Environmental and Natural Resources

Water Analysis Scorecard-

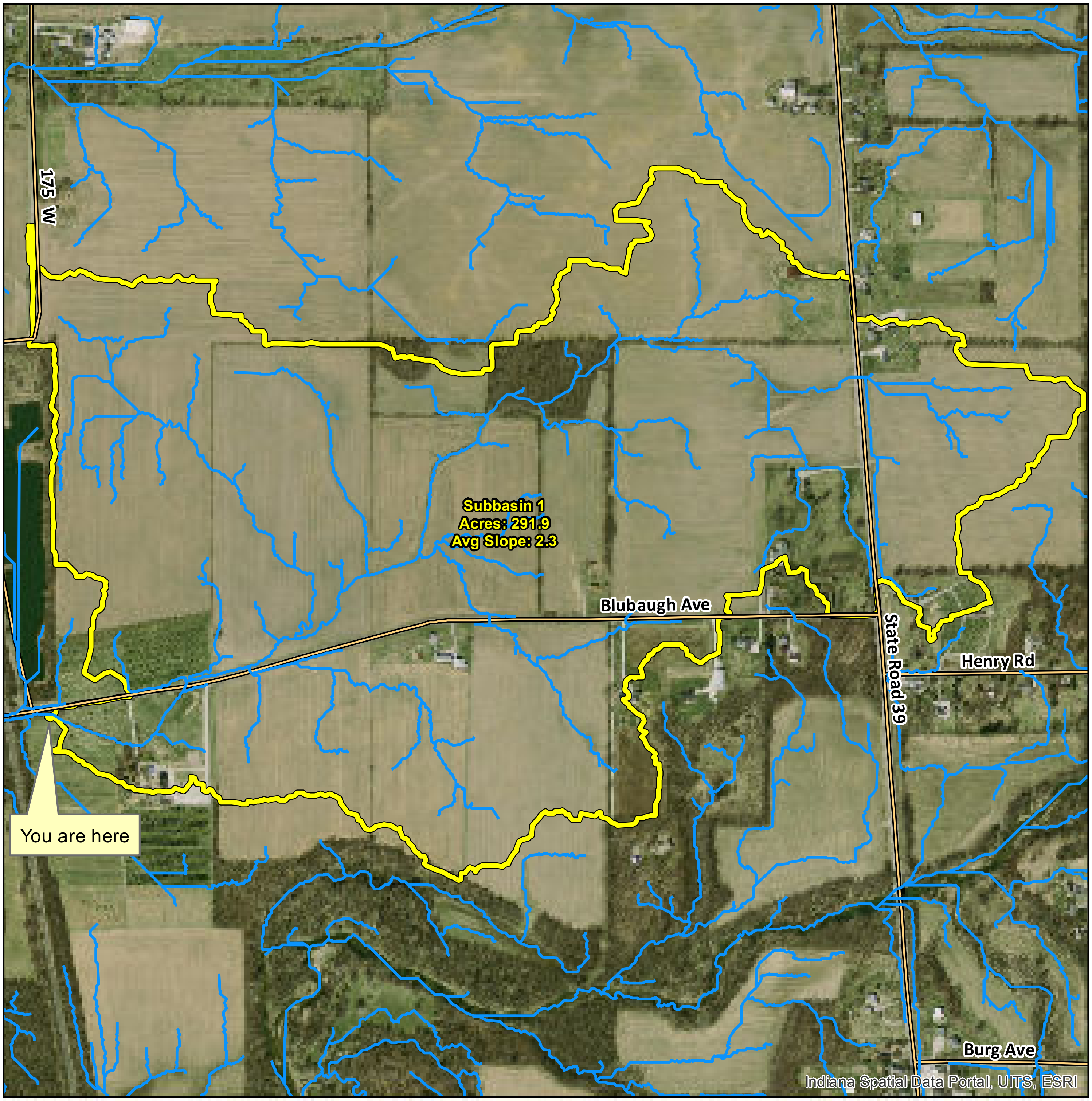
1. How many Acres are in the watershed for the stream point we are sampling today?
   A. 2.3
   B. 29.19
   C. 20
   D. 291.9
   E. 150
2. What is the main land use by volume of acres in the watershed?
   A. Tree Farm
   B. Row Crop
   C. Housing Additions
   D. Forest
   E. Pumpkin Patch
3. Of the options below which of these is NOT a potential point source pollutant in this watershed?
   A. Septic system outflow
   B. Lawn fertilizer run off
   C. Dumping an oil change pan into the creek
   D. Sub surface drainage tile outlet
   E. Fertilizer tank spill
4. Of the options below which of these is NOT a potential Non-Point source pollutant in this watershed?
   A. Animal Waste Pond Storage leak into creek
   B. Fertilizer runoff from the row crops
   C. Oil coming from the parking lot
   D. Lawn fertilizer runoff
   E. Herbicide runoff from row crop fields
5. Select a type of land use in this watershed that would contribute to lower water temperatures in the stream.
   A. Row Crop Farming
   B. Parking Lots
   C. Forest/Timber production
   D. Grazing
   E. Roads
6. What land use in this watershed would NOT contribute to high E.coli counts in our water sample from the creek?
   A. Non grazed forest land
   B. Row crop fertilized with manure
   C. Failing septic systems
   D. Over grazed pasture with animals in creek
   E. Animal Waste Storage Pond

7. Of the water quality analysis test below which one cannot be taken on site?
    A. Nitrites
    B. Nitrates
    C. E.Coli
    D. pH
    E. Temperature
8. What is the major land use at the outlet of the watershed for the stream we are testing?
    A. Row crop
    B. Pasture
    C. Housing addition
    D. Christmas Tree Farm
    E. Drive in Movie Theatre
9. Of the water quality analysis test below which one can be taken on site?
    A. E.Coli
    B. Nitrate
    C. Temperature change over time
    D. Biochemical Oxygen Demand
    E. Heavy Metals
10. If the Fish in the stream all die what would be the one limiting factor that could cause that.
    A. Food
    B. Turbidity
    C. Temperature
    D. Low Dissolved Oxygen
    E. Too many big fish
11. What would be the most likely number one contributing factor to poor water quality in the watershed?
    A. Sediment from runoff
    B. Oil from parking lots
    C. Nutrients from animal waste
    D. Nutrients from failing septic tanks
    E. Fertilizer from Christmas tree farm

We could use the final four questions to put in the water test example knowing what the approximate samples would be in that range? Or We could come up with an additional 4 more questions?

What is the sample Temperature?

A. 69
B. 70
C. 71
D. 72
E. 73



1 inch = 773 feet

Stream Drainage Area= 291.9 Acres
Watershed Slope= 2.3%

Legend

Stream Drainage Area

2017_FFA_Streams

USDA United States Department of Agriculture

TREE FARM
Stream Watershed

Boone Co. SWCD, Indiana

Section _____, T _____, R _____

	Date
Designed ______________	____
Drawn ________________	____
Checked ______________	____
Approved _____________	____
Title ________________________	

Sheet ___ of ___

Appendix D -
Chemistry Ranges, Averages and Q-Values

Chapter 4 listed values representing the likely ranges into which your chemical data results may fall. These ranges were taken from the 2012 Monitoring Water In Indiana: Choices for Nonpoint Source and Other Watershed Projects or also known as the Environmental Indicators Manual. This manual can be accessed at, **https://engineering.purdue.edu/watersheds/monitoring/MonitoringWaterinIndiana.2012.1.pdf.** Data from existing monitoring sites in Indiana have been compiled to provide a range. These ranges are provided to help you have a better idea of what if found in Indiana streams and lakes. This section relied on IDEM Fixed Station Data, compiled by IDEM staff or at Purdue University. In addition, the Indiana water quality standards for rivers are included for each applicable parameter.

Typical range for DO = 1.2 to 22.3 mg/L

Game fish require more than 5ppm

Indiana Average = 9.6 mg/L

State Water Quality Standard:
4.0 mg/L - 12.0 mg/L

Min: 6.0 mg/L in coldwater fishery streams

Min: 7.0 mg/L in spawning area of coldwater fishery streams

The maximum temperature rise at any time or place above natural temperatures shall not exceed State Water Quality Standard:

< 5° F (approximatively 2.8° C)

< 2° F (approximatively 1.1° C) for trout streams

Typical range for E. coli =
2 to 1,204 K colonies/100mL

Indiana Average = 210 colonies/100mL

State Water Quality Standard for total body contact recreation: <235 colonies/100 mL (single sample),
AND
< 125 colonies/100 mL (Geometric mean of 5 samples equally spaced over 30 days)

Typical range for NITRATE (NO_3) = 0 to 36.08 mg/L

Indiana Average = 12.32 mg/L

EPA recommends 1.5 mg/L as the dividing line between mesoeutrophic and eutrophic streams.

Average= 2.9mg/L Above 1 indicates humane influence

Typical range for pH = 7.2 to 8.8

Good for IN ponds is 7.5-9.0

Indiana Average = 8.0

State Standard = between 6 - 9

Due to the state's limestone geology, Indiana surface waters will typically have a pH that is relatively basic (> 7).

Typical range for Turbidity:
0 to 2150 NTU

Indiana Average = 15 NTU

U.S. EPA recommends 10.4 NTU

Typical range for BOD_5 =
0.4 to 33 mg/L

Indiana Average = 2 mg/L

There are no state water quality standards for Orthophosphate.
Total Phosphate typical range:
(0 to 0.85 mg/L) and average (0.05 mg/L).

We generally expect orthophosphate to be less than total phosphate, since orthophosphate is but one component of total phosphate.

Chapter 4 -
Chemical Monitoring

Chemical Parameters

Many types of chemical tests can be performed to assess varying aspects of stream water quality. However, volunteer monitoring programs are faced with both financial and technical limitations. Given these constraints, Hoosier Riverwatch trains volunteers to conduct eight of the chemical parameters considered by the National Sanitation Foundation to be most useful in determining stream water quality (as well as a few additional tests):

Dissolved Oxygen	***E. coli* and Coliform Bacteria**
pH	**Water Temperature Change**
Biochemical Oxygen Demand	**Nitrate and Nitrite**
Orthophosphate	**Transparency/Turbidity**

Riverwatch Chemical Testing Instructions

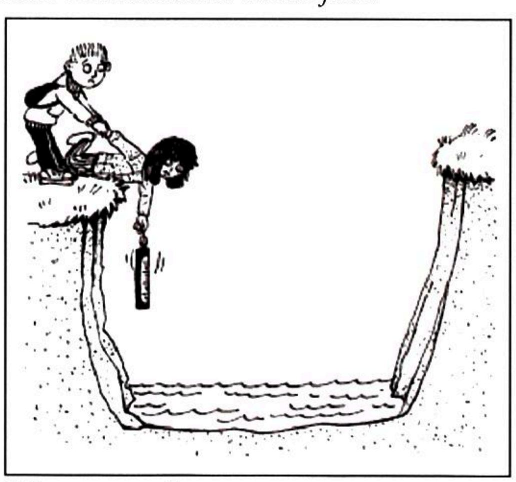
Hoosier Riverwatch does not require volunteers to use a standard set of equipment or methods for chemical testing. However, the majority of volunteer groups actively participating in the program have received equipment through the Riverwatch Equipment Application program. The chemical testing instructions provided are for the most common methods used by volunteer stream monitoring groups in Indiana. They are also the methods presented during Hoosier Riverwatch training sessions.

Tips on Collecting Water Samples

How you physically obtain the water sample depends on the size, depth, and banks of your stream. MostHoosier Riverwatch volunteers sample wadeable streams. If you are wading, make sure that you collect waterfrom a point upstream of where you are standing, being careful not to stir up any sediment. The sample mustbe collected in a clean container to avoid contamination. Collecting water directly from the stream with thecontainer used for the chemical test is preferred. Lower your container down 3 to 5 inches below the surfaceof the water (or until your wrist is completely submerged) so that your sample is representative of the wholestream. Be sure to rinse your collection container three times with sample water before collecting your finalsample.

Deep water or steep banks are dangerous (Figure 15). Depending upon conditions at your site, you may needto use alternative sampling techniques. If you have a bridge at the site, you may be able to lower a samplingcontainer or bucket down to the stream. When sampling with a bucket and line, it is helpful to have a small (~6 oz.) weight fastened to the rim of the bucket to tip it over. At some sites, you may be able to sample with anextension rod or cup on a stick (see Appendix A) from the edge of the stream. Regardless of the method ofcollection, sample water should be collected from the *main stream flow*.

Figure 15



What not to do

Images from GLOBE 1997

Hints For Performing Chemical Tests

- Practice! The more familiar you are with the tests, the easier they will be to perform, and the more accurate your results will be.
- Do not store chemical testing kits in your car, in direct sunlight, or in any extreme temperatures.The chemical reagents will degrade.
- Perform each test multiple times or have another volunteer read the results to assure precision.
- Wear protective gloves and safety goggles. Do not wear sunglasses when reading the test results.
- Rinse testing tubes or bottles with *sample* water before collecting the sample.
- Obtain your water sample from the stream's main stream flow (usually in the middle). Take the sample 3-5 inches under the surface.
- Rinse testing tubes and bottles with *distilled* water after completing each test.
- Wash your hands when you are finished.

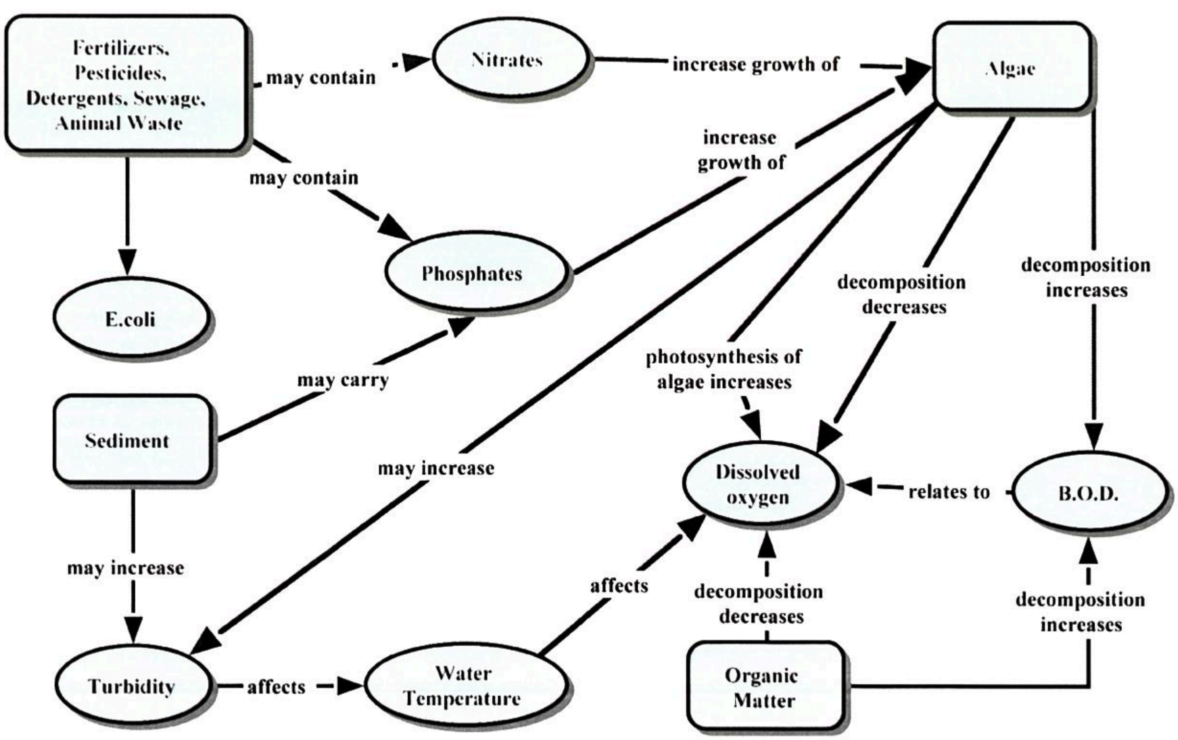
How to Discard Chemical Waste

Label a plastic container with a secure lid (such as a margarine or milk container) with "Chemical Waste". Place liquids and solids in the plastic container along with cat litter. The chemical waste is in a solid form and can be discarded with your regular trash.

Water Monitoring Parameters are Interrelated

Aquatic chemistry is complex and is influenced by many interrelated factors. The simplified concept map below (Figure 16) may help in understanding these relationships in an aquatic environment. The rectangles represent watershed inputs into a river or stream, while the circles represent chemical parameters we measure to determine water quality.

Figure 16



Units of Measurement and Indices

(Information modified from Rivers Curriculum Guide: Biology)

Parameter	Unit of measurement
Water Temperature Change (1 mile)	°C
Dissolved Oxygen	mg/L and % Saturation
Biochemical Oxygen Demand (BOD)	mg/L
pH	Units
Orthophosphate	mg/L
Nitrate/Nitrite	mg/L
Transparency/Turbidity	cm/in or NTU
E. coli and general coliforms	cfu/100 mL

Units of Concentration (ppm vs mg/L)

What does part per million (ppm) mean? How much are we talking about? The following examples are listed on "Water on the Web" **(http://wow.nrri.umn.edu/wow/under/units.html)** to provide further understanding of these units of concentration. One part-per-million is equal to:

- one inch in 16 miles
- one minute in two years
- one ounce in 32 tons
- one cent in $10,000
- one car in bumper-to-bumper traffic from Cleveland to San Francisco

So, how can it be that one part per million (ppm) of something in water (e.g. dissolved oxygen) is the same as one milligram per liter (mg/L)? It's because a liter of water weighs 1000 grams and a milligram is 1 one thousandth of a gram.This is true for freshwater since the density of freshwater is 1 g/mL (1 g/mL = 10-3 g/103 mL = 10-6, or 1 ppm), but it does not hold for saltwater because density increases with salinity. The units mg/L and ppm are equal in freshwater. They are used interchangeably throughout this chapter.

Index

An index is a rating system that assigns a value to an object or process, or to specific qualities it may possess. Grades are indices of academic achievement; other index examples include movie guides, TV ratings, wind chill factors, and pollen counts. An index easily allows you to observe and quantify fluctuations in river or stream water quality. Using an index ratio over a period of time can indicate whether the water is becoming more polluted or cleaner. The indices used in studying a river or stream offer a mathematical picture that reduces many values having different units to one or two overall numbers.

Chemical Monitoring Water Quality Index: To compare apples and oranges, you must find a unit that is common for both (e.g., apples and oranges are both fruits). The same is true for comparison of water quality parameters. Water quality experts have developed a unit common to all eight water quality tests performed by Hoosier Riverwatchers – it is called a Q-value. Determining overall water quality or comparing the results of different types of tests requires converting results from each of the eight tests to the common Q-value. Each test for water quality has its own Q-value chart and table that facilitates this conversion. Each Q-value chart follows the instructions for each test and is also listed in Appendix C

Chemical Testing Instructions

Background information and instructions were copied or modified with permission from CHEMetrics, Inc., Water Works, Inc., Earth Force-GREEN, and the Student Watershed Research Project/Saturday Academy of Oregon.

Typical Ranges

After each set of test instructions, you will find values representing the likely ranges into which your chemical test results may fall. These ranges were taken from the 2012 Monitoring Water In Indiana: Choices for Nonpoint Source and Other Watershed Projects or also known as the Environmental Indicators Manual. This manual can be accessed at **https://engineering.purdue.edu/watersheds/monitoring/MonitoringWaterinIndiana.2012.1.pdf**. Data from existing monitoring sites in Indiana have been compiled to provide a range. These ranges are provided to help you have a better idea of what if found in Indiana streams and lakes. This section relied on IDEM Fixed Station Data, compiled by IDEM staff or at Purdue University. In addition, the Indiana water quality standards for rivers are included for each applicable parameter.