A School, a Stream and a Teacher's Dream

Testing in Fairfax County Public Schools for Urban Stream Water Quality

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Rotary Club of Tysons Corner
August 17 & 24, 2017

So since some of you asked…

"How an Astronautical Engineer and fighter pilot ended up in rubber boots counting bugs in the bottom of urban creeks in Northern Virginia."

The Winding Route

- **Retired in 2010 from 46 year career in Aerospace Defense (26 years flying Marine jets, 20 years with industry)**

- **Spotted small AAAS Ad in Metro section of WashPost for retired Scientist and Engineers to volunteer to help science teachers in the National Capital Region.**

Next Seven Years in the Schools

Bull Run Elementary , 5 years, 16 teachers!

Grades K-5th, Community and advanced academic levels. A range of science subjects.

Little Run Elementary, 2 years, one teacher.

Engineering lab weekly and development of a program for ***Urban Stream Health testing in Long Branch Creek adjacent to the school property.***

Bull Run E.S. (>850 students)

Little Run E.S. (<400 students)

Part I
Urban Stream Health, the Clean Water Act, and "TMDLs"

Huh! What the heck is a "TMDL?"

What is a “TMDL?”

Clean Waters Act of 1972

Program Overview: 303(d) Listing of Impaired Waters

The term "303(d) list" or “list” is short for a state’s list of impaired and threatened waters (e.g. stream/river segments, lakes). States are required to submit their list for EPA approval every two years. For each water on the list, the state identifies the pollutant causing the impairment, when known. In addition, the state assigns a priority for development of Total Maximum Daily Loads (TMDL) based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors

In general, once a water body has been added to a state’s list of impaired waters it stays there until the state develops a TMDL and EPA approves it. EPA reporting guidance provides a way to keep track of a state’s water bodies, from listing as impaired to meeting water quality standards. This tracking system contains a running account of all of the state’s water bodies and categorizes each based on the attainment status. For example, once a TMDL is developed, a water body is no longer on the 303(d) list, but it is still tracked until the water is fully restored.

Ack! Isn’t there a shorter answer?

TMDL (Short Answer)

Total Maximum Daily Loads, or TMDLs, are pollution "budgets" developed to restore waters that are impaired.

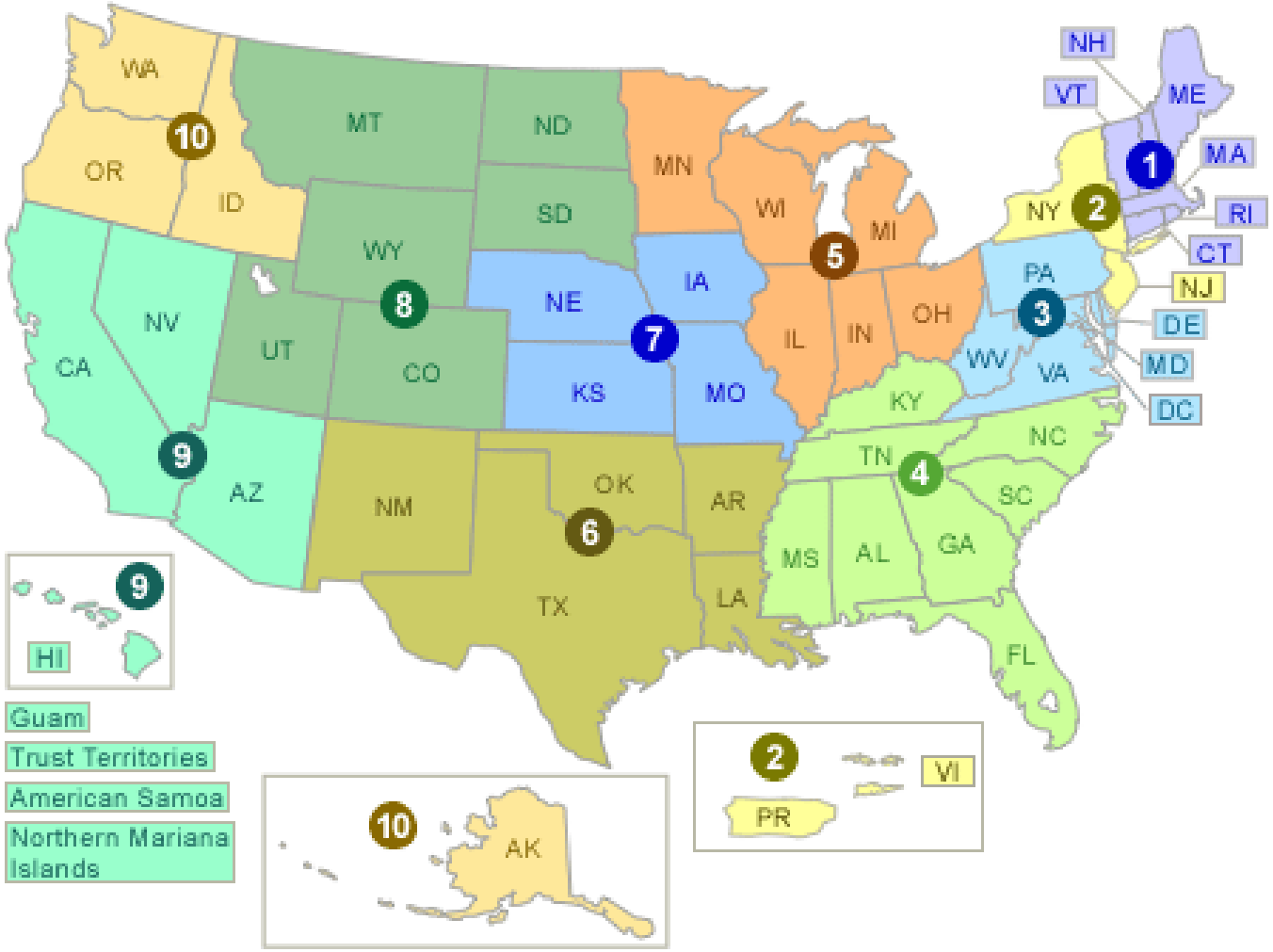
Okay, then what are the probable sources of pollution in assessed streams?

Probable Sources of Impairments in Assessed Rivers and Streams

Description of this table

Probable Source Group	Miles Threatened or Impaired
Agriculture	142,776
Unknown	138,626
Atmospheric Deposition	91,660
Hydromodification	88,565
Habitat Alterations (Not Directly Related To Hydromodification)	64,772
Urban-Related Runoff/Stormwater	60,230
Municipal Discharges/Sewage	58,821
Unspecified Nonpoint Source	57,640
Natural/Wildlife	49,760
Silviculture (Forestry)	40,799
Resource Extraction	33,097
Construction	20,716

Ten TMDL Regions

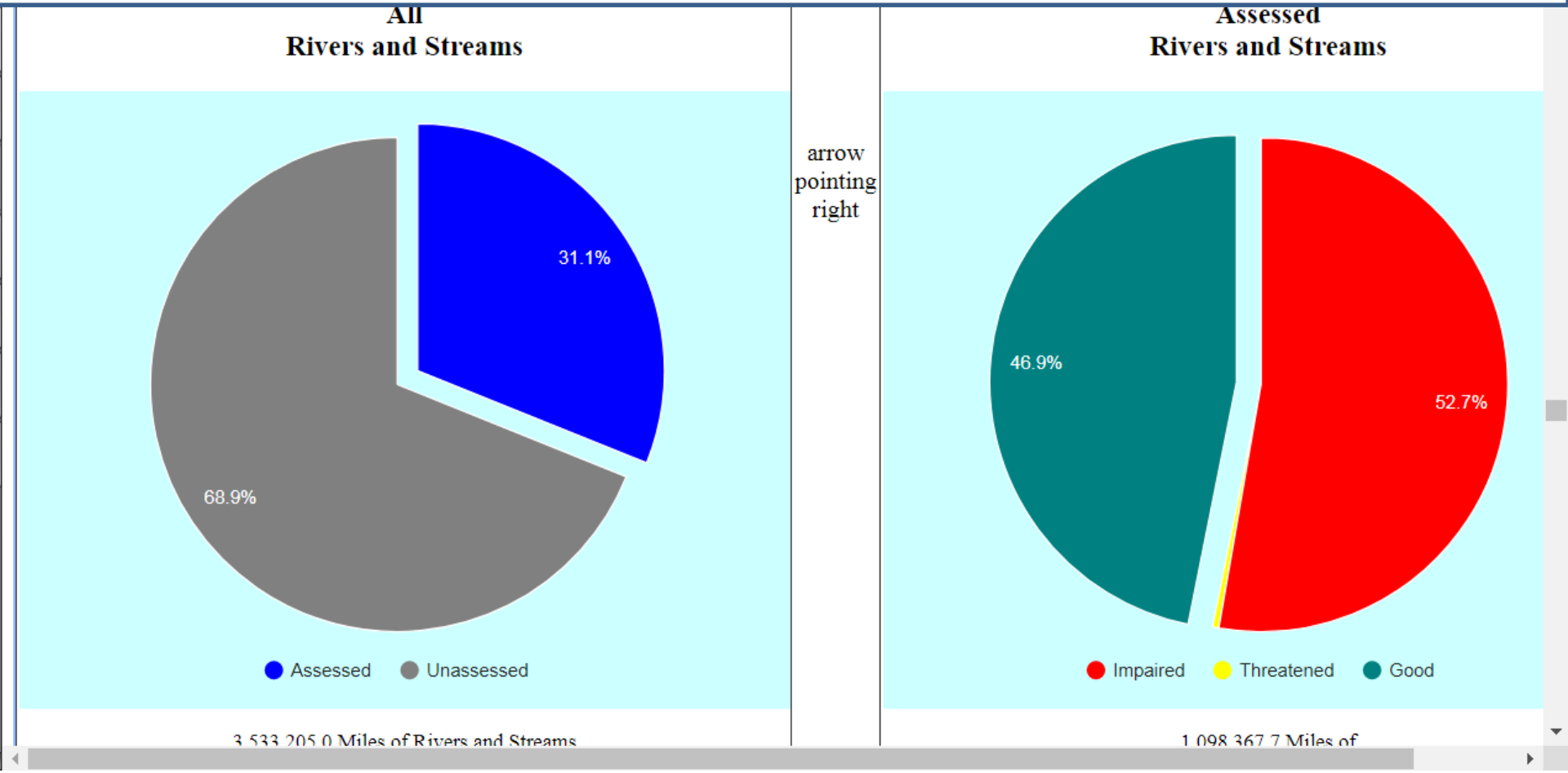


So, how many TMDLs are there nationwide since 1996 anyway?

Over 74,000!

Okay, but how are the ones that apply to streams going?

National Summary of Rivers and Streams



Okay, but to put this in context, what are the other Categories of Assessed Waters besides Rivers and Streams?

Categories of Assessed Waters

Assessed Waters of United States

Incomplete state reported information may lead to discrepancies and/or missing information in these reports.

Description of this table

	Size of Water							
	Rivers and Streams (Miles)	Lakes, Reservoirs, and Ponds (Acres)	Bays and Estuaries (Square Miles)	Coastal Shoreline (Miles)	Ocean and Near Coastal (Square Miles)	Wetlands (Acres)	Great Lakes Shoreline (Miles)	Great Lakes Open Water (Square Miles)
Good Waters	514,632	5,363,451	11,556	1,290	617	569,328	102	
Threatened Waters	4,495	30,309						
Impaired Waters	579,241	12,918,363	44,692	3,325	6,263	665,494	4,354	39,183
Total Assessed Waters	1,098,368	18,312,122	56,247	4,615	6,881	1,234,822	4,457	39,183
Total Waters	3,533,205	41,666,049	87,791	58,618	54,120	107,700,000	5,202	196,343
Percent of Waters Assessed	31.1	43.9	64.1	7.9	12.7	1.1	85.7	20.0

Let's get Local
The Accotink Creek TMDLs

2013 EPA test case: Using stormwater runoff as a surrogate for sediment, a stream pollutant under the CWA.

- *Contested by Commonwealth of Virginia and Fairfax County. Challenged science, economics, and legality.*
- *Shot down in Alexandria Federal District Court as illegal! Science and economics not considered.*

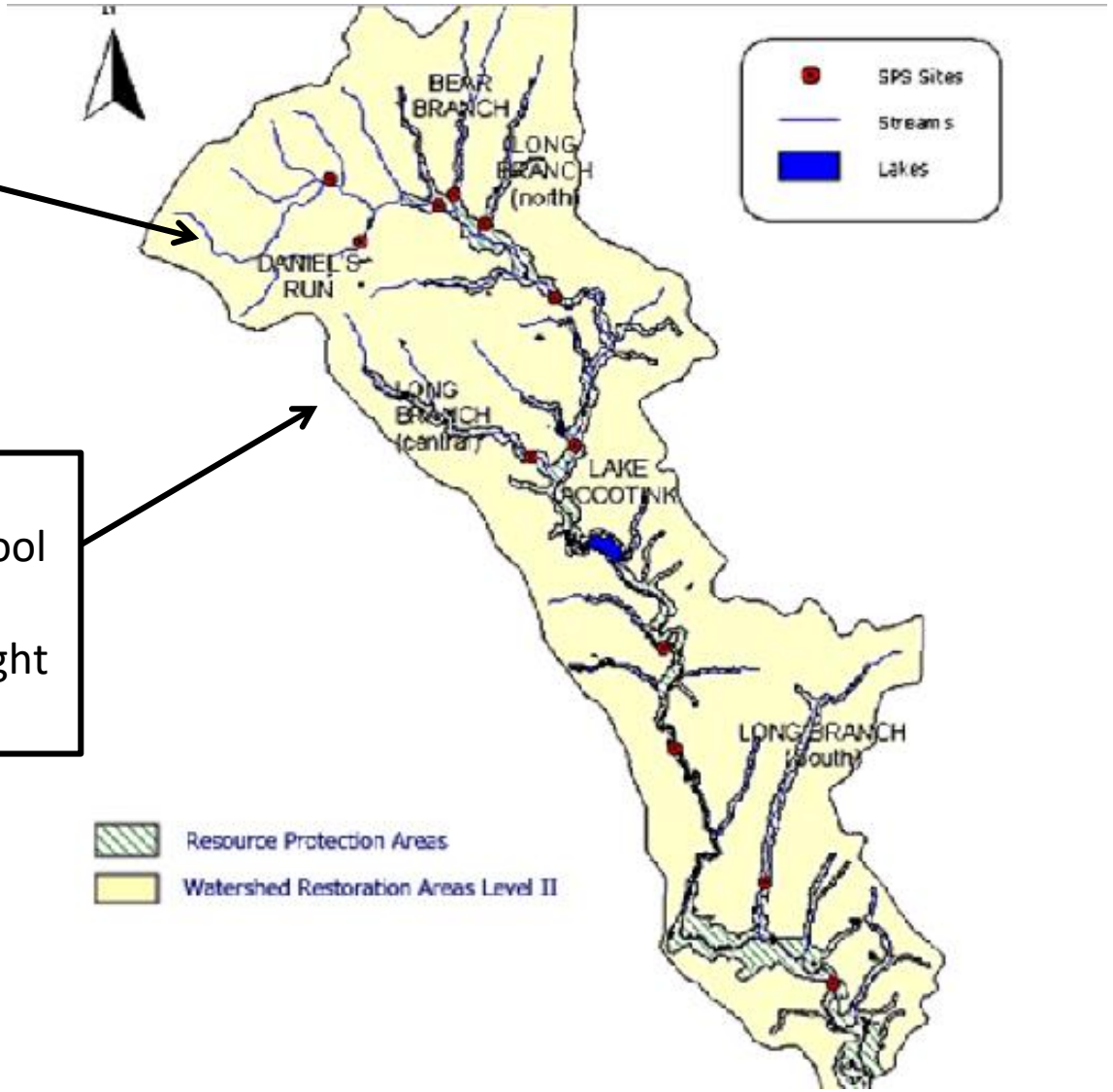
Current EPA TMDL: Testing for two pollutants

- *Sediment*
- *Chlorides*

The Accotink Creek Watershead

Daniels Run ES
(Trained here)

Little Run Elementary School and adjacent testing site is right about **here**



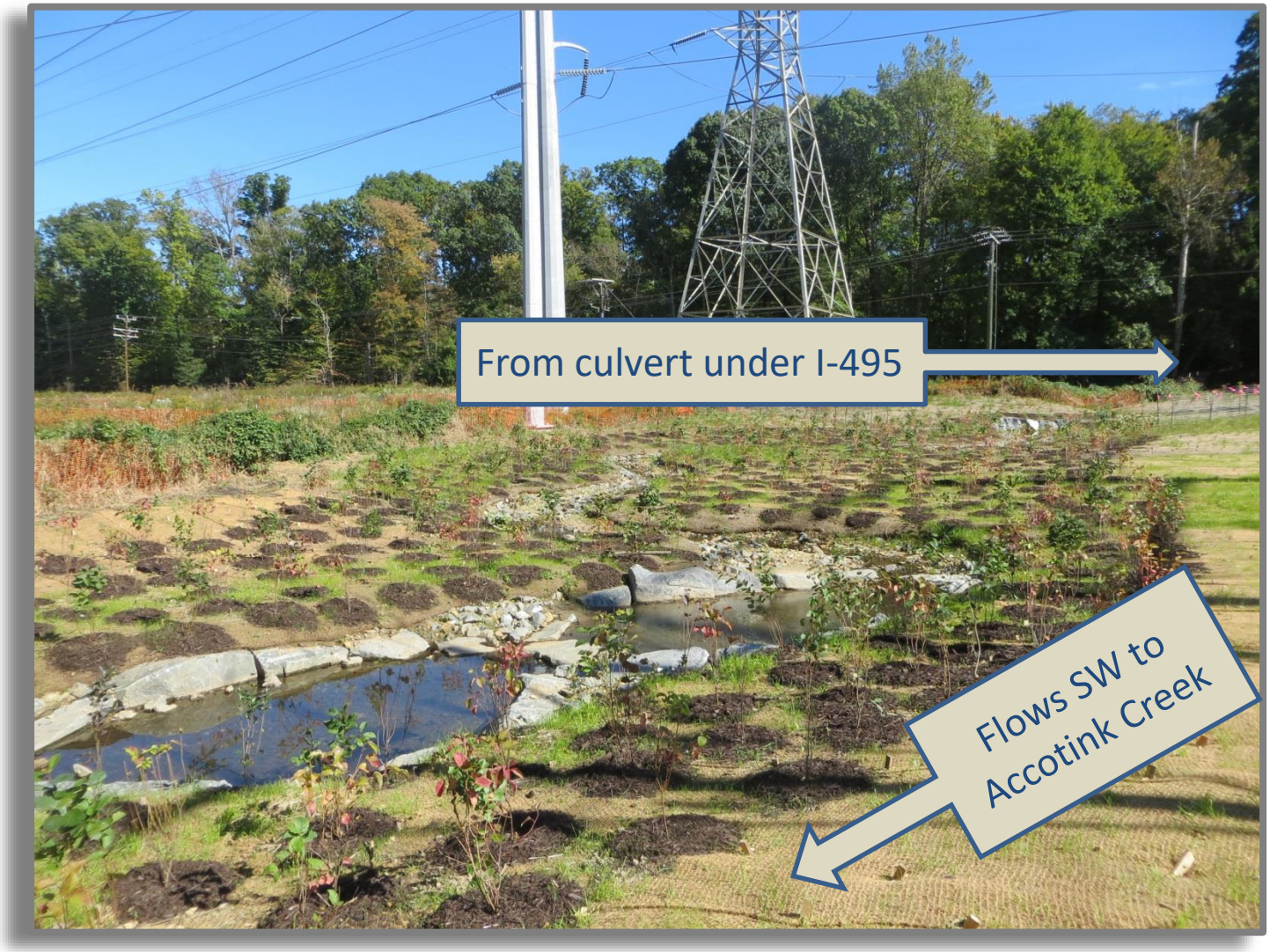
An Unhealthy Stream

Unhealthy Stream

A Healthy Stream

So, can you make an unhealthy stream healthy?

Let's Look at a Newly Restored Section of a Local Stream Tributary of Accotink Creek crossing the Gerry Connolly Trail North of Audrey Meadows Rec Center



Part II
The School Testing Program

The School Testing Program
-- Six lab classes –
-- Two types of tests --

- Classroom Lecture on Watersheads and Urban Streams
- Streamside **Macroinvertibrate** Data Collection
- Classroom **Macroinvertibrate** Analysis and Scoring
- Streamside **Chemical** analysis
- Classroom **Chemical** Analysis and Scoring
- Classroom Review

Macroinvertibrate Testing

OK, what the heck is a macroinvertibrate?

Three Levels of Benthic Pollution Tolerance

Macroinvertebrate Identification Key

GROUP 1 **DO NOT TOLERATE POLLUTION**

Stonefly nymph  5-35mm	Caddisfly larva  2-40mm	Mayfly nymph  3-10mm	Alderfly nymph  10-25mm	Fishfly larva  5-16mm
Stonefly adult  10-40mm	Caddisfly adult  14-25mm	Mayfly adult  5-25mm	Alderfly adult  24-50mm	Water penny  4-6mm
Hellgrammite (dobsonfly larva)  25-90mm	Freshwater mussel  2-250mm	Pouch snail  2-70mm	Ramshorn snail  2-70mm	Snipe fly larva  12-18mm

Macroinvertebrate Identification Key

GROUP 2 **TOLERATE SOME POLLUTION**

Dragonfly larva  15-50mm	Damselfly larva  10-50mm	Water beetle larva  2-6mm	Whirligig beetle  3-15mm	Riffle beetle adult  2-4mm
Dragonfly nymph  30-50mm	Damselfly nymph  10-50mm	Water beetle  3-40mm	Whirligig beetle larva  3-12mm	Water strider  10-25mm
Dragonfly adult  17-200mm	Damselfly adult  25-55mm	Backswimmer  5-16mm	Waterboatman  5-16mm	Cranefly larva  10-25mm
Scud (amphipod)  5-21mm	Crayfish  10-150mm	Water scorpion  20-43mm	Sowbug  5-22mm	Freshwater clam  30-270mm

Macroinvertebrate Identification Key

GROUP 3 **TOLERATE POLLUTION**

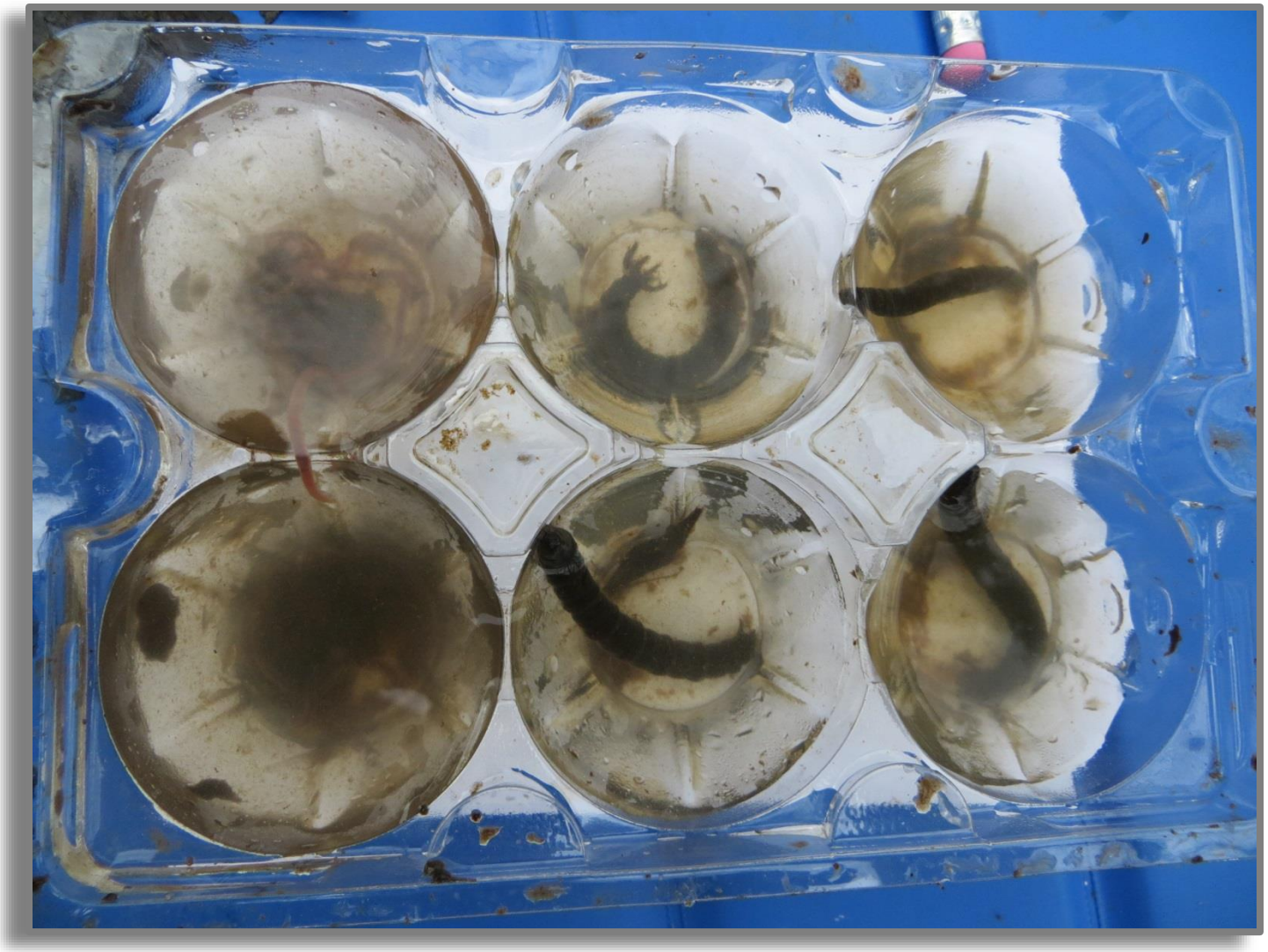
Blackfly larvae  3-12mm	Midge larva  2-15mm	Mosquito larva  1-6mm	Flatworm (planaria)  1-6mm	Freshwater worm  1-30mm
Blackfly adult  2-5mm	Midge adult  3-4mm	Mosquito adult  6-13mm	Leech  5-40mm	Water snail  2-70mm

Collecting

Finding, Sorting, Identifying, Recording

Finding, Sorting, Identifying, Recording

Finding, Sorting, Identifying, Recording



Finding, Sorting, Identifying, Recording

Finding, Sorting, Identifying, Recording

Recording, Computing, and Analyzing

Students Record

- Number of each type of macro
- Total found – all types
- Number of different types

Students Compute

- use multi-stage scoring matrix to compute Stream Pollution Index (SPI)

Students Analyze

- Compare to regional and national averages

Chemical Testing

Normally done a week or two after macro testing and classroom analysis

Requires purchase of standard testing kits

- pH
- Oxygen
- Temperature
- Nitrogen
- Phosphorous
- Turbidity

Little Run E.S. Stream Test
"First Ever"

6th grade class

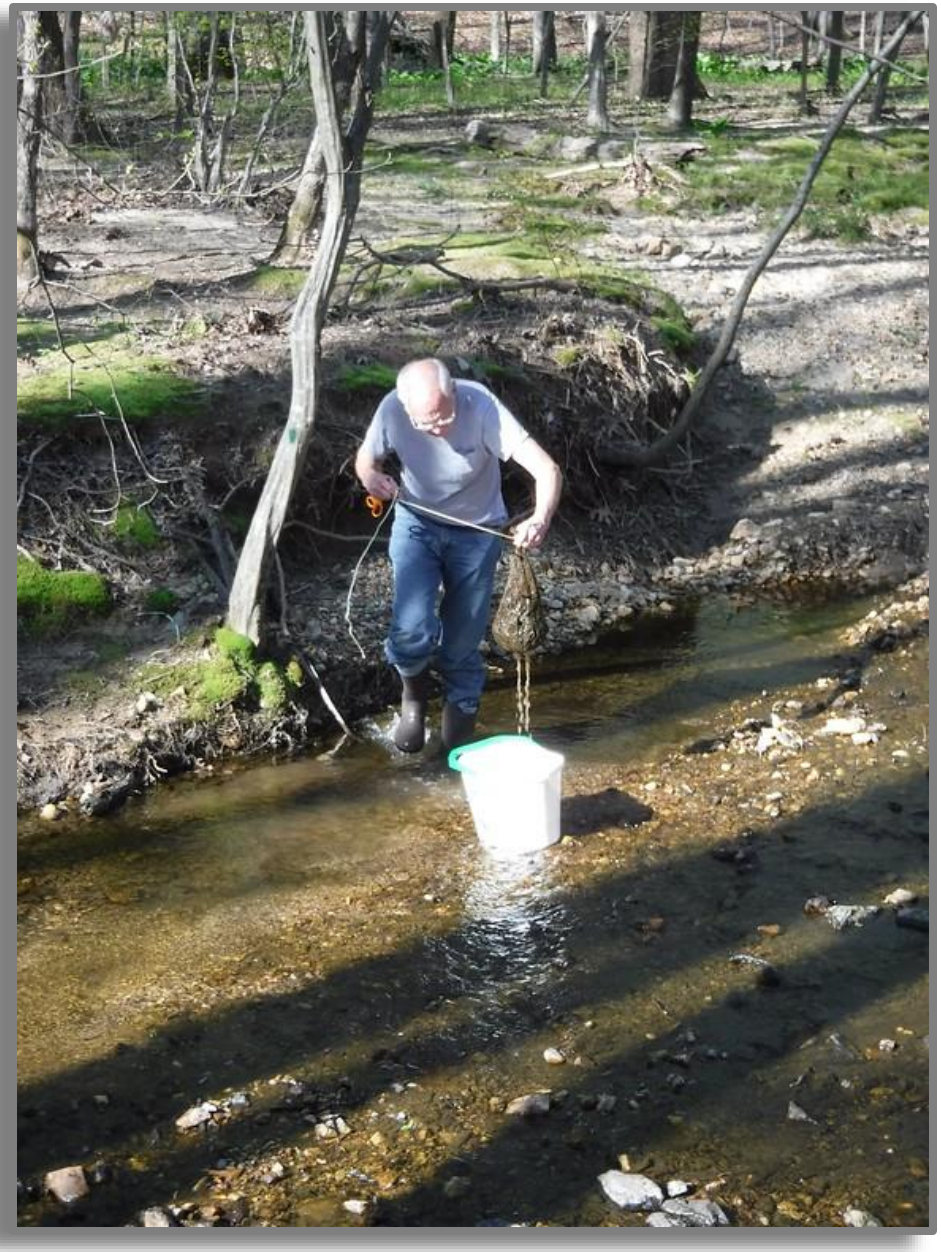
April 18, 2016

Volunteers

AAAS: George Kralovec, Sally Berman
FACC: Kris Unger, Philip Latasa
Lands and Waters: Jeanette Stewart

Teacher:

Misty Clatterbuck
Gifted Education Teacher
Little Run Elementary School




JONES
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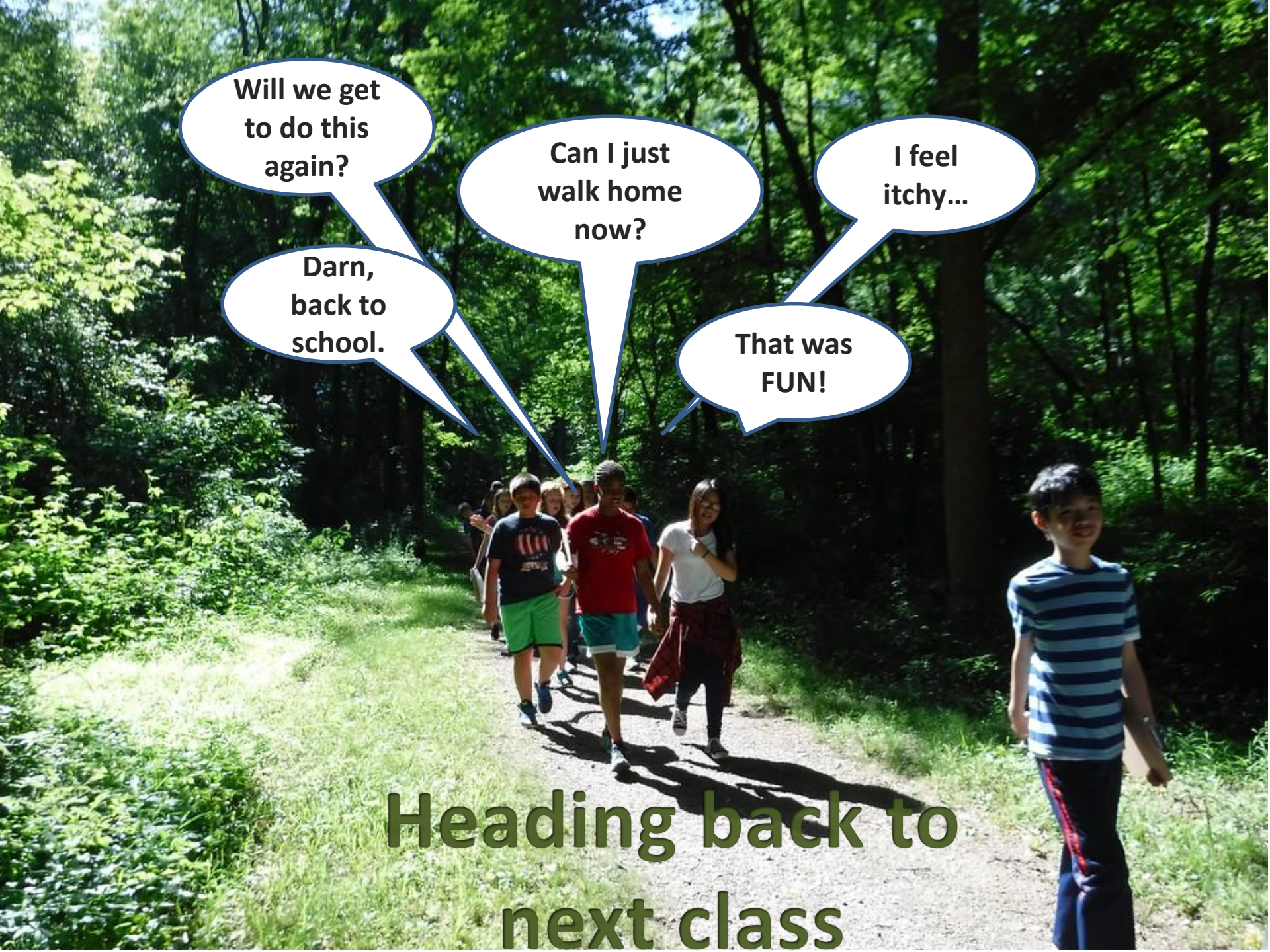
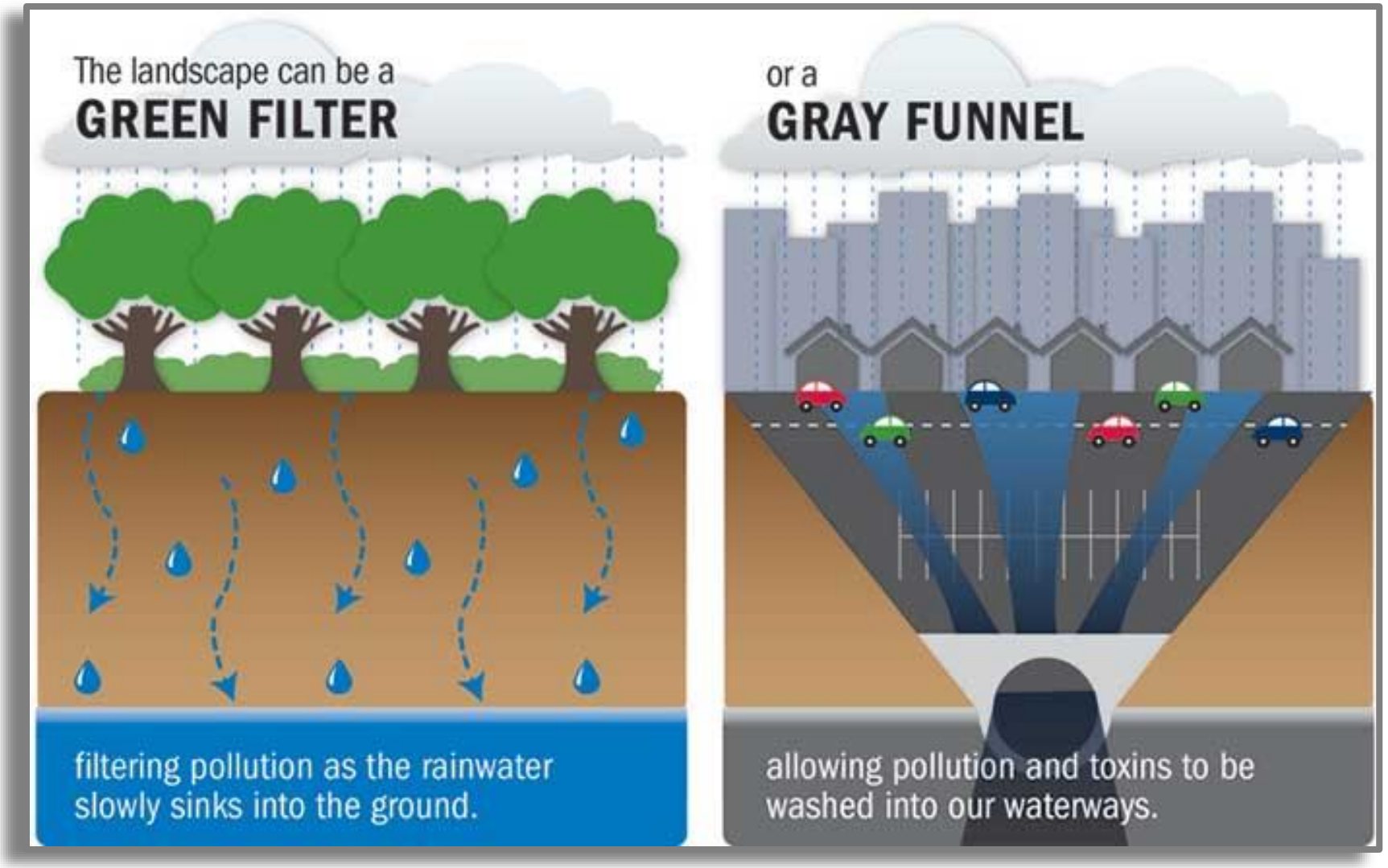
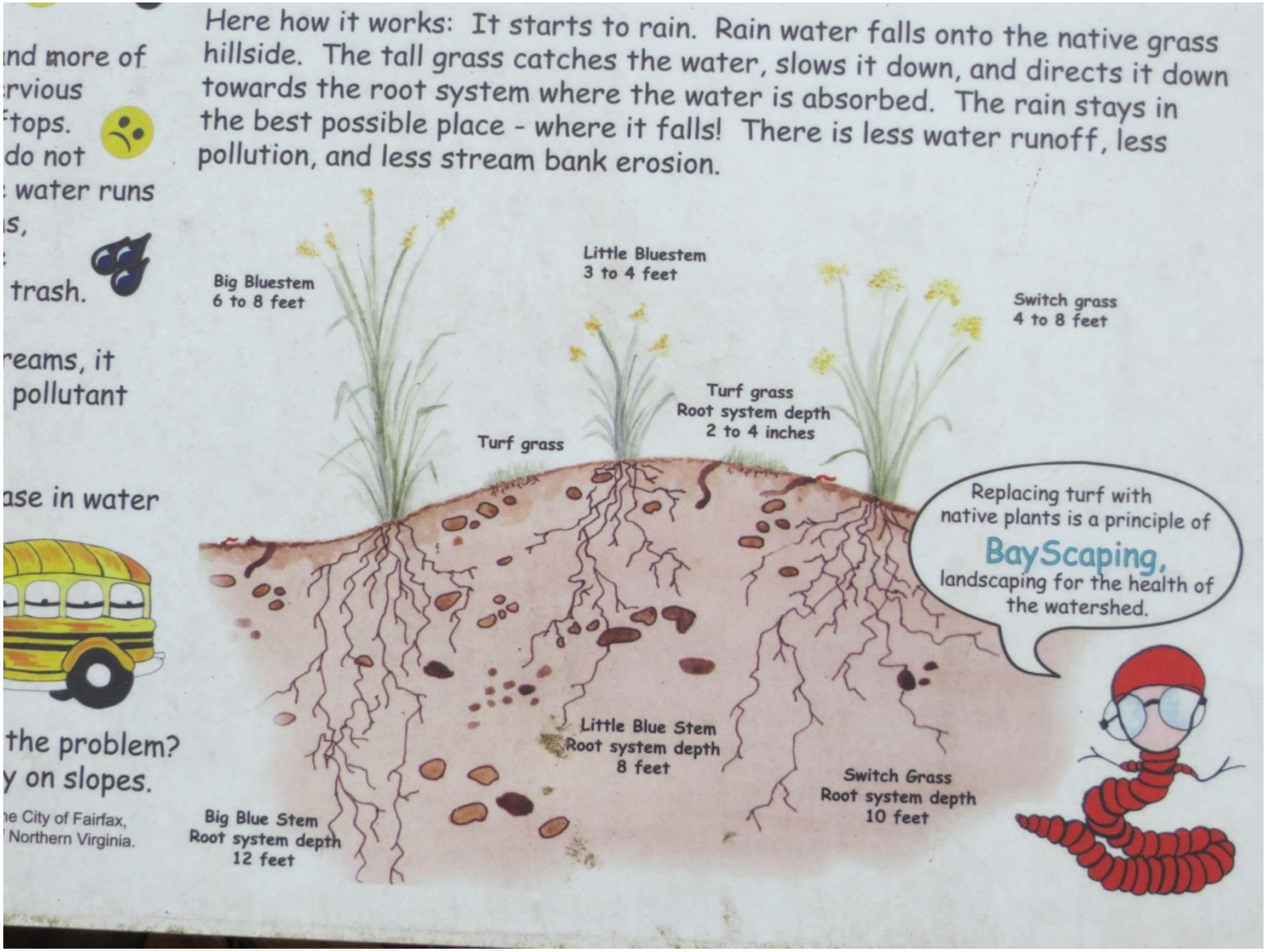

Will we get to do this again?
Can I just walk home now?
I feel itchy…
Darn, back to school.
That was FUN!
Heading back to next class

Improving Urban Stream Health

The Urban Situation -- In a Nutshell



One of Many Actions to Help



The Water Cycle


On Path to Canterbury Woods E.S.

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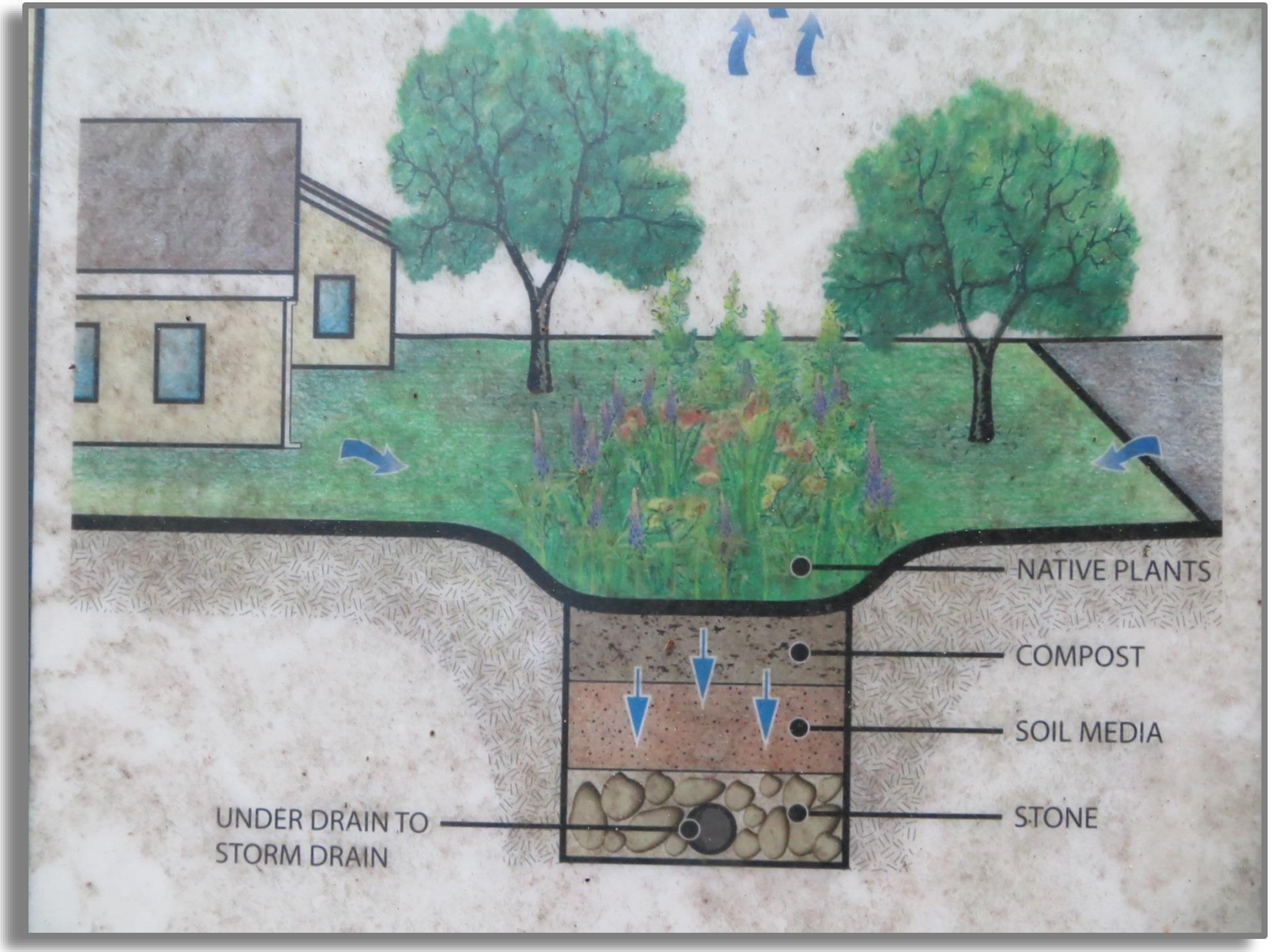
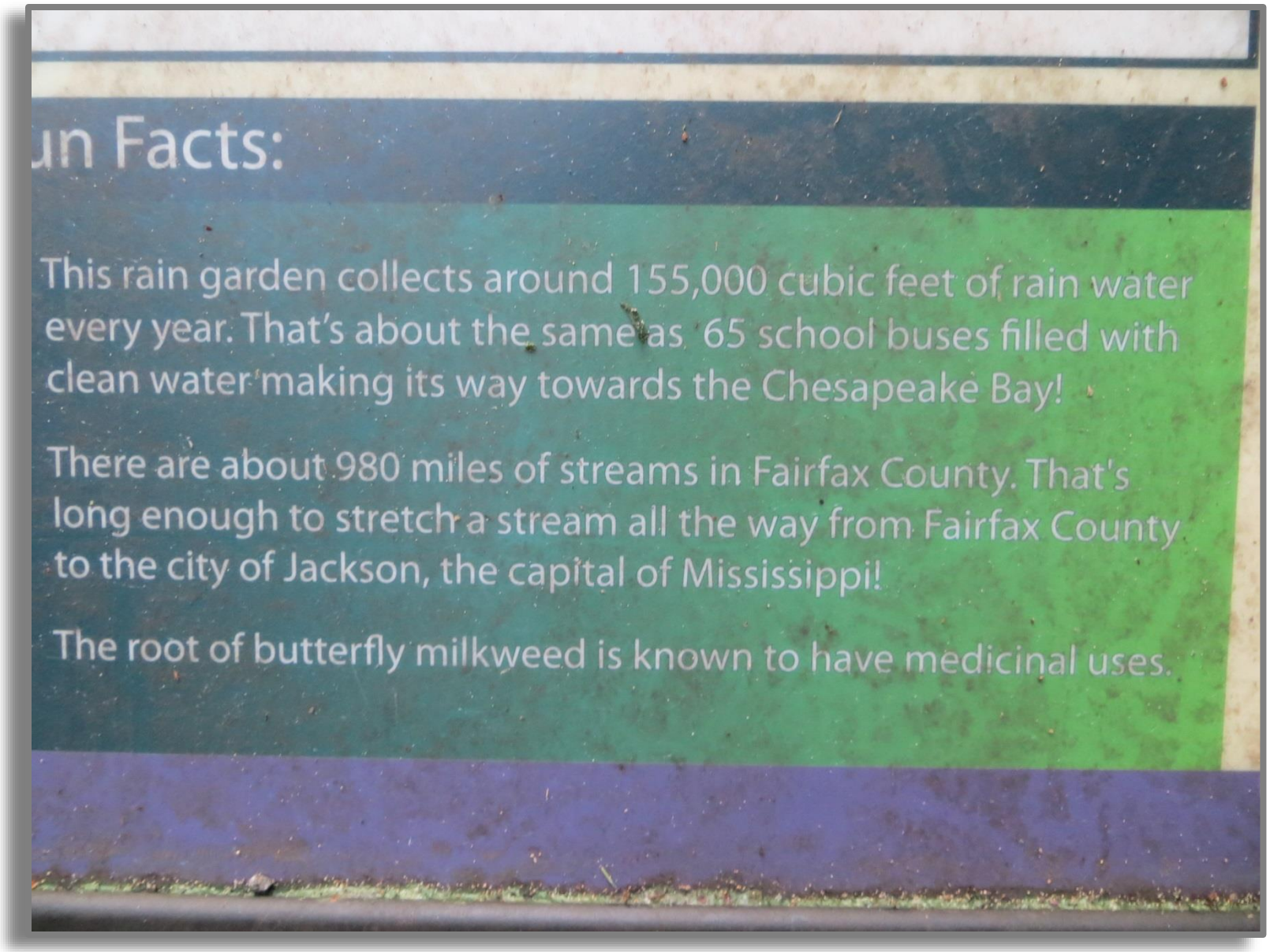
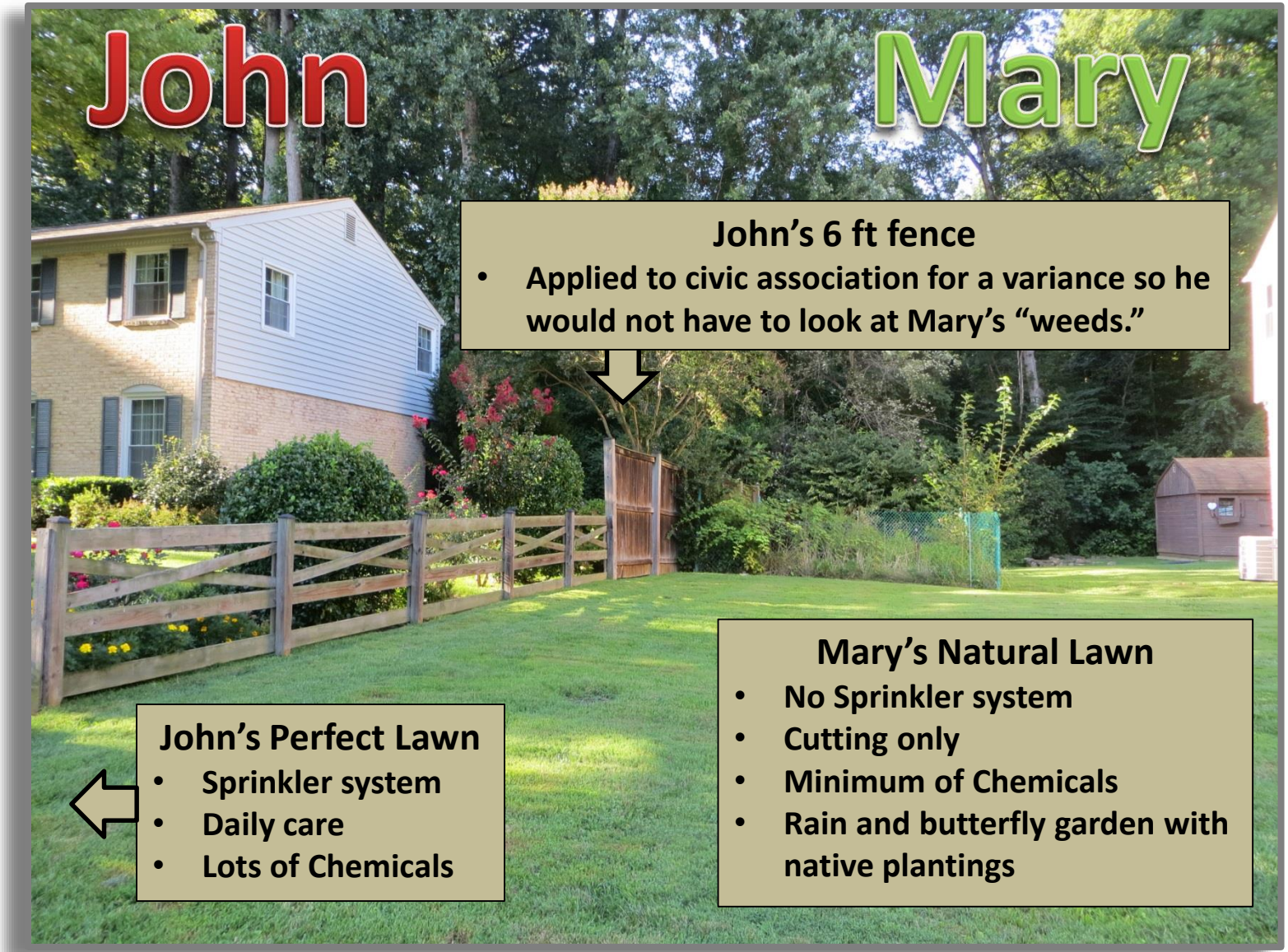


On Path to Canterbury Woods E.S.



Neighborhood Values Sometimes Clash
-- The Saga of John and Mary --



Fairfax Water Competitive Grant Award

First Project-

The “Little Watershed” at
Little Run Elementary School

Rain Garden planted by two 1st grade and two 6th grade classes

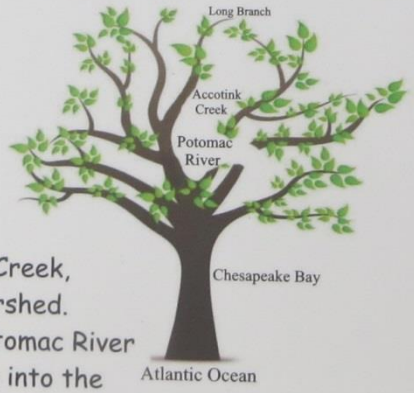
May 30th, 2017

Welcome to the Little Watershed!

What is a watershed? A watershed is an area of land where all the rain that falls flows to one point. The area in front of you is a little watershed. The rain that flows over the land drains to one point, the storm drain.

The storm drain connects to a pipe that carries the water to Long Branch Stream. This Little Watershed is in the Long Branch watershed. All the rain that falls on your school campus flows into Long Branch. So your school is in the Long Branch Watershed.

Like branches on a tree, small streams in small watersheds join streams from other small watersheds to form larger streams and watersheds.



Long Branch flows into Accotink Creek, joining the Accotink Creek Watershed. Accotink Creek flows into the Potomac River (Potomac River Watershed), then into the Chesapeake Bay (Chesapeake Bay Watershed), and finally into the Atlantic Ocean.

What happens here affects everything downstream. Clean water from Long Branch would improve the water in the Accotink, Potomac, Chesapeake Bay, and Atlantic Ocean. But polluted water from Long Branch would degrade the water all the way to the Atlantic Ocean.

Funding by Fairfax County Public School Schoolyard Stewardship Mini Grant

What causes watersheds and streams to become unhealthy? Rain flowing off our lawns and impervious surfaces, such as driveways and rooftops, become polluted by eroded soil (sediment), motor oil, trash, pesticides, and fertilizers.

This unhealthy stormwater runoff travels over surfaces in our communities then into the storm drains and streams. This polluted water harms plants, animals, and degrades water quality.

When we develop land, we cover surfaces like forest and meadows that absorb and clean stormwater run-off. We replace these with impervious surfaces that do not absorb water. This increases stormwater runoff. Water enters the stream at a faster rate eroding and damaging our streams even more.

The best place for a raindrop is where it falls!

What can we do to help our watershed become healthier?

- Replace impervious with pervious surfaces whenever possible
- Replace lawn areas with native plant gardens to increase wildlife habitat
- Plant different kinds of native plants to increase biodiversity
- Get to know, love, and care for your watershed

Why did we plant Native Plants here?

- Support wildlife by providing food and shelter
- Reduce the need for water, fertilizers, and pesticides
- Attract pollinators and beneficial insects
- Well-adapted to local soils and climate

Partners: FRIENDS of ACCOTINK CREEK; FRIENDS of LONG BRANCH STREAM VALLEY

Rewards of Volunteering

- The Kids are Great
- The Teachers are Awesome
- The Parent and Community Volunteers
- The Supporting Organizations (Lands and Waters, Friends of Accotink Creek, Friends of Long Branch Stream Valley Park, Fairfax Water)
- Recognition is always appreciated too

American Association for the Advancement of Science Award for Best Teacher-Volunteer Partnership of the 2016-2017 School Year –

Misty Clatterbuck, George Kralovec

Could This School Be Next to Test?

Questions?
Suggestions?