The West Branch of the Mighty Susquehanna: The Good the Bad and the Ugly

Our Internships with Geisinger Medical Center and The Clean Water Institute

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Susquehanna River Heartland Coalition for Environmental Studies

(SRHCES) partners include: Bloomsburg University, Bucknell University, Kings College, Lock Haven University, Lycoming College, Susquehanna University, DEP, the Northcentral Pennsylvania Conservancy, the Western Pennsylvania Conservancy, SEDA-COG, Forum-for-the-Future, and the Geisinger Health System.

Current Projects:

- Monitoring of water quality in the Susquehanna River Lower West Branch at 17 sites between Lock Haven and Sunbury.
- Assessment of the effectiveness of riparian buffers to reduce Non-point Source Pollution in the Chillisquaque Creek at PPL's Montour Preserve.

GOAL: to focus more attention and get more resources to solve the environmental problems in the Middle and Upper Susquehanna River Watershed, the area from Lock Haven and the New York border to the confluence at Sunbury.

Mission:

- Promote collaborative community-based research opportunities between local organizations, colleges, and universities.
- Create multi-disciplinary educational opportunities for undergraduates interested in the natural and cultural resources of the Susquehanna River.

Future Projects:

- An annual "BioBlitz" to identify all biological resources in a geographic area.
- The development of a field station and a mobile education and research center.
- Assessment of the status of an endangered Lamp Mussel in White Deer Creek.

Overview:

Getting things organized

The Study Area

Data we collect

Sampling Techniques

What we found and what it means

AMD and Waste Water Treatment

How PA Effects the Chesapeake Bay

Other activities as CWI interns

Acknowledgements

Getting Things Together: The First Summer

From Lick Run to The Convergence:

The study area includes about 70 miles of the West Branch of the Susquehanna River flowing from where Lick Run enters the River in Lock Haven to the convergence of the West Branch and North Branch near Sunbury

Sites Include:

Lick Run

Big Island

Jersey Shore

Susquehanna Campground

Hiawatha

Montoursville

Muncy

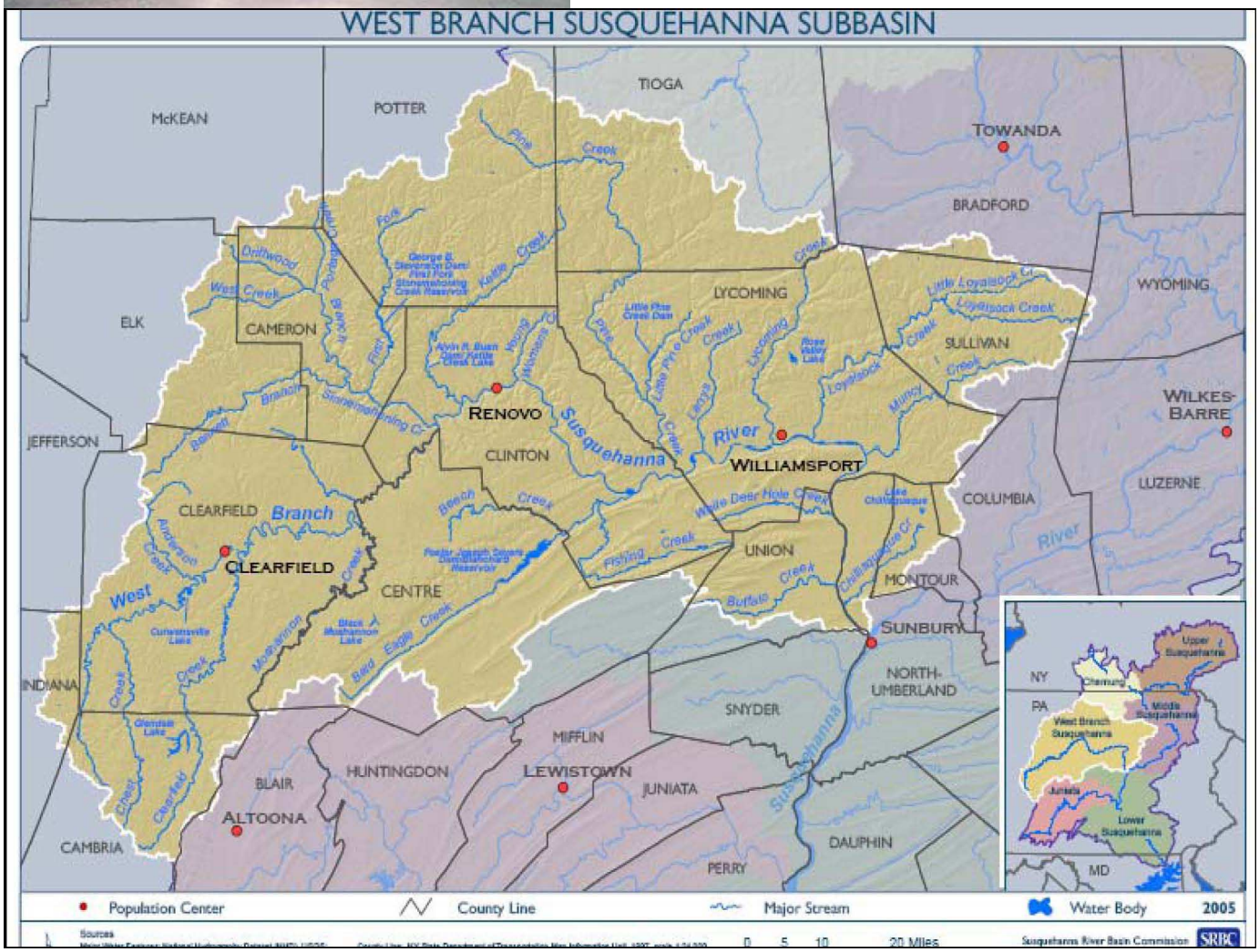
Montgomery

Watsontown

Milton

Montandon

Northumberland



What We Sample:

In the Lab

Nitrate

Nitrite

Total Phosphate

Orthophosphate

Alkalinity

pH

Turbidity

Conductivity

Coliforms

TDS

On Site (in the field)

Dissolved Oxygen

Temperature

Nitrogen

Forms found in water: Nitrate, Nitrite, Ammonia

What happens if there's too much?

How much is safe (Nitrate)

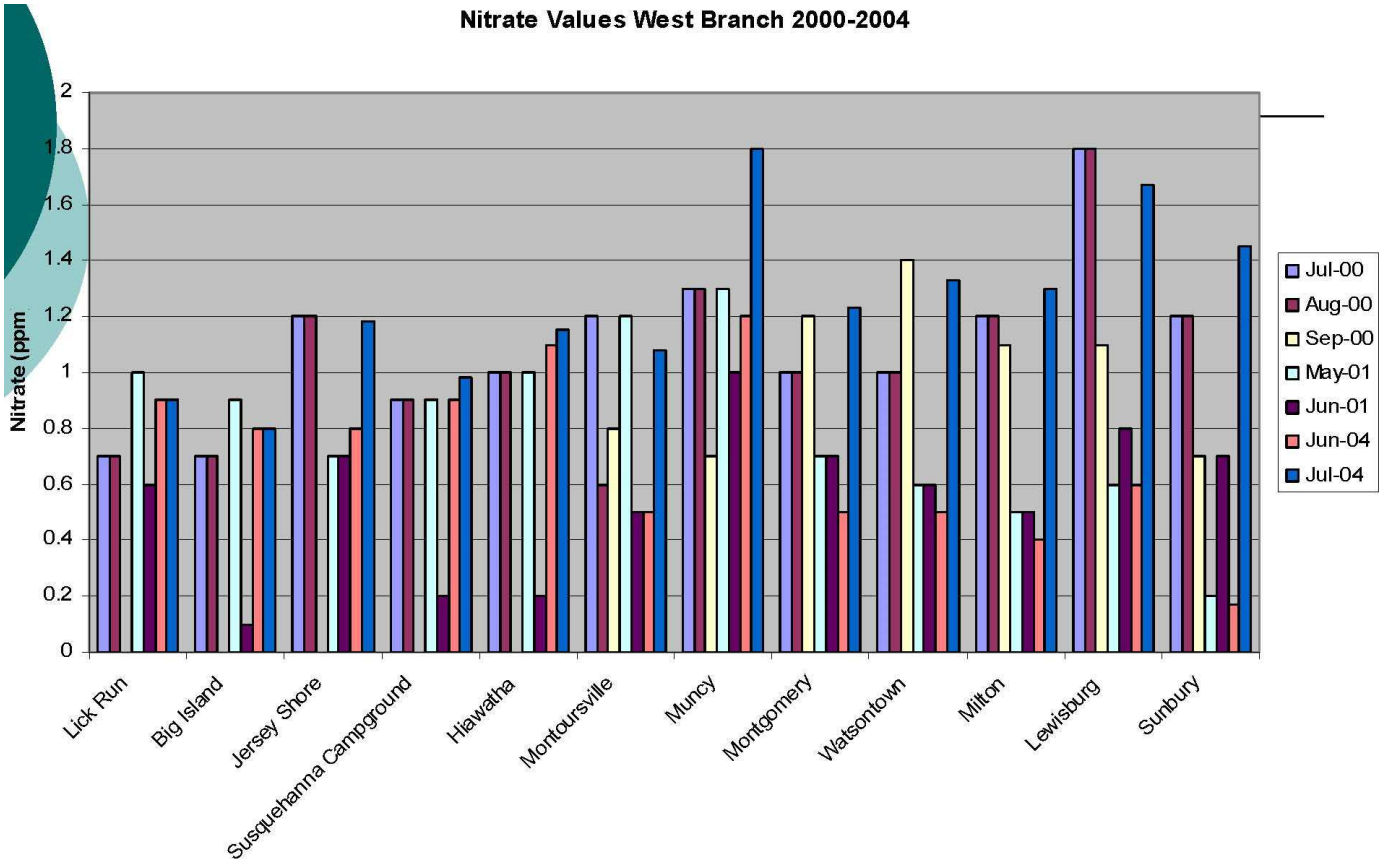
10mg/L is considered the level at which water is no longer safe to consume

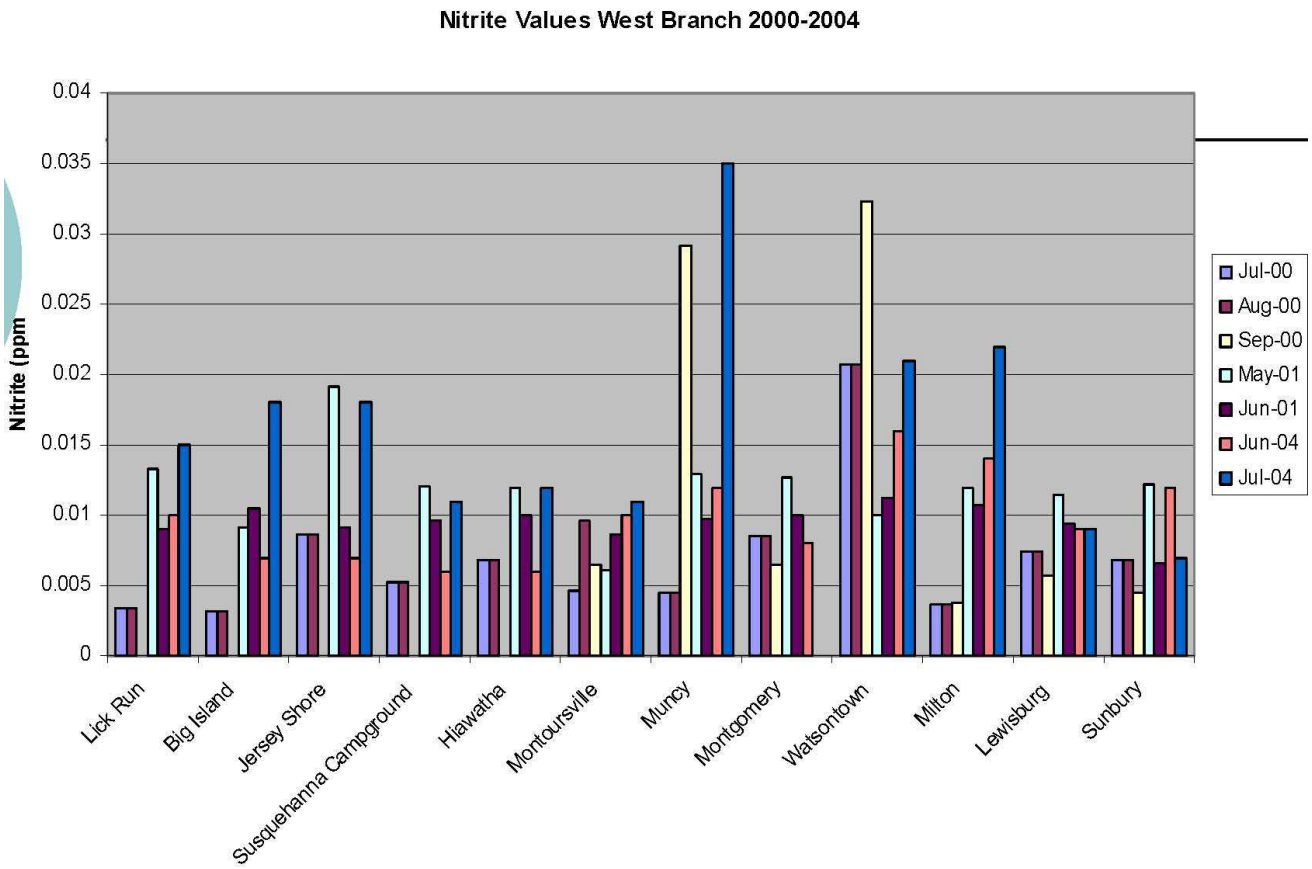
Any level above 1.0mg/L signifies an unnatural input

Influences on Nitrogen levels

Natural Occurrences

Human Influences





Phosphate

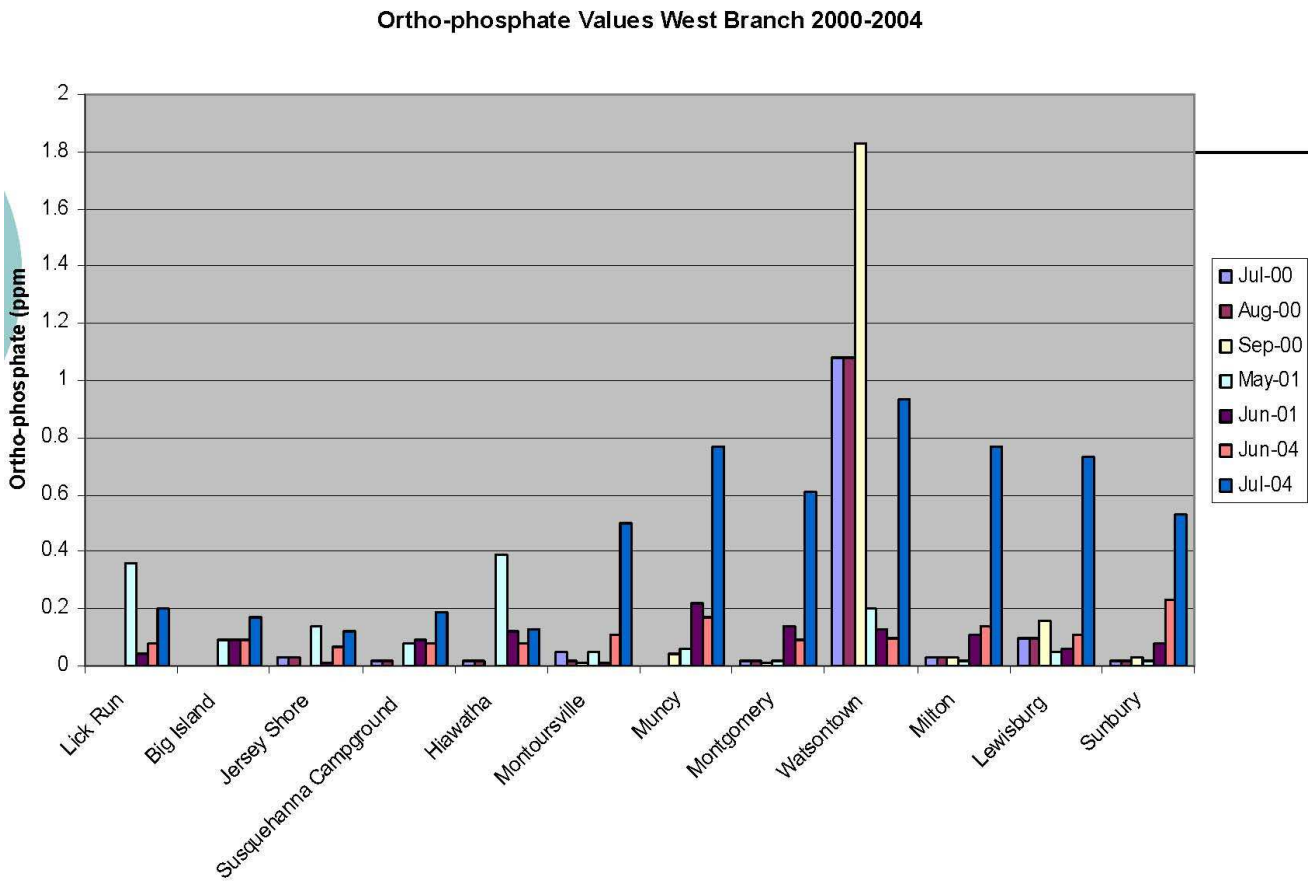
Forms found in water: organic phosphate (total phosphate) and inorganic or ortho-phosphate

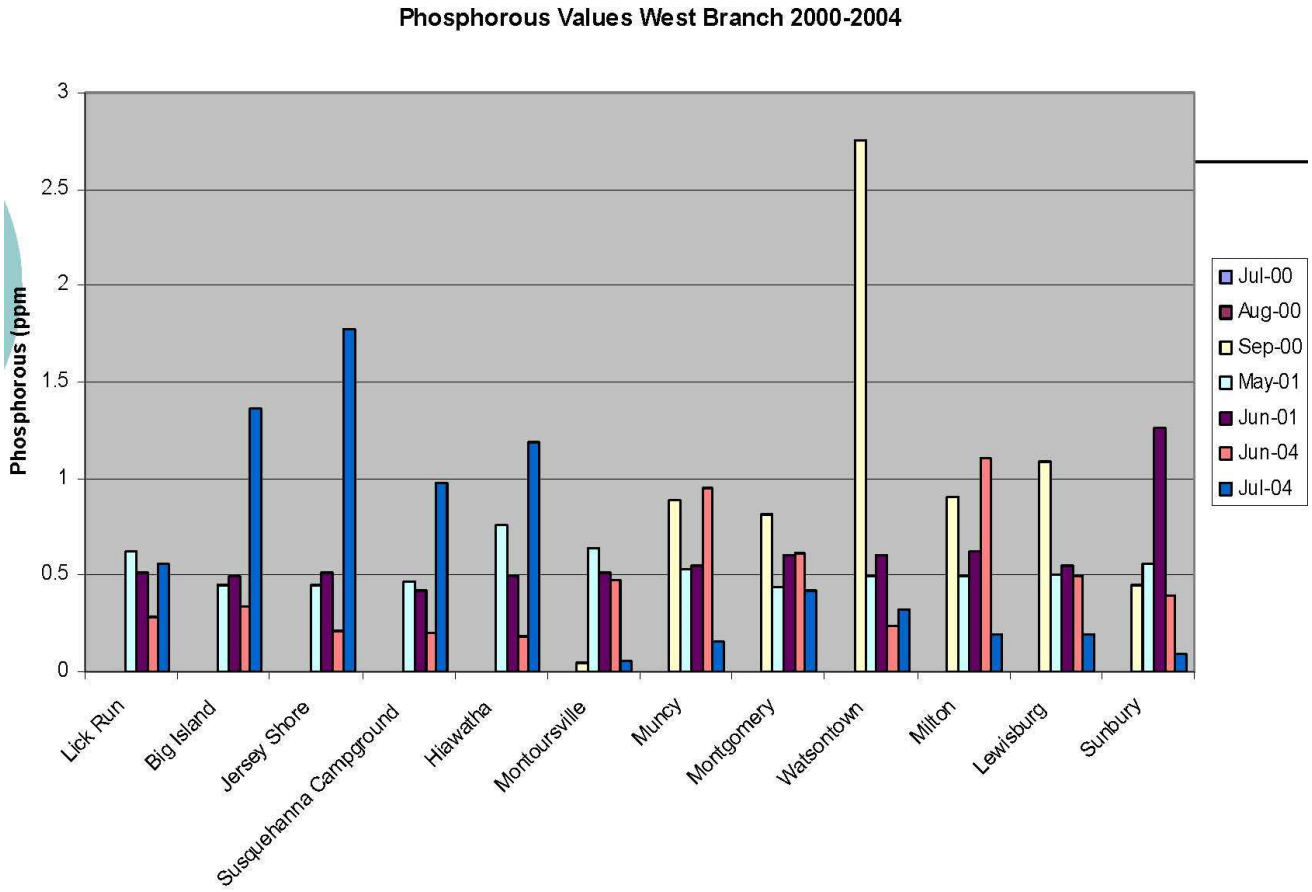
How much is safe

Normal levels are around 0.01mg/L

Levels reaching 0.1mg/L indicate pollution

Human activities that influence phosphate levels





Dissolved Oxygen

As DO levels drop animals get stressed

At 5.0mg/L a noticeable decrease in diversity occurs

Hardier species can survive in levels below 4.0mg/L

2.0mg/L is considered an absolute lethal level

The amount of oxygen in water is dependent on:

Temperature

Flow

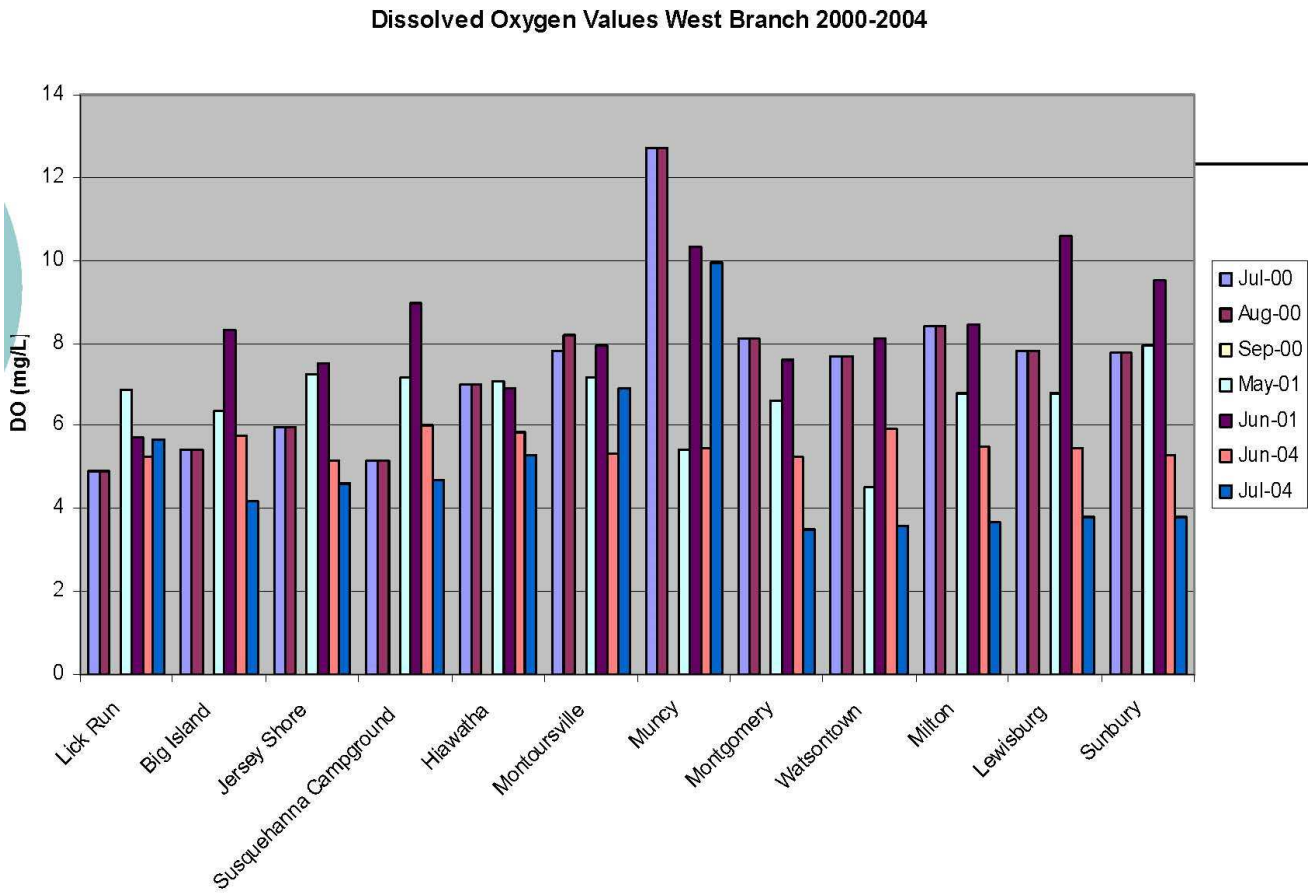
Aquatic plants

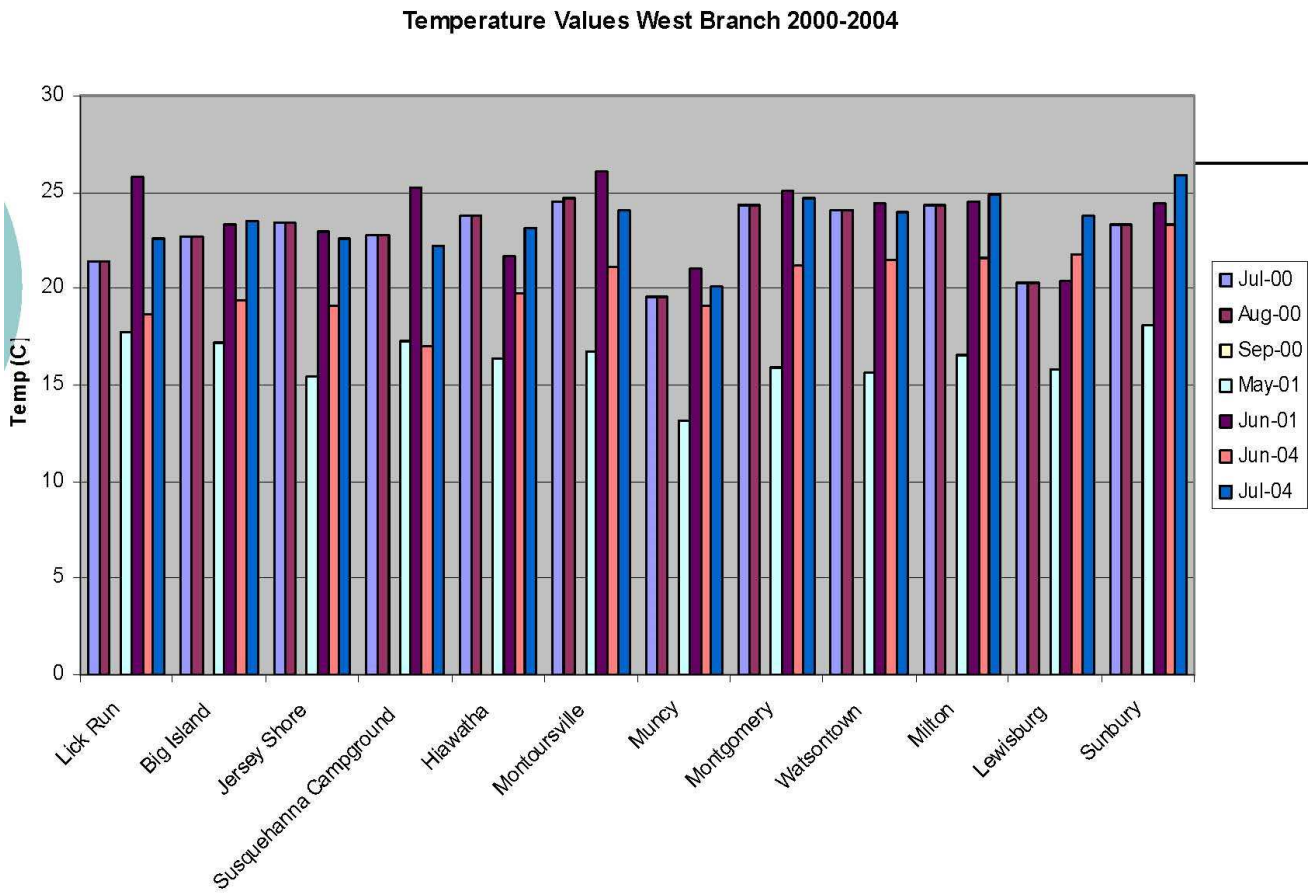
Bacteria

Altitude

Dissolved or suspended solids

And various human activities





Turbidity

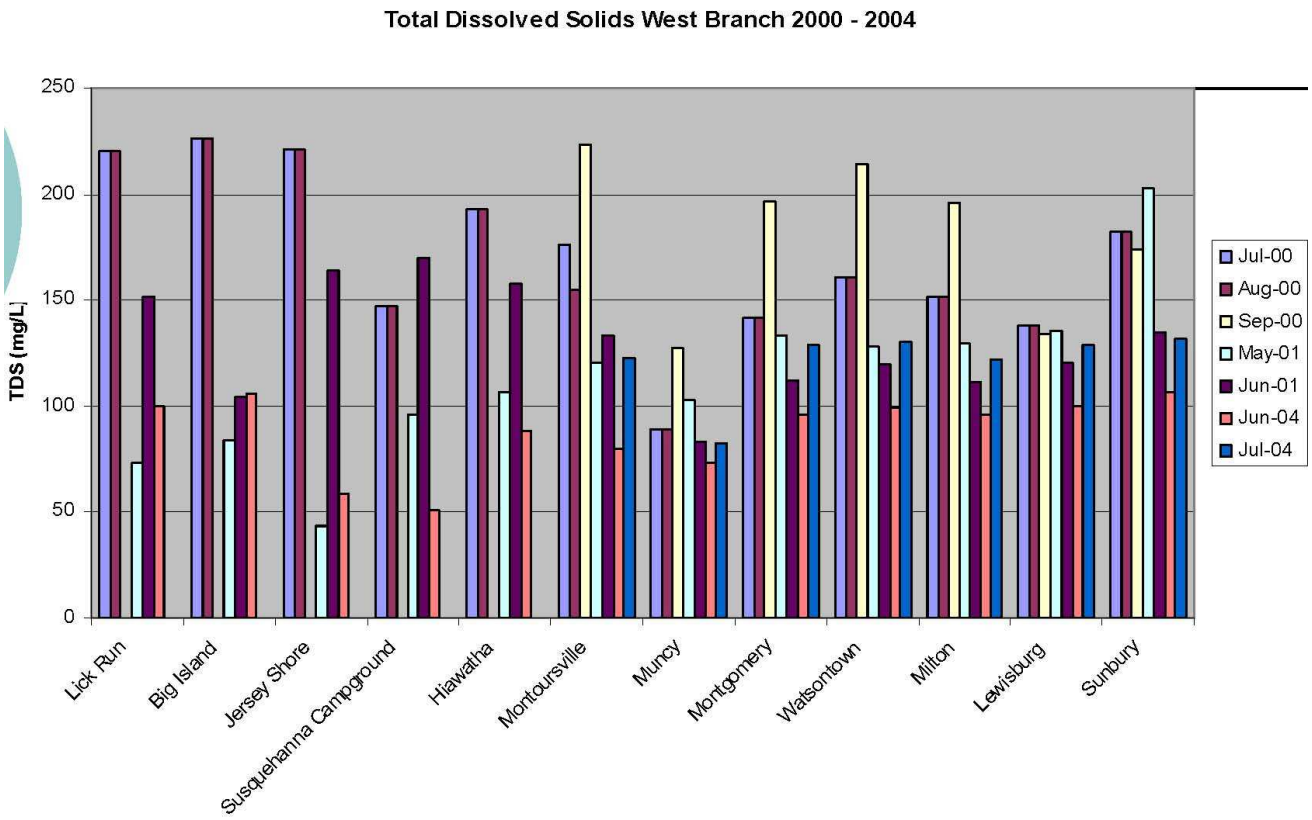
The clarity of water in relation to total dissolved solids (TDS)

What are the results of high levels of turbidity?

Filling in shallow areas of stream

Aquatic habitat/effects on bugs and fish

Effects on humans



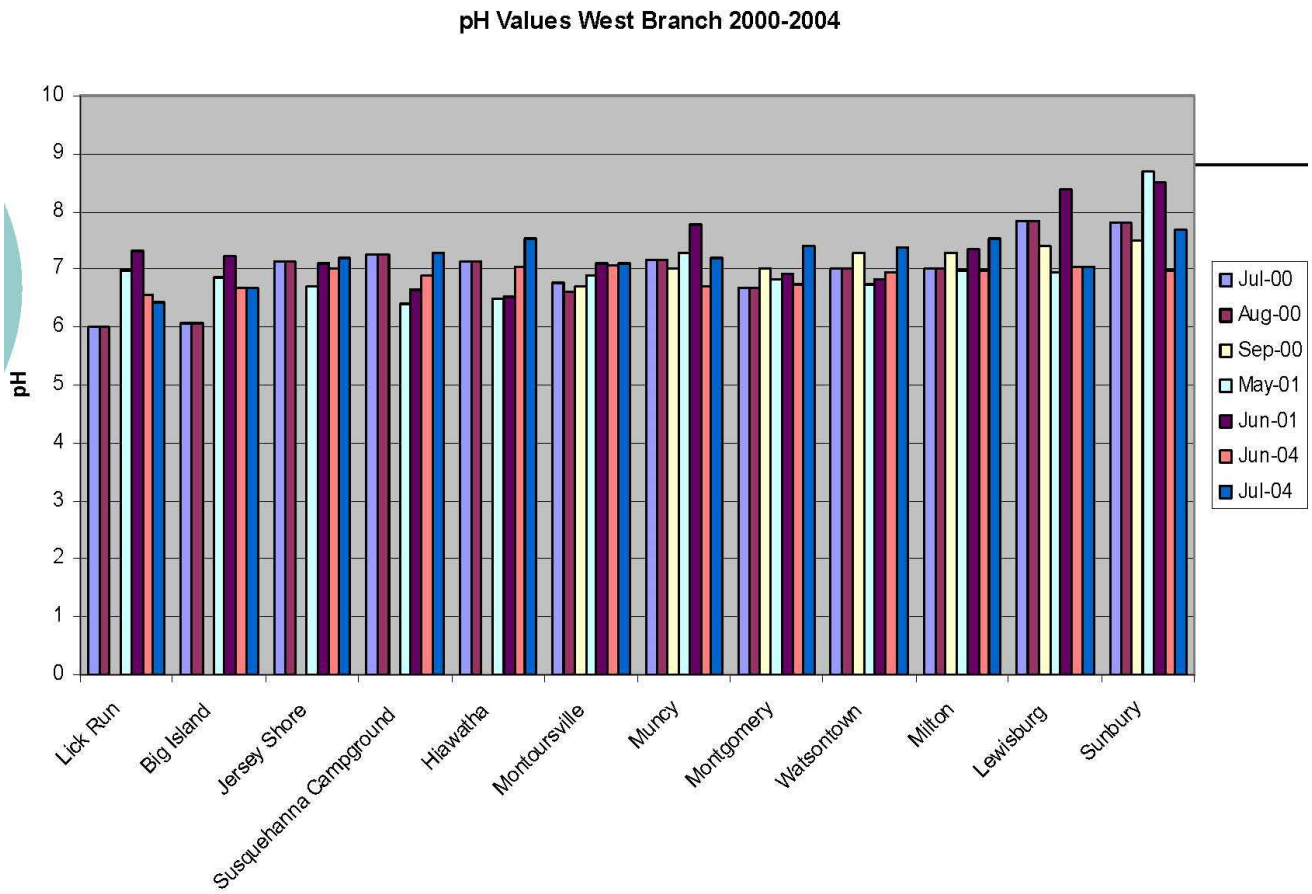
pH

pH is a measure of hydrogen ions and hydroxyl ions determining how acidic or basic a solution is

Aquatic organisms prefer a pH within the range of 6.5 to 8.0

pH levels around 4.0 may destroy larva and eggs, result in fish kills, or cause mutations

Factors affecting pH

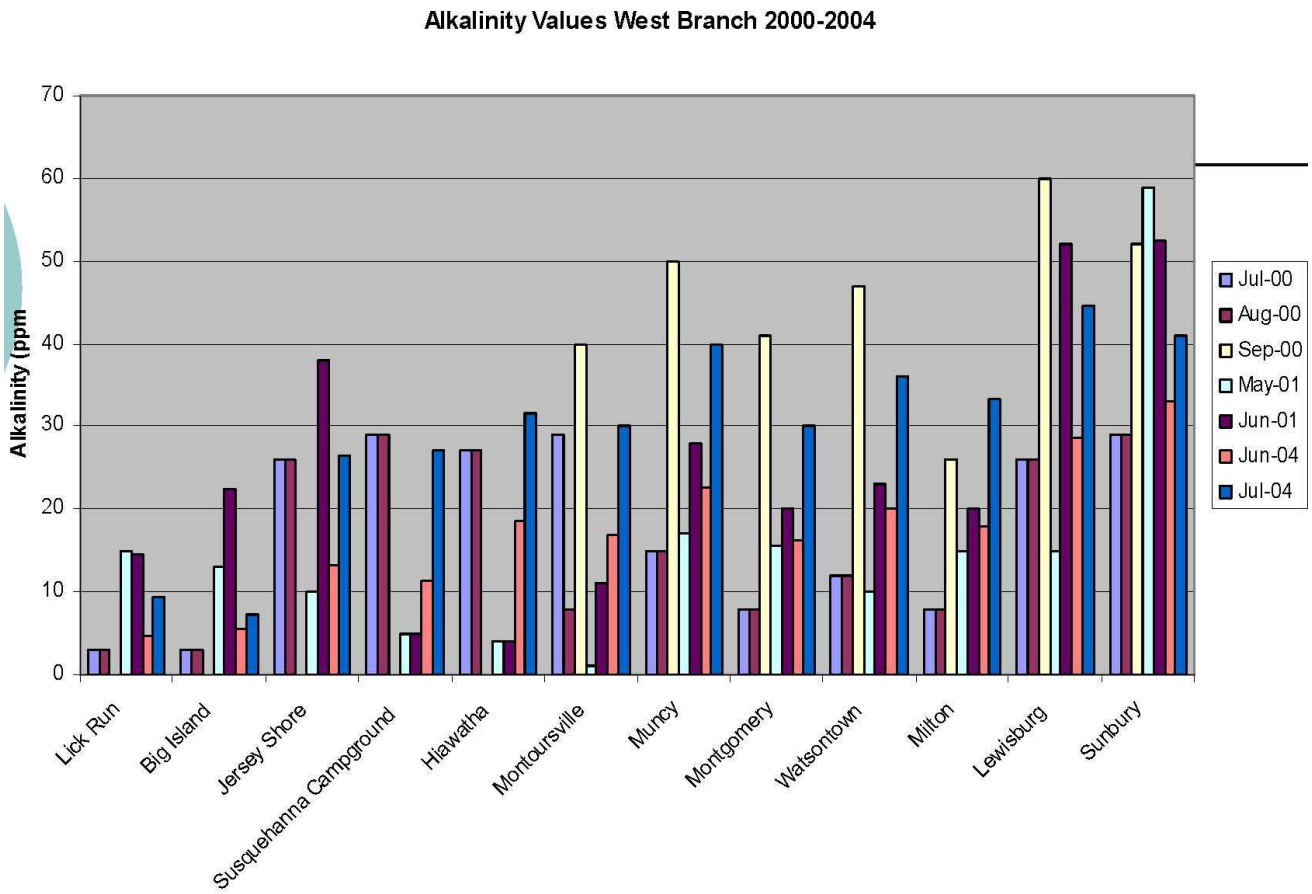


Alkalinity

Alkalinity = the buffering capacity of water

Important in determining the streams ability to maintain a constant pH and neutralize acidic pollution from rainfall or waste water

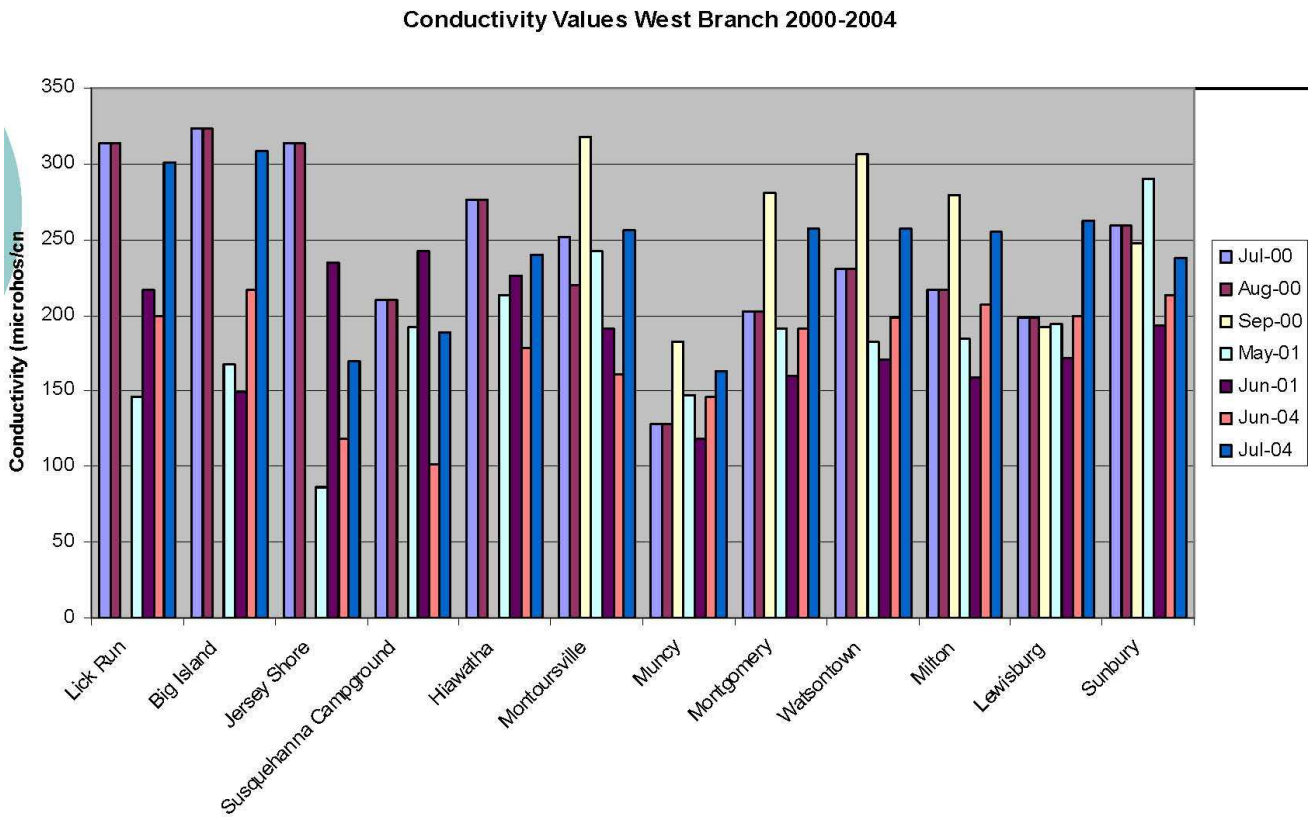
Streams low in alkalinity are susceptible to changes in pH while those higher in alkalinity resist these changes



Conductivity

a measure of the capability of water to pass an electric current

Freshwater streams ideally should have a conductivity between 150 to 500 µS/cm to support diverse aquatic life.



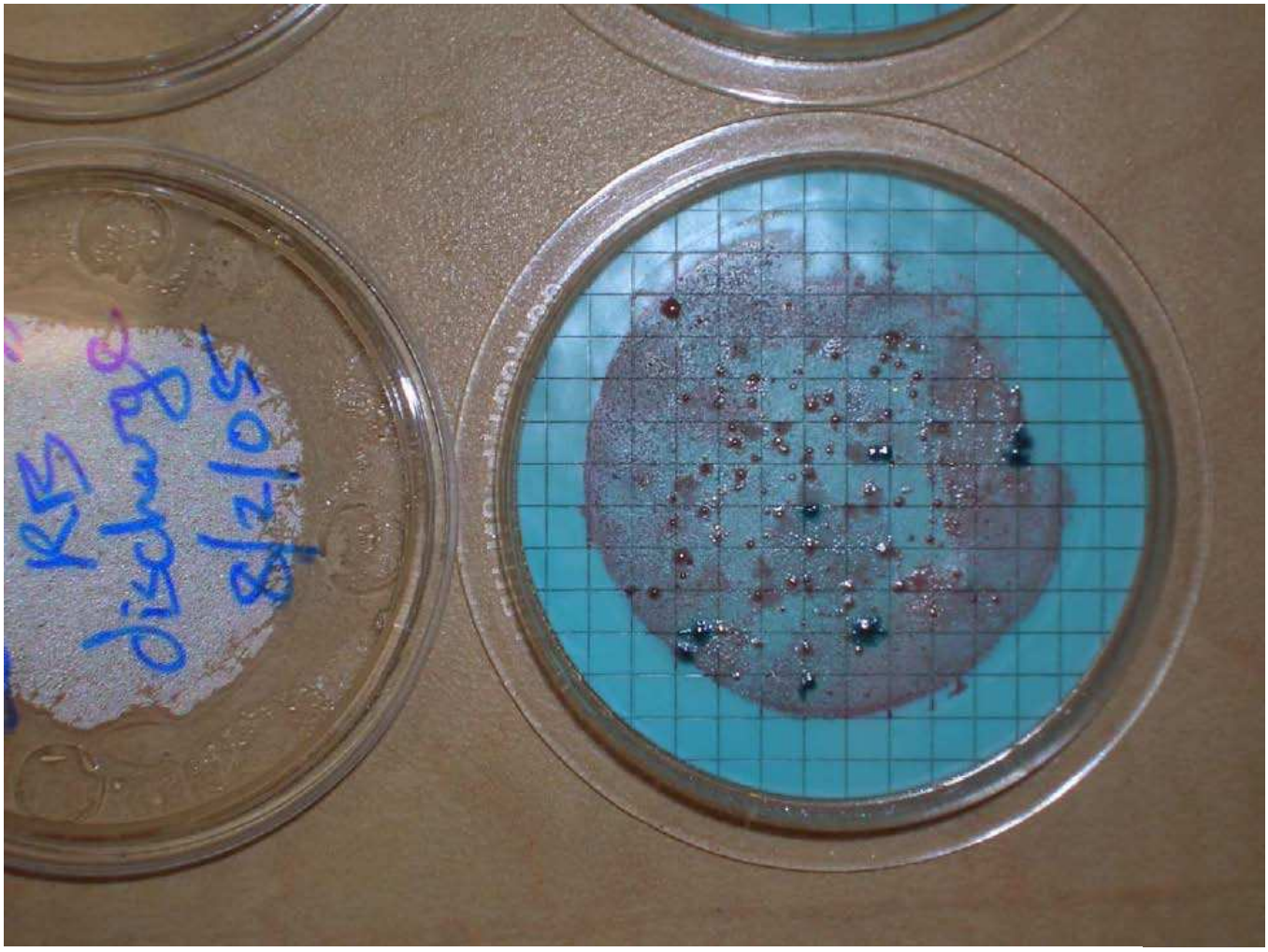
Coliforms

Coliformsare bacteria that are naturally occurring in animals and in the environment

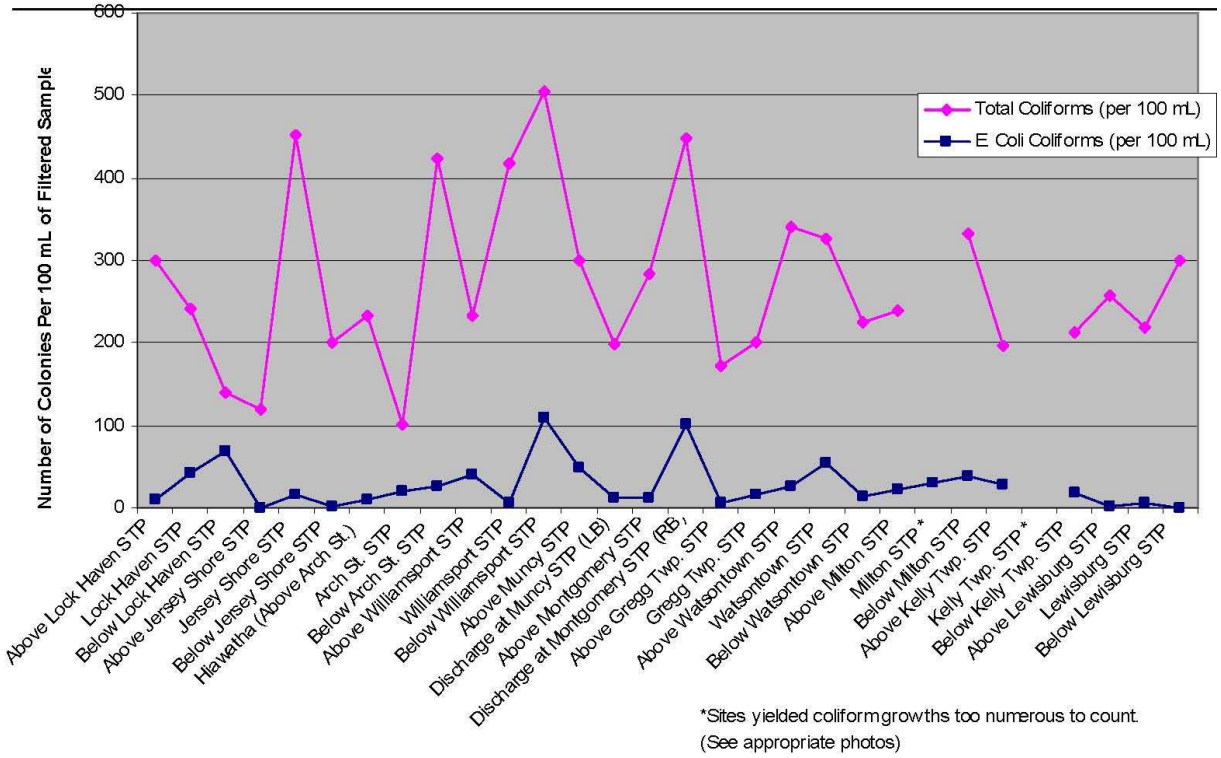
indicate water contaminated with animal or human waste

So when there are increased levels of waste in the water the coliformcounts go up

Water with the intended use of primary contact should not have fecal coliformcounts above 200 fecal coliformsper 100 ml



Coliform Colonies Grown From Samples Collected at or near Sewage Treatment Plants Along the Lower West Branch of the Susquehanna River - Summer 2005



*Sites yielded coliform growths too numerous to count.
(See appropriate photos)

Pennsylvania Fish & Boat Commission

PRESS RELEASE

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PFBC PROBING INFECTION IMPACTING YOUNG SMALLMOUTH BASS IN SUSQUEHANNA WATERSHED

July 26, 2005

The Pennsylvania Fish and Boat Commission (PFBC) today said that it has identified the common bacterial agent causing skin anomalies in young smallmouth bass at various locations throughout the Susquehanna River watershed and is working to learn more about its impacts.

PFBC biologists making their annual collections of young-of-year smallmouth bass over the past several weeks have observed an unusually high number of the fish with skin lesions. At the same time, recreational anglers have been making reports of seeing dead and dying young smallmouth in a variety of locations throughout the river system.

Examinations of afflicted fish have revealed that an infectious bacterial agent is responsible for the skin condition and for the mortalities. The bacterial agent, *Flavobacterium columnare* (columnaris), is a common soil and water bacteria. While harmless to humans, columnaris can infect all species of freshwater fish. Columnaris disease is a secondary infection brought on by environmental or nutritional factors that stress fish.

Fish health can be caused by a combination of environmental and other factors that do not individually cause significant problems, but collectively are sufficiently stressful to cause disease. Although a pollutant has not been ruled out in the current fish loss, a discrete pollutant doesn't usually cause mortality or stress over an area as large as the affected section of the Juniata and Susquehanna Rivers.

The specific stress factors associated with the current smallmouth bass infections are hard to pinpoint, but most likely include high water temperatures and low dissolved oxygen levels. Columnaris mortalities are known to occur when water temperatures exceed 85 degrees. Susquehanna River temperatures have exceeded 80 degrees during the ongoing annual field sampling. Likewise, Commission biologists have recorded low dissolved oxygen readings from the waters they have sampled. Recently on the Juniata River, dissolved oxygen was measured at 4.65 milligrams per liter at 9 a.m. Overnight dissolved oxygen levels can be expected to dip below daytime levels; anything below 4.0 mg/l can be stressful to fish.

Smallmouth bass young-of-year inhabit shallow, near shore areas, where water temperature can be expected to be highest and dissolved oxygen levels lowest. While some adult smallmouth bass and adult white suckers have been reported to exhibit the anomaly being seen in the young bass, those occurrences have been very low.

Although water pollution has not been completely ruled out in the current fish loss, pollutants rarely impact just one species of fish. Likewise, a single pollution event doesn't usually cause mortality or stress over an area as large as is being documented. Reports from biologists and anglers indicate the fish disease is being seen primarily in the Juniata River downstream of Lewistown and the Susquehanna River downstream from Sunbury to below Harrisburg. Lighter incidences have been reported from the West Branch Susquehanna River, the North Branch Susquehanna River, Loyalsock Creek, and Penns Creek. To date, the fish flesh anomaly has not been reported from the other major rivers of Pennsylvania such as the Delaware, Lehigh

The Two Biggest Problem Areas on the West Branch

1. AMD –Abandoned Mine Drainage/Acid Mine Drainage

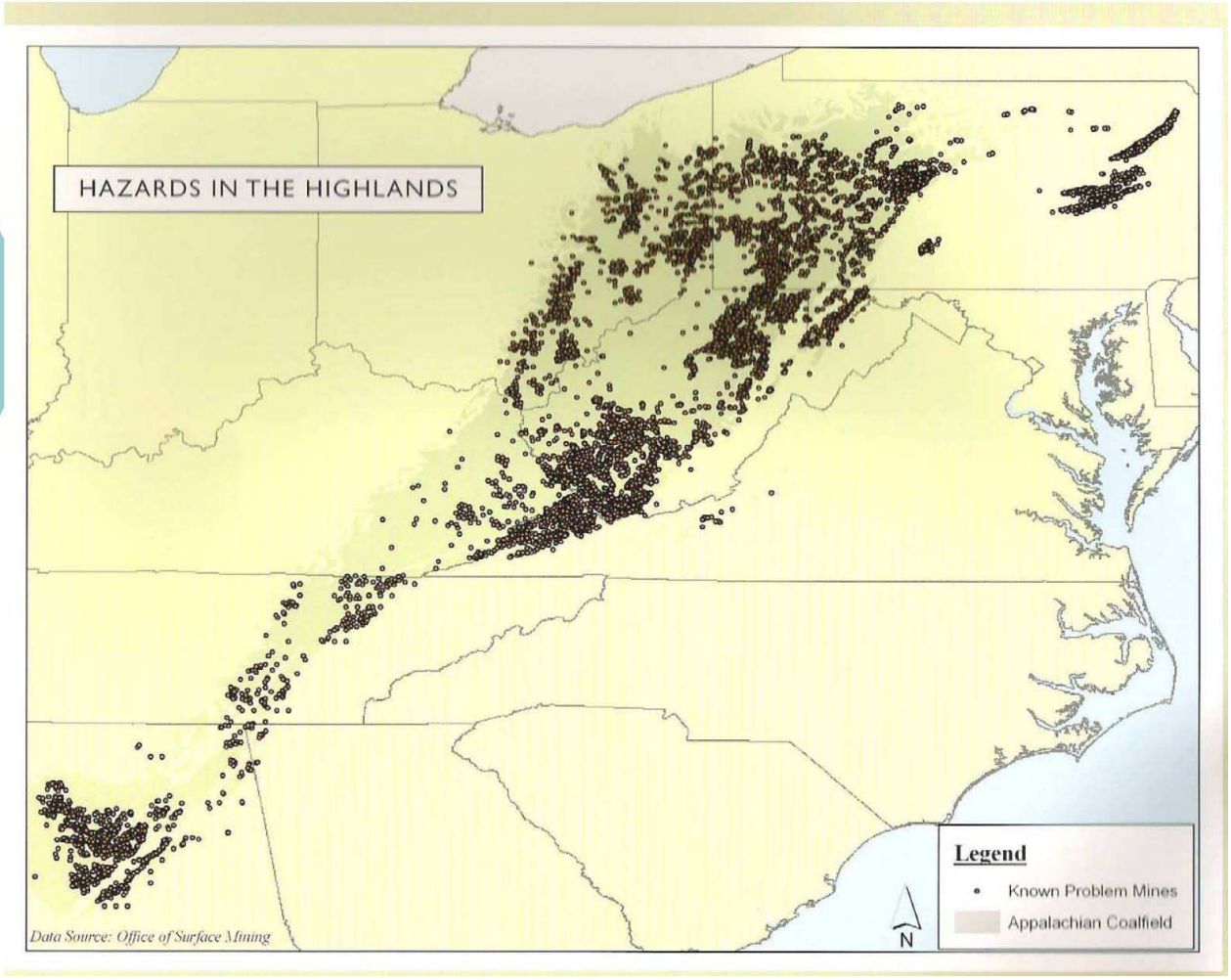
-results when the mineral pyrite (FeS_2) is exposed to air and water, resulting in the formation of sulfuric acid and iron hydroxide

Results in the lowering

of the streams pH and the

coating of stream bottoms

with iron hydroxide



What Can We Do to Clean Up AMD?

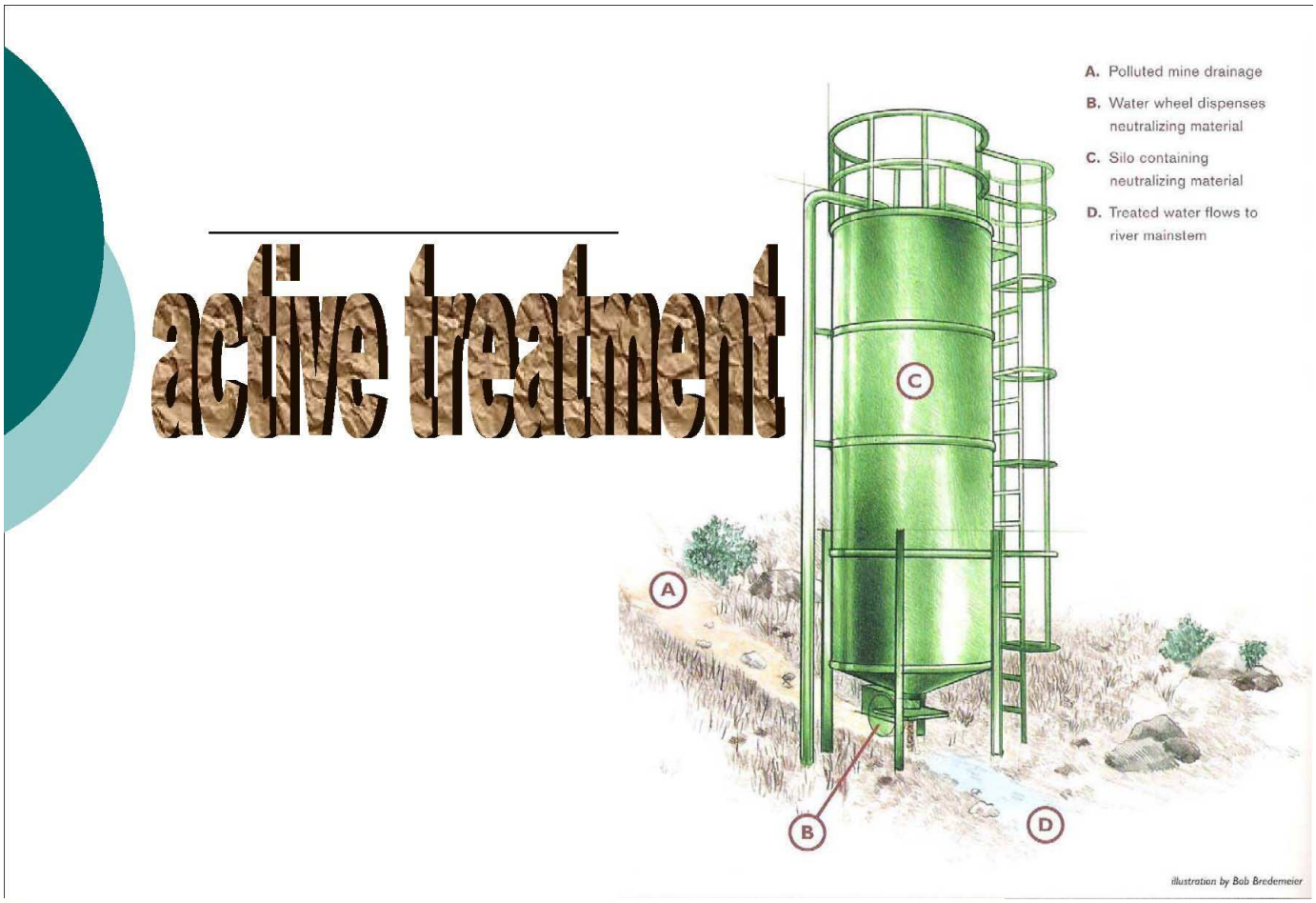
Active Treatment Systems

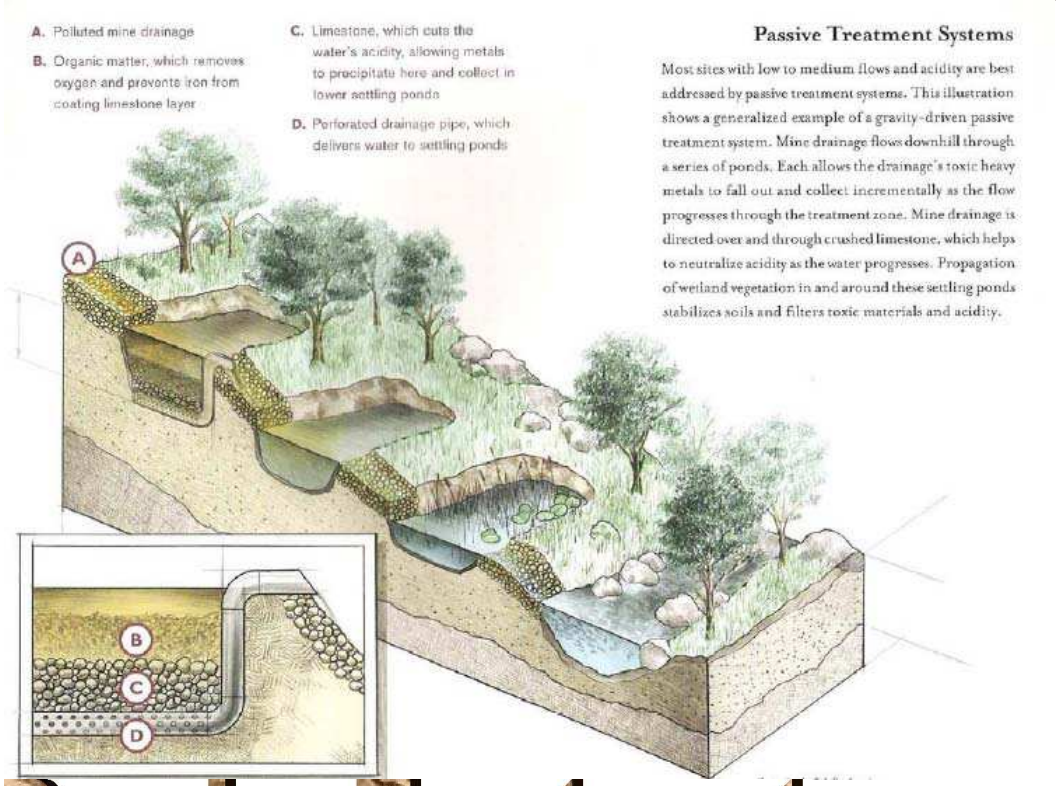
Used on areas with high flow levels of AMD –commonly uses calcium oxide aka pebble quick lime that is stored in a silo and dispensed directly into water

Passive Treatment Systems

Used on areas with low to medium flows –use crushed

limestone to neutralize acidity





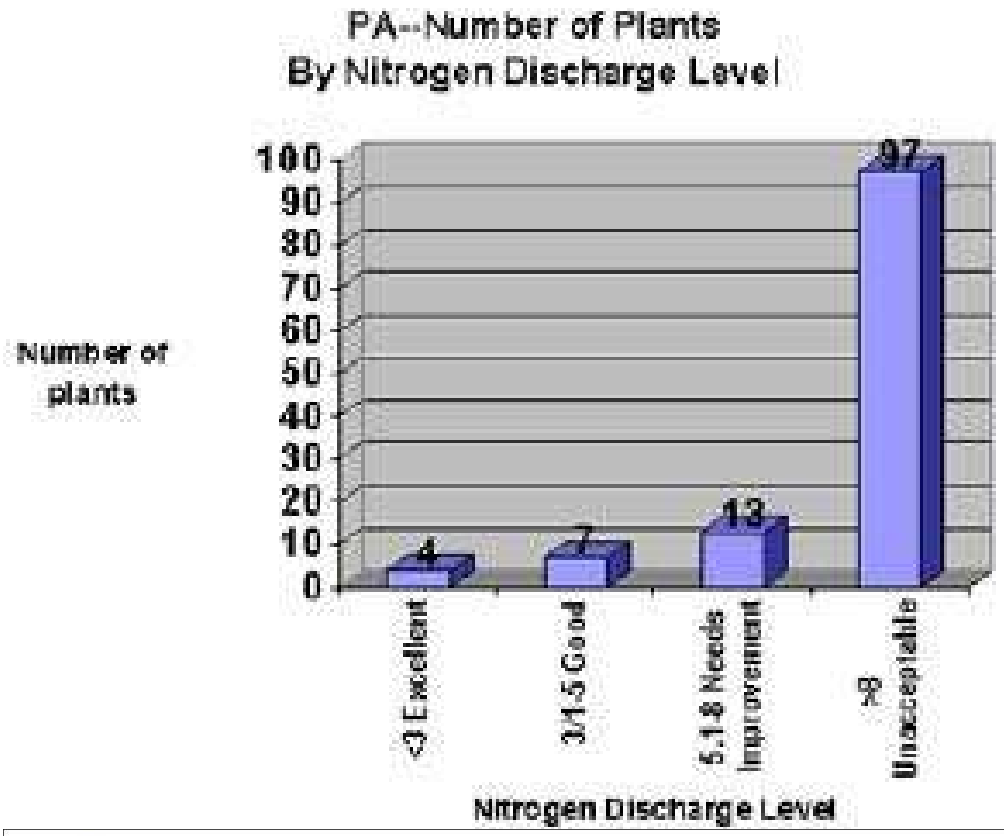
Passive Treatment

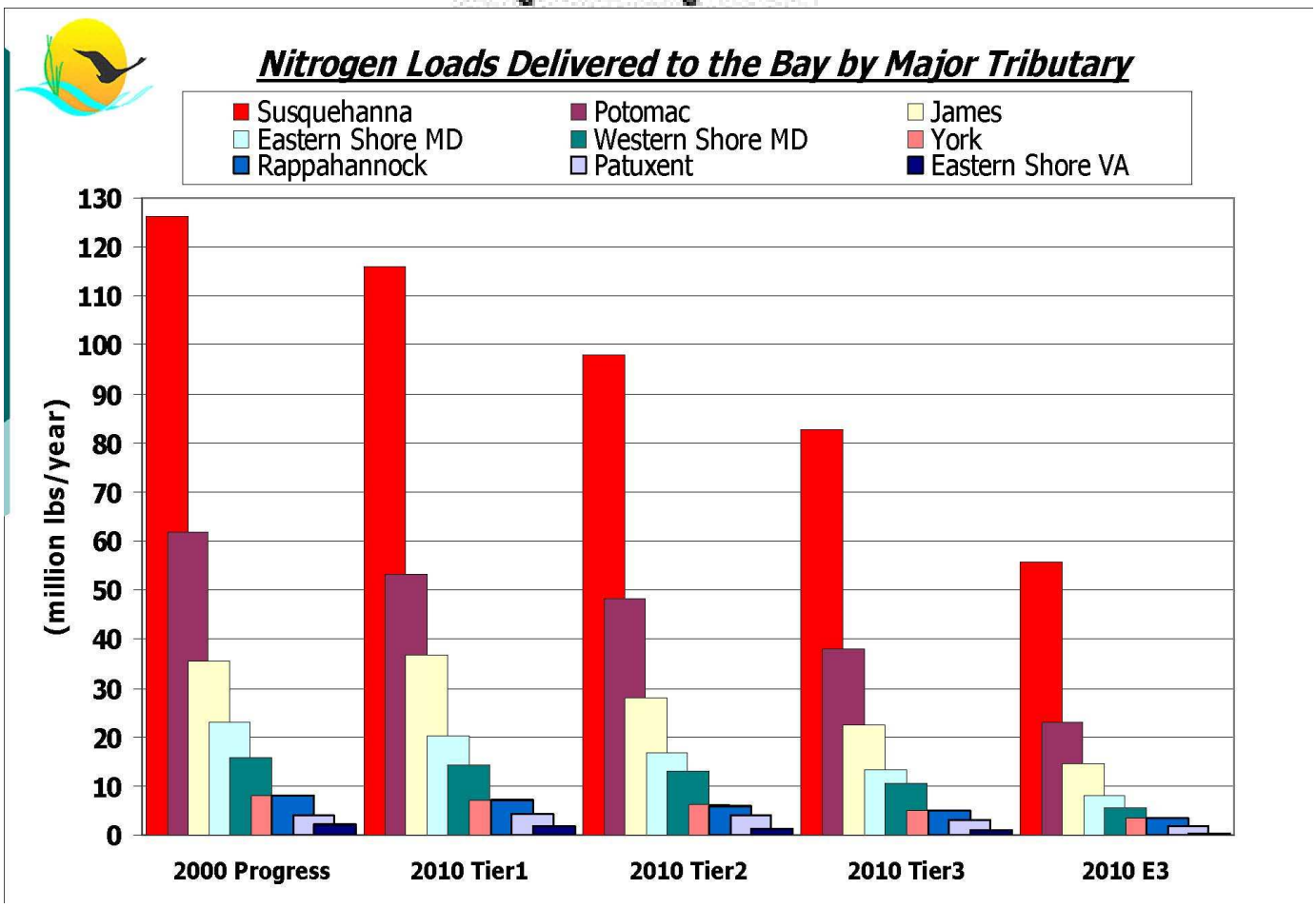
Problem #2 –Sewage Treatment Plant Effluents

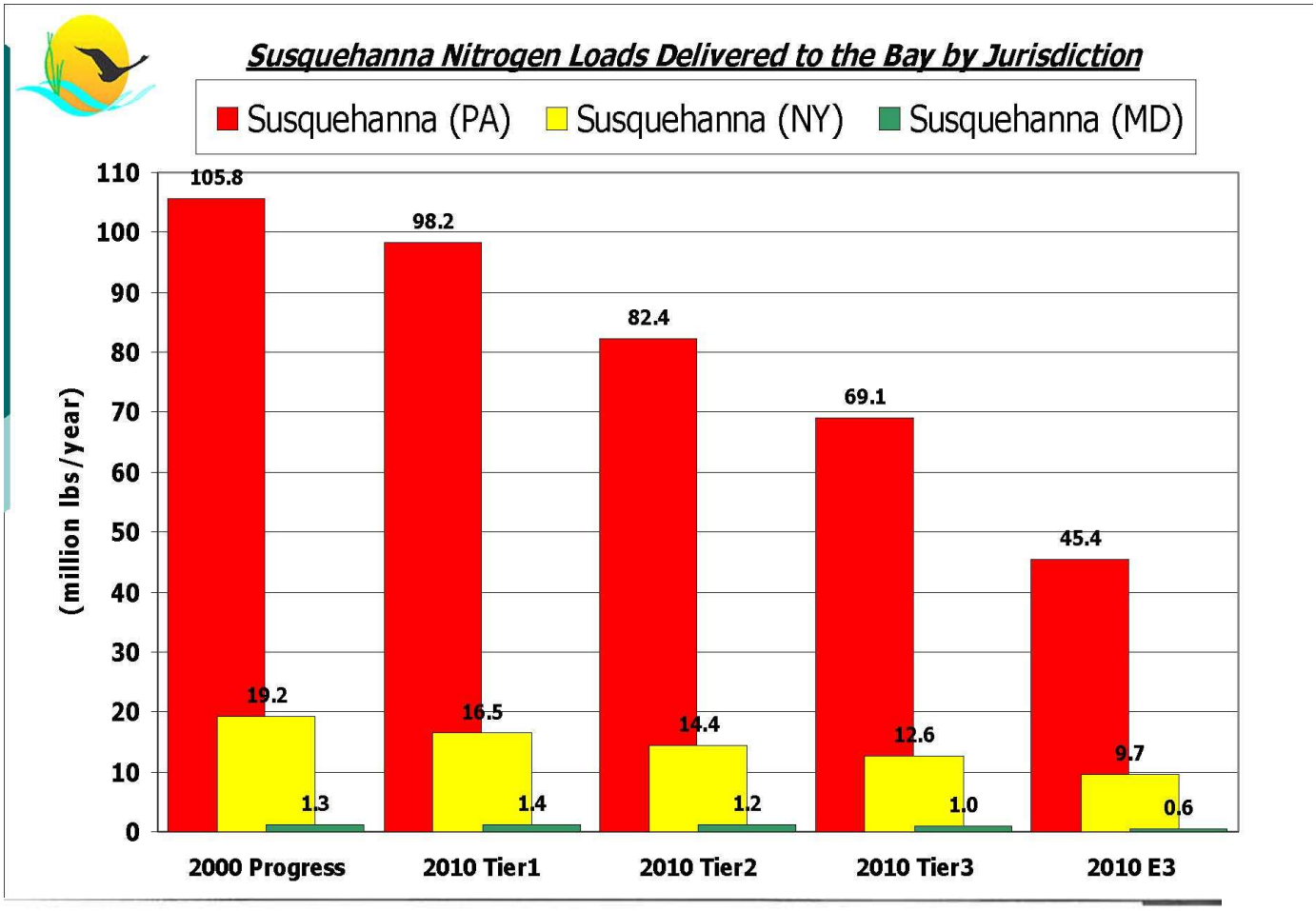
How Sewage Treatment Plants in Our County Score

Lycoming

	Overall Score	Flow(mgd)	Nitrogen Concentration(mg/l)	Nitrogen Load
MUNCY BOROUGH MUNICIPAL AUTHORITY	Unacceptable	0.6	9.9	17,188
WILLIAMSPORT SANITARY AUTHORITY - CENTRAL	Unacceptable	7.2	19.3	397,919
WILLIAMSPORT SANITARY AUTHORITY - WEST	Unacceptable	2.8	26.4	224,761
JERSEY SHORE BOROUGH	Unacceptable	0.4	26.6	35,406
MONTGOMERY BOROUGH	Unacceptable	0.5	53.5	82,342


PA--Number of Plants
By Nitrogen Discharge Level
Number of plants
100
90
80
70
60
50
40
30
20
10
0
4
7
13
97
<3 Excellent
3/1.5 Good
5.1/8 Needs Improvement
>8 Unacceptable
Nitrogen Discharge Level


Nitrogen Loads Delivered to the Bay by Major Tributary
Susquehanna
Potomac
James
Eastern Shore MD
Western Shore MD
York
Rappahannock
Patuxent
Eastern Shore VA
(million lbs/year)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
2000 Progress
2010 Tier1
2010 Tier2
2010 Tier3
2010 E3



Why is Pennsylvania preparing Tributary Strategies?

- The C2K Agreement calls for us to --
  - *By 2010, correct the nutrient and sediment related problems in the Chesapeake Bay sufficient to remove the Bay from the list of impaired waters under the Clean Water Act*

What are Tributary Strategies?

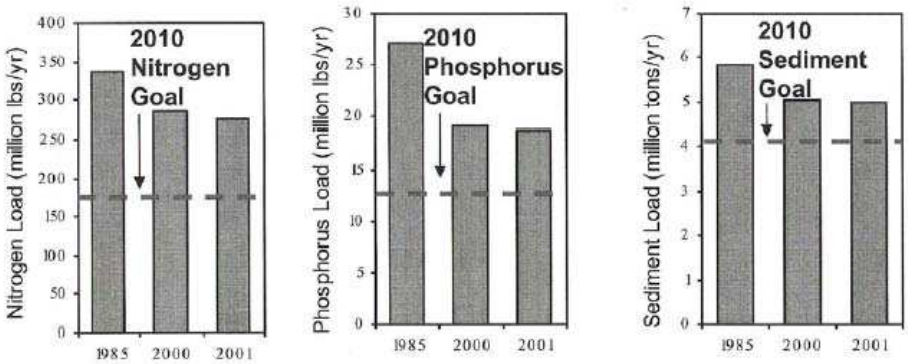
- Watershed based plans to reach Chesapeake 2000 (C2K) Agreement goals for -
  - Nutrient Reduction
  - Sediment Reduction
  - Habitat Restoration
- Reflect each Tributary's land use and nutrient sources.

Bay-wide Nutrient and Sediment Load Reduction Goals

Nitrogen - Reduce annual loads to no more than 175 million pounds.

Phosphorus - Reduce annual loads to no more than 12.8 million pounds.

Sediment - Reduce annual loads to no more than 4.15 million tons.



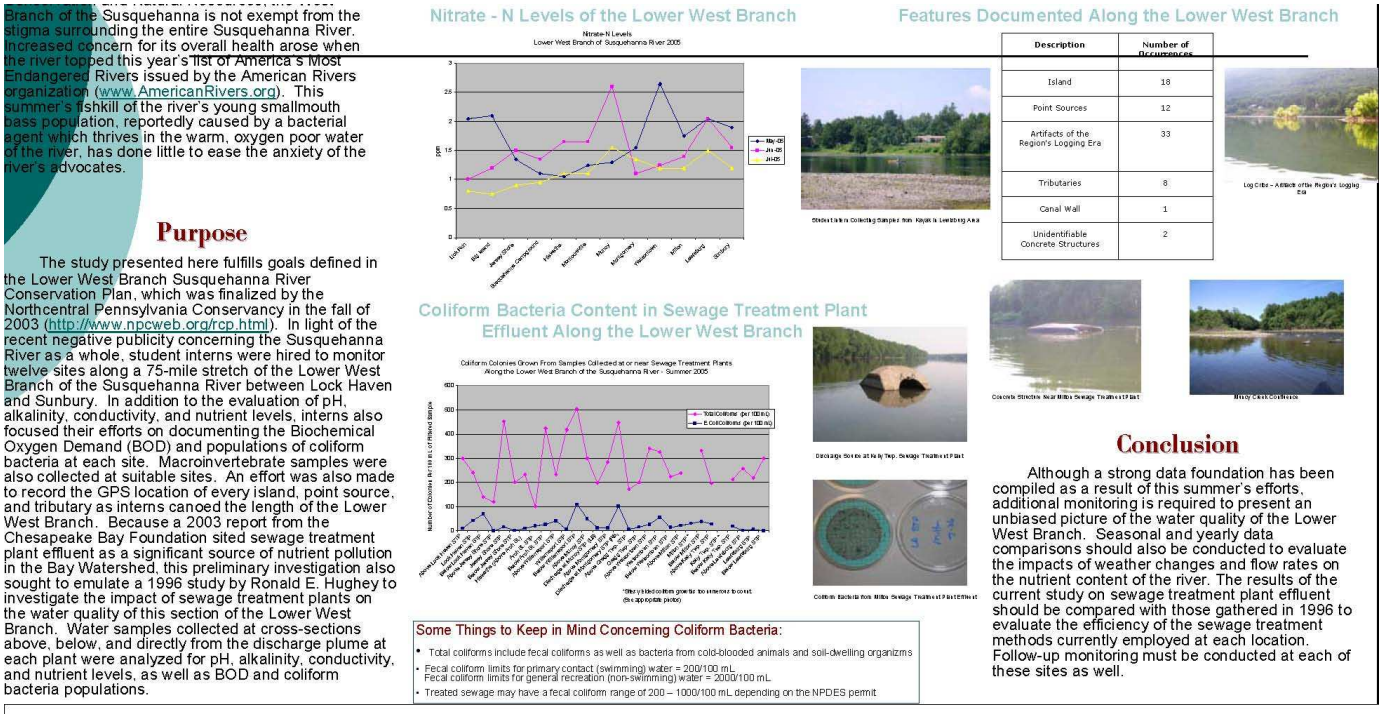
Background

Despite being designated as Pennsylvania's River of the Year for 2005 by the Department ofConservation and Natural Resources, the West Branch of the Susquehanna is not exempt from the stigma surounding the entire Susquehanna River. Increased concern for its overall health arose when the river topped this year's list of America's

Most Endangered Rivers issued by the American Rivers organization (www.AmericanRivers.org). This sumer's fishkilof the river's young smalmouth bass population, reportedly caused by a bacterial agent which thrives in the warm, oxygen poor water of the river, has done little to ease the anxiety of the river's advocates.

Conclusion

Although a strong data foundation has been compiled as a result of this summer's efforts, additional monitorng is required to present an unbiased picture of the water quality of the Lower West Branch. Seasonal and yearly data comparisons should also be conducted to evaluate the impacts of weather changes and flow rates on the nutrient content of the river. The results of the curent study on sewage treatment plant effluent should be compared with those gathered in 1996 to evaluate the eficiency of the sewage treatment methods curently employed at each location. Follow-up monitorng must be conducted at each of these sites as well.



A Base-line Water Quality Assessment of the Lower West Branch of the Susquehanna River – Summer 2005

Partners:

Lycoming College Clean Water Institute Intern - Laura Lockard

Bucknell University Intern - Dan Hayward

Under the Direction of Dr. Mel Zimmerman and Dr. Matt McTammany

Susquehanna River Heartland Coalition for Environmental Studies

Grant from PA DEP Growing Greener Program

Results

- The following results reflect CWI data only. For complete water quality data and accompanying graphs please log onto http://www.lycoming.edu/biology/cwi/reports.htm

Other activities as CWI interns

Hellbender Hunting with Dr. Petokas

High School Education Events

Stream Restoration Projects

Deer Vegetation Studies

Restoring Riparian Buffer Zones

Acknowledgements:

Dr. Melvin Zimmerman and the rest of the Lycoming Biology Faculty

To all of the professors at Bucknell, Lock Haven, Kings and every other school that has helped put together information regarding the river

And to all the ZB's out there who have at some point run some

of our water chemistry…THANKS!