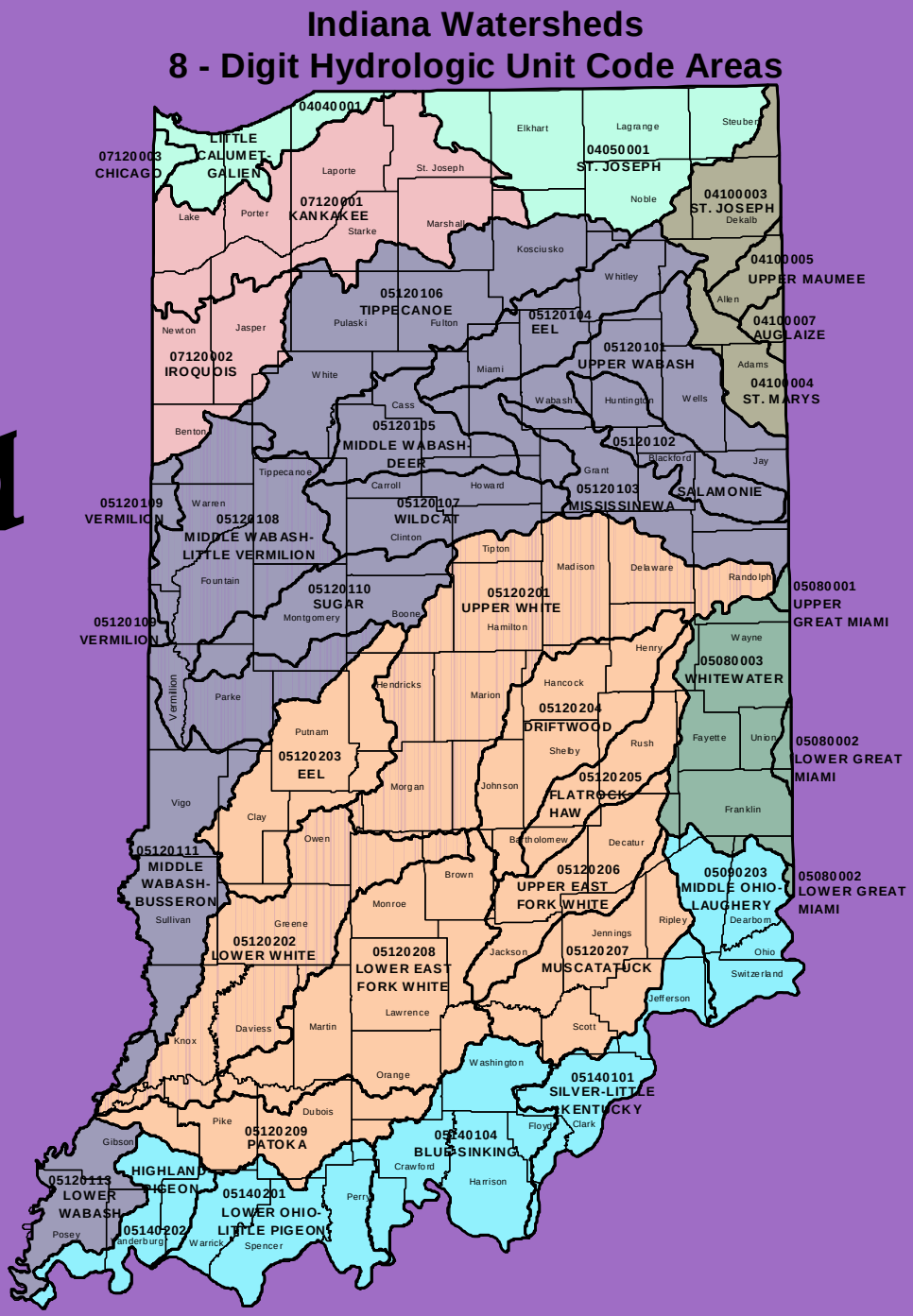
Local Water Quality and the Watershed Concept

Kelly Dungan

Wayne County Watershed Project Coordinator



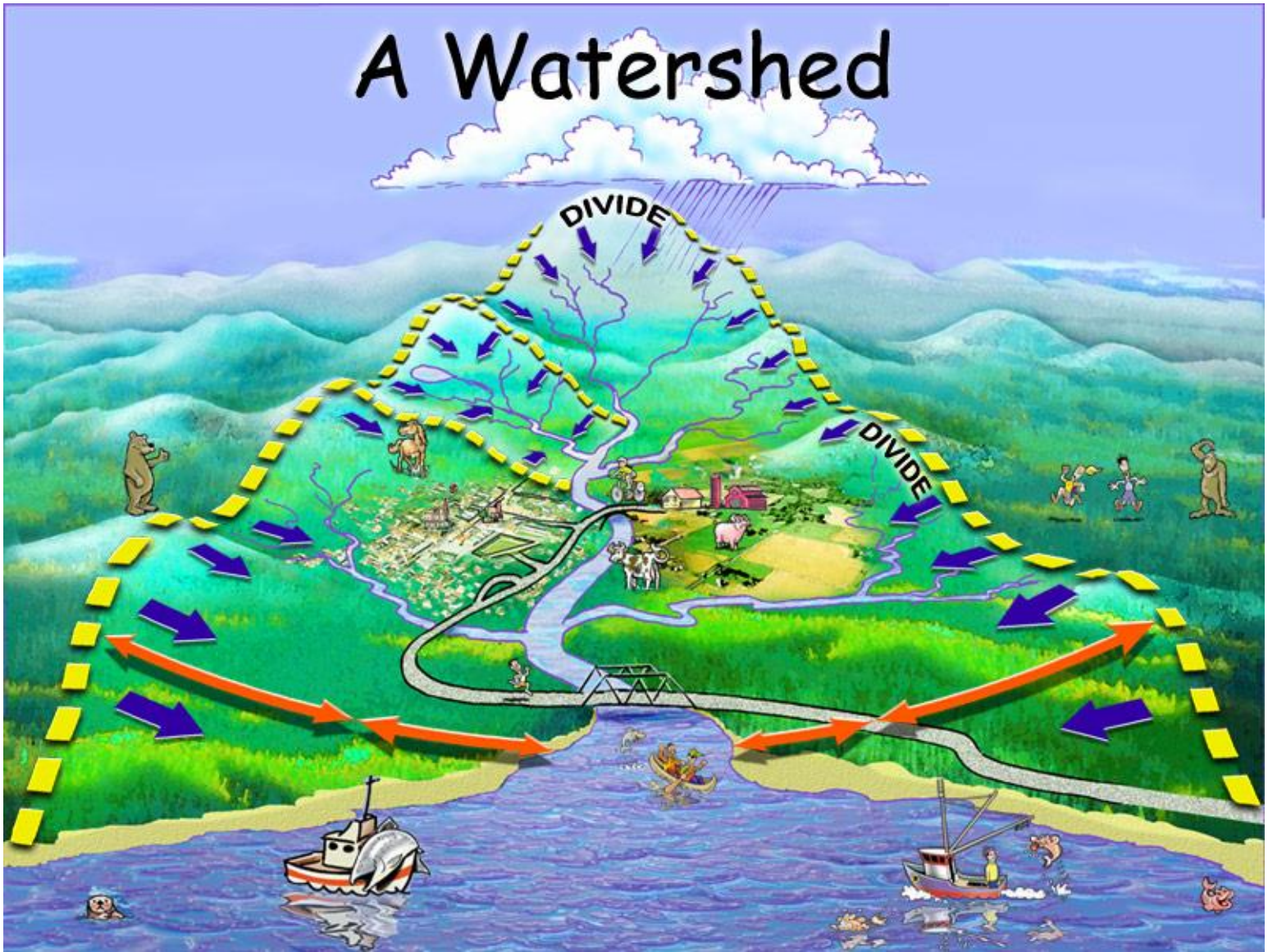
1. Is water *really* a renewable resource?

Yes, but it's limited!!

2. Water as a Resource

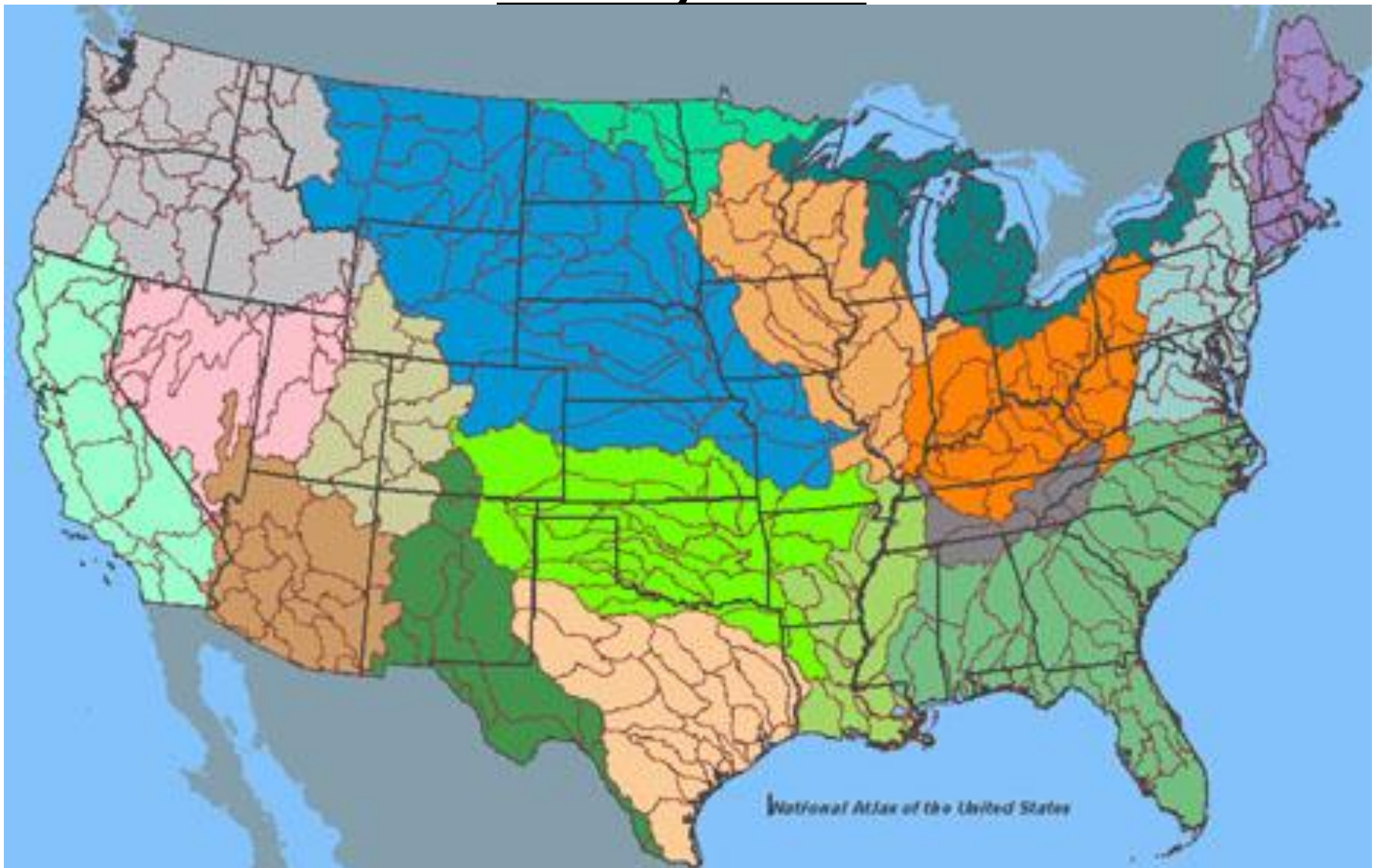
3. What is a watershed?

<u>All the land that drains into a body of water!</u>

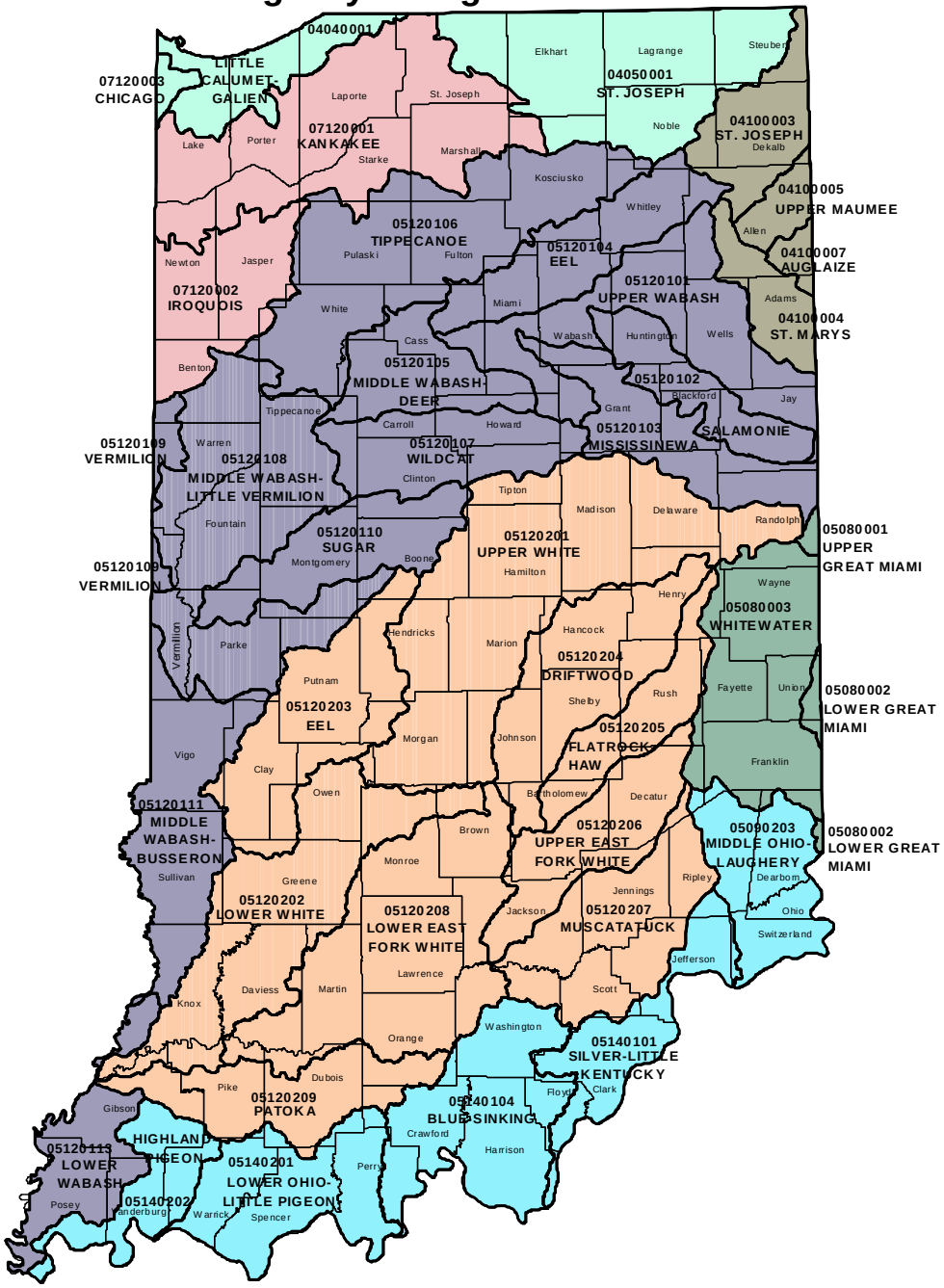


4. Who lives in a watershed?

Everyone!

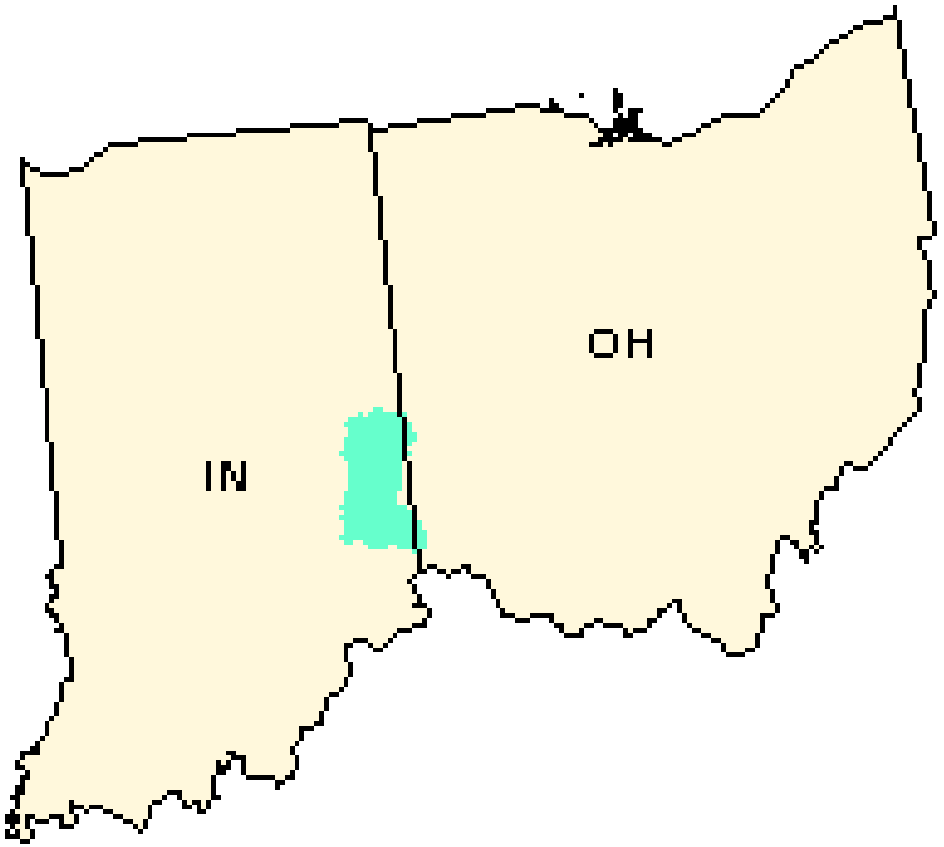


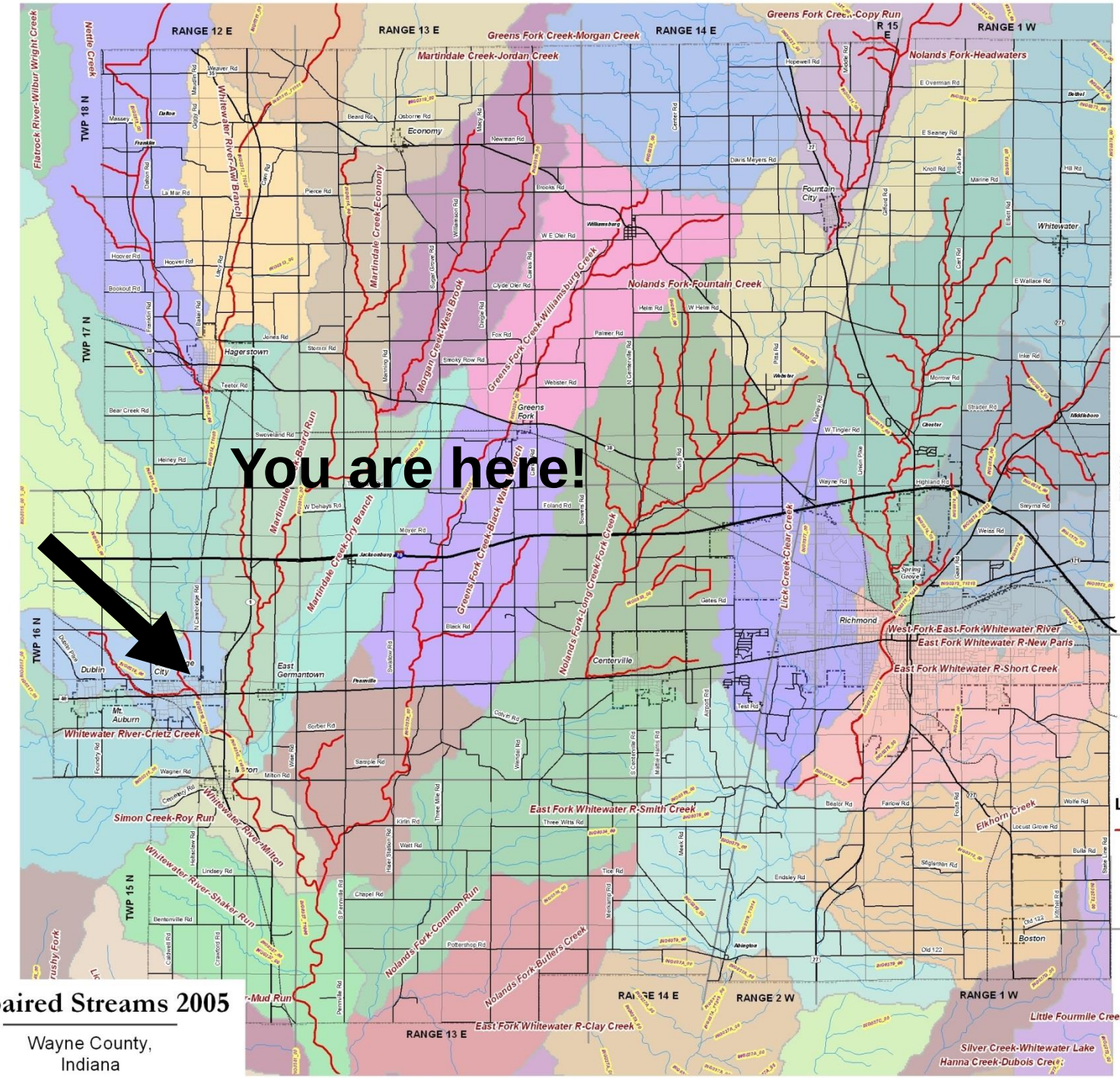
Indiana Watersheds
8 - Digit Hydrologic Unit Code Areas



5. What watershed do we live in?

The Whitewater Watershed





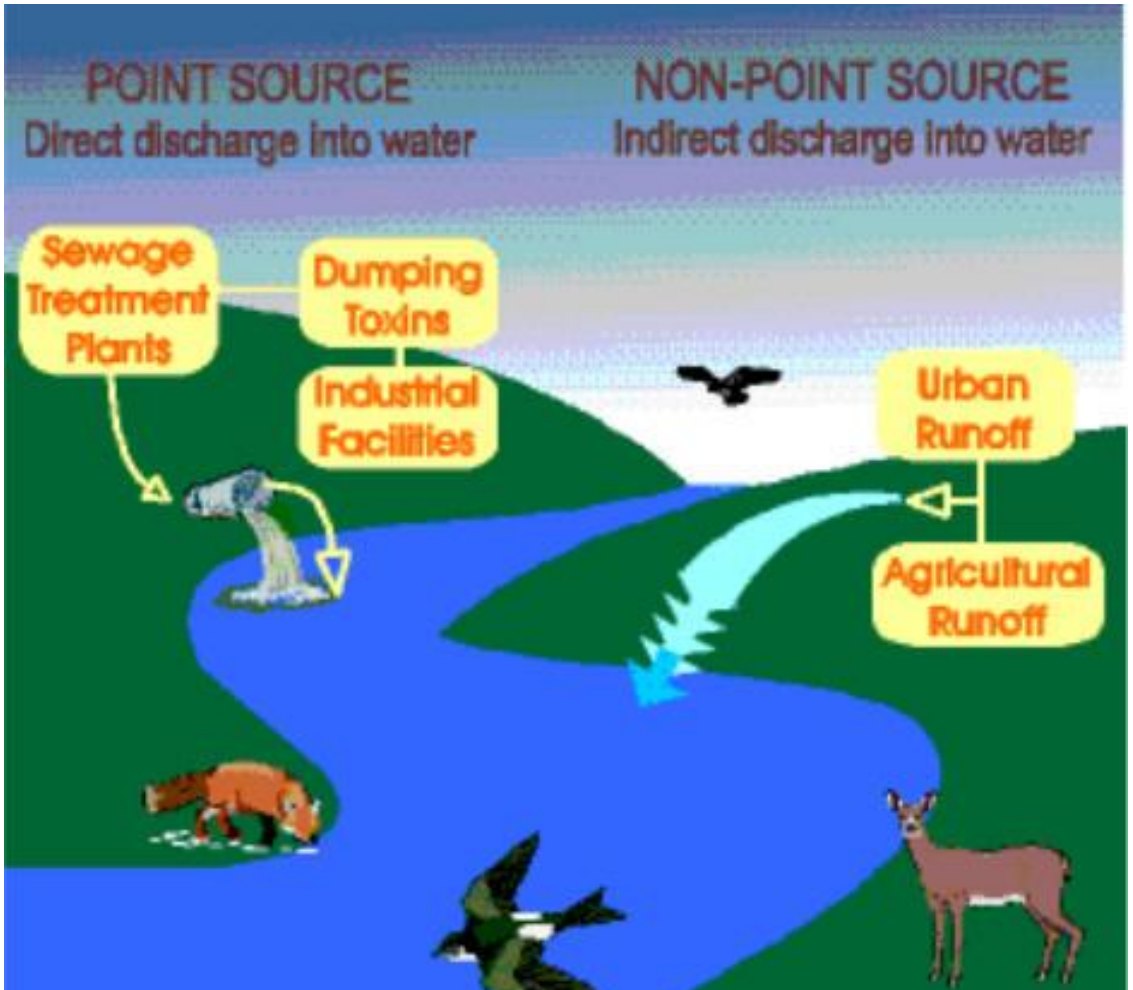
Impaired Streams 2005

Wayne County,
Indiana

6. How do watersheds get polluted?

Many sources,

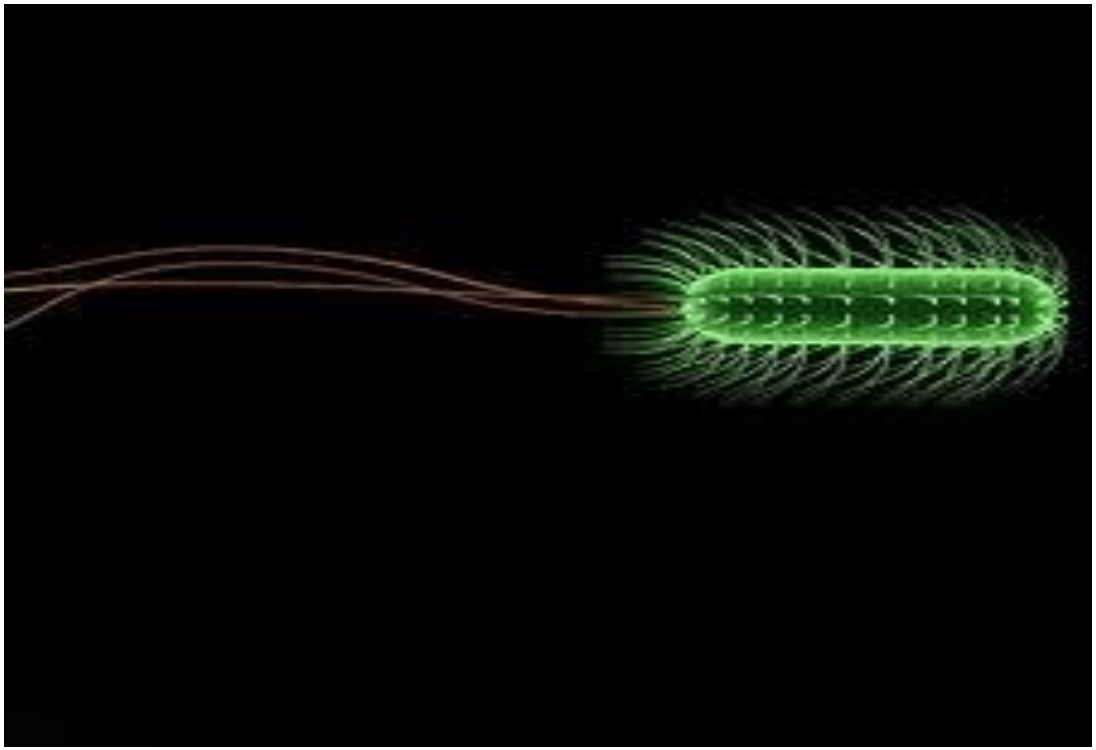
including natural and human causes!

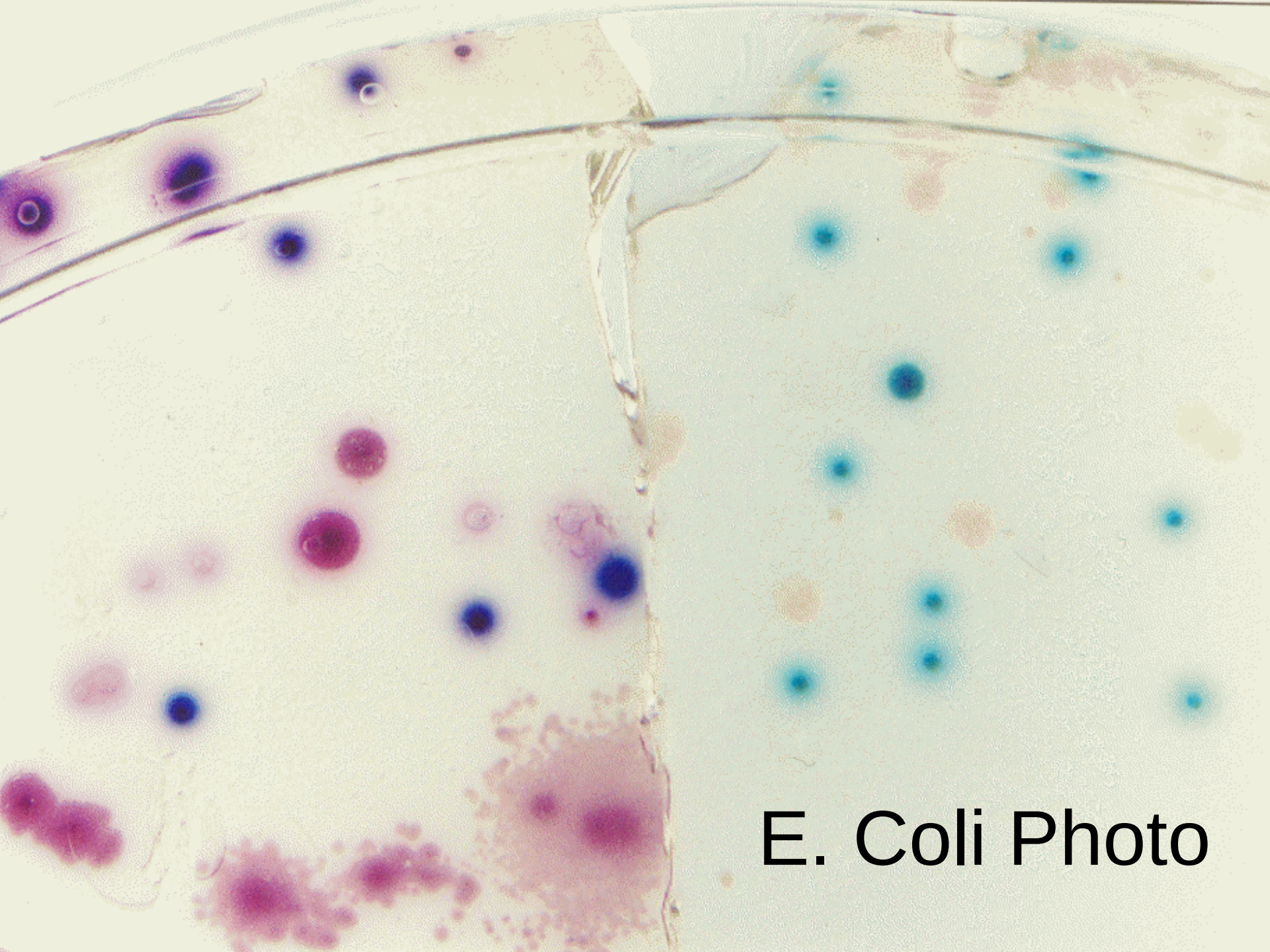


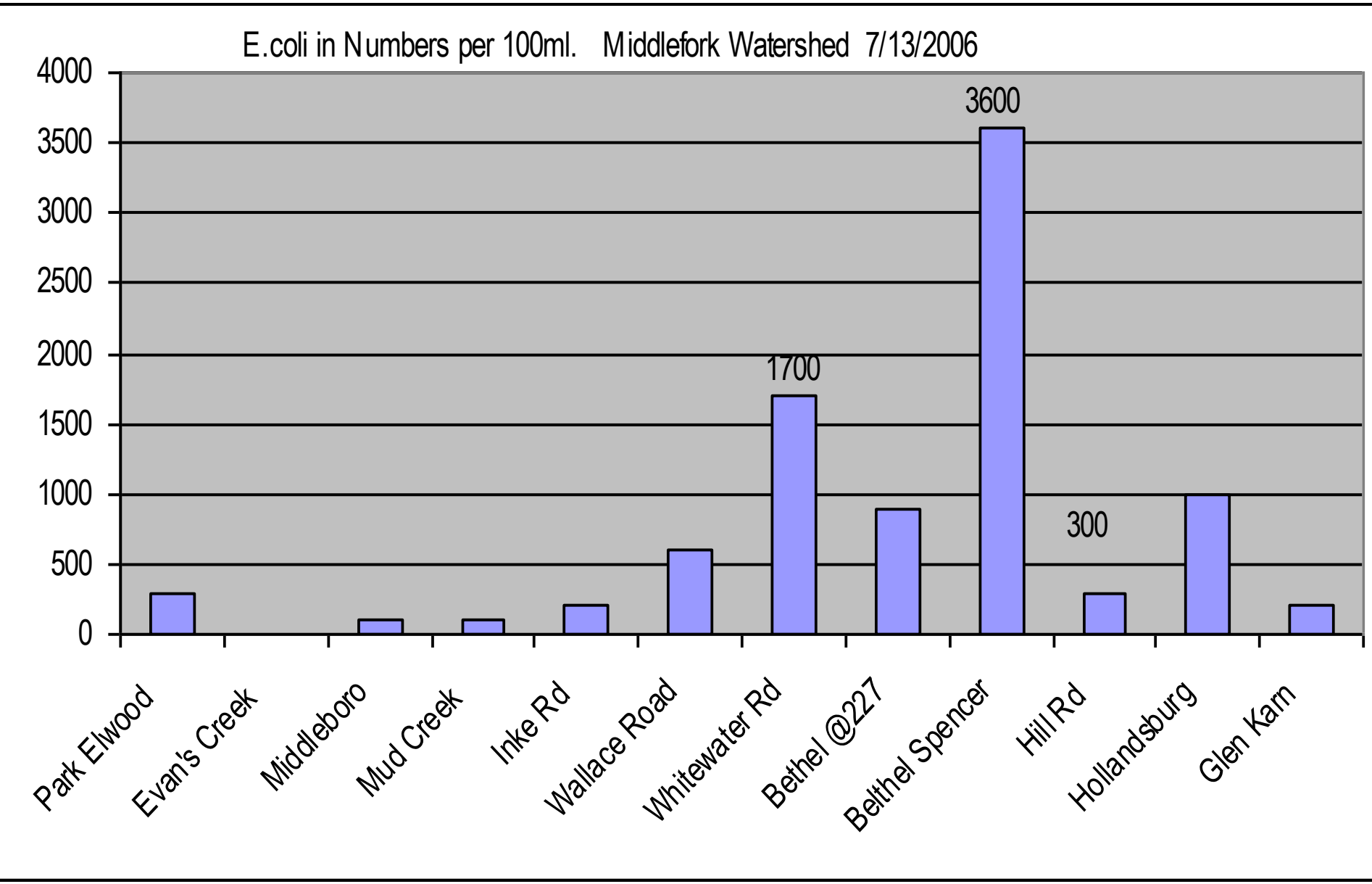

The Middle Fork Reservoir

7. What is one of the biggest problems within our watershed?

E. Coli bacteria, which comes from human or animal waste!!

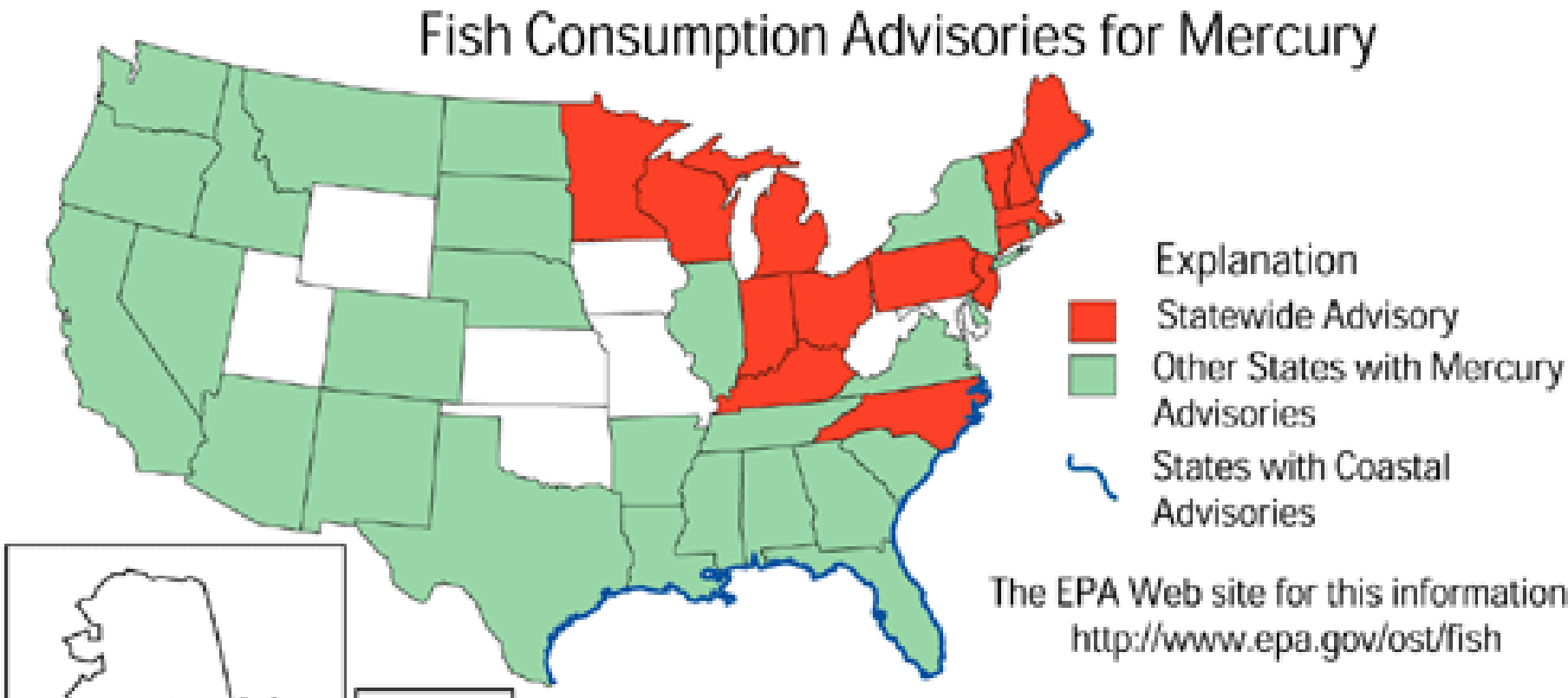



E. Coli Photo


E.coli in Numbers per 100ml. Middlefork Watershed 7/13/2006
4000
3500
3000
2500
2000
1500
1000
500
0
3600
1700
300
Park Elwood
Evan's Creek
Middleboro
Mud Creek
Inke Rd
Wallace Road
Whitewater Rd
Bethel @227
Belthel Spencer
Hill Rd
Hollandsburg
Glen Karn

8. Why are some fish not safe to eat in large amount in our watershed?

<u>They can contain mercury, which at high levels is toxic to humans!</u>



Fish Consumption Advisory

GREAT MIAMI	508000301 0010	WAYNE CO	ING0311_T1001	Whitewater River, WF	FCA for MERCURY
GREAT MIAMI	508000301 0020	WAYNE CO	ING0312_T1002	Whitewater River, West Fork	FCA for MERCURY
GREAT MIAMI	508000302 0070	WAYNE CO	ING0327_T1006	WHITEWATER RIVER - West Fork	FCA for MERCURY
GREAT MIAMI	050800030 70040	WAYNE CO	ING03P1012_00	MIDDLE FORK RESERVOIR	FCA for MERCURY

Water Monitoring and Data Collection

Water Monitoring

9. Common Water Tests

Dissolved Oxygen, pH, nitrates, phosphates, and turbidity

After the Q-values have been determined and recorded in the second column, multiply the Q-value for each test by the Weighting Factor and record the value in the final Calculation column.

Test Results			Q-Value		Weighting Factor		Calculation
	7.5	mg/L					
Dissolved Oxygen	85	% saturation	92	X	.18	=	16.56
E. coli	200	colonies/100ml	37	X	.17	=	6.29
pH	8.0	units	82	X	.12	=	9.84
B.O.D. 5	2.0	mg/L	80	X	.12	=	9.6
H_2O Temp Change	0.67	change in°C	90	X	.11	=	9.9
Total Phosphate	0.06	mg/L	98	X	.11	=	10.78
Nitrate (NO_3)	10.0	mg/L	51	X	.10	=	5.1
Turbidity	28	NTU's	53	X	.09	=	4.77

Once the calculations are completed for each parameter, you can then sum the Weighting Factor column and the Calculation column. Divide the total of the *Calculation* column by the total of the *Weighting Factor* column to obtain the Water Quality Index (WQI).

TOTALS 1.0 72.84

Excellent	90 - 100%	Bad	25 - 50%
Good	70 - 90%	Very Bad	0 - 25%
Medium	50 - 70%		

WATER QUALITY INDEX RATING: Good!

Water Quality Index 5/17 and 5/18 2006

DO,E.coli,pH BOD,Temp
PO4 NO3, Turbidity

Excellent-90-100 Good 70-89 Medium 50-69 Bad 25-49 Very Bad 0-24

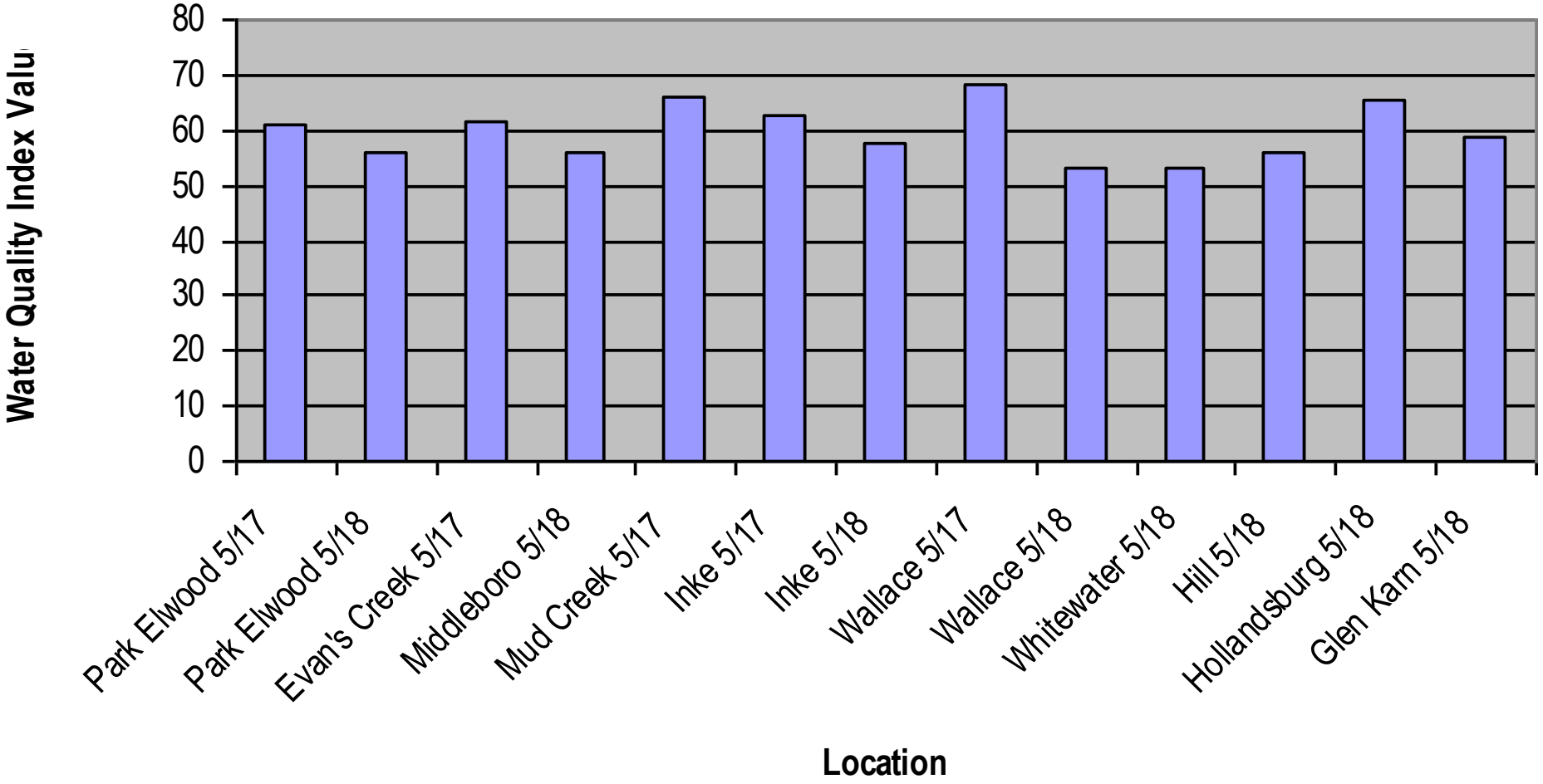
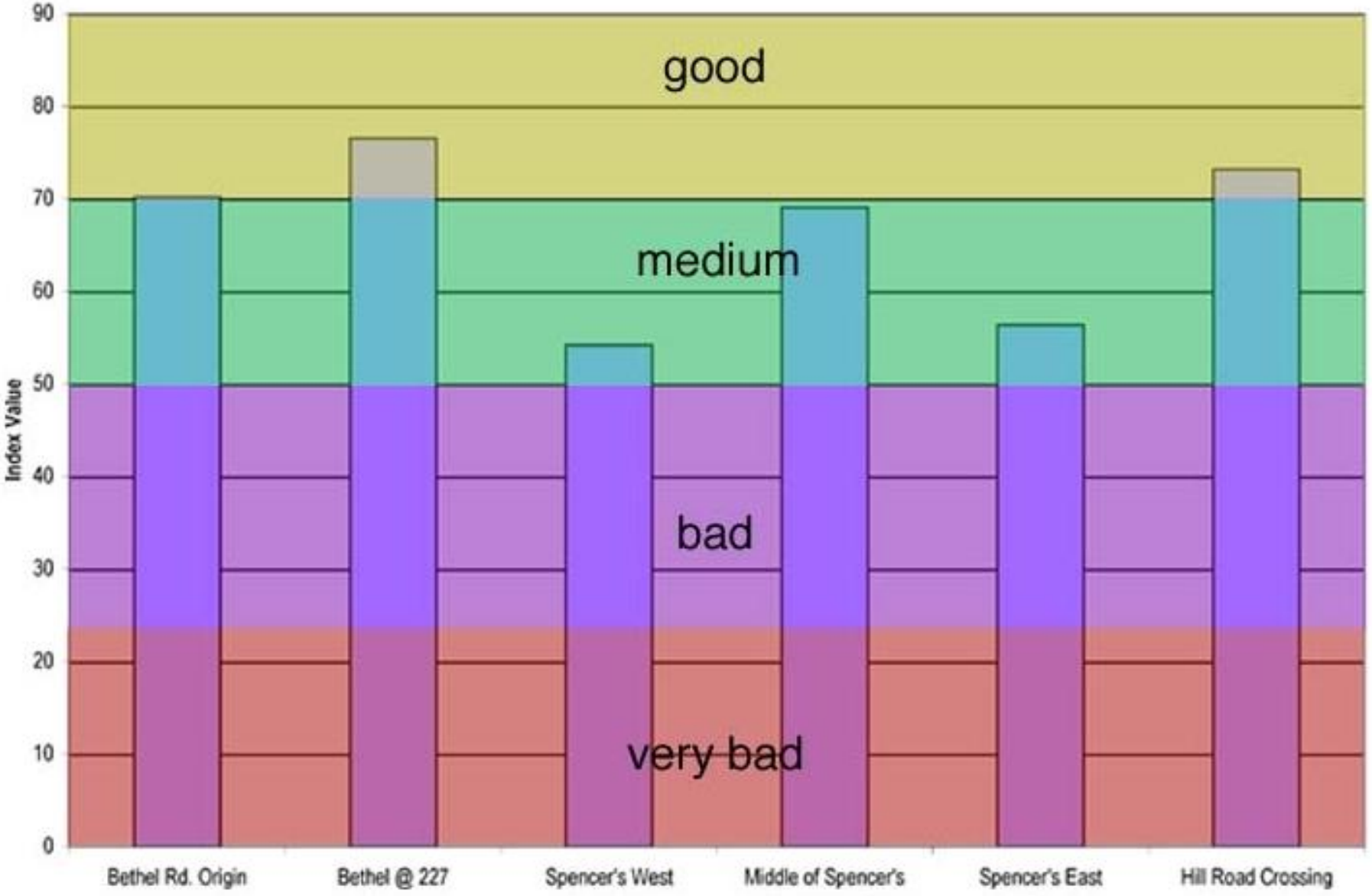


Figure B-1 Bethel Creek Water Quality Index 6-2-2005



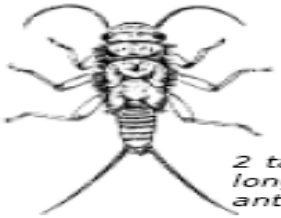
Biological Water Monitoring

10. What are macroinvertebrates?

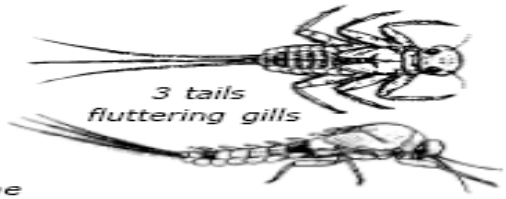
They are animals that have no backbone and are visible without magnification.

Macroinvertebrate Identification Key

GROUP 1 – Very Intolerant of Pollution



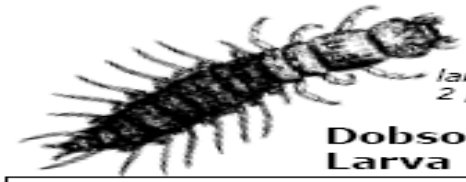
Stonefly Nymph



Mayfly Nymph

Riffle Beetle
Adult & Larva

Caddisfly Larva



Dobsonfly
Larva

Water Penny Larva

Right-
Handed
Snail

GROUP 2 – Moderately Intolerant of Pollution

Damselfly Nymph

Dragonfly
Nymph

no tails
large eyes

Scud

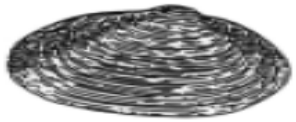
Crayfish

looks like
a mini-
lobster

Sowbug

flattened top to
bottom (looks
like a pill bug)

Cranefly



must be
alive to
count

Clam/Mussel

GROUP 3 – Fairly Tolerant of Pollution

Midge
Larva

small, but
visible head
intense wiggler

Planaria

2 eye spots
& very small

Black Fly Larva

Leech

flattened &
segmented

GROUP 4 – Very Tolerant of Pollution

Aquatic Worms

Left-
Handed
Snail

Rat-tailed
Maggot

Blood Midge
Larva

Stonefly

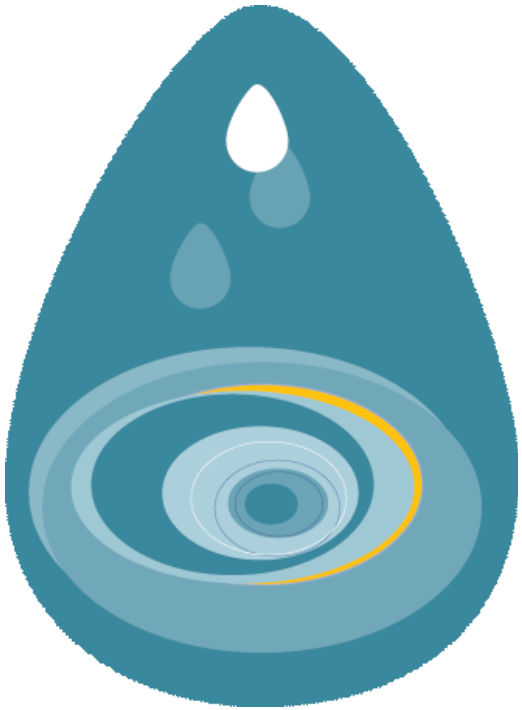
Mayfly

Water Penny Beetles

Takes a trained eye!

11. How do macroinvertebrates help determine water quality?

If animals with low pollution tolerance are present, you must have healthy water.



Now you will assess the quality of streams based on the animals that live there.

Bring in macroinvertebrates from a stream near you for participation points!*

*Ask permission first –

never walk into a strong water current!

Q. What happens after a waterbody is listed on IDEM's 303d list??

A. TMDL is scheduled and/or a Watershed Management Plan is completed

Section 319 of the Clean Water Act

In 1987 Congress recognized that state and local water authorities needed assistance with developing and implementing measures to control nonpoint source (NPS) pollution. The enactment of Section 319 of the Clean Water Act (CWA) established a national program to control nonpoint sources of water pollution, as well as a means to help fund state and local implementation of nonpoint source management programs. Nonpoint source pollution occurs as water from rain and snowmelt moves over and through the ground collecting natural and human-made pollutants and eventually enters lakes, rivers, streams, wetlands, estuaries, coastal waters, and ground water. Atmospheric deposition and hydrologic modification are also sources of nonpoint source pollution.

Section 319 addresses nonpoint source pollution control by requiring states to report to EPA all the major sources of nonpoint source pollution and nonpoint source problems in their state. States must also develop management programs with identified best management practices (BMPs) suitable for reducing nonpoint source pollution. To ensure the management programs are realized, Congress established Section 319(h) to award grants to states for implementation of nonpoint source management programs.

What is a TMDL??

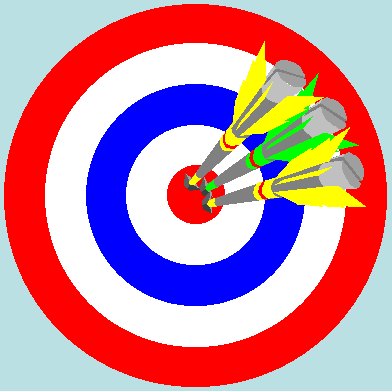
Total Maximum Daily Load

Wasteload allocations +
(point-sources)

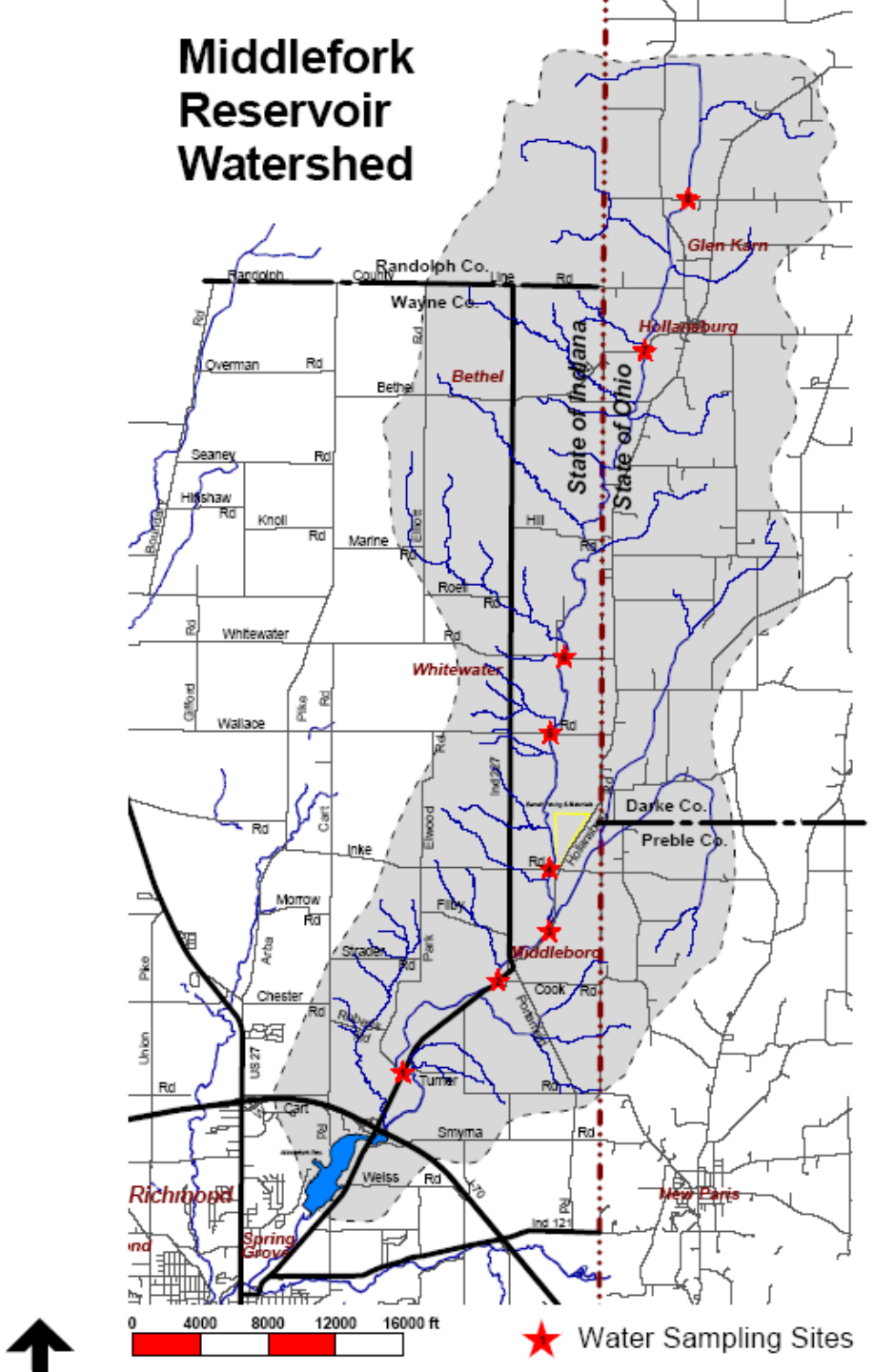
Load allocations +
(nonpoint-sources)

Margin of Safety =
(uncertainty)

TMDL Target



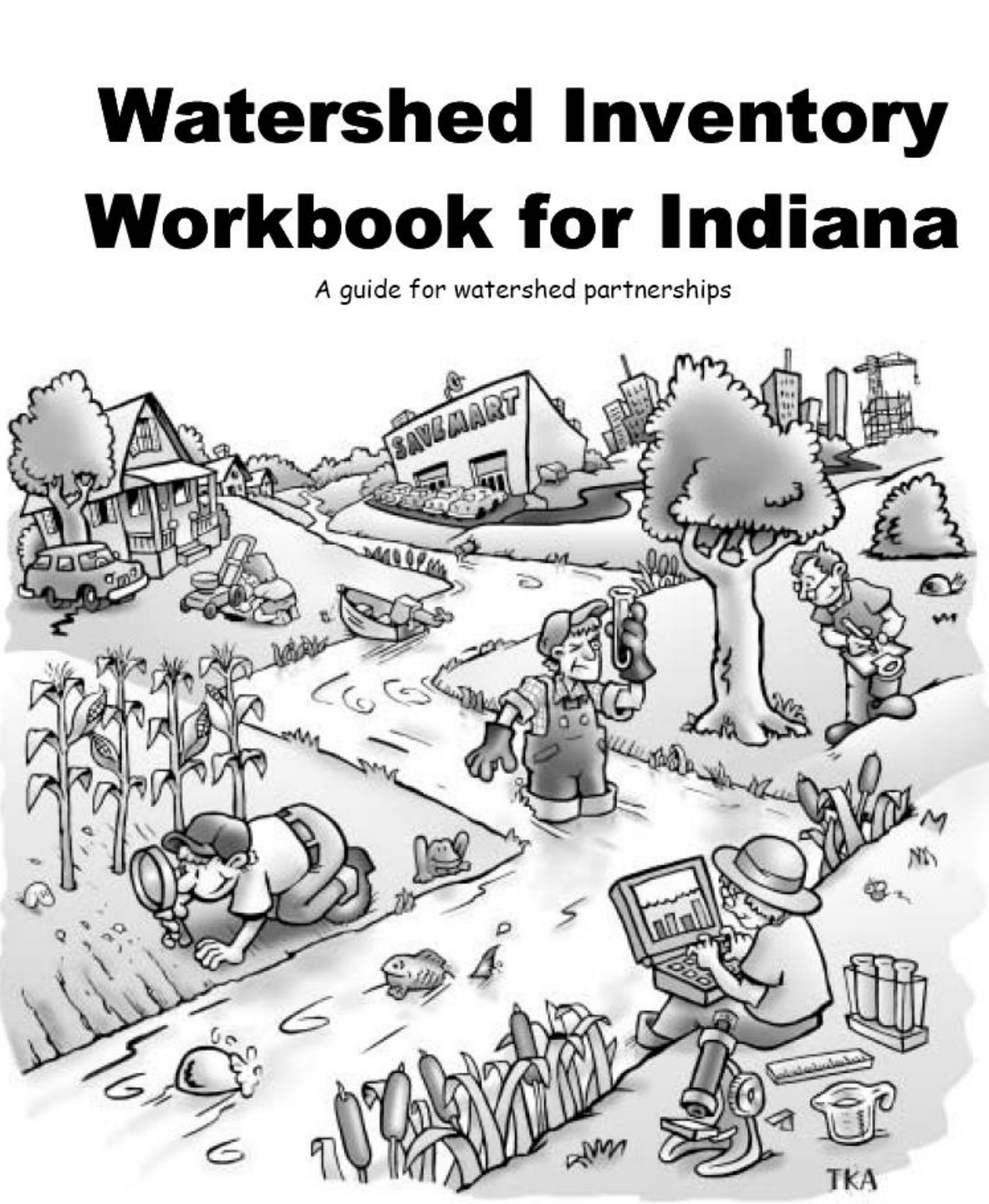
Section 319 - Watershed Grant Projects



Phase 1 – The Discovery Phase

- Watershed Inventory
- Water Monitoring
- Public Outreach and Education
- Watershed Management Plan

Complete a watershed Inventory



Outreach and Education

Reservoir Clean-ups

Watershed Management Plan

- **Investigation – land inventory**
- **Water Resources – monitoring**
- **Analysis – identify the problems**
- **Goal setting – to help solve identified problems**
- **Decisions – identify critical areas**

Phase 2 – Implementation

- Create a Cost-share Project based on management plan
- Advertise
- Put conservation on the ground
- Calculate benefits

Putting conservation on the ground

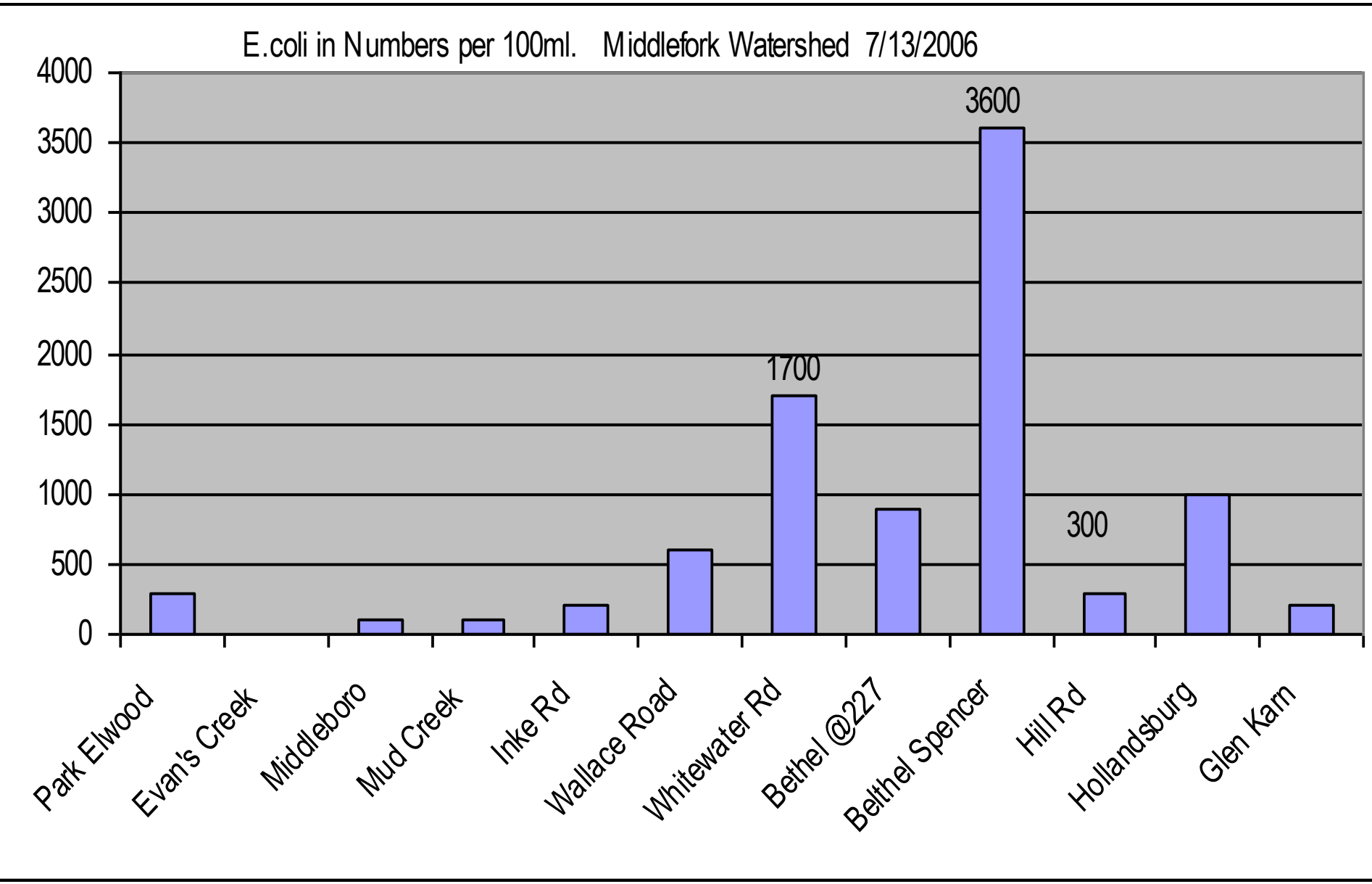
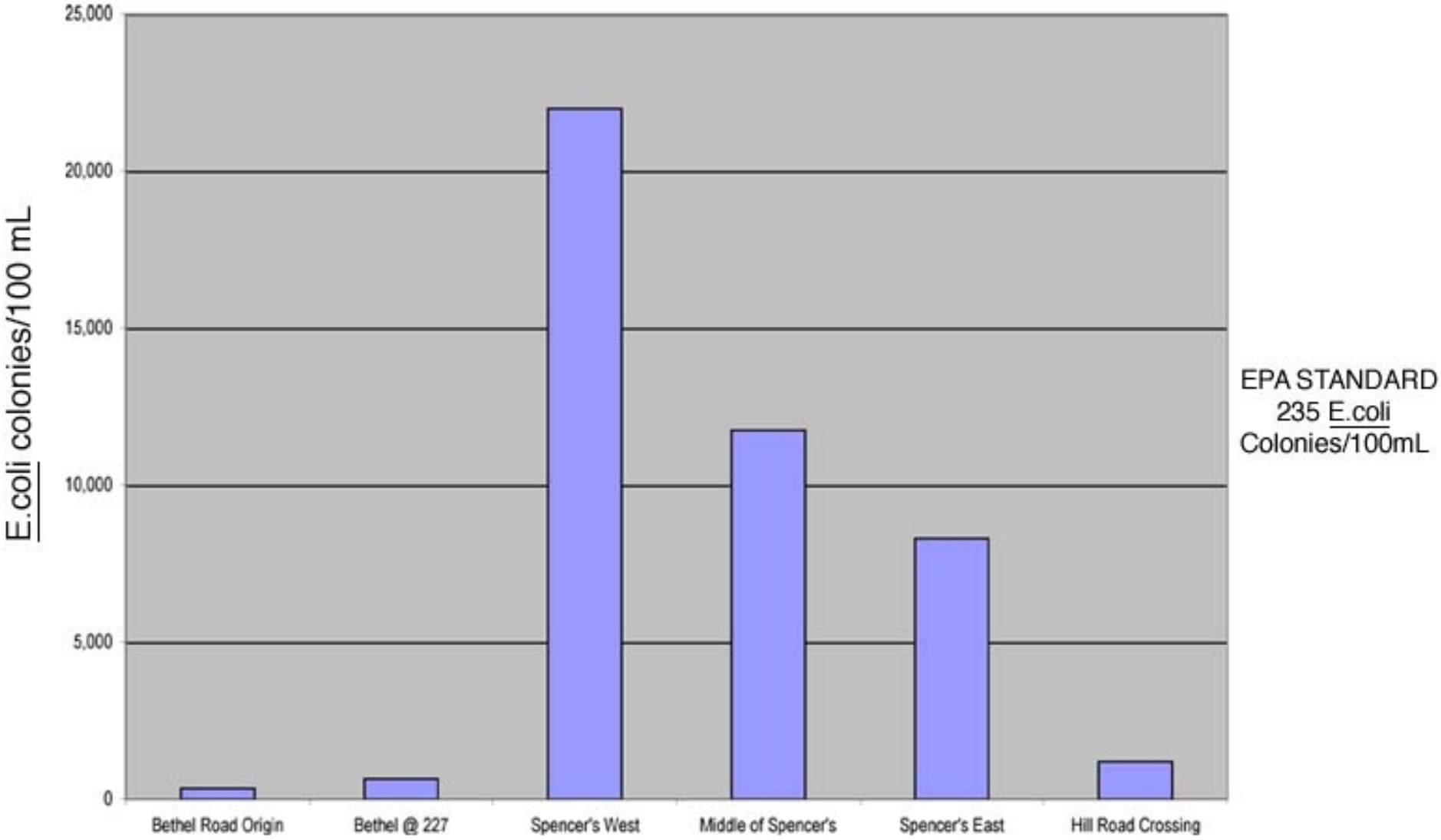
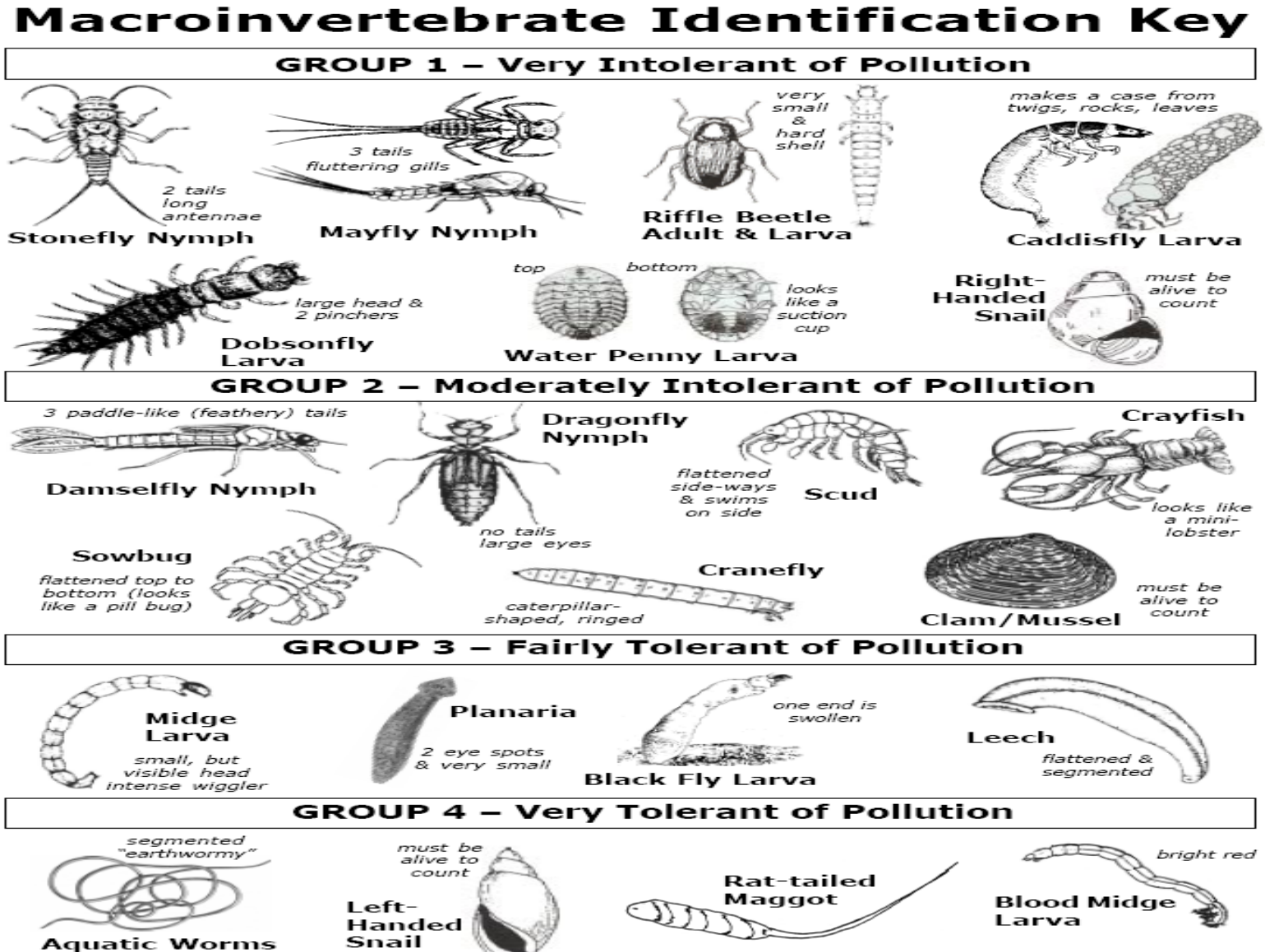

E.coli in Numbers per 100ml. Middlefork Watershed 7/13/2006
4000
3500
3000
2500
2000
1500
1000
500
0
3600
1700
300
Park Elwood
Evan's Creek
Middleboro
Mud Creek
Inke Rd
Wallace Road
Whitewater Rd
Bethel @227
Belthel Spencer
Hill Rd
Hollandsburg
Glen Karn

Figure B-2 Bethel Creek E.coli Levels 6-2-2005



Using macroinvertebrates to determine water quality



Stonefly

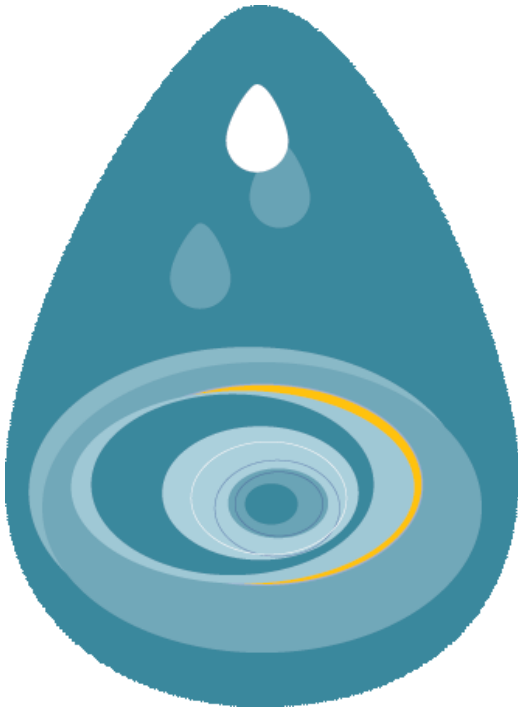
Mayfly

Takes a trained eye!

Water Penny Beetles

How do macroinvertebrates help determine water quality?

If animals with low pollution tolerance are present, you must have healthy water. They will not live in polluted water.



REPRESENTATIVE STREAMS

HABITAT & SPECIES DIVERSITY

FOREST

STREAM A

LOW TEMP — HIGH D.O.

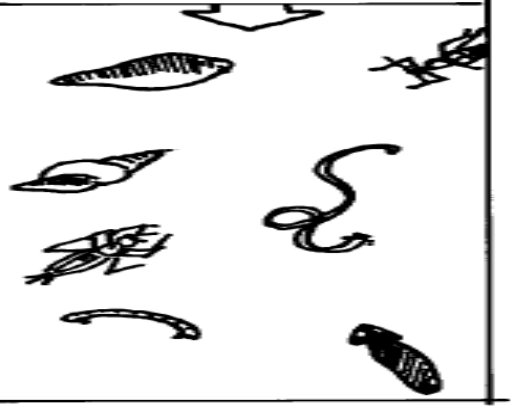
HIGH SPECIES DIVERSITY

GRASSED DITCH

STREAM B

MID TEMP — MID D.O.

MEDIUM SPECIES DIVERSITY



FEEDLOT

STREAM C

HIGH TEMP — LOW D.O.

LOW SPECIES DIVERSITY

Habitat Parameters for Selected Macroinvertebrates*

pH Ranges for Selected Macroinvertebrates*

TAXA	1	2	3	4	5	6	7	8	9	10	11	12	13	14
mayfly							XXXX							
stonefly							XXXX							
caddisfly							XXXX							
snails							XXXXXXXXX							
clams							XXXXXXXXX							
mussels							XXXXXXXXX							

* pH ranges 1-6 and 10-14 are unsuitable for most organisms.

Temperature Ranges for Selected Macroinvertebrates

TAXA	Cold Range < 12.8°C	Middle Range 12.8 - 20°C	Warm Range >20°C
caddisfly	X	X	X
stonefly	X	X	
mayfly	X		
water pennies	X		
water beetles		X	
water striders		X	
dragonfly		X	X

Minimum Dissolved Oxygen Levels for Selected Macroinvertebrates

TAXA	High Range 8-10 ppm	Medium Range 4-8 ppm	Low Range 0-4 ppm
stonefly	X		
water penny	X		
caddisfly	X	X	
some mayflies	X	X	
dragonfly		X	
true bugs		X	
damselfly		X	
mosquito			X
midges			X
pouch snail			X
rat-tailed maggot			X

The values provided are preferred ranges for most species of these groups of organisms.

BIOLOGICAL MONITORING DATA SHEET

Date ____/____/____ (MM DD YY) Begin Time ____:____ (am/pm) # Adults _____

End Time ____:____ (am/pm) # Students _____

Certified Monitors' Names _____ Volunteer ID _____

Organization Name _____

Watershed Name _____ Watershed # _ _ _ _ _ _ _ _

Stream/River Name _____ Site ID _____

(Please do not abbreviate.) (Above ID numbers are required.)

Check Methods Used

- ☐ Kick Seine Net (3 times)
- ☐ D-Net (20 jabs or scoops)

Check Habitats Sampled

- ☐ Riffles
- ☐ Undercut Banks
- ☐ Sediment
- ☐ Leaf Packs
- ☐ Snags/Vegetation
- ☐ Other

POLLUTION TOLERANCE INDEX (PTI)

PT GROUP 1 *Intolerant*		PT GROUP 2 *Moderately Intolerant*		PT GROUP 3 *Fairly Tolerant*		PT GROUP 4 *Very Tolerant*	
Stonefly Nymph		Damselfly Nymph		Midges		Left-Handed Snail	
Mayfly Nymph		Dragonfly Nymph		Black Fly Larvae		Aquatic Worms	
Caddis Fly Larvae		Sowbug		Planaria		Blood Midge	
Dobsonfly Larvae		Scud		Leech		Rat-tailed Maggot	
Riffle Beetle		Crane Fly Larvae					
Water Penny		Clams/Mussels					
Right-Handed Snail		Crayfish					
# Of TAXA		**# Of TAXA**		**# Of TAXA**		**# Of TAXA**	
Weighting Factors: **(x 4)**		**(x 3)**		**(x 2)**		**(x 1)**	

23 or More	Excellent
17 - 22	Good
11 - 16	Fair
10 or Less	Poor

POLLUTION TOLERANCE INDEX RATING
(Add the final index values for each group.)

Other Biological Indicators

- ☐ Native Mussels
- ☐ Zebra Mussels
- ☐ Rusty Crayfish
- ☐ Aquatic Plants
- _____ % Algae Cover
- _____ Diversity Index

Figure B-5 Bethel Creek PTI 8-2-2005