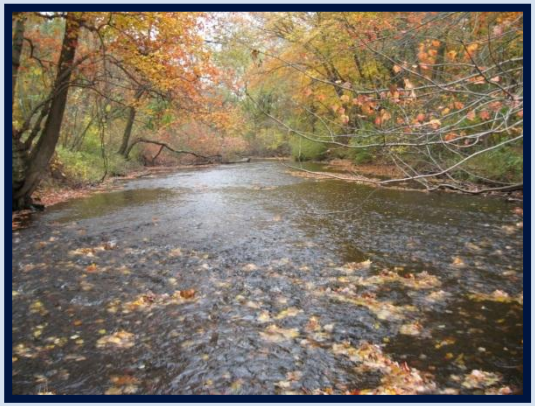
Water Quality Monitoring and Stream Health Assessments- A Primer for Wetlands Officials


November 8 and November 14, 2012

Presented by Chris Bellucci, Supervising Environmental Analyst

Sessions Woods Wildlife Management Area

Burlington, Connecticut

Connecticut Department of Energy and Environmental Protection

Schedule for Today

09:30-10:15	WATER QUALITY MONITIORING OVERVIEW
10:15-10:30	BREAK
10:30-11:15	AQUATIC MACROINVERTEBRATES AND STREAM HEALTH ASSESSMENTS

BREAK INTO TEAMS

11:15-12:00	TEAMS PROCESS SAMPLES AND IDENTIFY MACROINVERTEBRATES
12:00-12:20	GROUP ASSESSMENT OF STREAM HEALTH

OPTIONAL FIELD DEMO




PART 1
WATER QUALITY MONITIORING OVERVIEW


Why Monitor Water ?

- Federal Clean Water Act
- Characterize waters
- Trend identification
- Evaluate pollution controls
- Evaluate environmental damage
- Complaints
- Inventory
- Learn
- Support better natural resource management

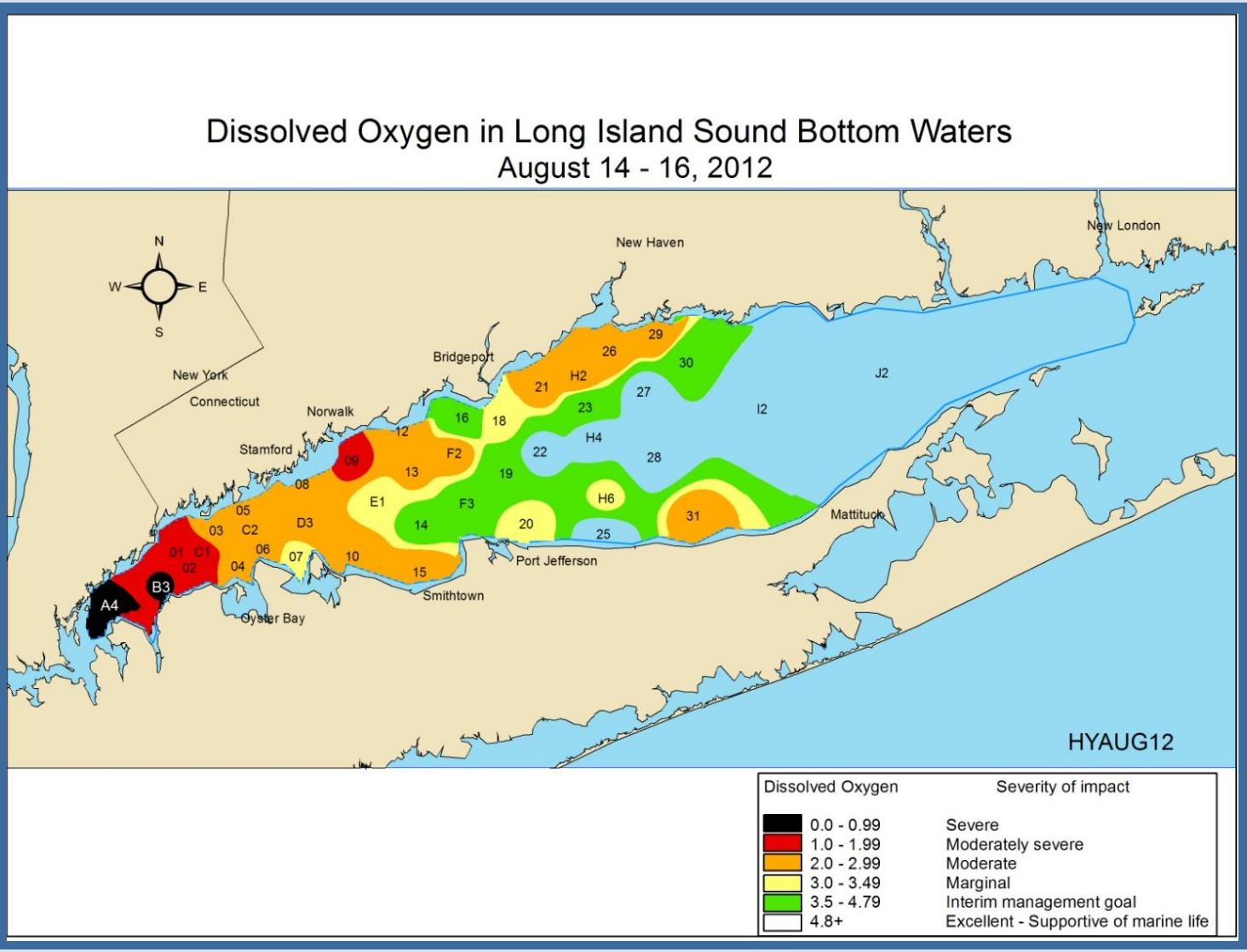
What We Monitor

- **Physical**
  - *Habitat quality*
  - *Temperature*
  - *Flow*
- **Chemical**
  - *General constituents*
  - *Nutrients*
- **Biological**
  - *Fish*
  - *Macroinvertebrates*
- **Sanitary Quality**
  - *Indicator Bacteria*
- **Tissue contaminants**
  - *Mercury*
  - *PCB*

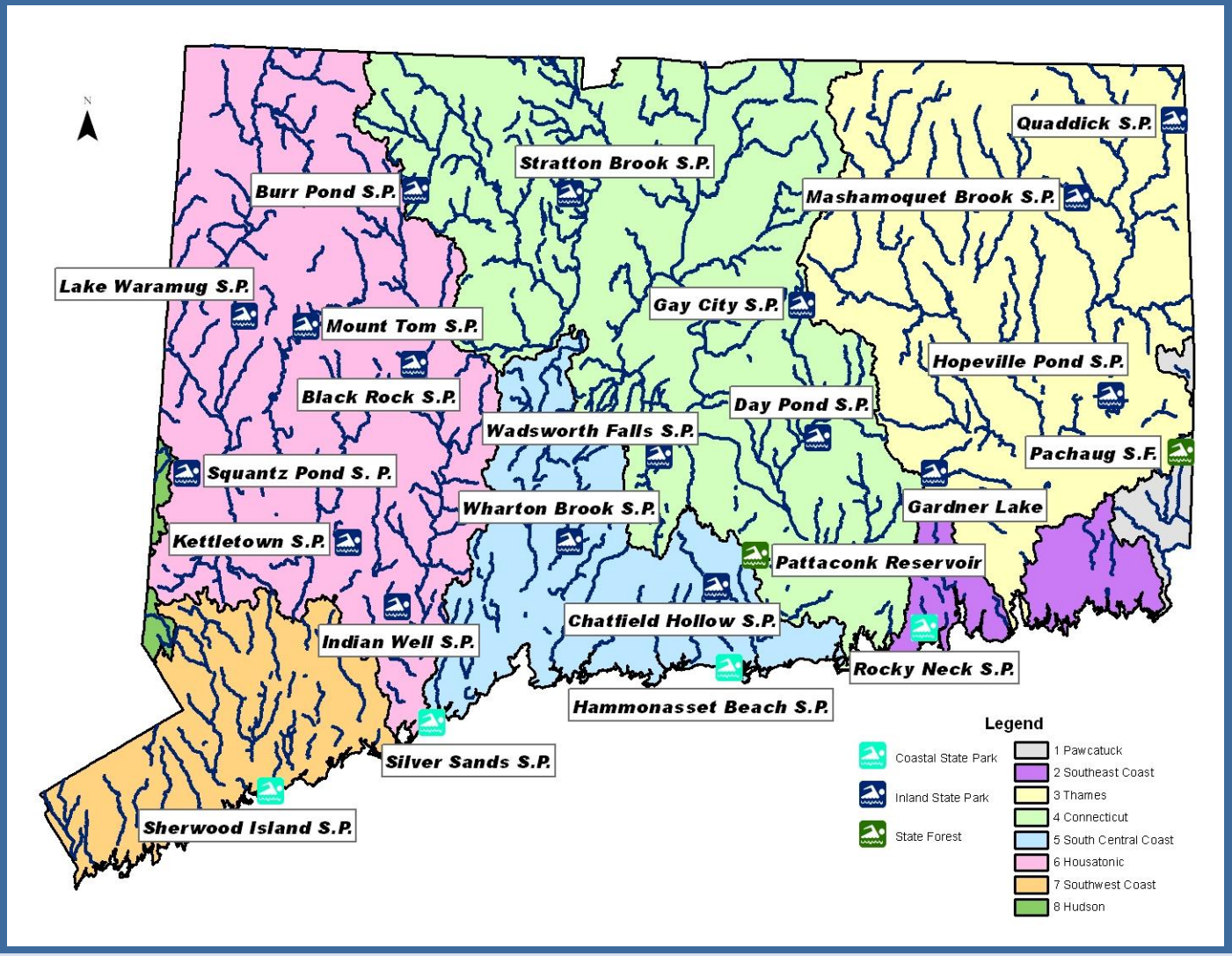
Where We Monitor

- Long Island Sound
- Beaches at DEEP State Parks
- Lakes
- Wetlands
- Rivers and Streams

Long Island Sound



Beach Monitoring
23 State Owned/Managed Bathing Areas



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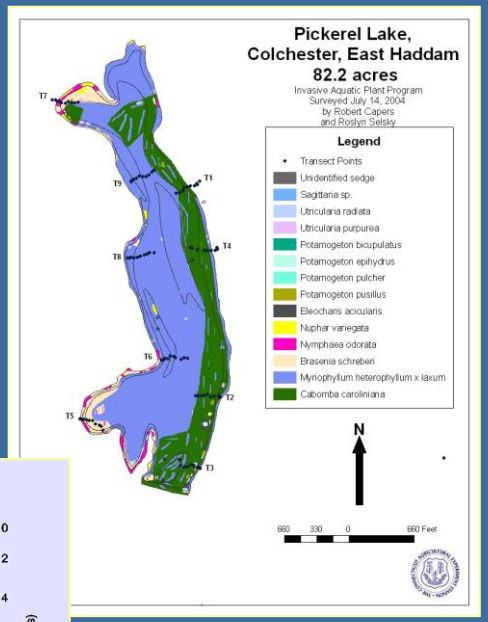
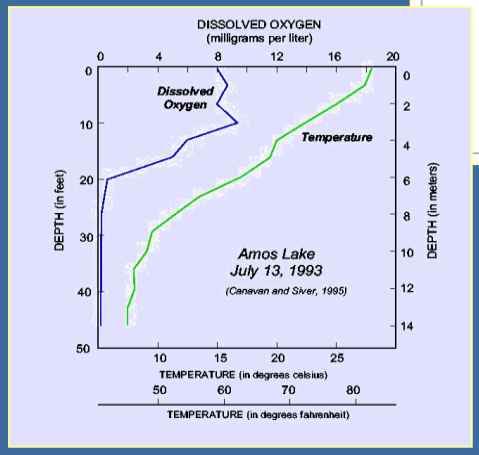
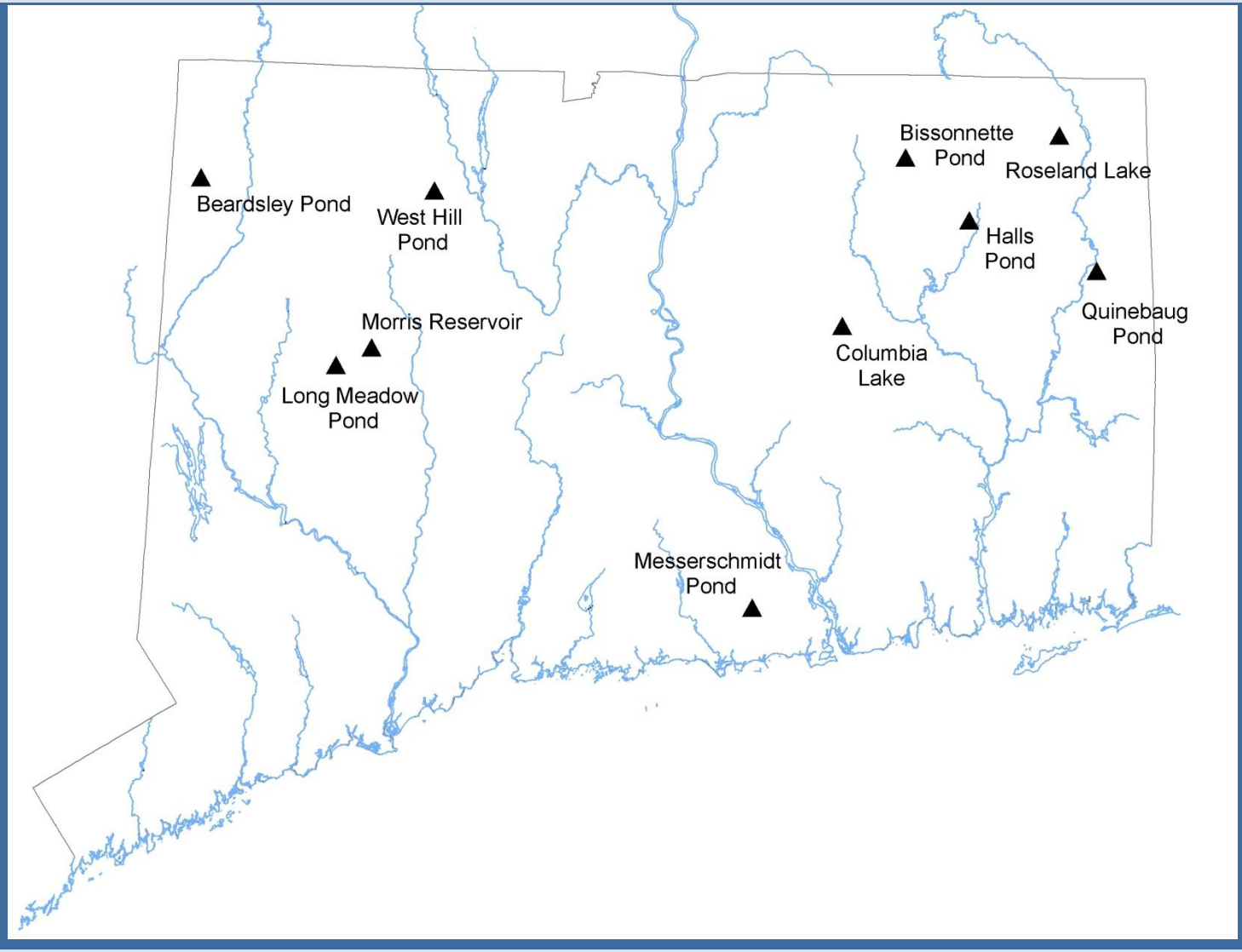
Lakes



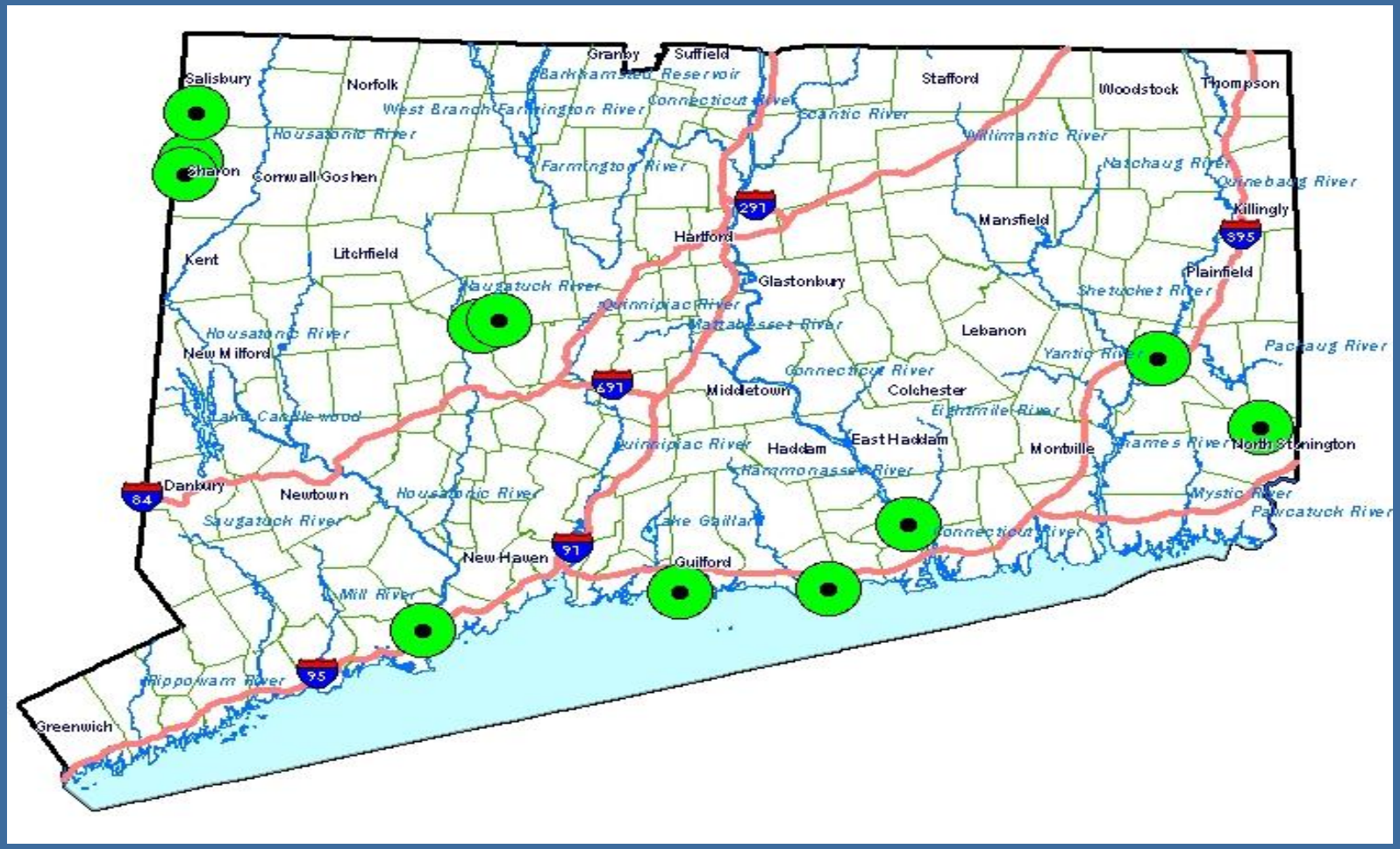


- Expanding the monitoring program
- Diagnostic feasibility studies (consultants)
- Complaints

2012 National Lakes Assessment



2011 National Wetland Condition Assessment



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2011 National Wetland Condition Assessment

- **The presence and abundance of grassy plants, trees, and shrubs**
- **Algae collected from sediments and the surface of plant stems and leaves**
- **Soil properties and chemistry**
- **Water chemistry (such as dissolved oxygen, nutrients, chlorophyll-a)**
- **Condition of the habitat in the area surrounding the wetland.**
- **A SUMMARY REPORT IS FORTHCOMING…..**

National Wetland Condition Assessment

Field crews sampled 1,179 sites from Florida to Alaska this summer in the first-ever national survey on the ecological condition of the Nation's wetlands.

Over the next year EPA and its State, Tribal, and Federal partners will process the field samples, assure the quality of the data collected, and begin to analyze the data. A report detailing the results of the survey will be released in 2013.

Features

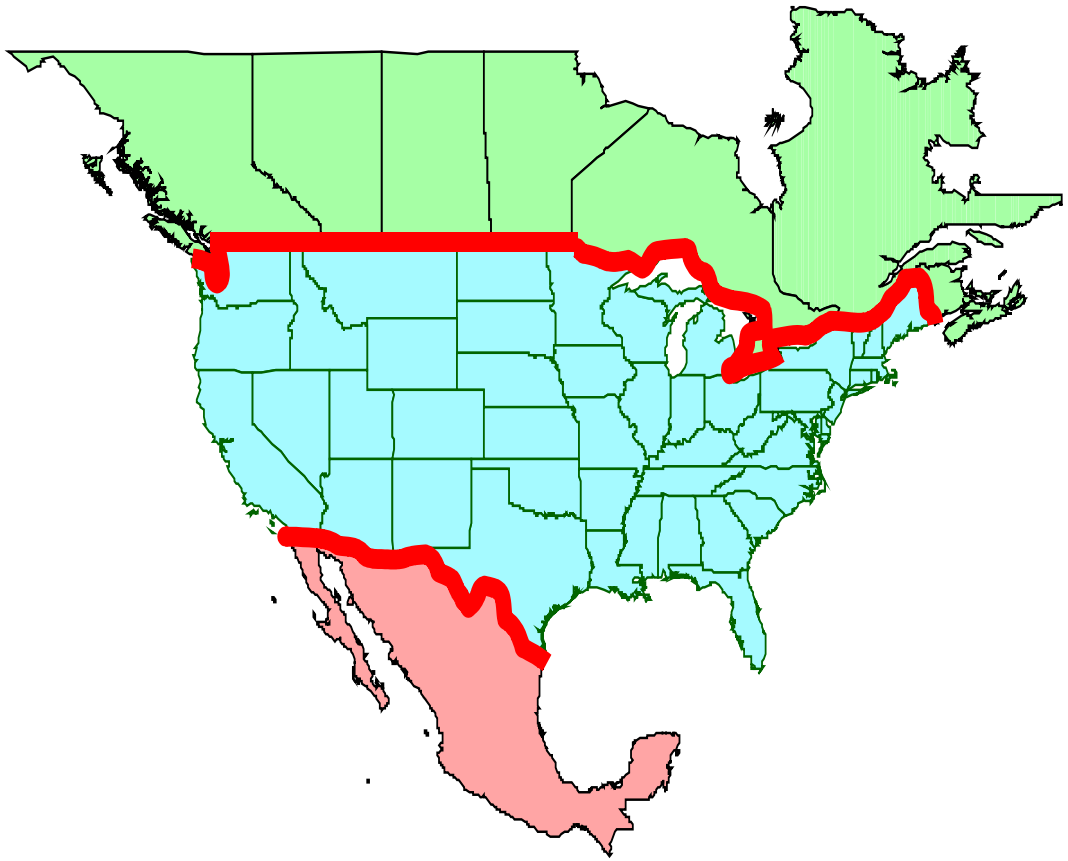
- NWCA Fact Sheet (2 pp, 77K, About PDF)
- Video on the NWCA EXIT Disclaimer
- National Aquatic Resource Surveys

ABOUT | DESIGN | METHODS/MANUALS | DATA | REPORT | PLANNING | COLLABORATION

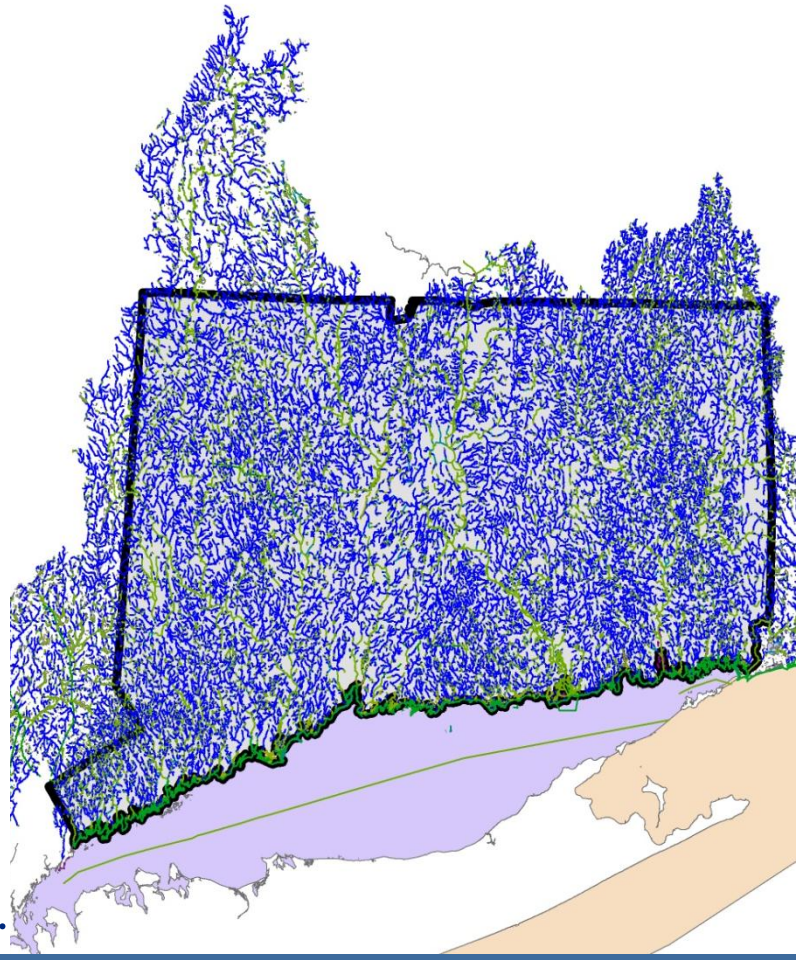
EPA and its State, Tribal, and Federal partners are implementing the first-ever national survey on the condition of the Nation's wetlands. The survey is designed to provide regional and national estimates of wetland ecological integrity and rank the stressors most commonly associated with poor conditions. The process of designing and conducting the survey is also intended to help build state and tribal capacity to monitor and analyze wetland condition while promoting collaboration across jurisdictional boundaries.

The National Wetland Condition Assessment (NWCA) will use a probability-based sampling design to provide statistically-valid estimates of condition for a population of wetlands. States, tribes and federal partners will participate in the NWCA design, planning, and field assessment. A consistent field assessment procedure will be used for the NWCA to ensure that the results can be compared across the country.

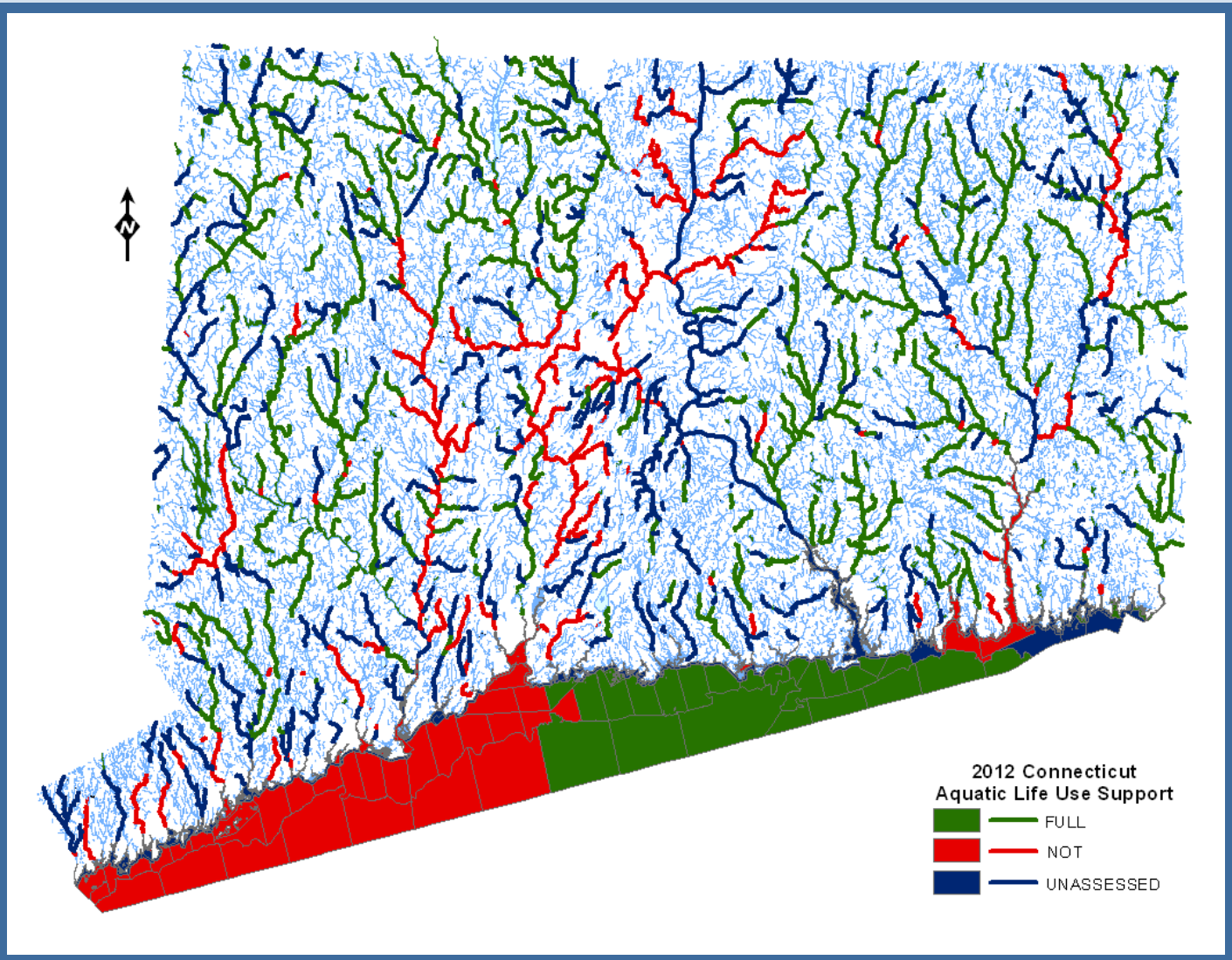
Rivers and Streams



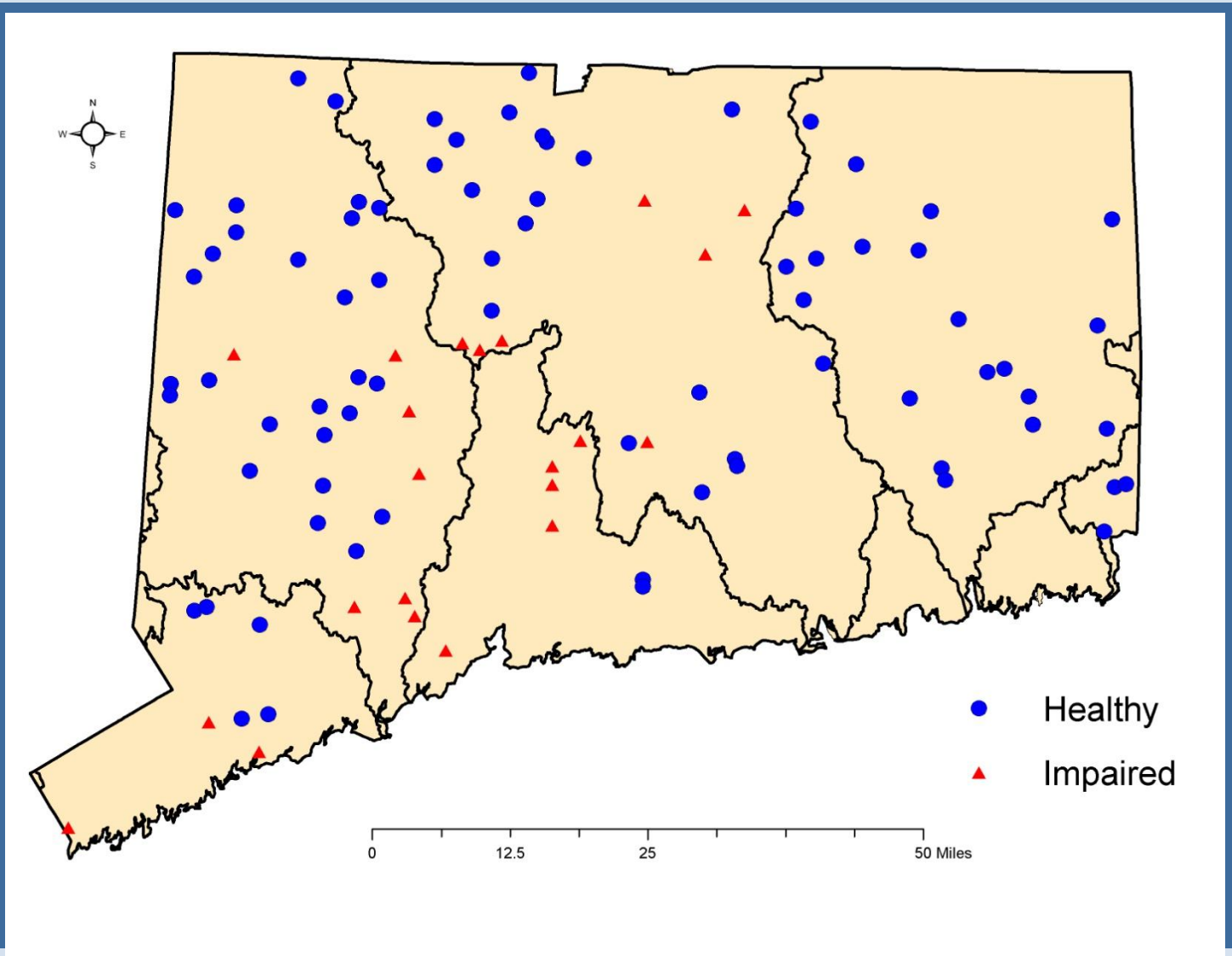
US Border with Canada & Mexico ~ 5,920 mi.



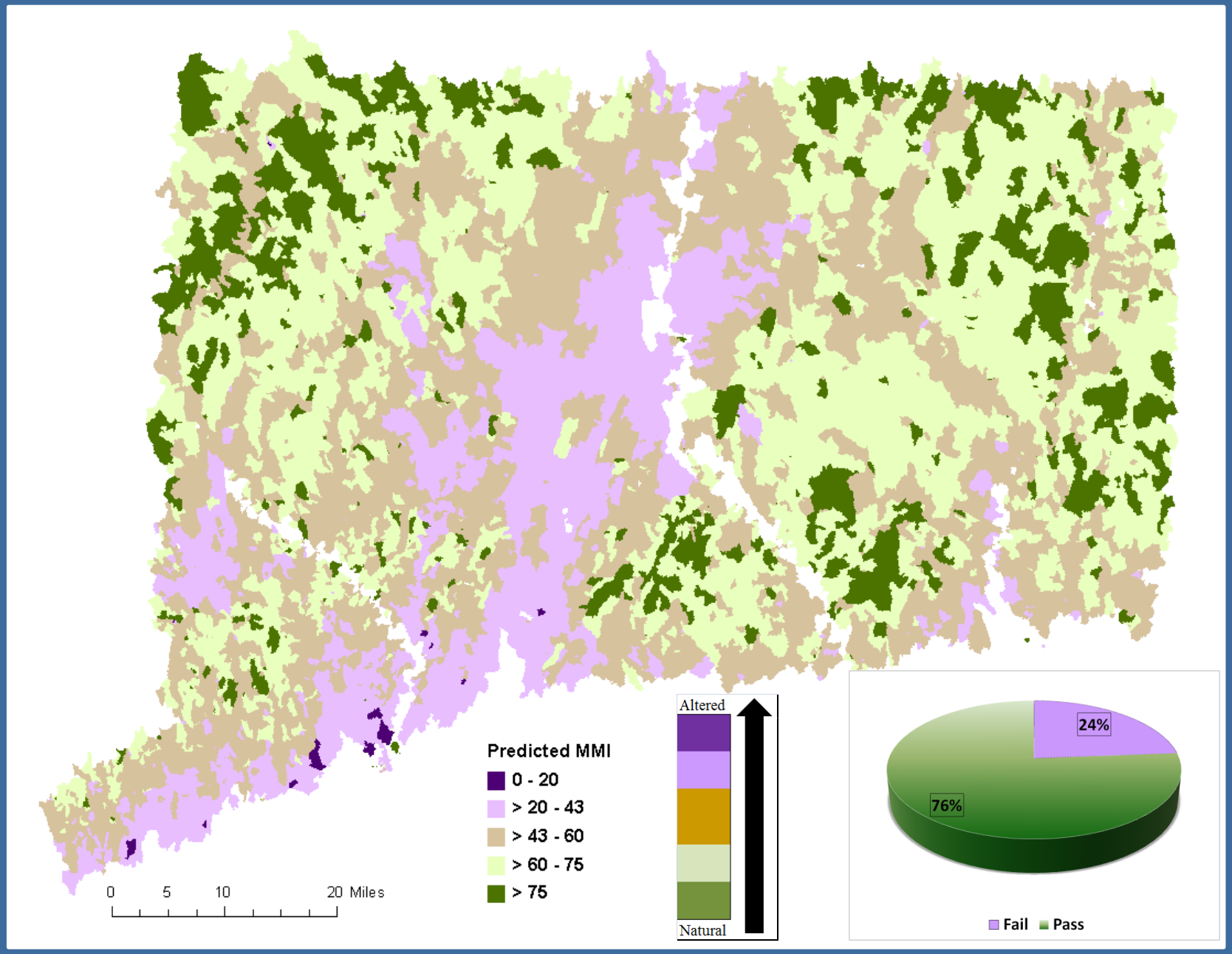
Rivers and Streams



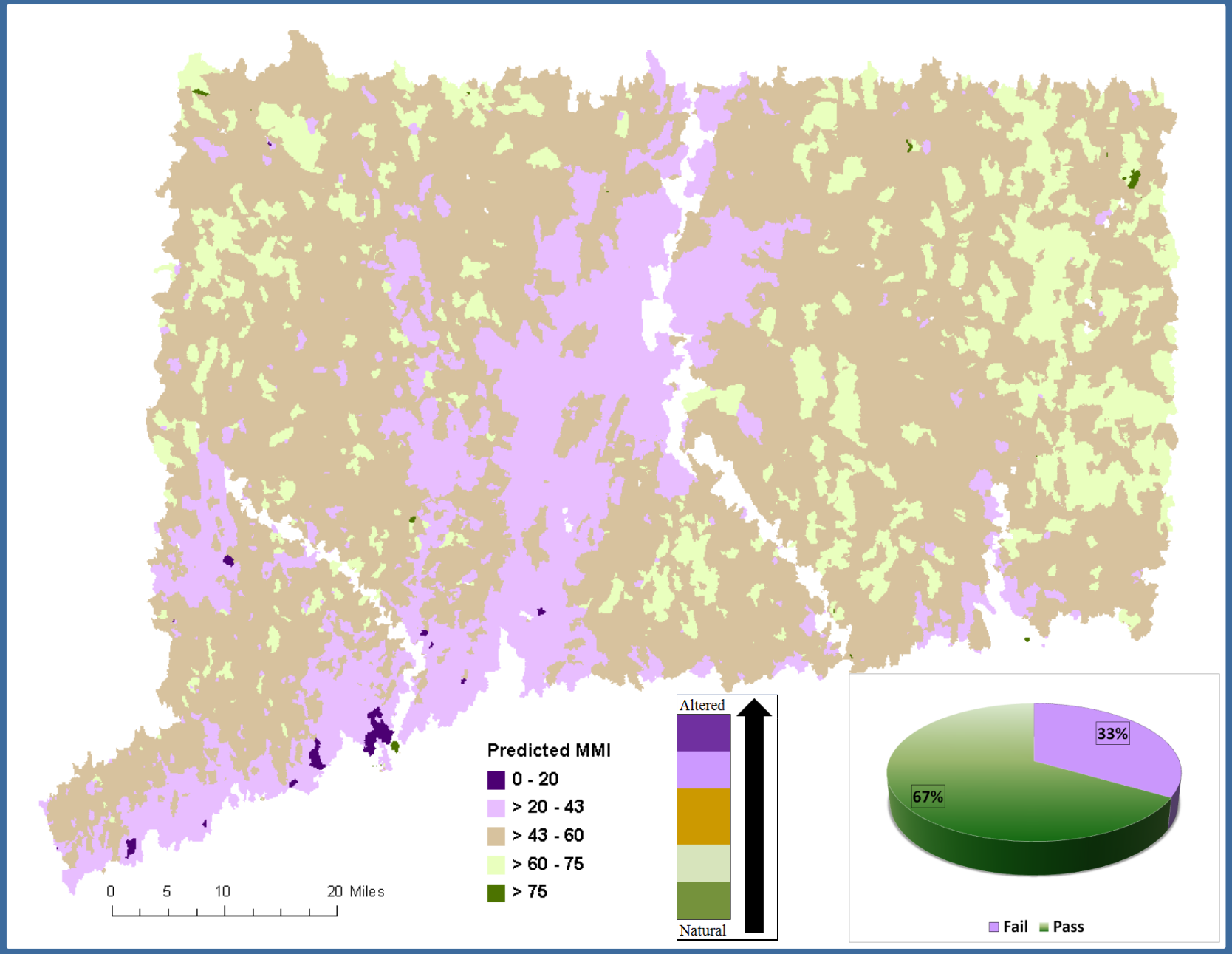
Aquatic life- 77% of Streams are Healthy



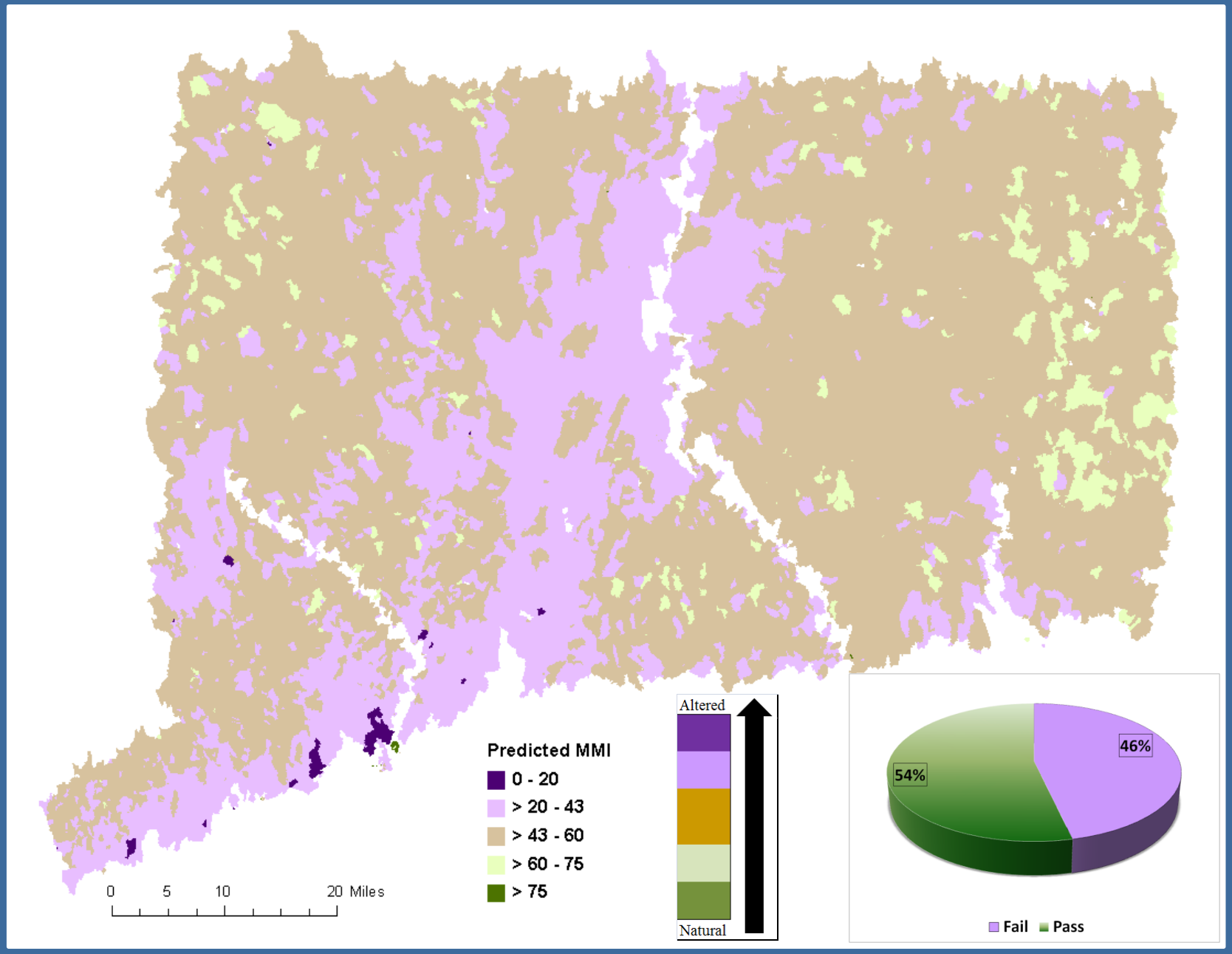
Build Out Analysis – Current Condition



Build Out Analysis – +2% Impervious Cover



Build Out Analysis – +4% Impervious Cover



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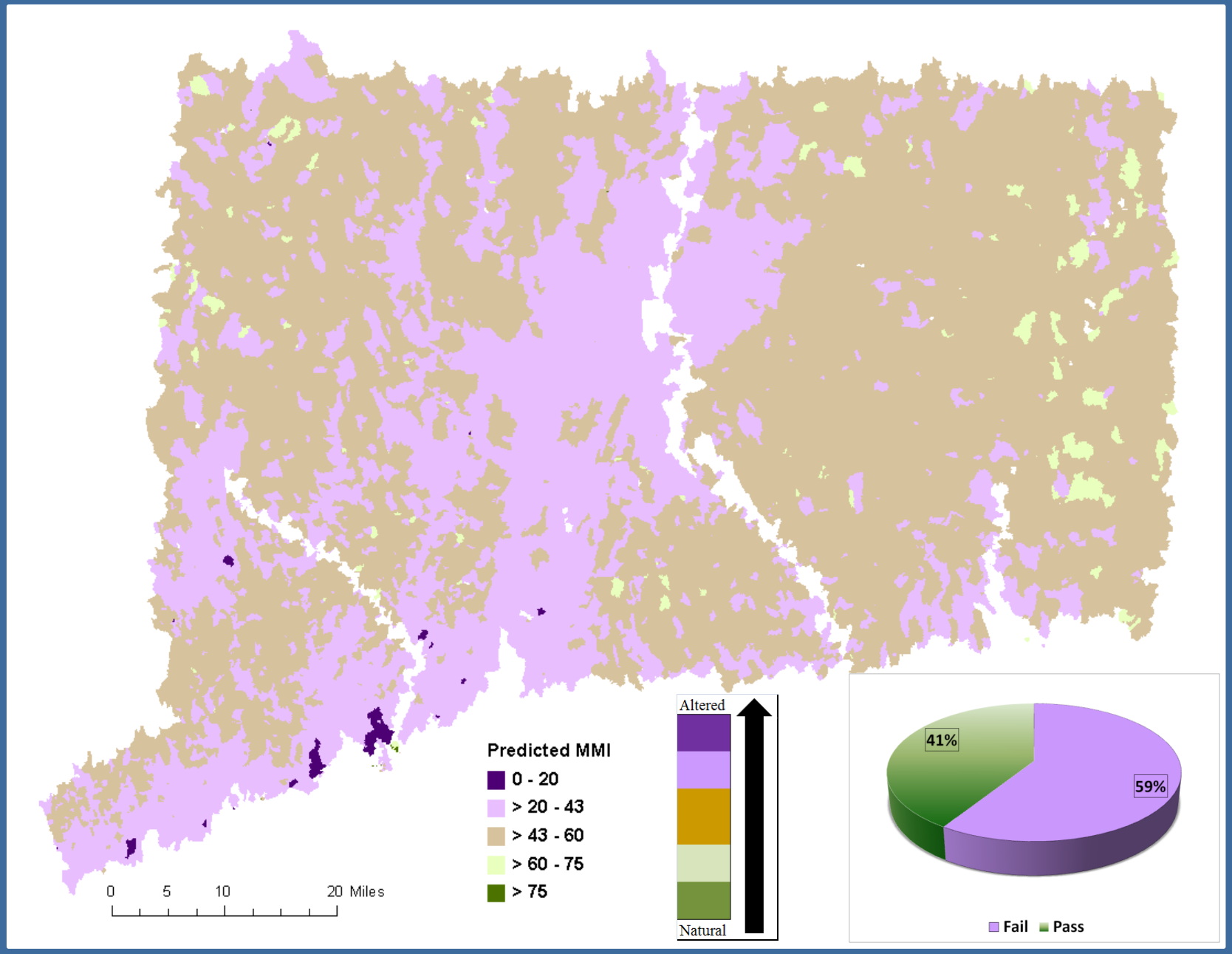
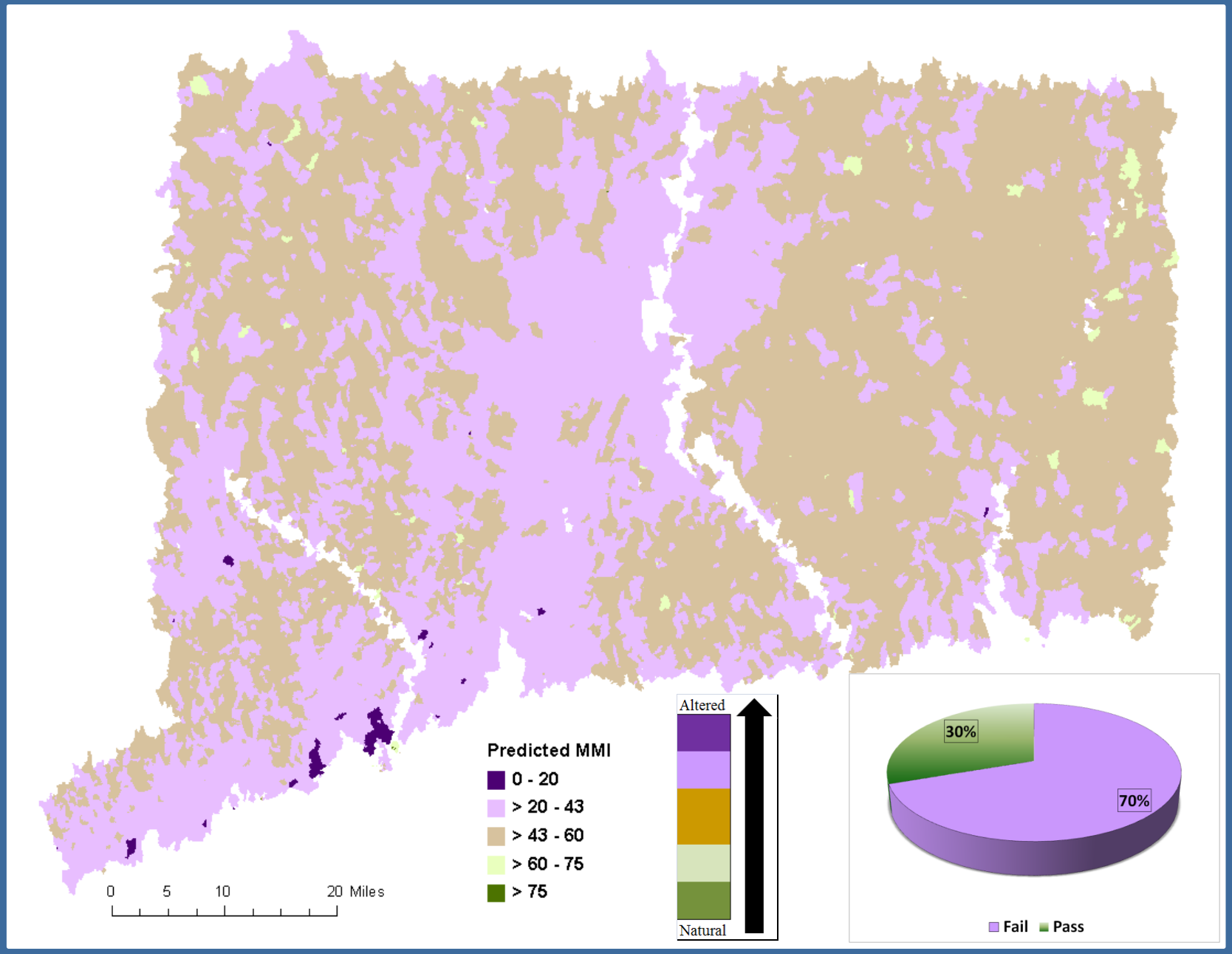
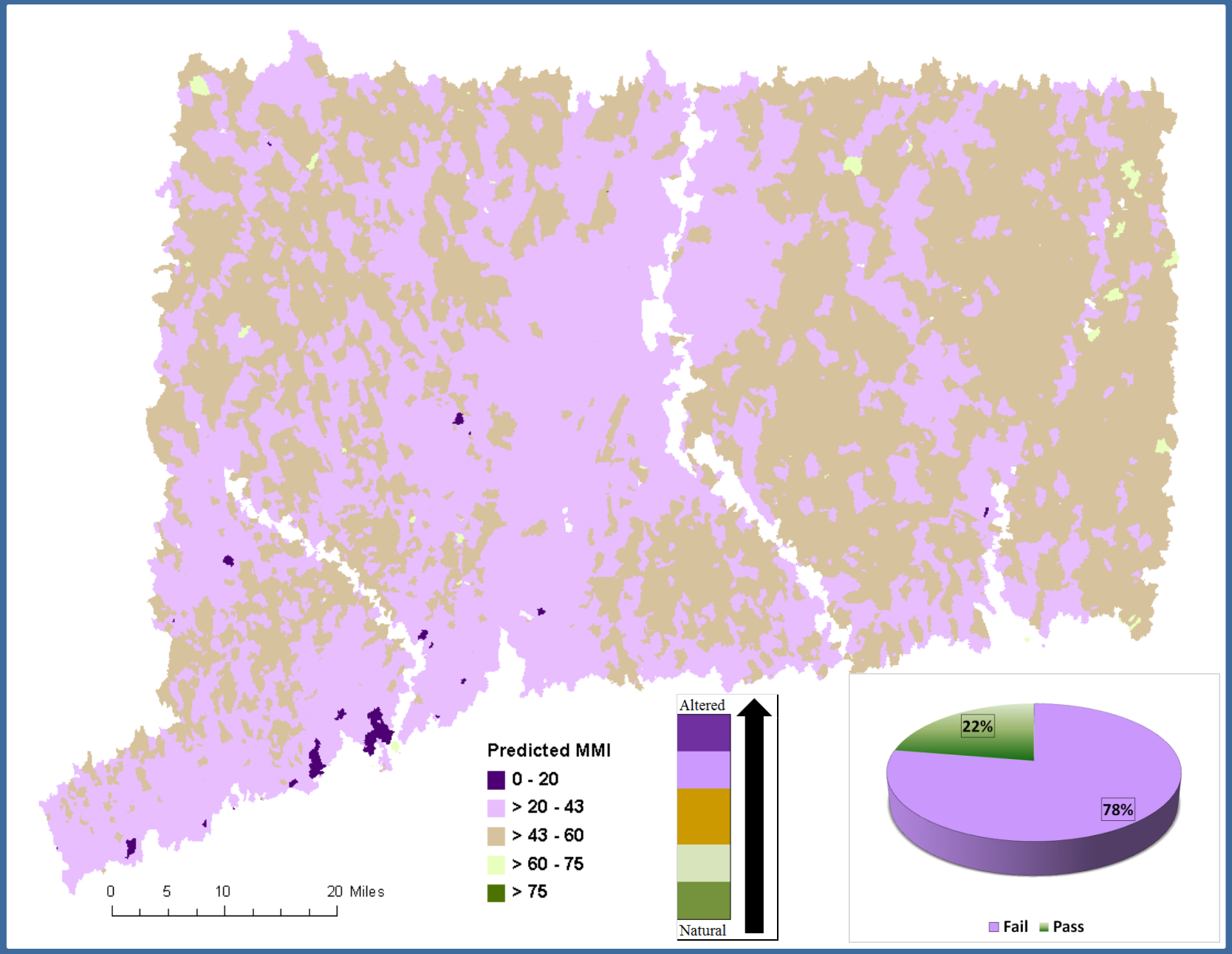


Build Out Analysis – +8% Impervious Cover



Build Out Analysis – +10% Impervious Cover



Biological Monitoring

Fish

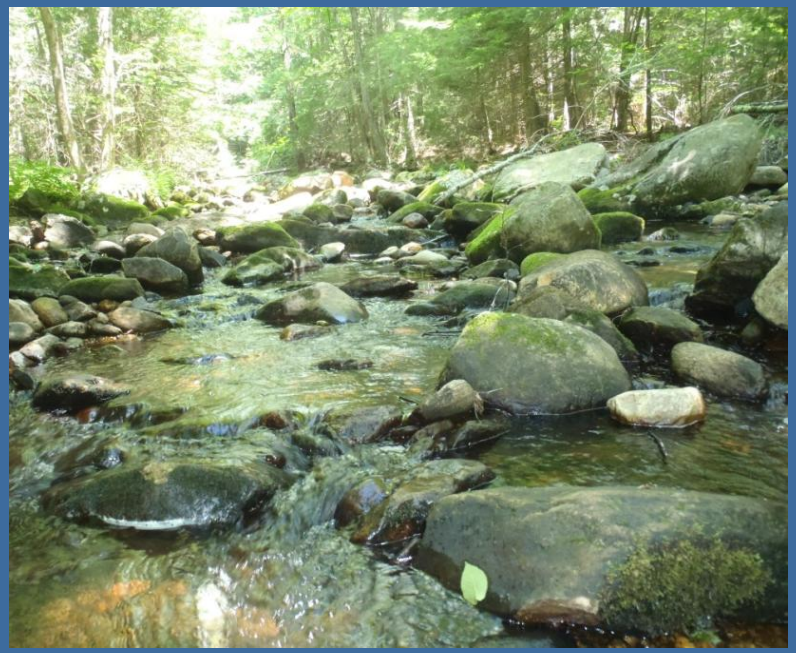
- ***Limited species***
- ***Easy to relate to public***
- ***Response is to water quantity and temperature***
- ***Need Special Gear to Collect***
- ***Easy to identify***

Macroinvertebrates

- ***Lots of species***
- ***Limited value to public***
- ***Response is to water quality***
- ***Easy to collect***
- ***Identification is challenging***

Stream Assessments

Fully Supporting a Designated Use
Meets Goals in Water Quality Standards
Meets Water Quality Criteria
Good Condition
Healthy



Not Supporting a Designated Use
Fails Goals in Water Quality Standards
Fails Water Quality Criteria
Poor Condition
Impaired

The presence of a trout in a body of water is a discrete ecological fact that nevertheless signifies certain things…

…a particular complex of biotic and chemical and physical factors a standard of richness and purity, without which that troutly presence is impossible….David Quammen

Questions then Break ……

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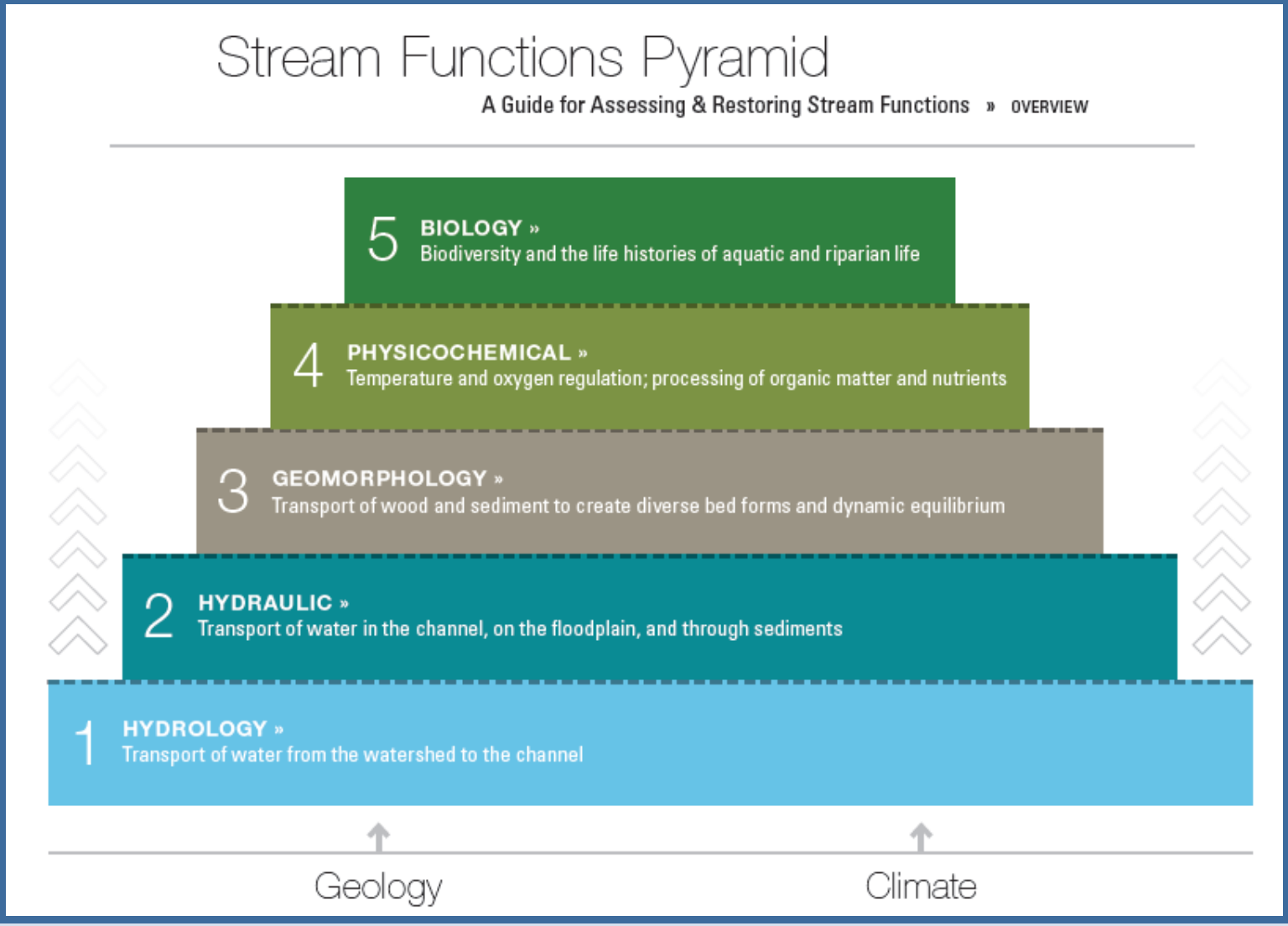
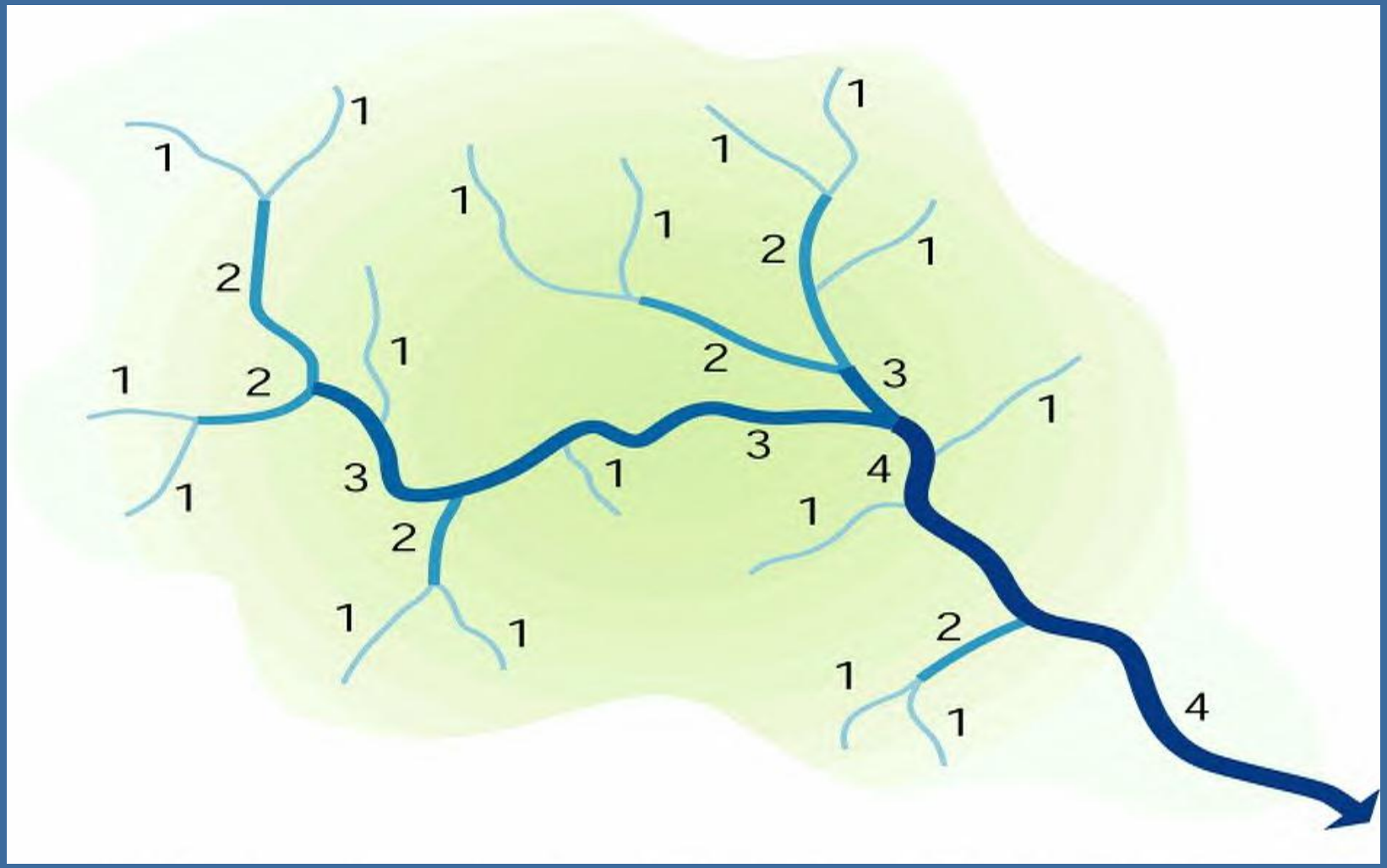
PART 2
STREAM MACROINVERTEBRATES AND STREAM HEALTH ASSESSMENTS



Stream Function

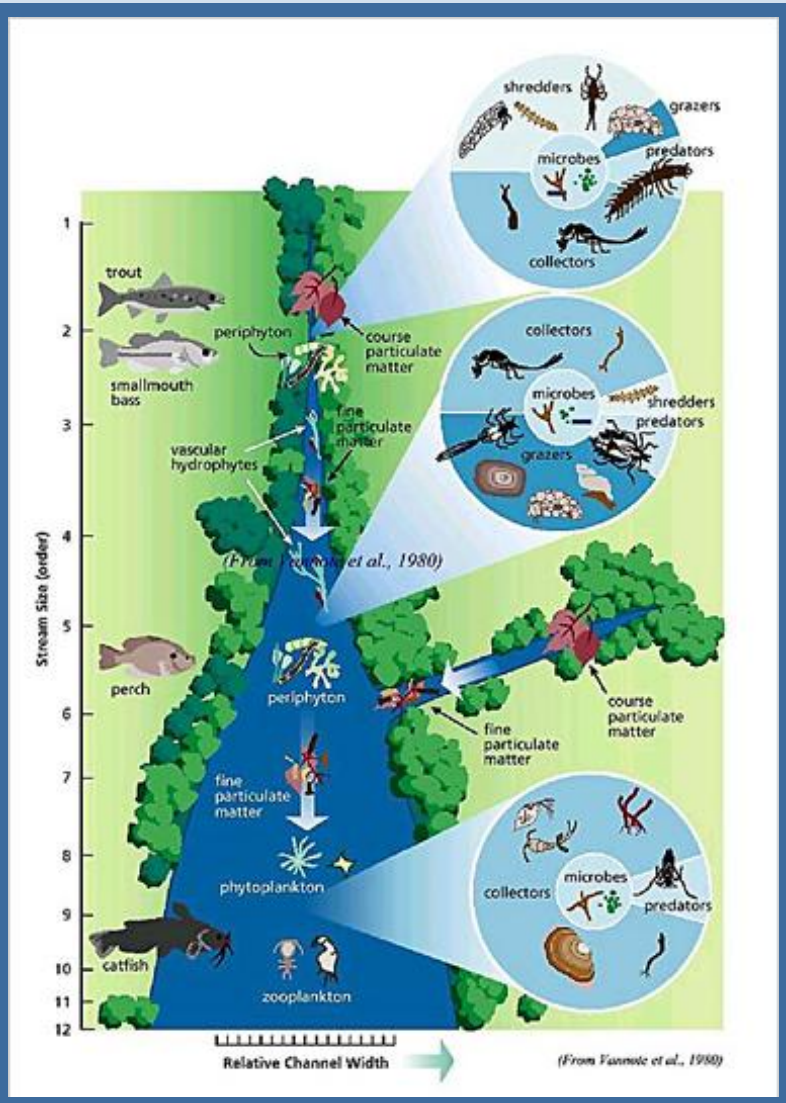


Stream Order

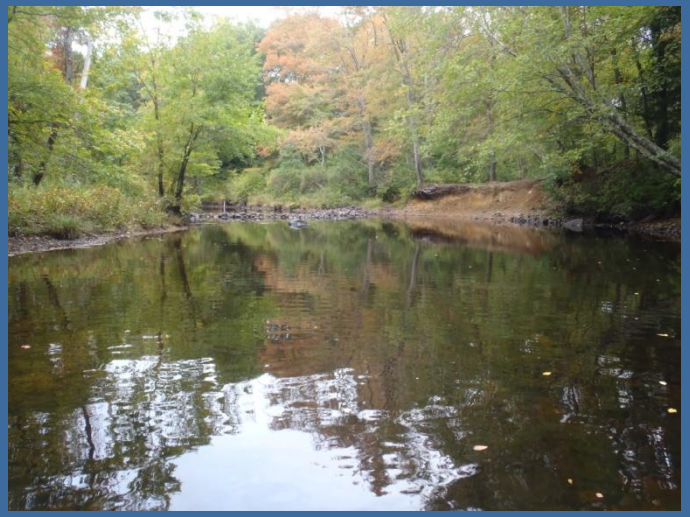


River Continuum Concept

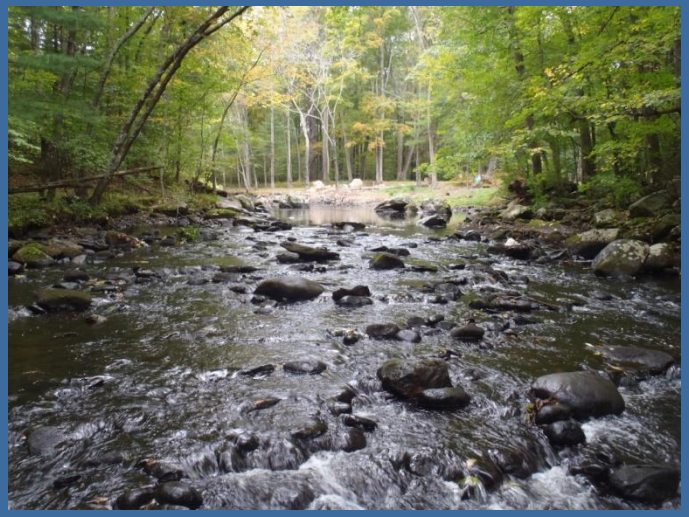
- **Small headwater streams are different from mid-sized streams are different from large rivers**
- **Longitudinal connectivity – downstream processes are influenced by upstream**
- **As the watershed changes from headwaters to mouth, water chemistry, energy flow and biological communities change**

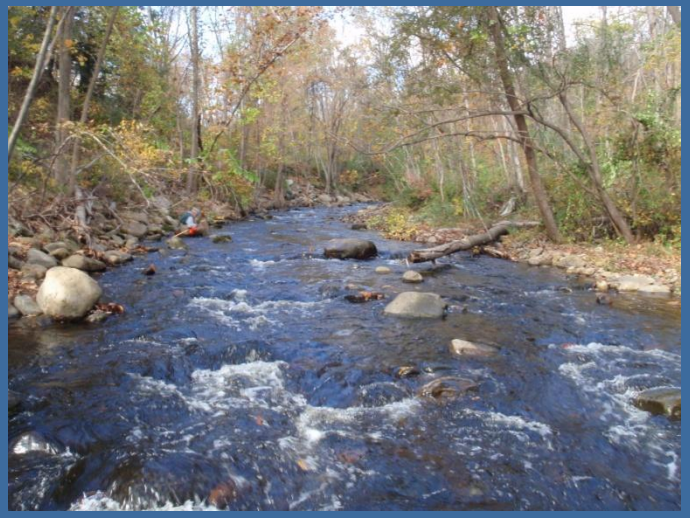


Pools



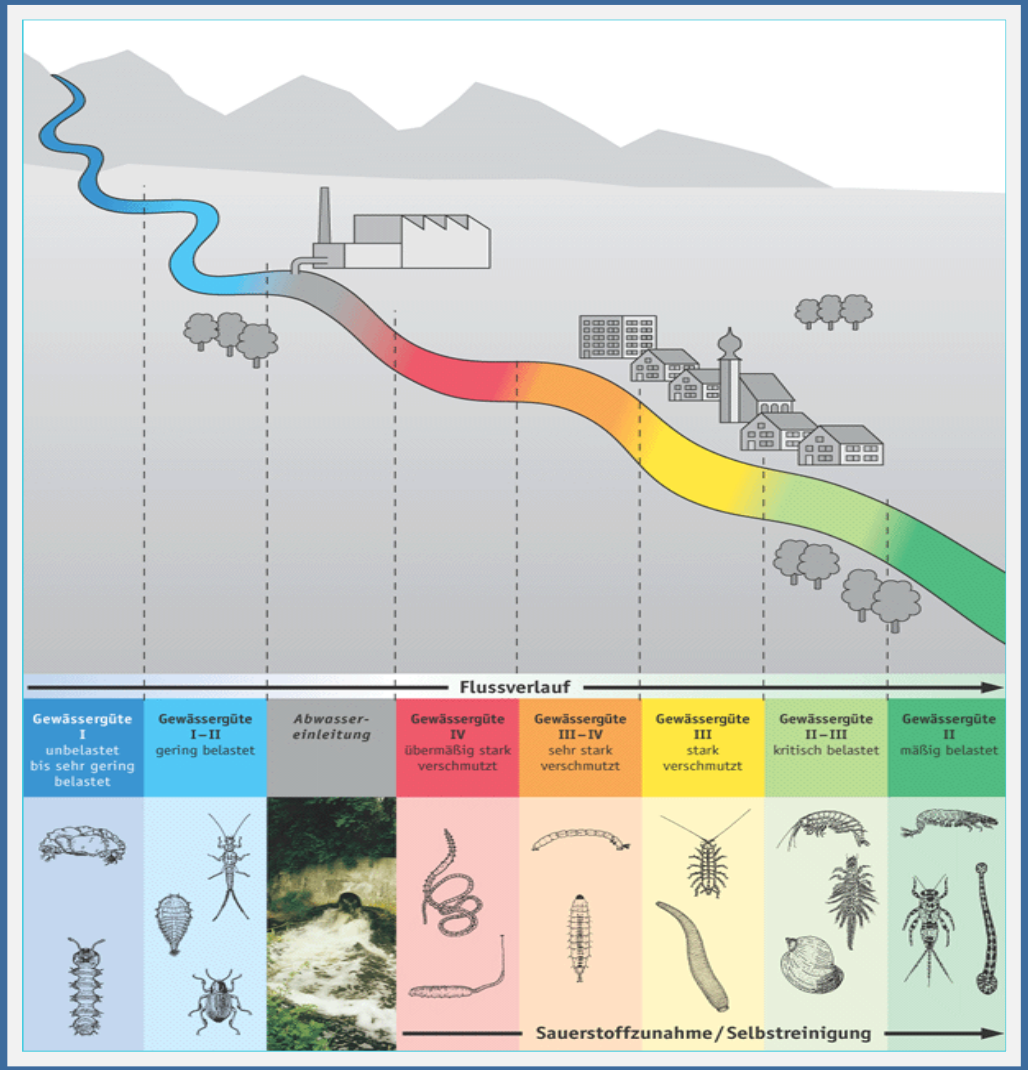
Riffles



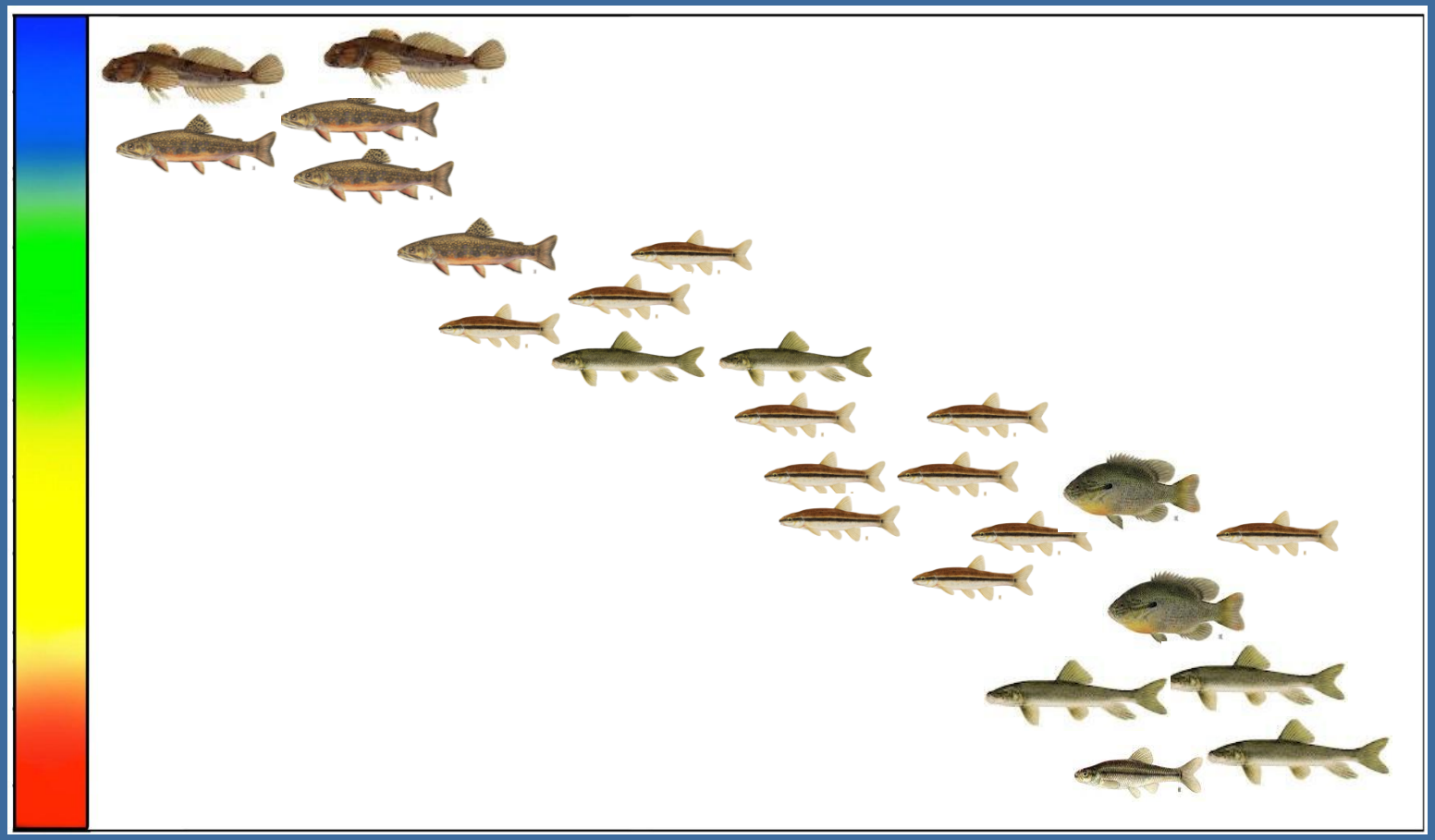


Kolkwitz & Marsson 1909

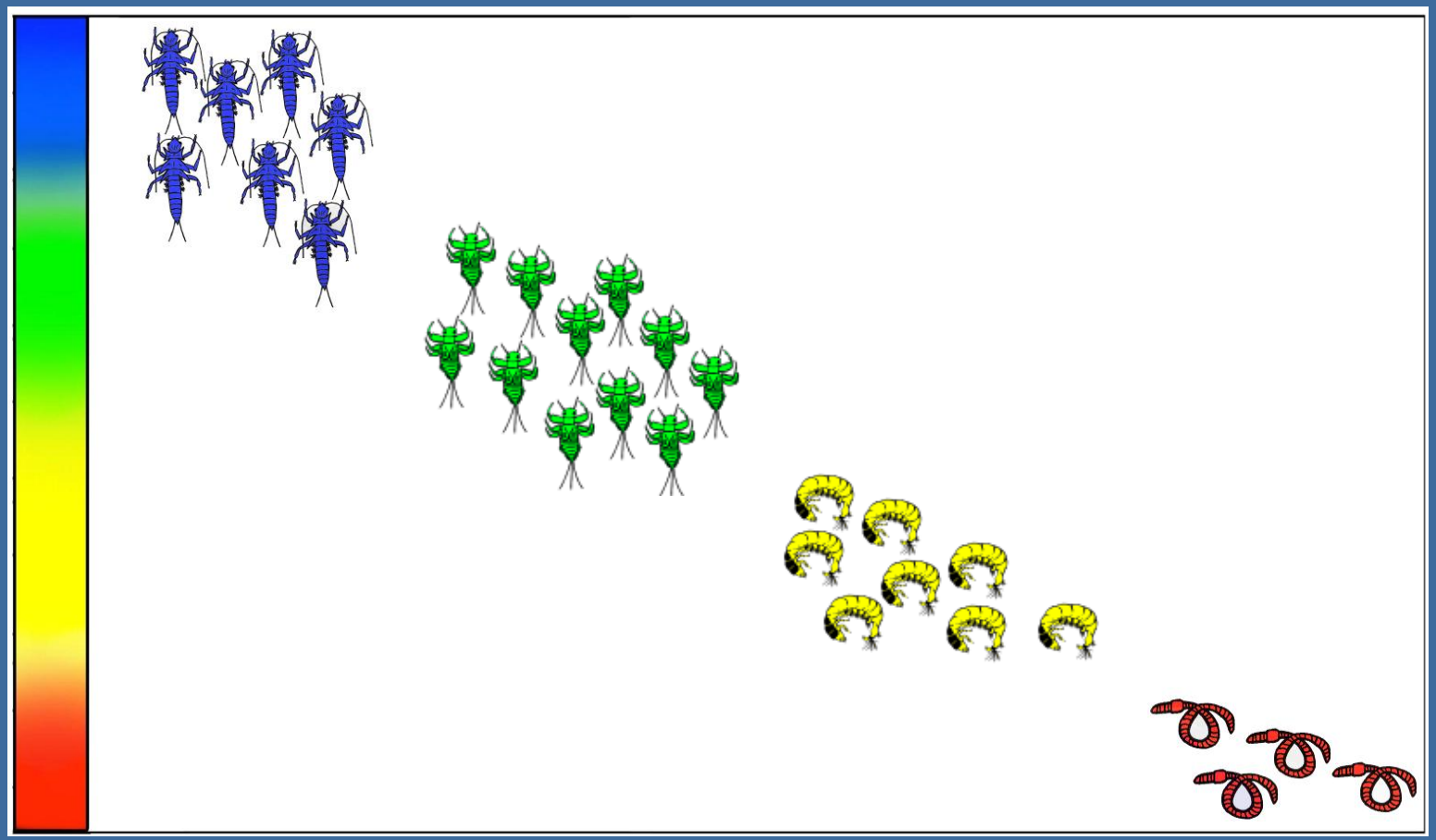
German scientists developed a Saprobien system based on the observation that organisms change in a river downstream of a sewage plant



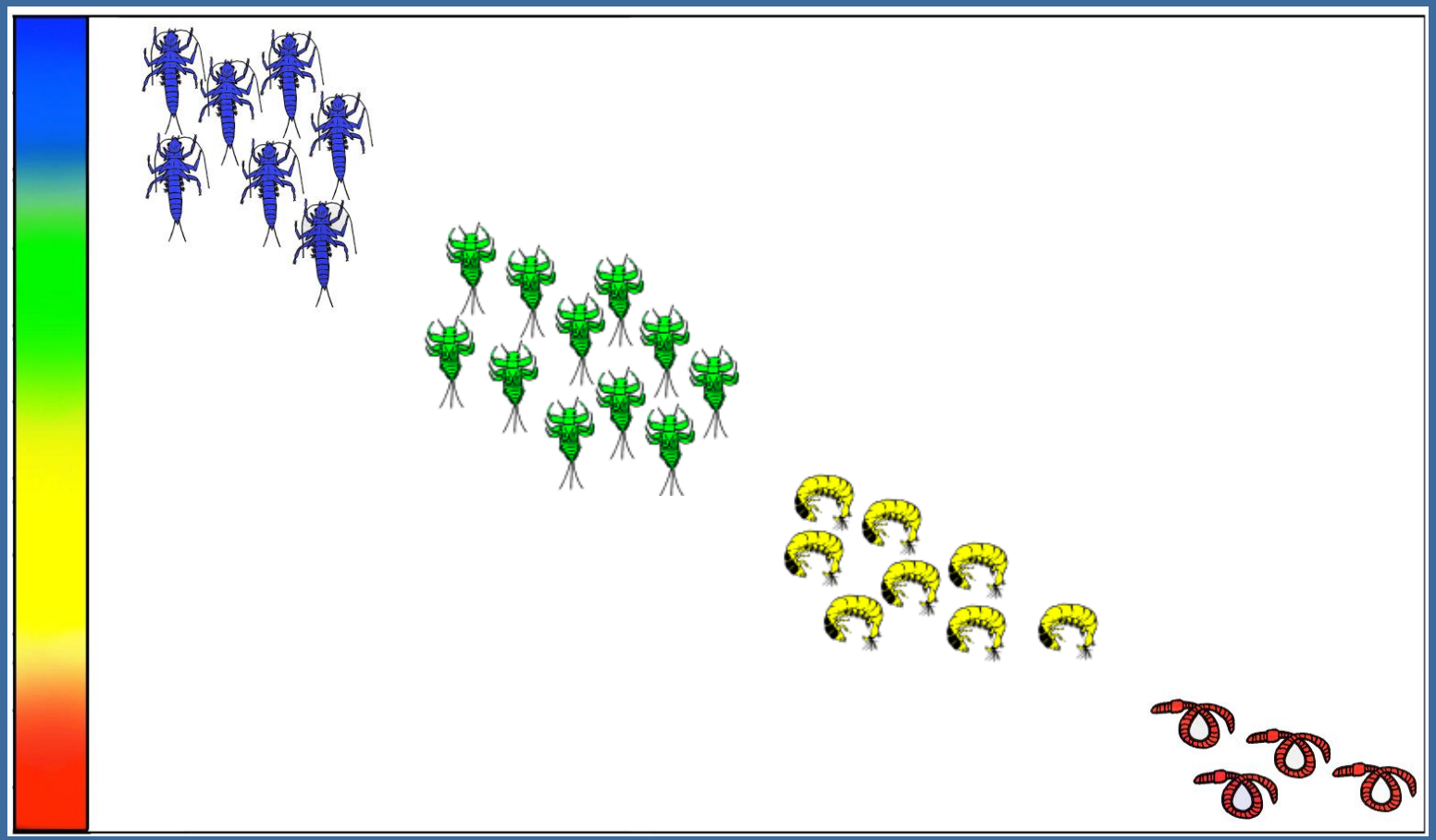
Biological Condition Gradient



Biological Condition Gradient



Stream Assessments Using Aquatic Macroinvertebrates



What is a Macroinvertebrate?

Macro = Can be seen with naked eye

Invertebrate = Animals without a backbone

Common Macroinvertebrates

GOOD	BAD	UGLY
Shrimp	Mosquitos	Horseshoe Crab
Crabs	House fly	Scorpion
Lobsters	Ants	

Common Aquatic Macroinvertebrates

Class Insecta

- Mayflies **E**phemeroptera
- Stoneflies **P**lecoptera
- Caddisflies **T**richoptera
- Dobsonflies and Alderflies Megaloptera
- True Flies Diptera
- Beetles Coleoptera

Aquatic Macroinvertebrates and Water Quality

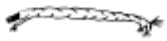
- Live in wide range of water quality
- Characteristic responses to environmental stresses
- Established collection methodologies
- Ease of capture
- Rapid recovery from repeat sampling
- Life history/Limited mobility

Today's Assessments- Data Sheet

	6A	6 B	7	8A	8 B
MOST	Saddle-Case caddis Glossosoma	Cornucopia Case caddis Apatania	Michelin Man caddis Rhyacophila	Mid-size plant case caddis Brachycentrus	Lepidostoma
					
Locs 1&2					
Locs 3&4					
Locs 5&6					

DATA INTERPRETATION	
# OF TYPES OF THE "MOST"	WATER QUALITY
5 OR MORE	EXCEPTIONAL
3 TO 4	EXCELLENT
1 TO 3	VERY GOOD
0	MORE INFO NEEDED TO ASSESS

	9	10	11	12	13 A	13 B	14
MODERATE	Common net-spinner Hydropsychidae	Fingernet Caddis Chimarra	Flat Head mayfly Stenonema	Water Penny Psephenus	Dobsonfly Corydalus	Fishfly Nigronia	Dragonfly & Damselfly Odonata
							
Locs 1&2							
Locs 3&4							
Locs 5&6							

	15 A	15 B	15 C	15 D	15 E	15 F	15 G
LEAST	Amphipod	Isopod	Leech	Midge	Black fly	Snail	Worm
							
Locs 1&2							
Locs 3&4							
Locs 5&6							

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Today's Assessments-Most Wanted

ROACH-LIKE STONEFLY

Family Peltoperlidae
Order Plecoptera

Ecological Information
Tolerance Value = 0
Feeding Group = Shredder

Key features to look for:

- ☐ Tear-drop body shape.
- ☐ Uniformly shinny brown exoskeleton.
- ☐ 2 tails at the end of the abdomen.
- ☐ Two sets of wing pads.
- ☐ No gills on the sides of the abdomen.
- ☐ No larger than 1/2 inch.

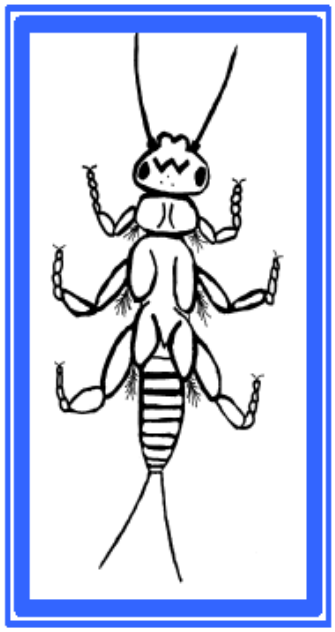
Key behaviors to look for:

- ☐ This stonefly nymph is commonly found crawling in and amongst leaf packs in riffle areas.
- ☐ Peel apart leaves, look for these stoneflies crawling around.
- ☐ May occasionally try to swim by moving side to side.

COMMON STONEFLY

Family Perlidae
Order Plecoptera

Ecological Information
Tolerance Value = 1
Feeding Group = Predator



Key features to look for:

- ☐ Large active organism (up to 1.25 inches).
- ☐ Flat body with obvious legs.
- ☐ Dark body with or without pattern.
- ☐ 2 tails at the end of the abdomen.
- ☐ Two sets of wing pads.
- ☐ Gill tufts at the base of each leg.

Key behaviors to look for:

- ☐ Very active crawler, highly mobile.
- ☐ May hide on like colored objects in the tray.
- ☐ May be observed doing "push-ups" in the tray.

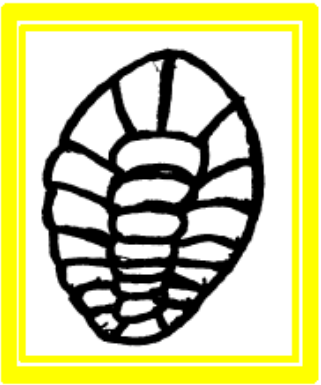
Points of Note:
When present in a sample, this organism will crawl out of the debris in the net. It is very active and extremely hard to miss. Often different sizes can extremely hard to miss. Often different sizes can be collected at the same site. For the smaller versions be sure to check the key characteristics.
Some of the darker versions of perlidae can be confused for a giant stonefly.

Today's Assessments-Moderately Wanted

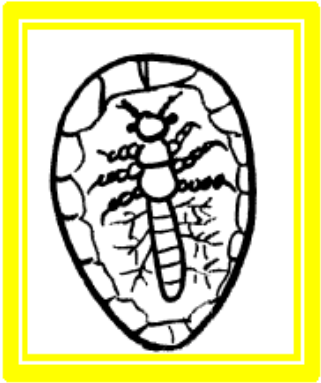
WATER PENNY BEETLE LARVA

Genus *Psephenus*
Family Psephenidae
Order Coleoptera

Top view



Bottom view



Ecological Information

Tolerance Value = 4
Feeding Group = Scraper

Key features to look for:

- ☐ Small disc shape organism.
- ☐ Very flat.
- ☐ Uniformly brown.
- ☐ No visible head or legs from top view.

Key behaviors to look for:

- ☐ Sticks very well to rocks.
- ☐ Glides along the bottom of the tray.
- ☐ May curl up when disturbed
- ☐ Very cryptic.

Points of Note:

Water penny beetle larva are very distinctive. They can also be very hard to locate in the field. Look very closely at the surfaces of rocks. Water penny beetle larva will adhere extremely close to the surface. These organisms can be locally abundant when conditions are appropriate.

COMMON NET-SPINNER

Family Hydropsychidae
Order Trichoptera

Ecological Information

Tolerance Value = 4
Feeding Group = Collector-filterer

Key features to look for:

- ☐ Worm-like body.
- ☐ Dark colored sometimes greenish body.
- ☐ Two paint brush-like tails at the end of the abdomen.
- ☐ Fluffy gills on the underside of the abdomen.
- ☐ Dirty or hairy appearance (sometimes).
- ☐ Two hooks at the end of the abdomen.
- ☐ Dark plate above each pair of legs.

Key behaviors to look for:

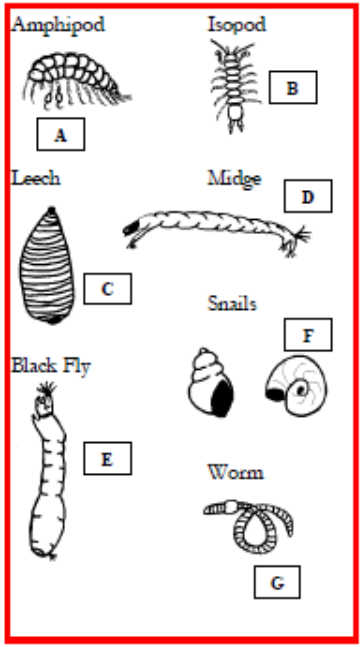
- ☐ Extremely active, wiggles violently back and forth.
- ☐ Gregarious, will form clumps of 2-4 in the tray.
- ☐ **MAY CLING STRONGLY TO THE NET**

Points of Note:

This is probably one of the most common organisms encountered during benthic sampling. These can be extremely abundant under appropriate conditions. Because some are greenish in color they may be confused as *Rhyacophila*. Hydropsychidae have a dark plate above each pair of legs and fluffy gills on the underside of the abdomen, *Rhyacophila* do not. The tiny filtering nets of this organism can be observed on and between substrate.

Today's Assessments-Least Wanted

Scuds, Aquatic Sowbugs, Leech, Midge, Black Fly, Snail, and Worm.



Ecological Information

Tolerance Values =		Feeding groups =
Amphipod (scud)	8	Collector-gatherer
Isopod (sowbug)	8	Collector-gatherer
Leech	8	Predator
Midge	7	Collector-gatherer
Black fly	6	Collector-filterer
Snail	7	Scraper
Worm	9	Collector-gatherer

Key features to look for:

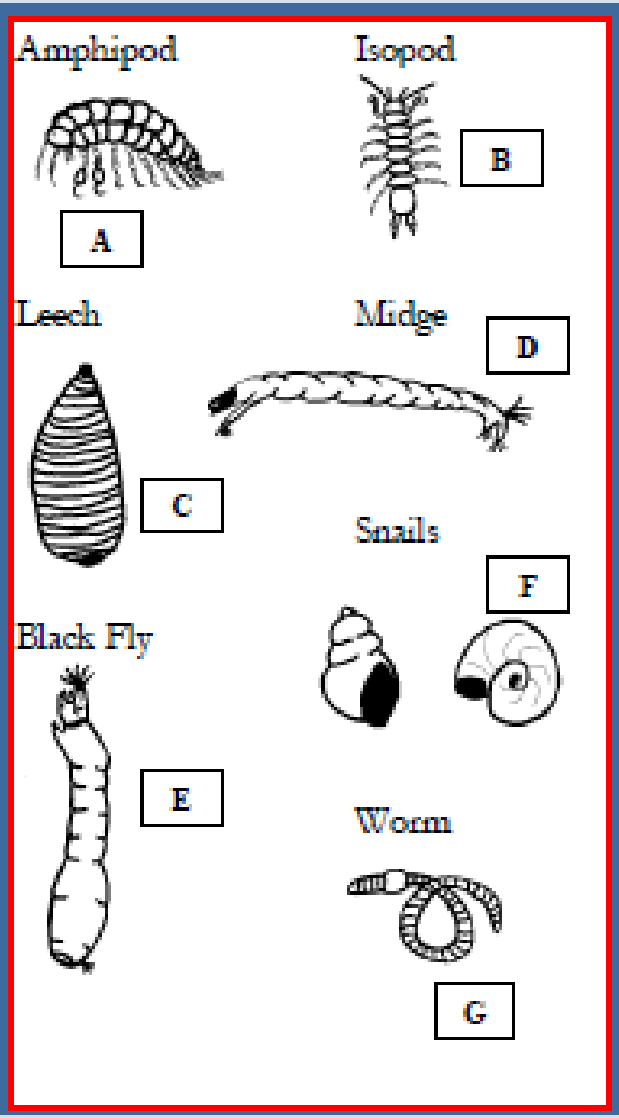
- Number of legs
- General body form
- Presence/absence of a true shell

Key behaviors to look for:

- Amphipods swim on their sides very fast
- Isopods crawl slowly amongst the debris.
- Leeches will stick to the bottom of tray and move like inch-worms.
- Midges swim by violent side to side wiggling. Some midge larvae may be bright red in color.
- Black flies will attach to the bottom of the tray and move like inch-worms.

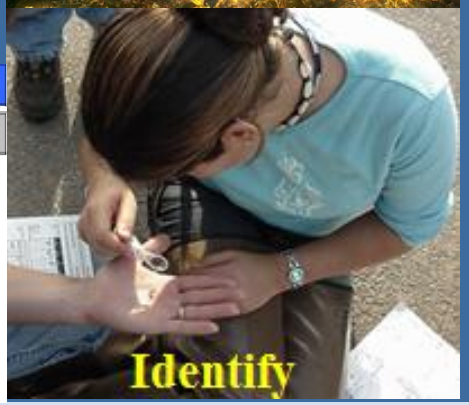
Points of Note:
Look carefully for midge and black fly larvae, they are extremely small.

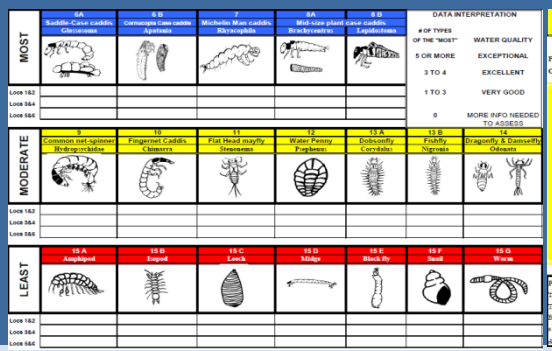
LEAST WANTED

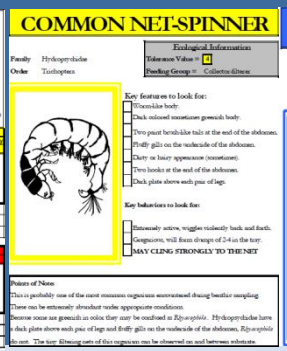


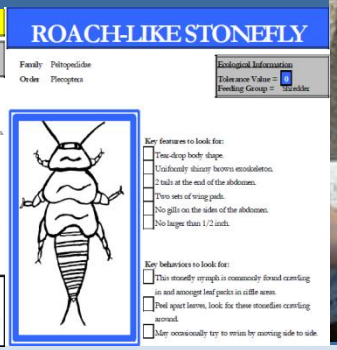
Process Overview

- ✓Site selection (set up) - done
- ✓Collect (scrub & kick) - done
- Process (observe & sort)
- Identify
- Record on Data Sheet
- Make Stream Health Assessment

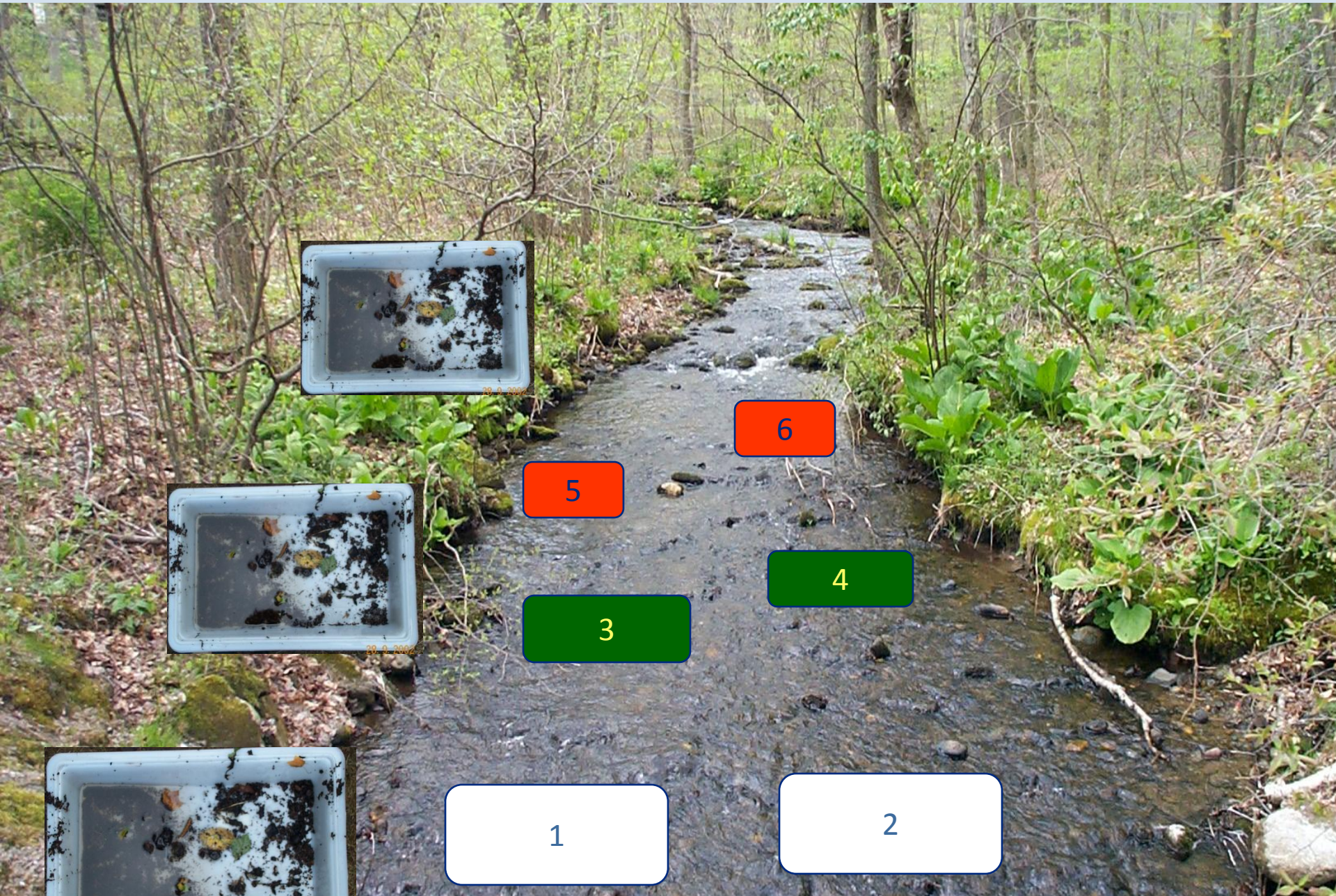






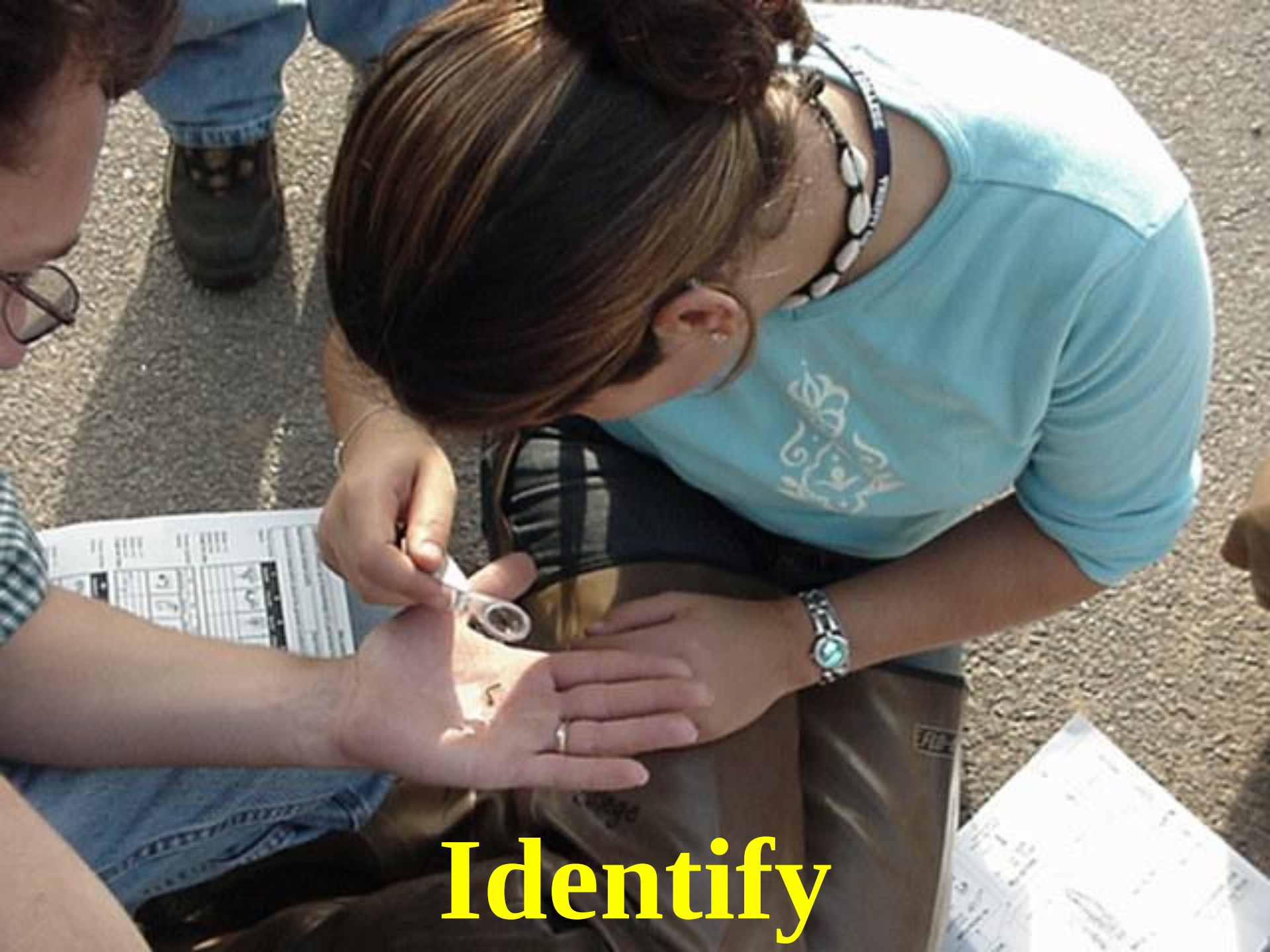


Sample Collection



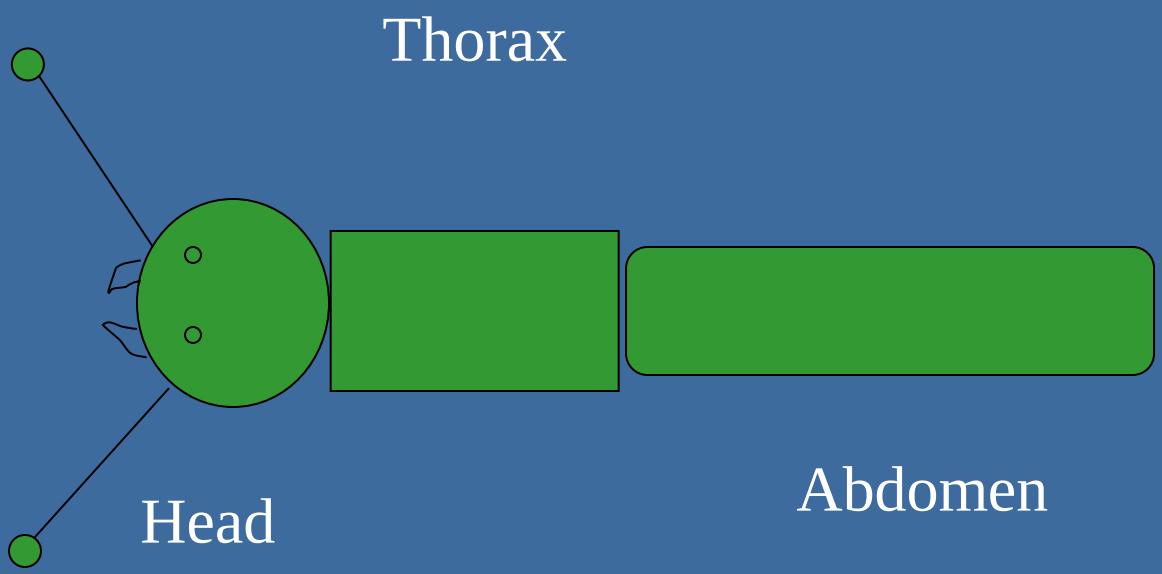
Pick out large debris from each tray and sort similar organisms into ice cube tray

Processing is complete when you have found as many of the different types as possible and put representatives of each type into the ice cube trays

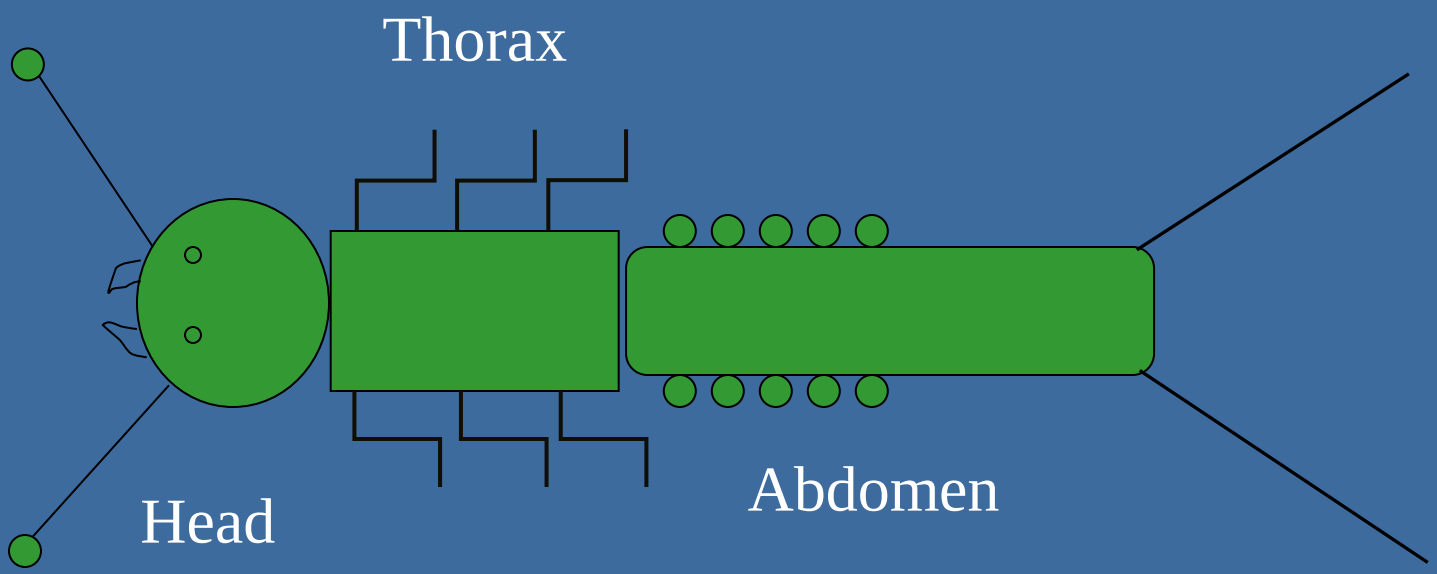


Identify

Macroinvertebrate Parts



Macroinvertebrate Parts



Rapid Bioassessment for Volunteers Kick Sample

Note: This chart is for preliminary sorting purposes when implementing RAPID BIOASSESSMENT FOR VOLUNTEER MONITORS. This chart is not intended to produce definitive identification of aquatic macroinvertebrates. It was designed to complement a series of field identification cards and the RBV data sheet. Additional information about the RBV program is available at http://dep.state.ct.us/wtr/volunmon/volopp.htm or by contacting Mike Beauchene at (860-424-4185) mike.Beauchene@po.state.ct.us

*Drawings represent the approximate maximum size of each organism.

Is the Organism Wide or Flat & Have Medium to Large Legs?

3 Long Thin Tails

Panel 1: Drunella (Mayfly)

Panel 2: Isonychia (Mayfly)

Panel 11: Stenonema (Mayfly)

Panel 14: Odonata (Damselfly)

2 Long Thin Tails

Panel 3: Epeorus (Mayfly)

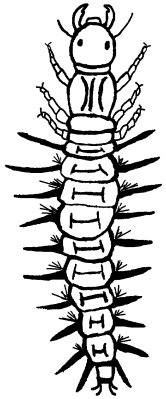
Panel 4: Peltoperlidae (Stonefly)

Panel 5A: Perlidae (Stonefly)

Panel 5B: Pteronarycs (Stonefly)

Panel 5C: Misc. Stoneflies

0 Long Thin Tails



Panel 14: Odonata (Dragonfly)

Panel 13B: Nigronia (Fishfly)

Panel 15A: Amphipod

Panel 13A: Corydalus (Dobsonfly)

Panel 15B: Isopod

Is the organism Round or Cylindrical & Have Small or No Legs?

Hidden Legs

Panel 12: Psephenus (Water Penny Beetle)

With Legs

Builds a Shelter/Case

Panel 6A: Glossosoma (Caddisfly)

Panel 6B: Apatania (Caddisfly)

Panel 8A Brachycentrus (Caddisfly)

Panel 8B Lepidostoma (Caddisfly)

No Shelter/Case

Panel 7: Rhyacophia (Caddisfly)

Panel 9: Hydropsychidae (Caddisfly)

Panel 10: Chimarra (Caddisfly)

Without Legs

Panel 15C: Leech

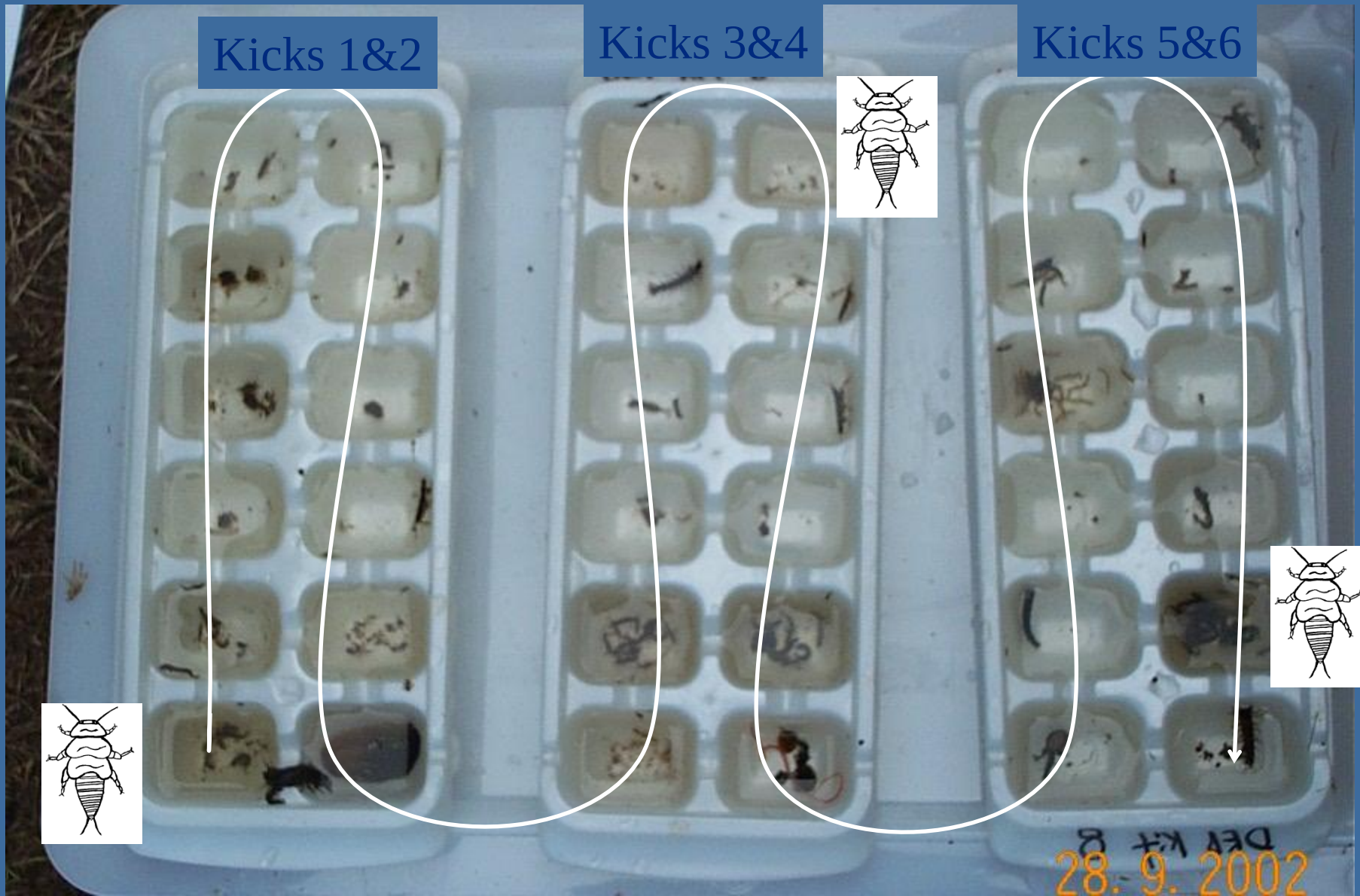
Panel 15D: Midge Larva

Panel 15E: Black Fly Larva

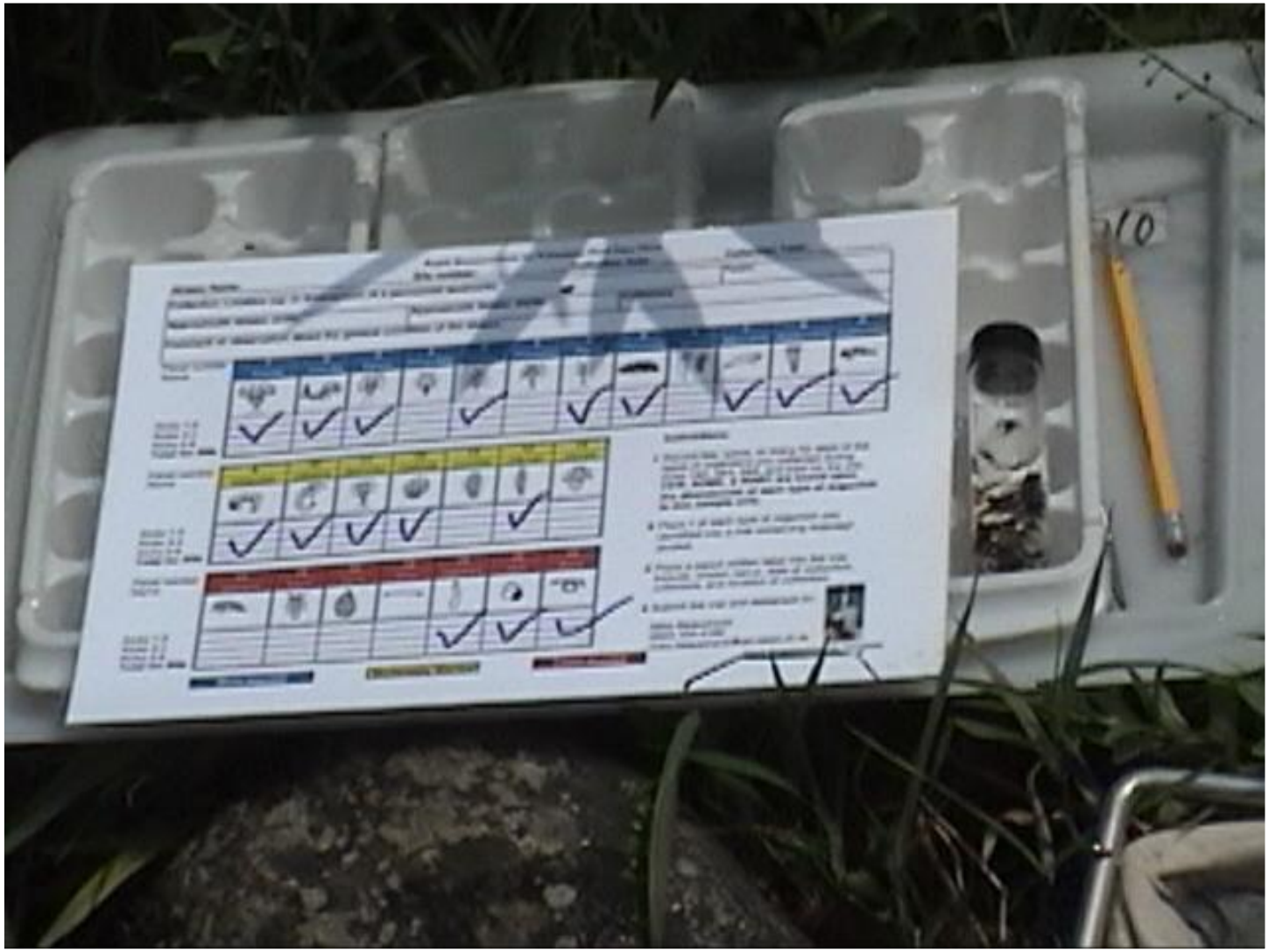
Panel 15F: Snail

Panel 15G: Worm

Start with the one ice cube well and weave your way through



The Bottom Line - Stream Health Assessment



Yes, You Can Do This !!

Connecticut Department of Energy and Environmental Protection



Break Into Teams



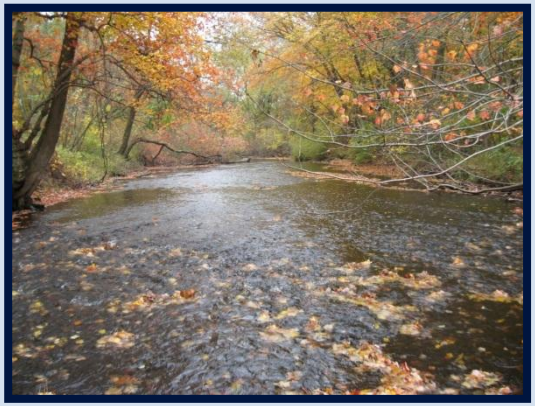
Each Team Will Get

- ✓ Macroinvertebrate Sample
- ✓ Sorting Trays
- ✓ Ice Cubes Trays
- ✓ Tweezers
- ✓ Identification Key
- ✓ Data Sheets

Assessment Process

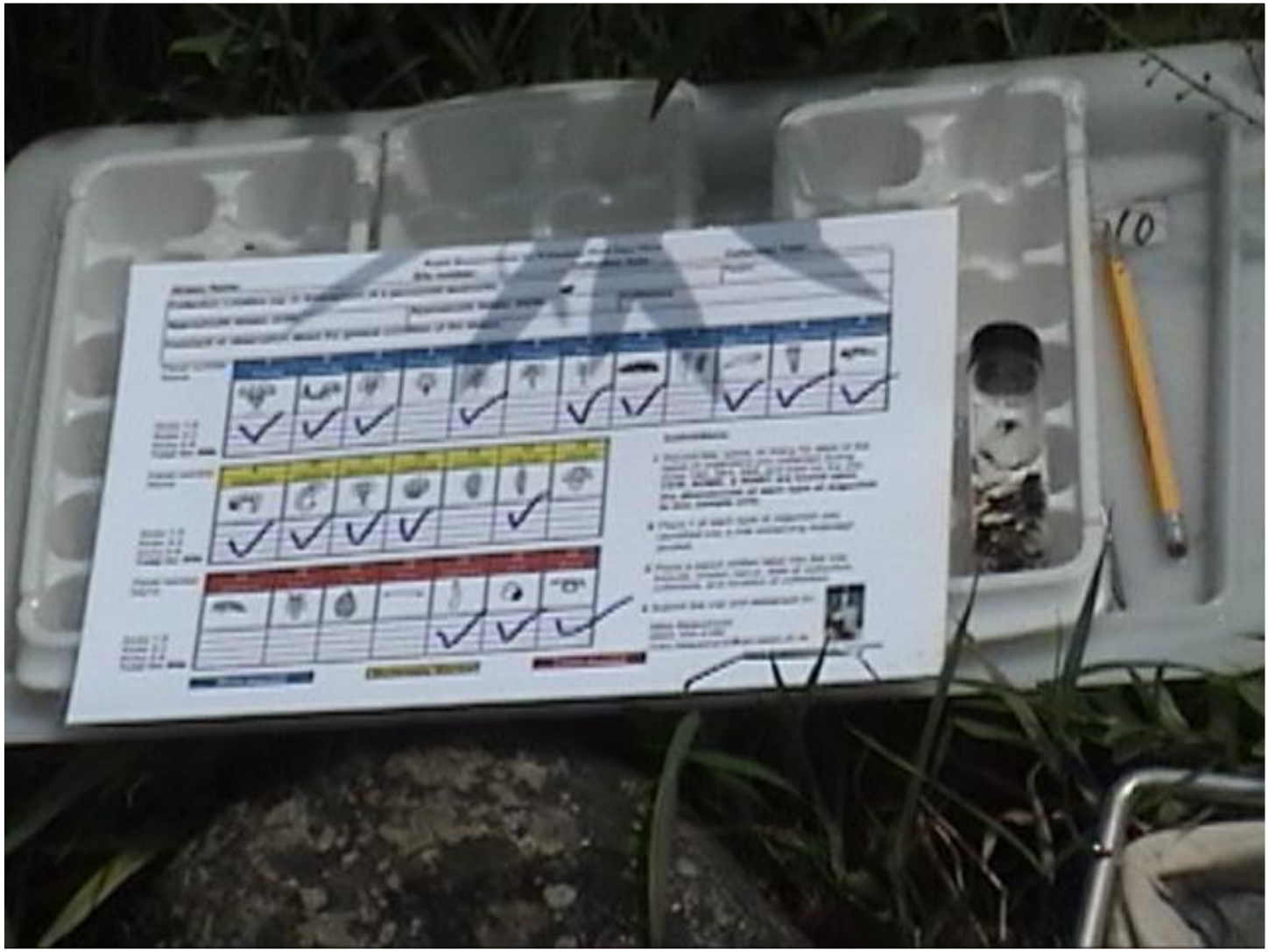
- ✓ Pick out large debris from each tray
- ✓ Sort like organisms into ice cube trays
- ✓ Use keys to identify organisms
- ✓ Check off findings of Most Wanted, Moderately Wanted, and Least Wanted on Data Sheet

Part 3
Group Stream Assessment


November 8 and November 14, 2012
Presented by Chris Bellucci, Supervising Environmental Analyst
Sessions Woods Wildlife Management Area
Burlington, Connecticut

The Bottom Line - Stream Health Assessment

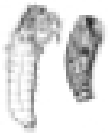


Group Assessment

MOST

1	2	3	4	5A	5 B	5 C
Body builder mayfly	Minnow mayfly	3-tailed flat head mayfly	Roach-like stonefly	Common stonefly	Giant stonefly	Misc
Drunella	Isonychia	Epeorus	Peltoperlidae	Perlidae	Pteronarcys	Stonefly
						
Loca 1&2							
Loca 3&4							
Loca 5&6							

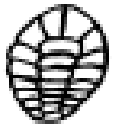
MOST

6A	6 B	7	8A	8 B
Saddle-Case caddis	Cornucopia Case caddis	Michelin Man caddis	Mid-size plant case caddis	
Glossosoma	Apatania	Rhyacophila	Brachycentrus	Lepidostoma
				
Loca 1&2					
Loca 3&4					
Loca 5&6					

DATA INTERPRETATION

# OF TYPES OF THE "MOST"	WATER QUALITY
5 OR MORE	EXCEPTIONAL
3 TO 4	EXCELLENT
1 TO 3	VERY GOOD
0	MORE INFO NEEDED TO ASSESS

MODERATE

9	10	11	12	13 A	13 B	14
Common net-spinner	Fingernet Caddis	Flat Head mayfly	Water Penny	Dobsonfly	Fishfly	Dragonfly & Damselfly
Hydropsychidae	Chimarra	Stenonema	Psephenus	Corydalus	Nigronia	Odonata
						
Loca 1&2							
Loca 3&4							
Loca 5&6							

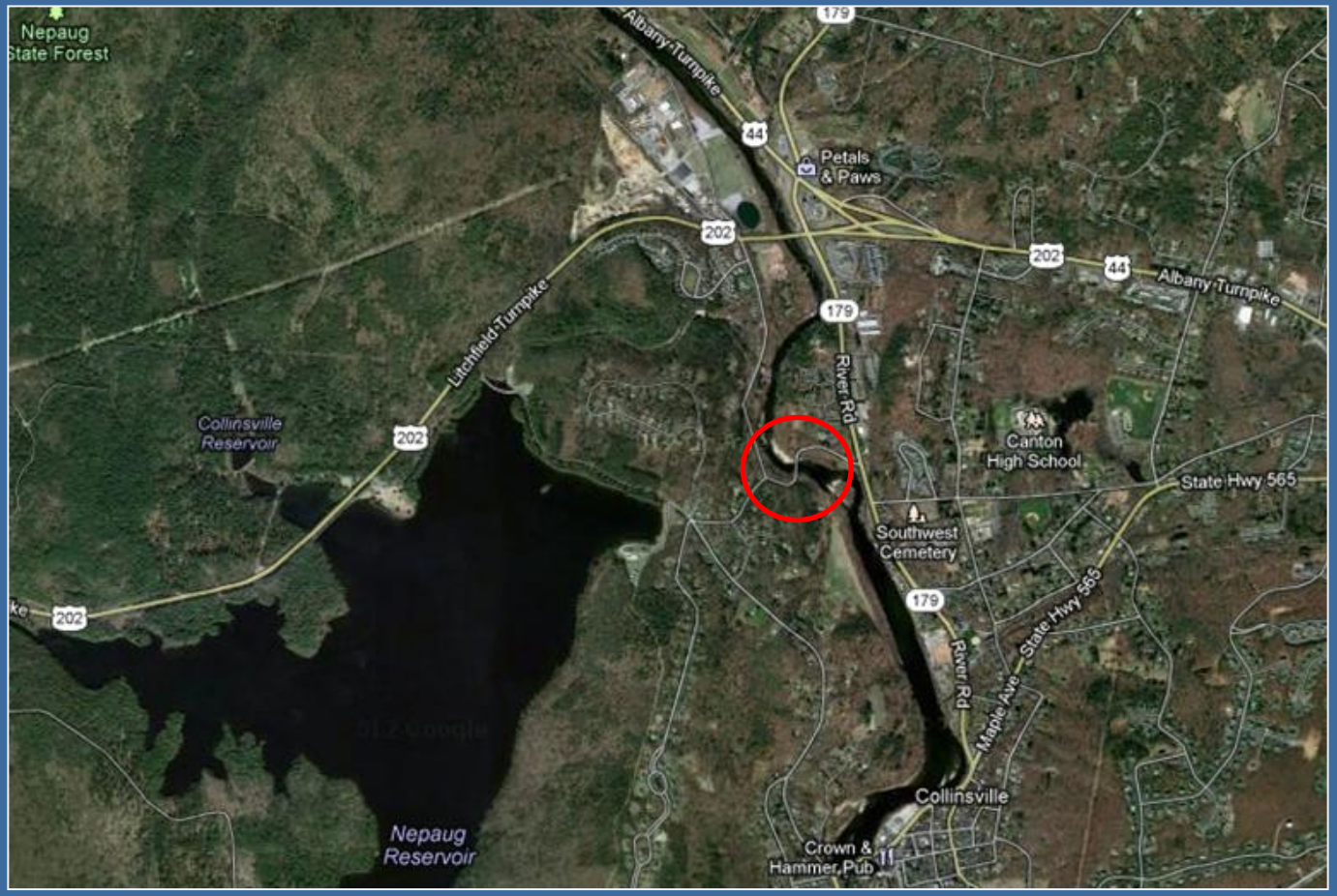
LEAST

15 A	15 B	15 C	15 D	15 E	15 F	15 G
Amphipod	Isoped	Leech	Midge	Black fly	Snail	Worm
						
Loca 1&2							
Loca 3&4							
Loca 5&6							

Stream Assessment

The Stream

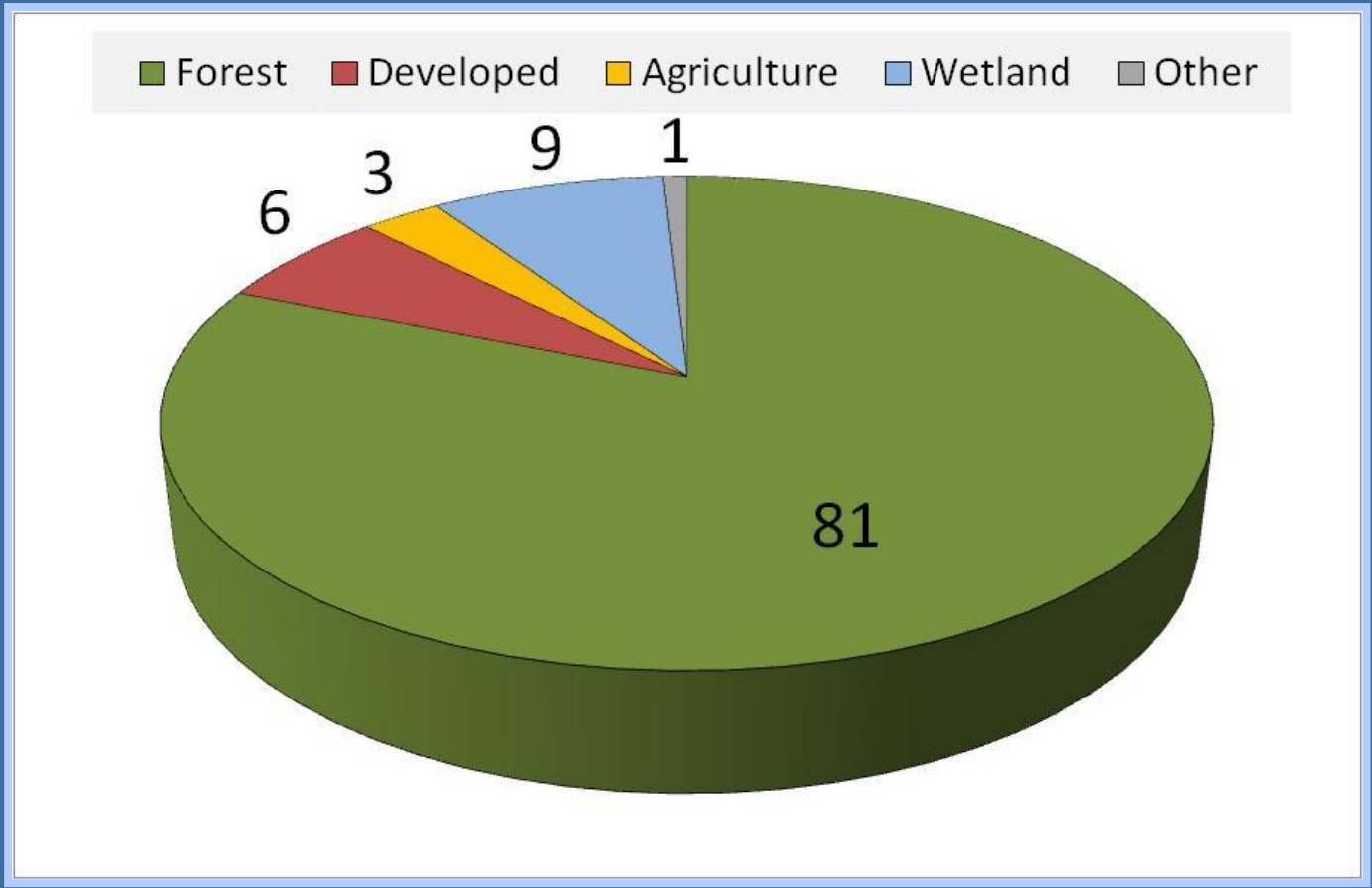
Farmington River at Town Bridge Road, Canton, CT



The Stream

Farmington River at Town Bridge Road, Canton, CT

Watershed Area = 354 square miles



The Stream

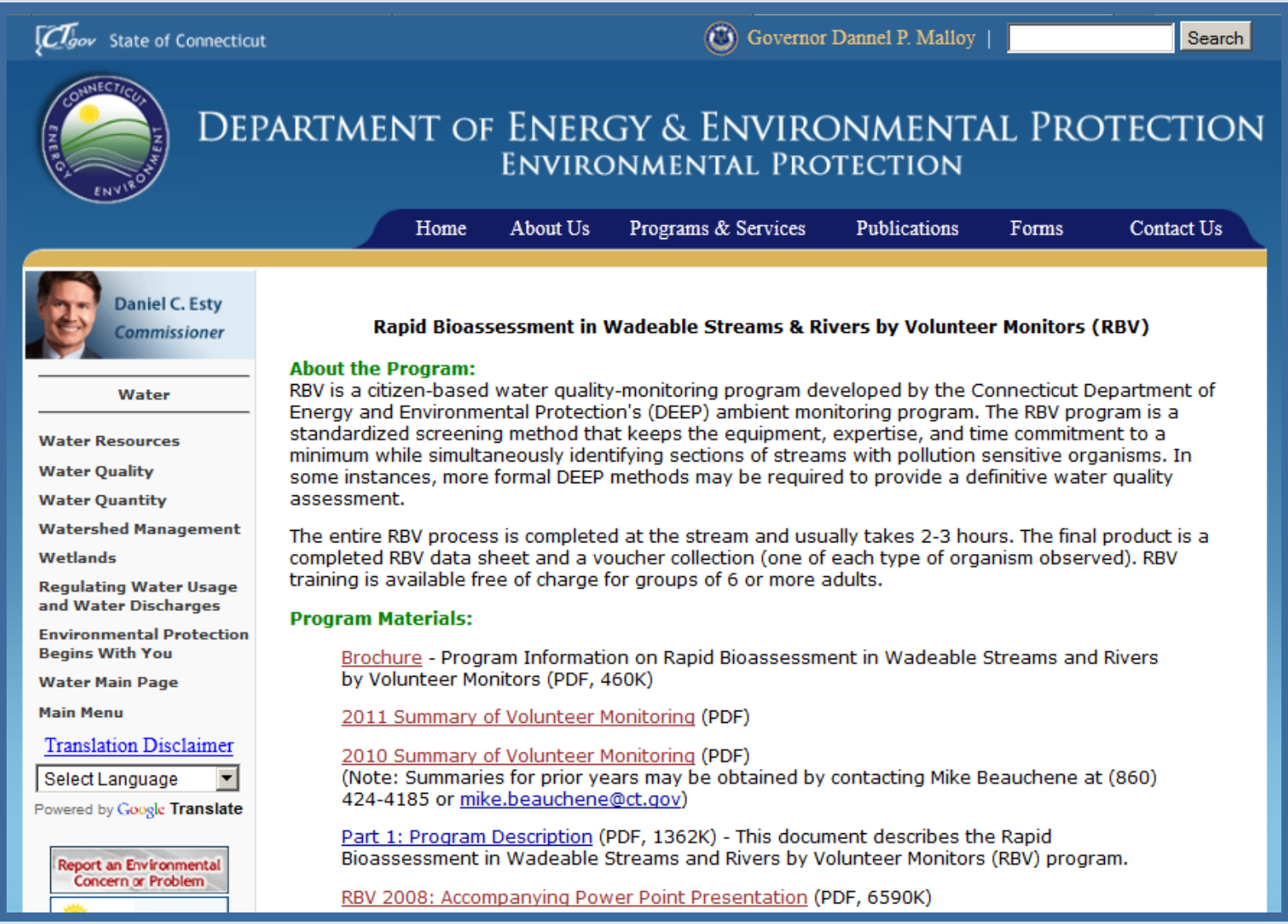
Farmington River at Town Bridge Road, Canton, CT

Watershed Area = 354 square miles

Upstream

Downstream

Volunteer Monitoring Program



Connecticut Department of Energy and Environmental Protection

Questions/Comments

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