Stream Restoration in the Delaware Inland Bay Watersheds

July 16, 2010

DELAWARE

Limulus polyphemus

CENTER FOR THE INLAND BAYS

Rehoboth Indian River Little Assawoman

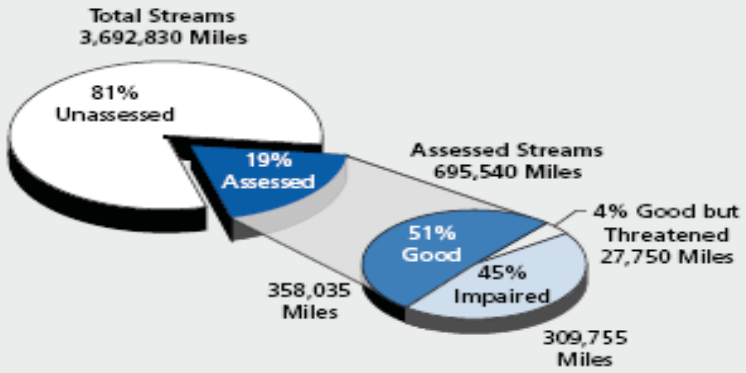
JMT

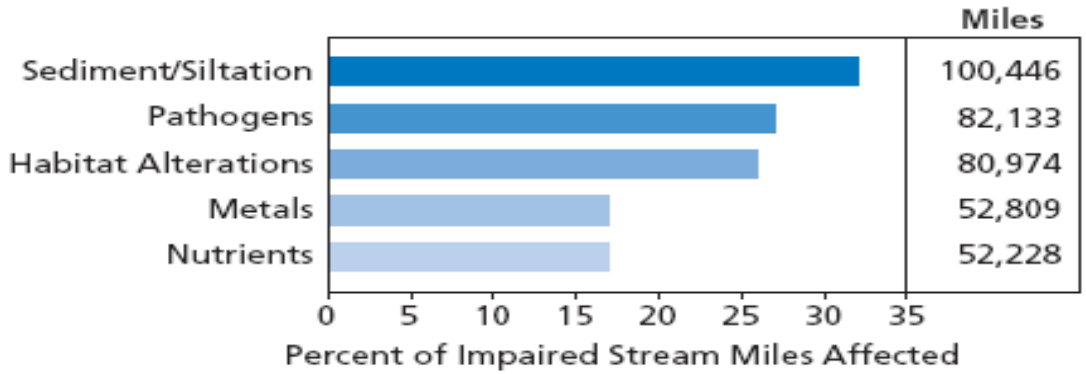
Engineering A Brighter Future

CENTER FOR WATERSHED PROTECTION

Sediment-siltation is one of the biggest problems

Table 2. Top Causes of Impairment in Assessed Rivers and Streams*.

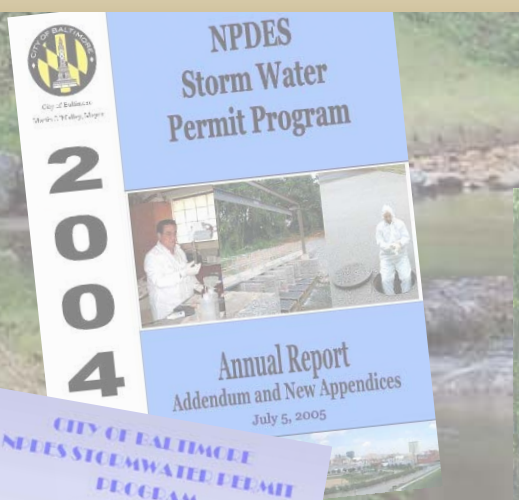


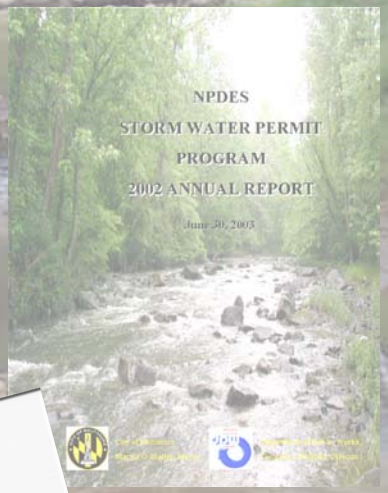


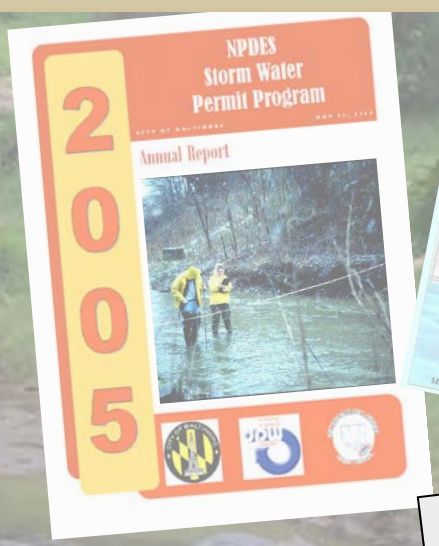
*Percents do not add up to 100% because more than one cause or source may impair a waterbody.

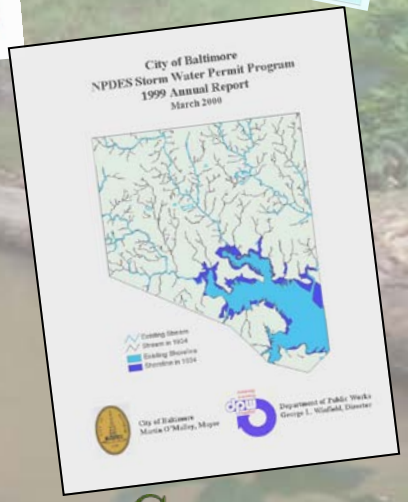
National Water Quality Inventory: Report to Congress

15 years of MS4 Permits have failed to get us there





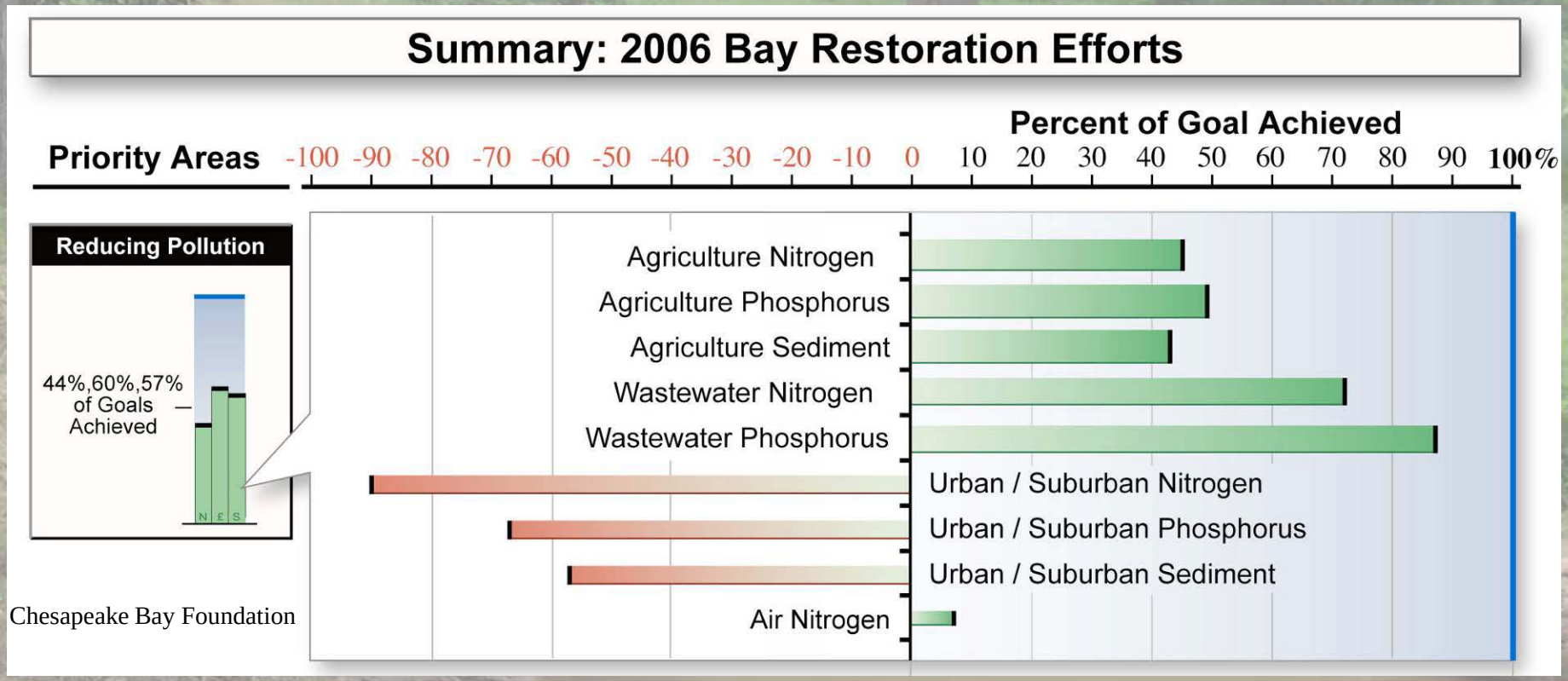




JMT
Engineering A Brighter Future

CENTER FOR
WATERSHED
PROTECTION

The “mandates” are here!



Bay TMDL estimates 35.5% reduction in nutrients from urban land

JMT Engineering A Brighter Future

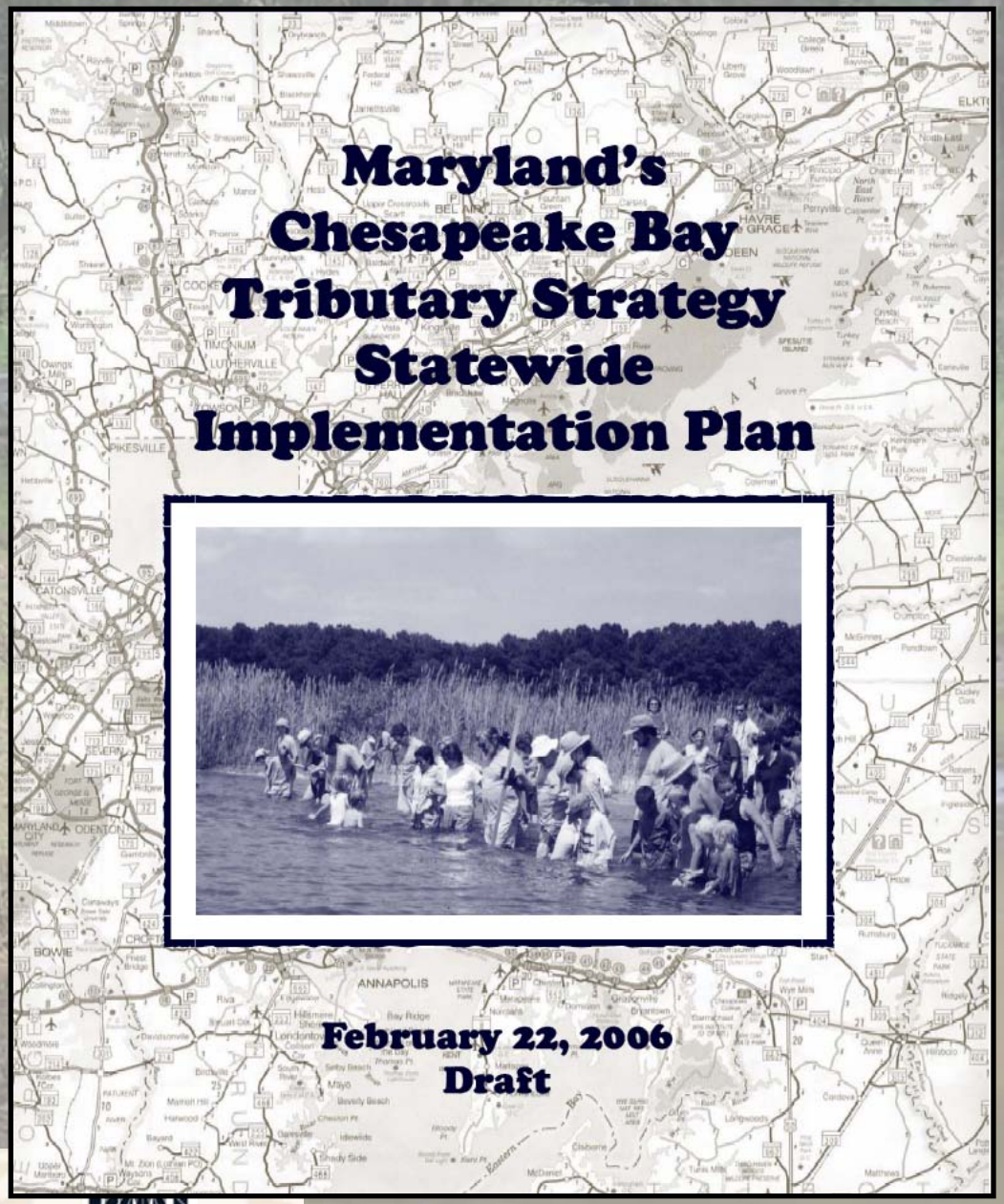
Center for Watershed Protection

Accelerated Bay TMDL Schedule

- Establish TMDL by Dec. 31, 2010
- Implementation deadline 2025
  - 2 year milestones
- State of Maryland deadline 2020
- 36% estimated urban load reduction
- $7.8 billion per year

JMT Engineering A Brighter Future

Center for Watershed Protection



WIP's

Engineering A Brighter Future

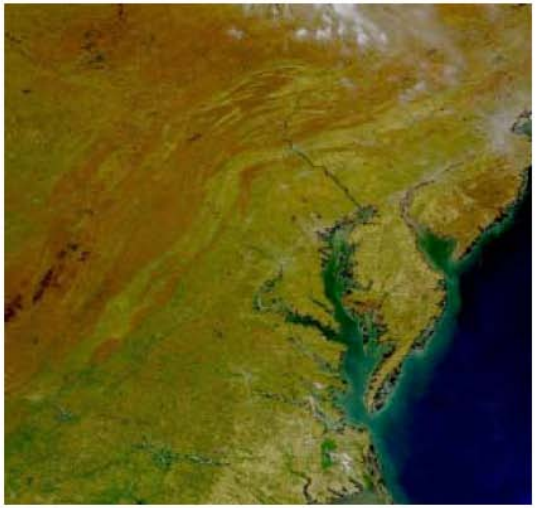
Center for Watershed Protection

Stream channel erosion is a huge local issue but it's role in the "big picture" is not clear

U.S. Department of the Interior
U.S. Geological Survey

A Summary Report of Sediment Processes in Chesapeake Bay and Watershed

Water-Resources Investigations Report 03-4123



USGS
science for a changing world

While there is a general consensus that streams are a major contributor to sediment loadings.

- Urbanization and development can more than double the natural background sediment yield; the increase in sediment yield is highest in the early development stages.
- After development is completed, erosion rates are lower; however, sediment yield from urbanized areas can remain high because of increased stream corridor erosion due to altered hydrology.
- One study in an urban setting estimated 2/3 of the sediment in the water column was from streambanks and 1/3 was from upland erosion.

Engineering A Brighter Future

WATERSHED PROTECTION

The Bay Program doesn't give much credit to stream restoration in meeting restoration goals

JMT Engineering A Brighter

Center for Watershed Protection

Historically, the approach to stream restoration projects has been similar to other infrastructure repair projects.

"It's broken so let's fix it."

JMT Engineering A Brighter Future

Center for Watershed Protection

Modeling stream restoration

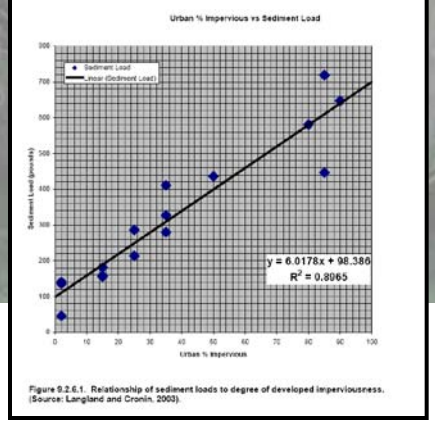
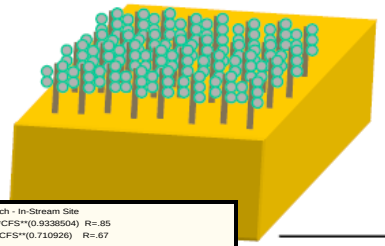
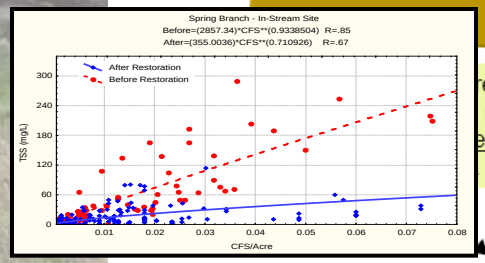


Figure 9.2.6.1. Relationship of sediment loads to degree of developed imperviousness. (Source: Langland and Cronin, 2003).



Edge-of-Field

BMP Factor



re simulated on
in an Edge-Of-
e land use types

2. A time series of Best Management Practices (BMPs) is applied based on available data.

Divide by 14.8

4. A delivery factor based on distance from the stream is applied (see below), resulting in the Edge-Of-Stream load.

Land Acre Factor

Delivery Factor

Edge-of-Stream

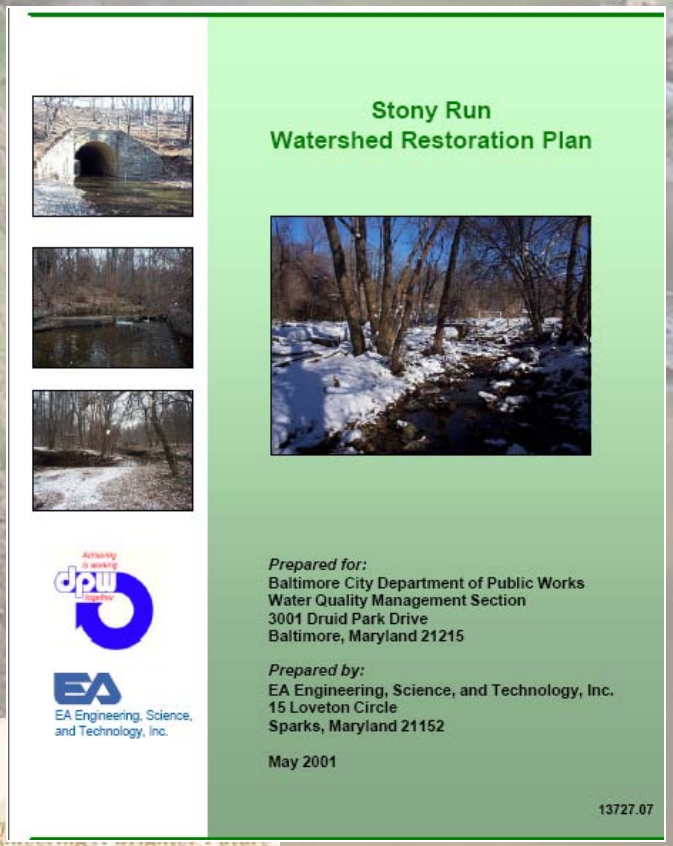
3. A time series of land use acreage factors is applied.

5. Processes of deposition and scour are simulated in the stream, resulting in concentrations that can be compared to observations.

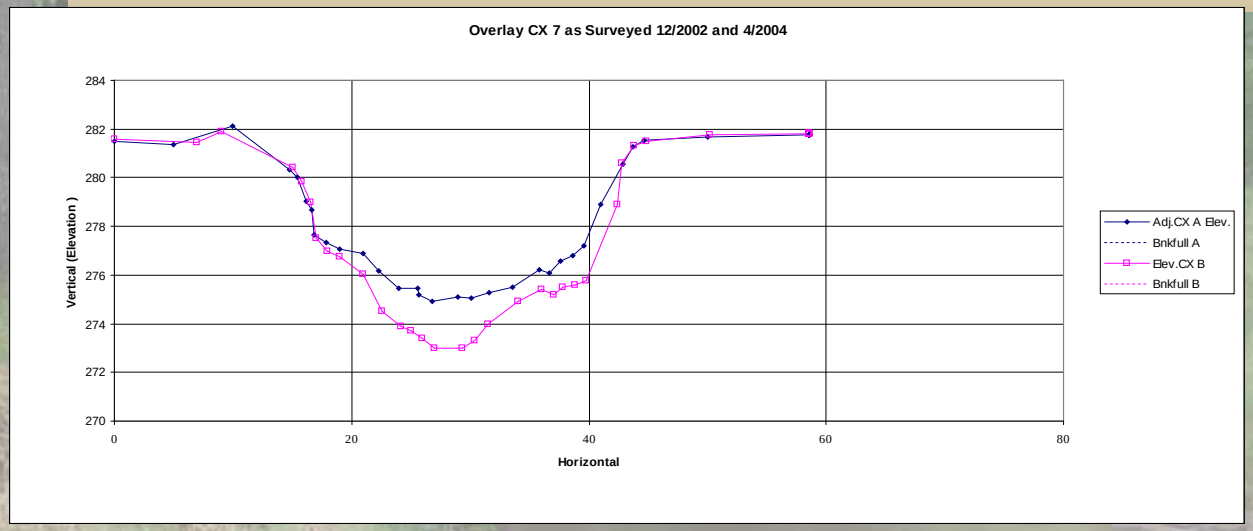
In Stream Concentrations

Figure 9.1. Phase 5 sediment simulation components.

Stony Run
(Better numbers are needed)

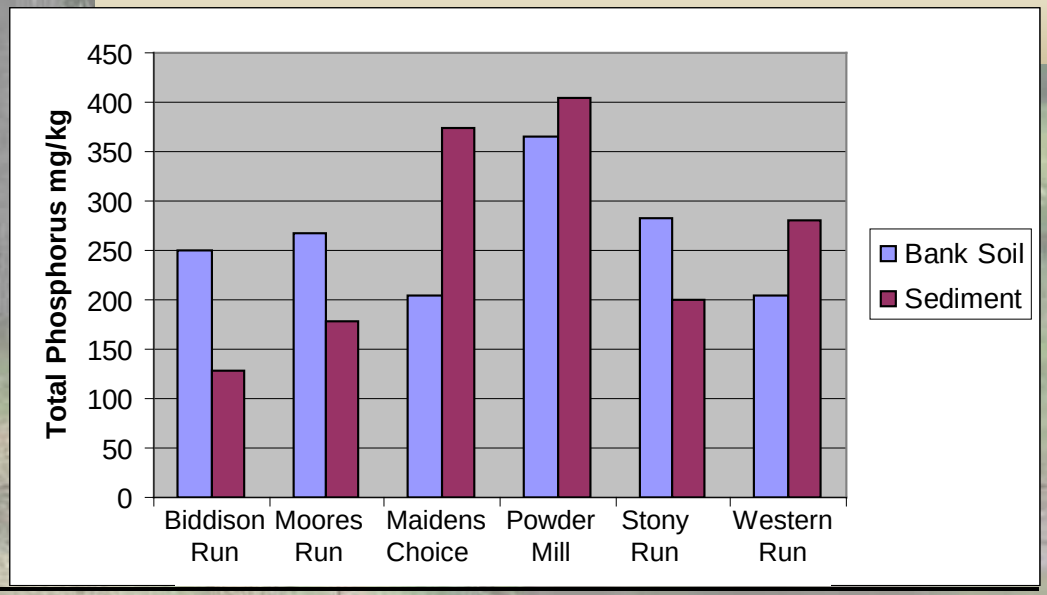


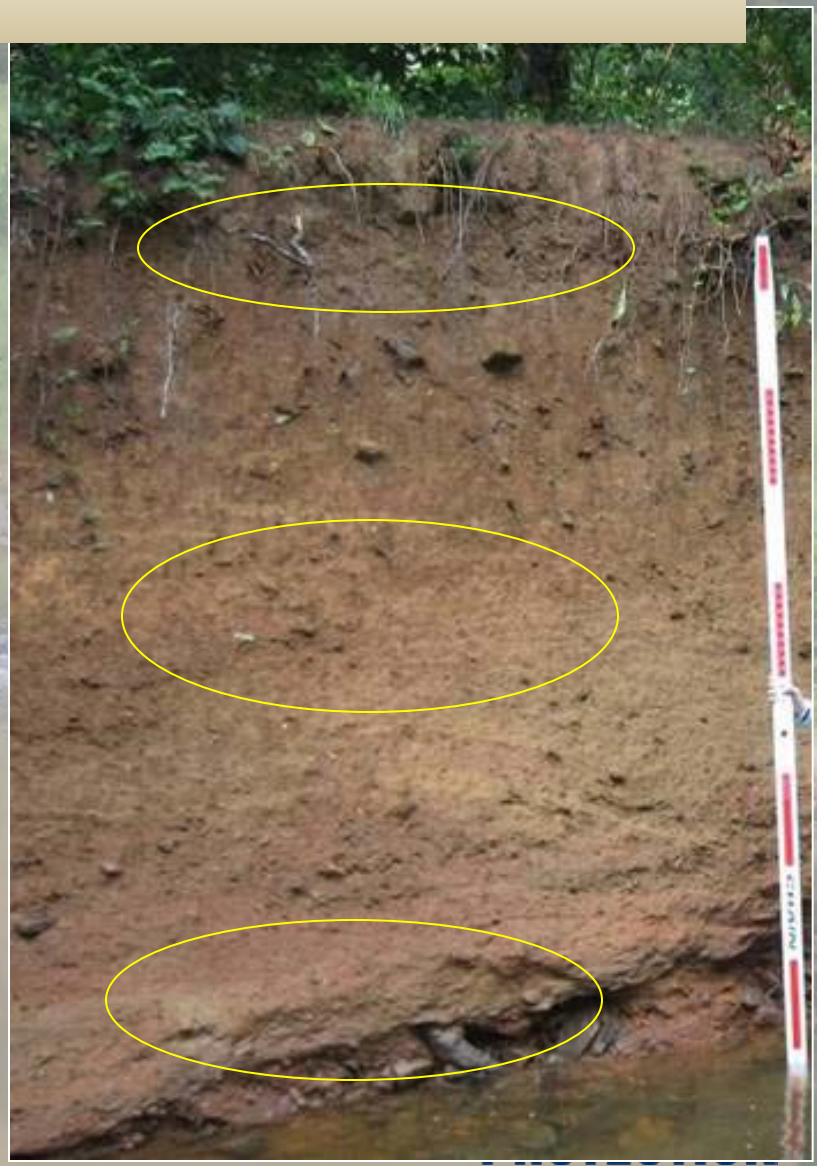
Stream Cross Section Monitoring



CENTER FOR WATERSHED PROTECTION

Soil Nutrient Analysis





Stony Run **Spring Br./CBP**

0.068 lb/lf/yr > 0.0035 lb/lf/yr

19 fold difference

(assumes 50% efficiency)

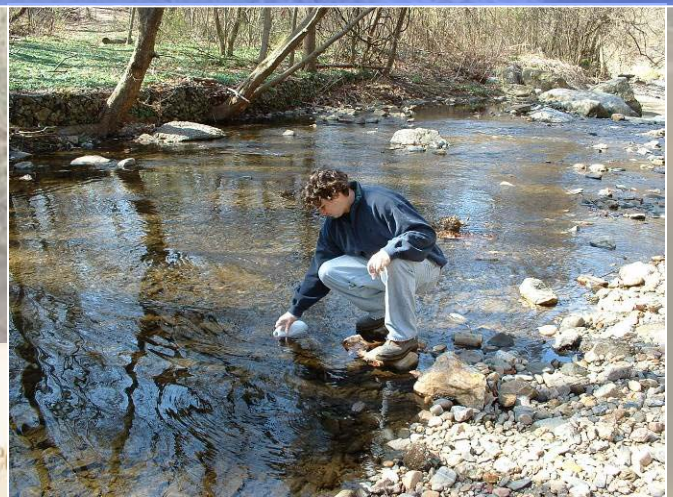
Additional Monitoring

Baseline and Storm Sampling

Automated Discrete Sampling

USGS Monitored Flow

Dry Weather Grab Sampling



Sediment load vs. impervious area

Sediment load for several urban land use types were compiled for sites in the mid-Atlantic and Illinois. Langland and Cronin (2003)

By setting pervious urban at the intercept and impervious urban at the maximum, the land use division within each particular segment determines the overall load according to the above relationship.

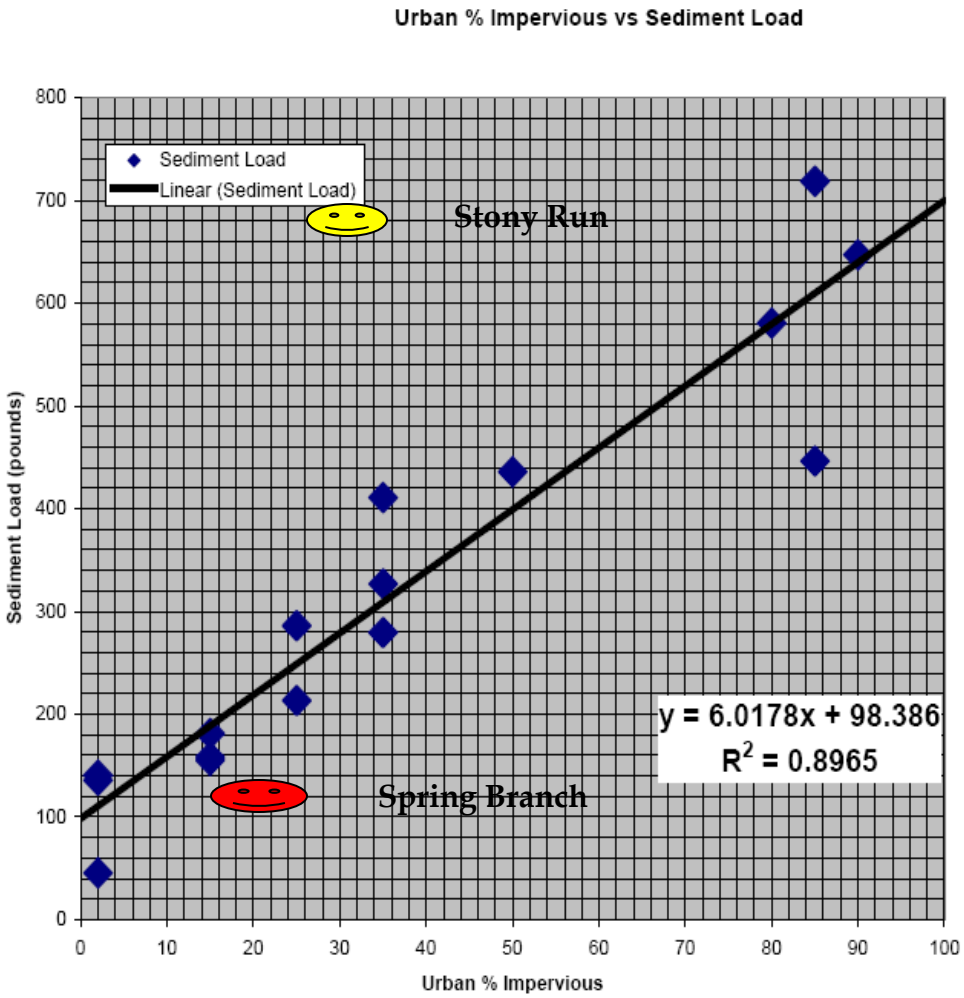
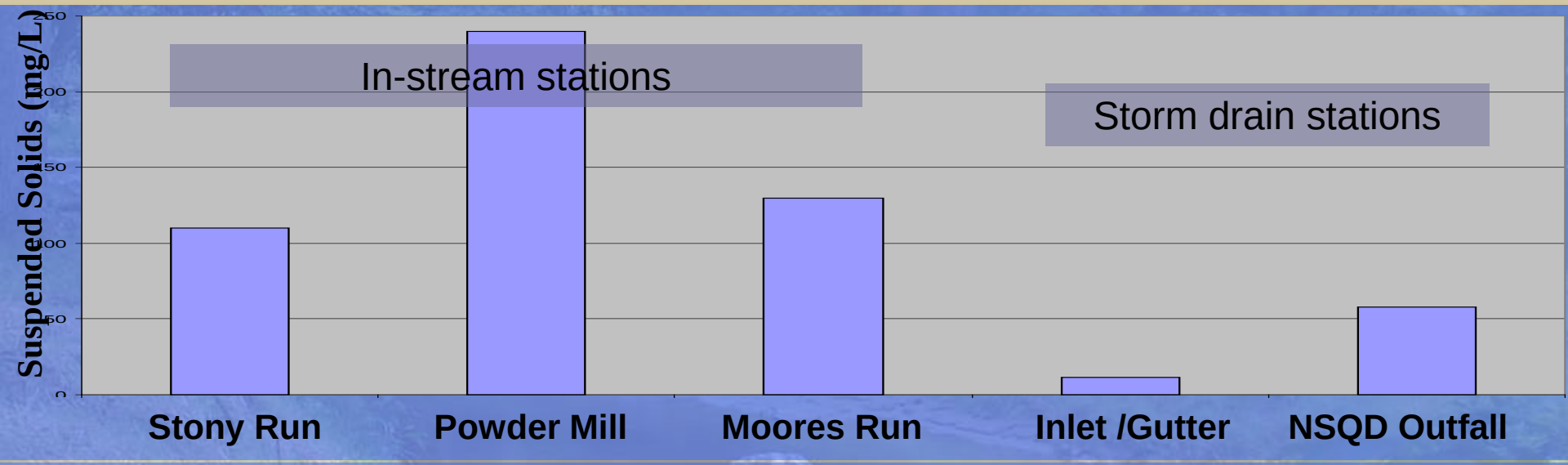


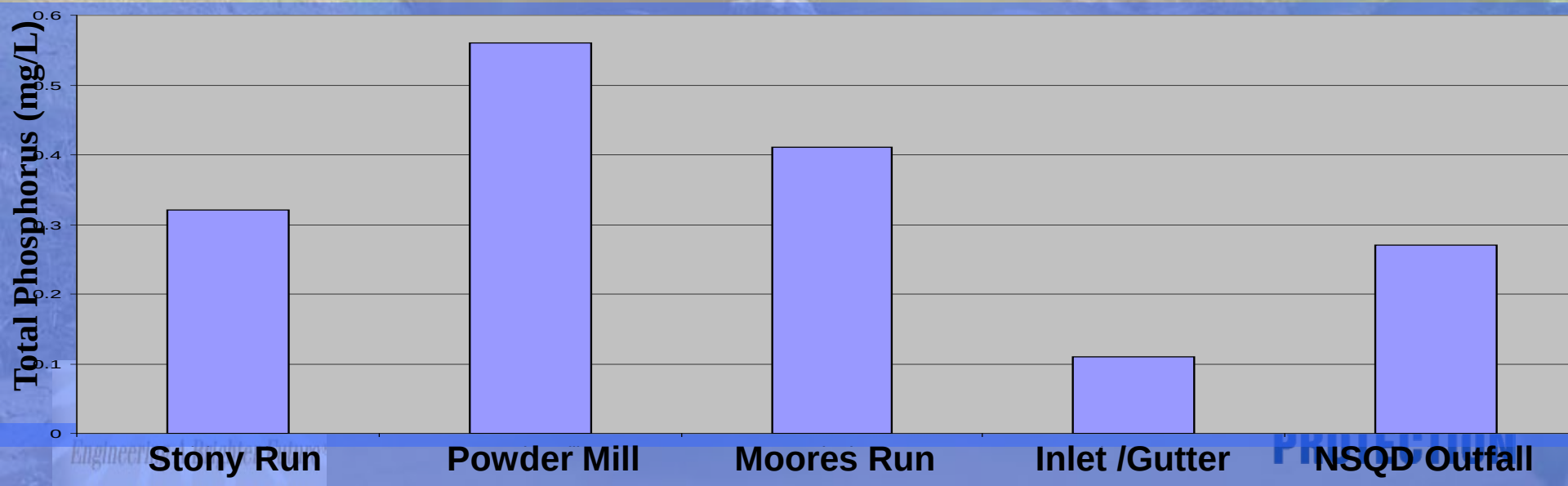
Figure 9.2.6.1. Relationship of sediment loads to degree of developed imperviousness. (Source: Langland and Cronin, 2003).

JMT Engineering A Brighter Future

Stream vs. storm drain data

Compare Storm EMC Medians
Suspended Solids and Total Phosphorus





LID type BMP's are expensive

Engineering A Brighter Future

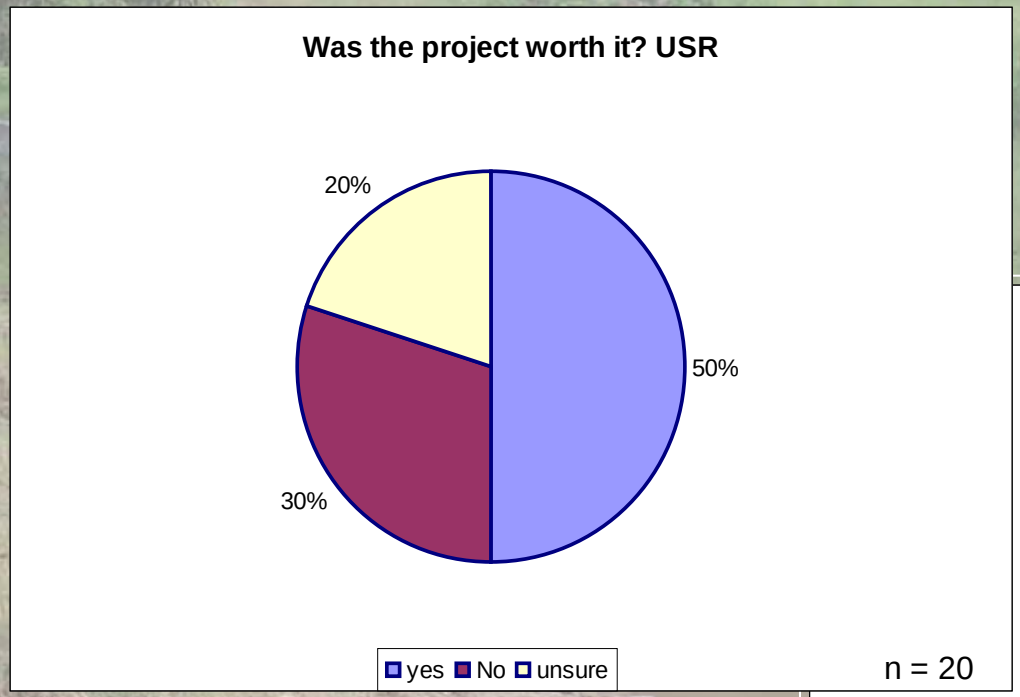
ER FOR
WATERSHED
PROTECTION

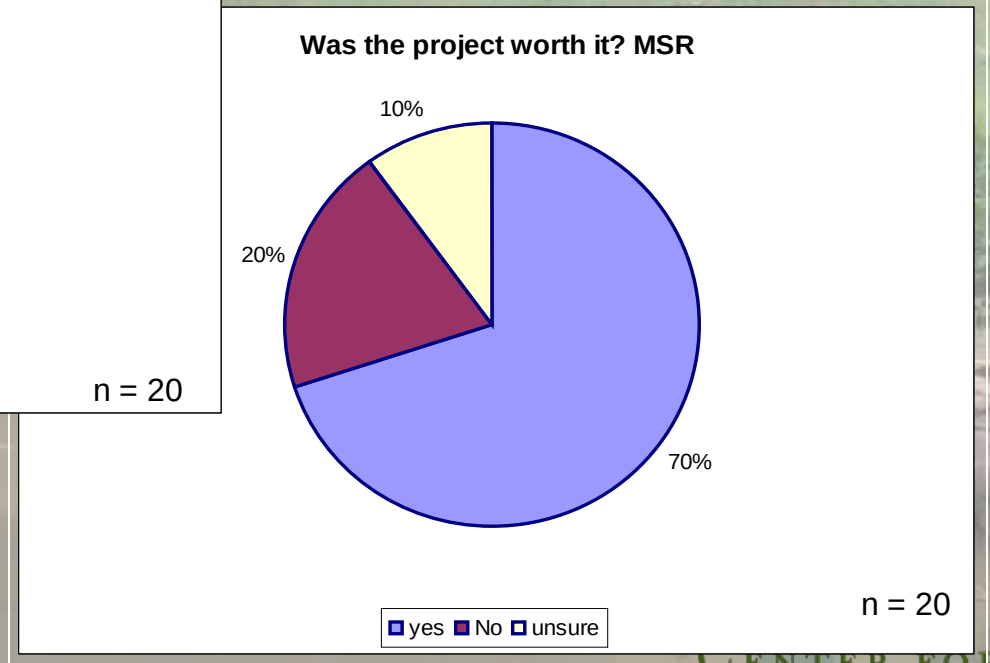
We need more BMP options

Relative Cost of BMP's
$150,000 vs $21,000 per acre

PROJECT NAME	Study/ Design Year	Comment	Construction Year	Study/Design Cost	Construction Cost	Watershed	Watershed Area (acres)	Percent Imperviousness	Stream Length (feet)	Impervious Acres Treated (to-date)	Impervious Area Treated (pending)	Impervious Acres Treated (mitigation)
Briarcliff Debris Collector	2002		2004		$521,000	Direct Harbor	238.00			NA		
Brooklyn Park Stormwater BMP	2002		2004		$1,252,885	Direct Harbor	306.00	45.00		137.70		
Vacant Lot Greening Phase I	2004		2006	$20,000	$60,000	Direct Harbor	1.00	50.00		0.50		
Harris Creek Debris Collector	2005		2005	$92,500	$500,000	Direct Harbor	1,984.00			NA		
Watershed 263 Phase I	2005		2008	$150,000	$350,000	Direct Harbor				NA	3.50	
Bush Street Debris Collector	2006	Mitigation	2009	$81,000	$520,000	Direct Harbor	918.00			NA		
Watershed [illegible]						Direct						
Gwynns Ru						Gwynn						
Maidens Ch						Gwynn						
ER4018 Po Environmer 1						Gwynn						
Biddison R						Herring						
Moores Ru						Herring						
Biddison R						Herring						
Chinquapin						Herring						
Upper Ston						Jones F						
Middle Sto						Jones F						
Lower Ston						Jones F						
Western Ru						Jones F						
East Stony						Jones F						
East Stony						Jones F						
Lower Ston						Jones F						
School Gre						Variou						
School Greening Phase II						Various				5.50		
School Greening Phase III						Various				4.40		
Total				$3,772,405	$28,243,885				26,875	1,251.35	1,831.85	370.00

Willingness to pay $12.50 per household for restoration of Upper and Middle Stony Run





Engineering A Brighter Future

CENTER FOR WATERSHED PROTECTION

THE SUN

LIGHT FOR ALL

Bulldozing a creek in order to help save it

"City spending $10 million on disputed Stony Run job"

by ********

August 18, 2006

THE SUN
LIGHT FOR ALL

Bay & Environment

Bay & Environment is The Sun's blog devoted to news about Maryland's environment

« More on the bay game | Main | Local travel: Herald Harbor »

And in the new ponds, scores of American toads, green frogs and bullfrogs are singing. No amphibians lived in this stream before the project. In terms of bringing new life to an urban stream, it's been successful. But one of the main goals of the project was also to filter out pollution and prevent sediment and nitrogen from flowing A stream reborn

Joel Snodgrass, a biology professor at Towson University and director of the school's urban ecology and conservation lab, introduced 100 finger-sized black nosed dace into the stream in May. He transplanted them from another urbanized stream, the Herring Run, after receiving permission from the Maryland Department of Natural Resources.

The dace survived a few rain storms and started breeding. He's also identified the calls of the toads and frogs in the stream. (To check out his school's great on-line guide to frog and toad calls, click here... it's fun). If you go walking at night in the new artificial wetlands behind the Friends School soccer field, you can hear a chorus of high pitched trilling sounds. Those are American toads. You can also hear the barking, coughing sounds of green frogs. And the deep, low, honking of bullfrogs.

New River Through An Old City

Two years after Baltimore spent about $5 million rebuilding the Stony Run, the once-dead stream is alive with frogs, toads, ducks, crayfish...even hardy little fish called black-nosed dace.

CENTER FOR WATERSHED PROTECTION

What about the low-gradient streams of the Coastal Bay watersheds

USGS
science for a changing world

Prepared in cooperation with the
U.S. Environmental Protection Agency
Chesapeake Bay Program

Chesapeake Bay Program
A Watershed Partnership

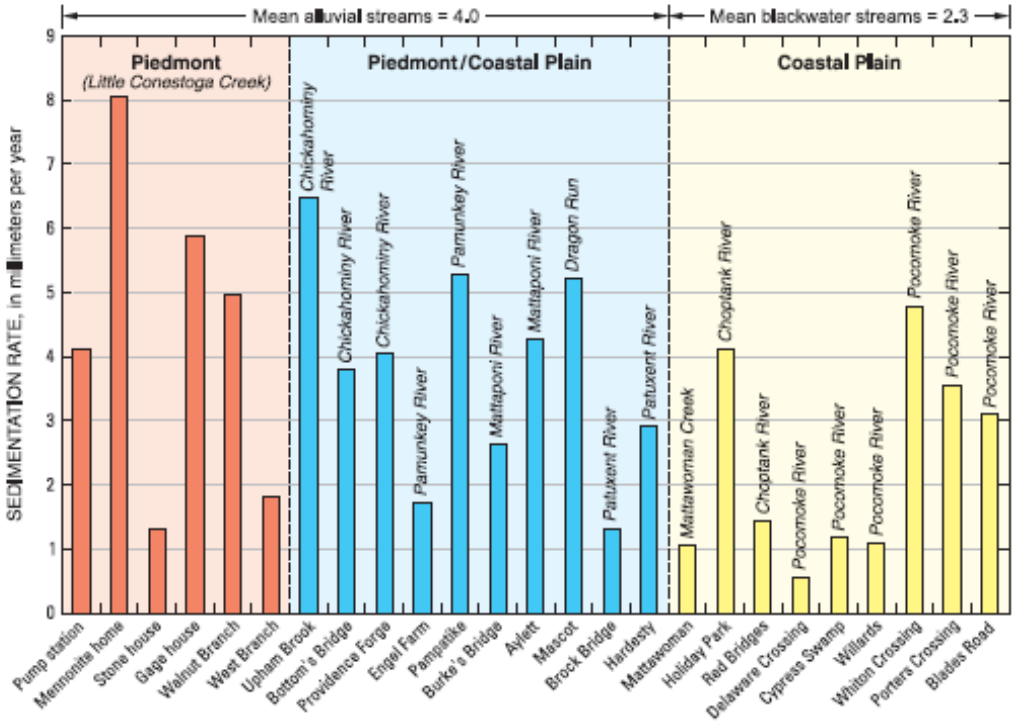
Sources, Transport, and Storage of Sediment at Selected Sites in the Chesapeake Bay Watershed

Scientific Investigations Report 2008–5186

U.S. Department of the Interior
U.S. Geological Survey

JMT
Engineering A Brighter Future

Coastal Plain Streams vs Piedmont



Engineering A Brighter Future

CENTER FOR WATERSHED PROTECTION

JMT
Engineering A Brighter Future

CENTER FOR
WATERSHED
PROTECTION

- … sediment and contaminant-trapping functions of forested flood plains on Coastal Plain fluvial systems is especially important because these flood-plain surfaces are the last sites for sediment storage and biogeochemical cycling)before sediment enters estuaries and their critical nurseries.

JMT
Engineering A Brighter Future

Center for Watershed Protection

- …suspended sediment yields in streams undergoing urbanization are 10 to 50 times greater than those in rural areas.

JMT Engineering A Brighter Future

Center for Watershed Protection

- …sources of sediment in the Mattawoman Creek Watershed were distributed as follows: streambanks (30 percent), forest (29 percent), construction (25 percent), and cropland (17 percent).

JMT Engineering A Brighter Future

Center for Watershed Protection