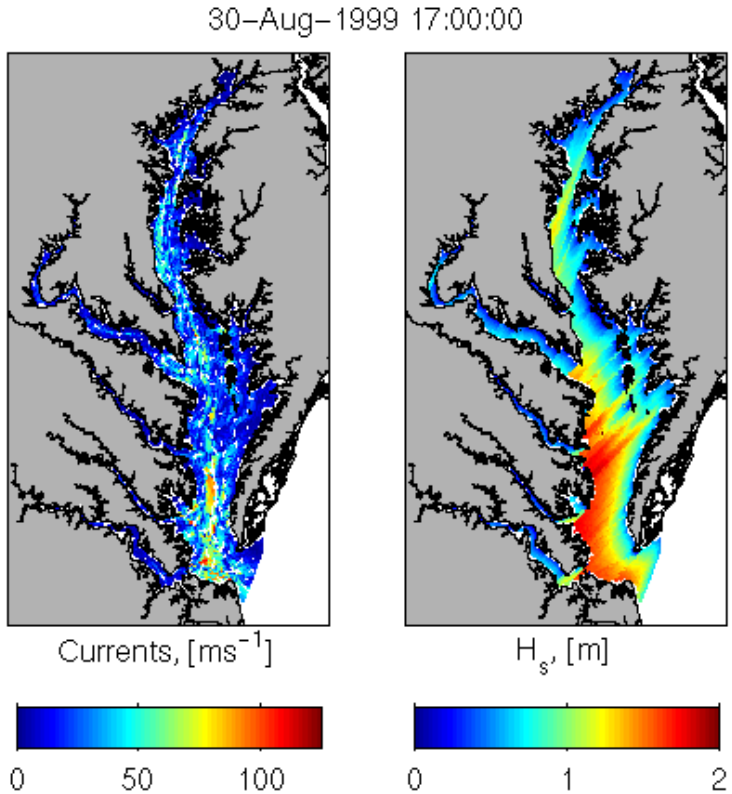
- Maryland Geological Survey updated MD tidal erosion estimates



From Halka (MGS) and Hopkins (CBP)

Sediment Resuspension

- Improved boundary layer model
  - Sediment texture
  - Current velocity and direction
  - Wave height and period
- Coupled to movable bed roughness
- Skin friction shear stress applied to sediment transport model



Hurricane Floyd

From Harris and Rinehimer (VIMS) and S.C. Kim (USACE)

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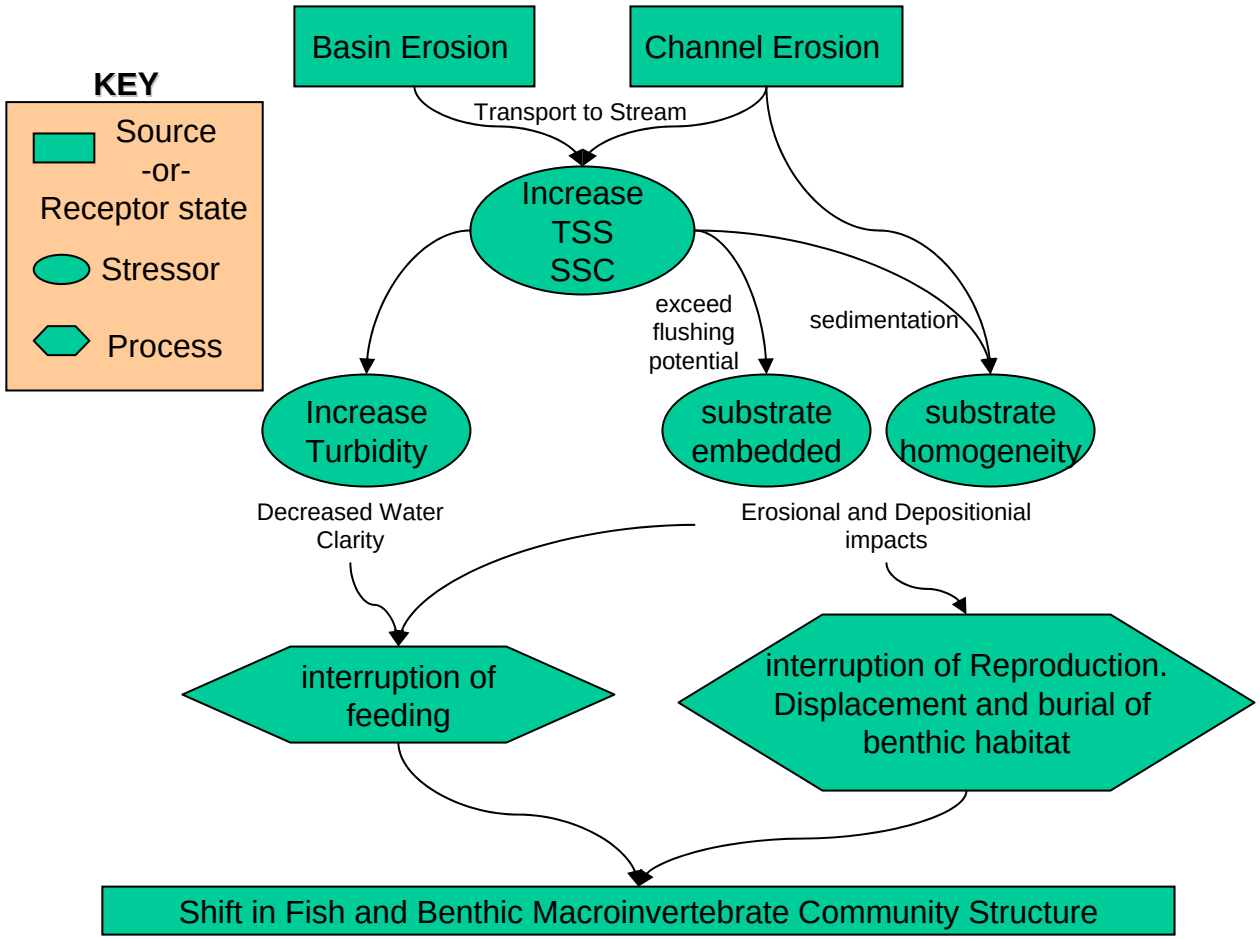
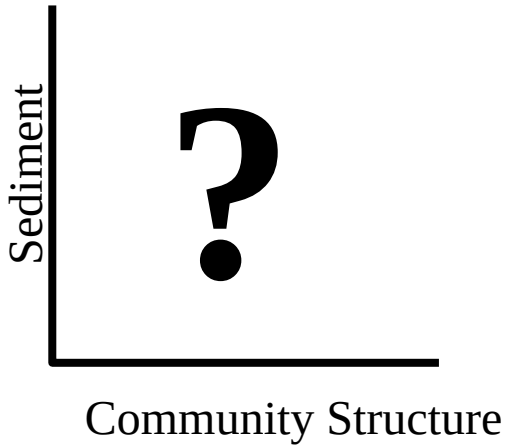
Non-tidal Sediment/Solids Stressor





- Relationship poorly understood
- Difficult to quantify

Non-tidal Sediment TMDL: Numeric Targets

Watershed

Sediment

Load

What is limiting sediment load that can support Aquatic life?

- Limits are determined by reference conditions (i.e. watersheds supporting aquatic life)
- Natural variability confounds watershed comparison
- Compare watersheds using the sediment delivery beyond natural conditions

<u>Endpoint</u>

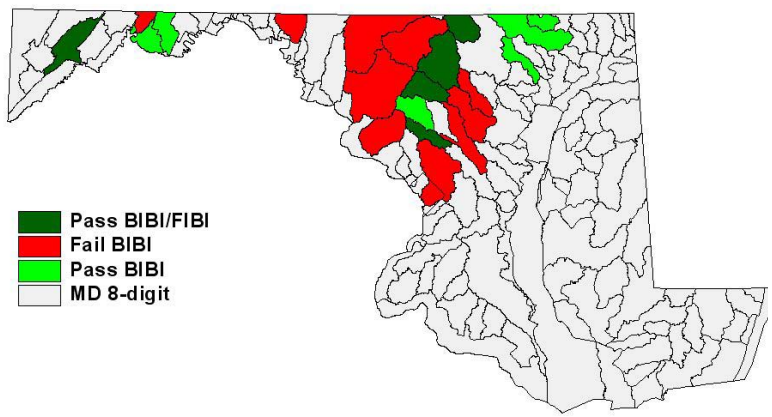
Watershed

Streams Support

Aquatic Life

Setting the Numeric Target

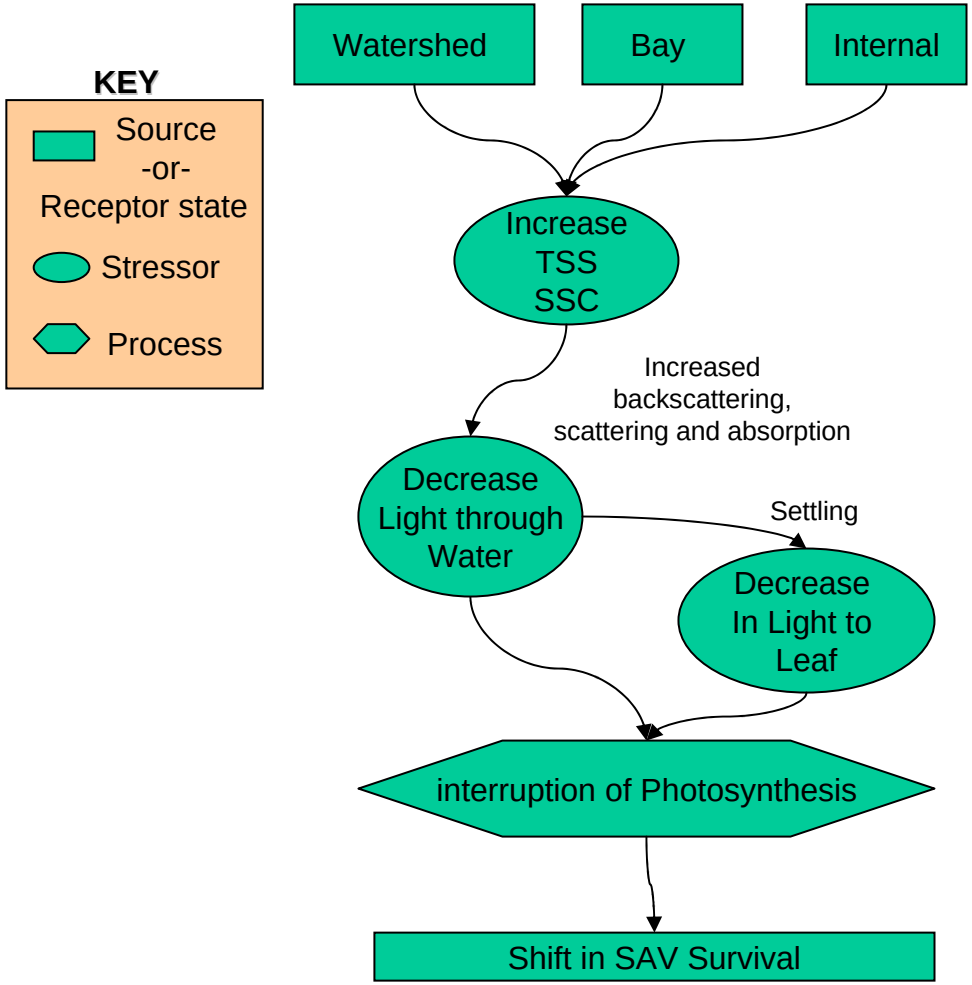
- Use generalized approach for increased confidence
- Select watersheds from Highland and Piedmont physiographic regions (Non-coastal plain)
- Normalize sediment loads to all forest condition
- Set sediment TMDL limit based on “healthy” watersheds

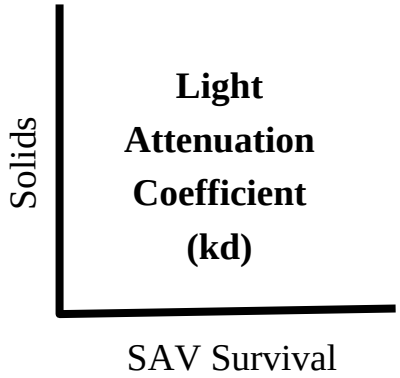


Challenges – Non-Tidal

- Reference sediment loads for urban watersheds
- Legacy sediment
- Particle size and effect on endpoint

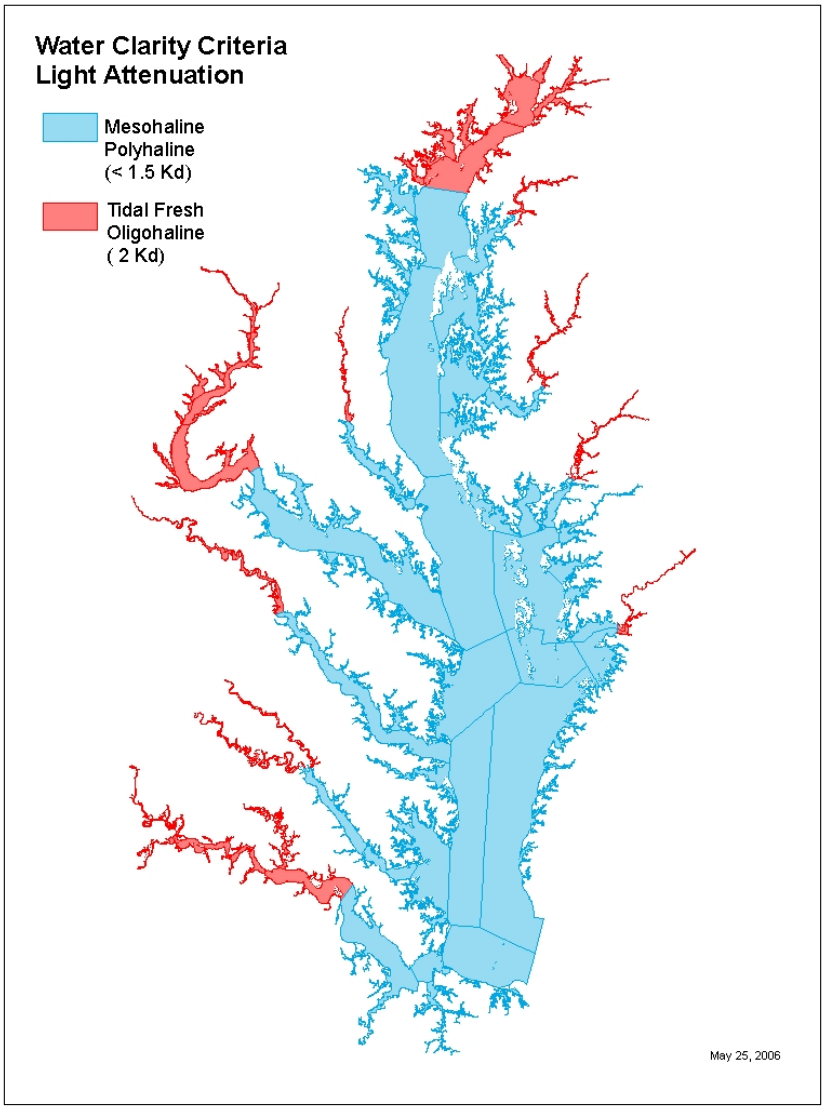
Tidal Sediment/Solids Stressor

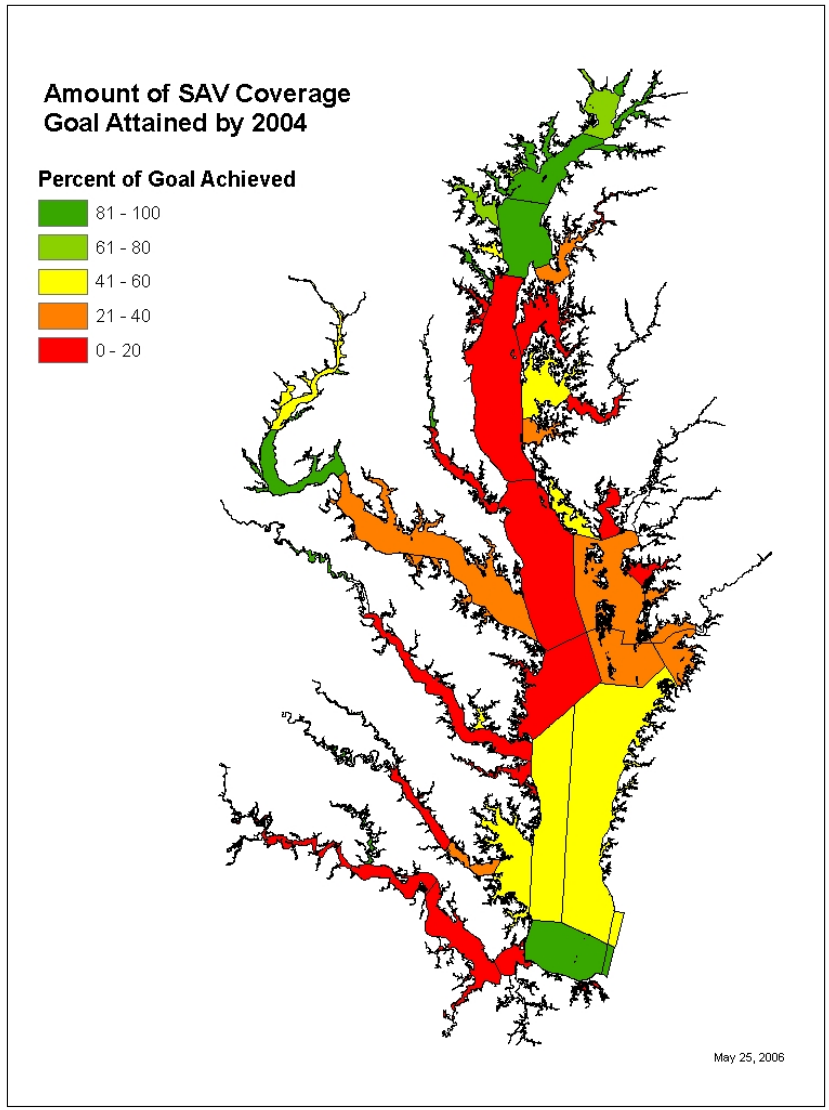




•Complicated by distribution of fixed vs. volatile solids

Tidal Sediment TMDL: Numeric Targets





Figures courtesy of CBP

Challenges – Tidal

- Model scale
  - Poorly flushed headwater areas
- The “sediment” contribution to light attenuation
- Sediment as a beneficial use
- Interaction of nutrients and sediment and the effect on water clarity

Summary

- Non-tidal TMDL
  - Reference watershed approach
- Tidal TMDL
  - Water clarity
- Coordinated and consistent analysis tools
  - Developed through partnerships
  - Consistent with 303(d) listing scale
  - Consider downstream conditions
  - Allow for a regional planning
  - Facilitate stakeholder support

Contact and Information

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- Maryland TMDL Program

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/index.asp

- Chesapeake Bay Program

http://www.chesapeakebay.net/