

## Chapter 3 — Habitat Assessment

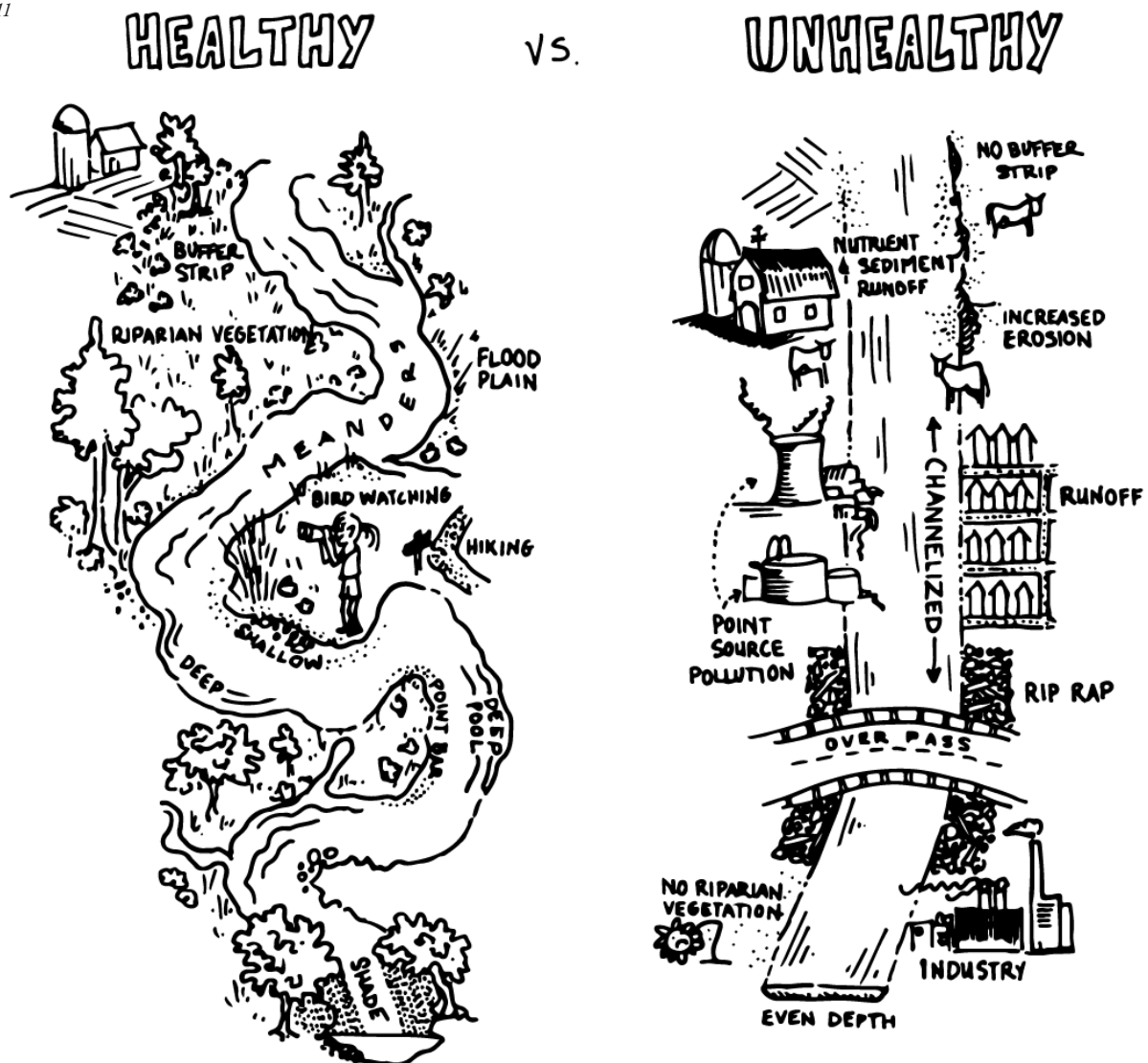
Chapter 2 discussed how water quality is a reflection of the land use in the watershed. However, the condition of land within and along the stream channel is also critical to the health of the stream and its ability to support aquatic life.

### What is a Healthy Stream Habitat?

A natural stream channel does not flow in a straight line; it meanders. Rivers meander as they flow because this pattern releases the kinetic energy of the water in the most even or uniform manner. Meanders also provide a variety of habitats for many species of plants and animals. Pools, riffles, undercut banks and snags (fallen limbs or small log piles) all provide different types of habitat. The more types of habitat present in a stream system, the greater the potential for aquatic plant and animal diversity.

A uniformly straight or deep channel provides less potential habitat than a stream with variable flows and depths. Examples of healthy and unhealthy stream habitats are shown in Figures 11 and 12.

Figure 11



## What is a riparian zone?

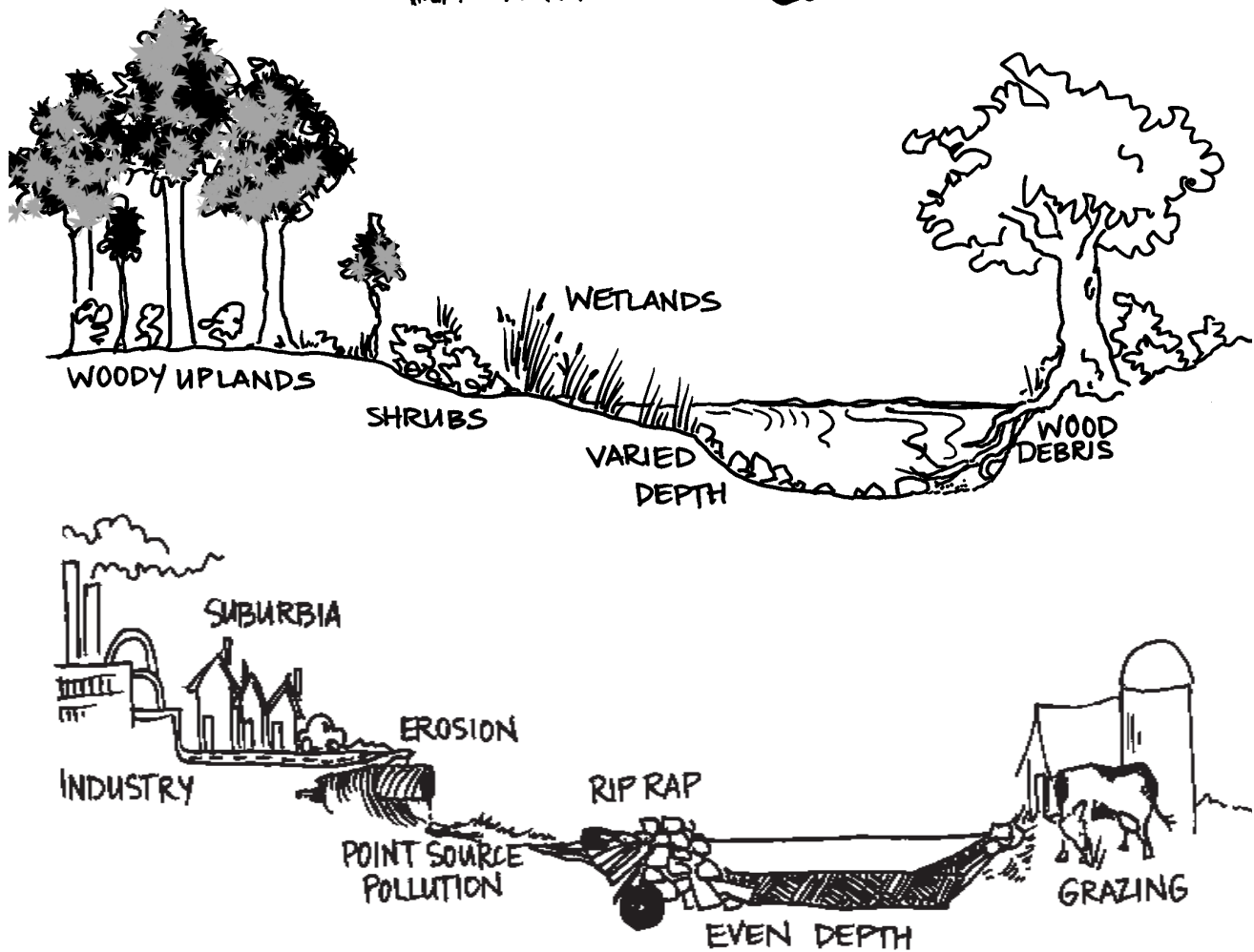
The term “riparian zone” refers to the areas adjacent to stream channels (Figure 11). The riparian zone is the strip of land between the stream channel and upland hills. Stream riparian zones form an important transition zone between land and freshwater systems. Riparian vegetation refers to the plants that occur naturally on stream banks and along stream channels.

Streamside vegetation and wetlands are important components of a stream ecosystem because they provide streams with bank support and stabilization, erosion and flood control, water quality protection, fish and wildlife habitat, and scenic beauty. Plant roots bind soil to stream banks and reduce erosion, and deflect the cutting action of swift flowing stormwater, expanding surface ice, and strong winds. Streamside vegetation keeps the water cool by providing shade, and it provides habitat for aquatic and terrestrial creatures. In addition, plant litter that falls in upland streams is a major source of food for organisms in the stream.

*(From the “Streamwalk Training Manual,” Thames River Basin Partnership Initiative.)*

Figure 12

## HEALTHY vs. UNHEALTHY RIPARIAN HABITAT



## Citizens Qualitative Habitat Evaluation Index (CQHEI)

This index was developed by the Ohio Environmental Protection Agency as a “Citizens” companion to the Qualitative Habitat Evaluation Index (QHEI) used by the state’s professional staff. The diagram’s data sheet on pages 26-27 were modified from information provided by the Ohio EPA. The purpose of the index is to provide a measure of the stream habitat and riparian health that generally corresponds to physical factors affecting fish and other aquatic life (i.e., macroinvertebrates). The CQHEI produces a total score that can be used to compare changes at one site over time or compare two different sites.

*NOTE: The CQHEI data sheet was designed to be used primarily in wadeable streams. The index scores do not necessarily reflect the conditions found in intermittent streams or large rivers.*

### **When completing the CQHEI, evaluate your entire stream site (200’ section).**

*In each category choose the most predominant answer. If sections of the stream or stream banks have completely different characteristics, you may check two boxes and average the points to obtain a score for the subsection (a), (b), or (c). An example is provided on page 27.*

#### **I. Substrate (Bottom Type) - Max 24 pts**

*(Note: “smothering” is the same as “embeddedness.” See Figure 8 on page 17. Check “yes” for smothering, if the stream bottom is more than 50% embedded.)*

#### **II. Fish Cover (Hiding Places) - Max 20 pts**

*Select all the cover types that you see using Figure 13a on page 25 as a guide. Add the points.*

#### **III. Stream Shape and Human Alterations - Max 20 pts**

#### **IV. Stream Forests and Wetlands (Riparian Areas) & Erosion - Max 20 pts**

a) Width of the Riparian Forest or Wetland - *This is not the width of the stream!* Estimate the width of the area containing trees or wetlands on each side of the stream by answering: “Can you throw a rock to the other side?”

b) See Appendix C - Glossary for a description of conservation tillage.

#### **V. Depth & Velocity - Max 15 pts**

a) Deepest Pool - If your stream is a consistent depth, select the maximum depth.

b) Select all the flow types that you see and add the points.

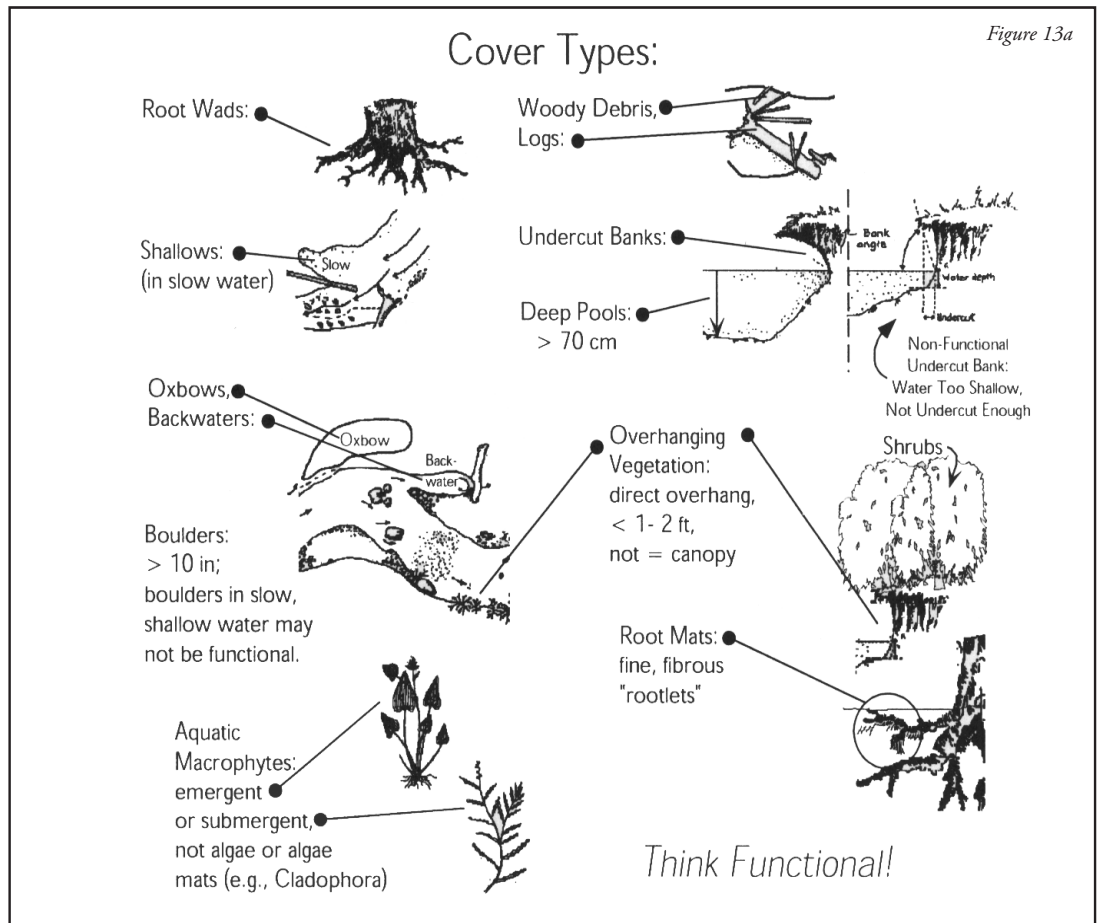
#### **VI. Riffles/Runs (where the current is turbulent) - Max 15**

Using the lower diagrams (Figure 13b) on page 25 as a guide.

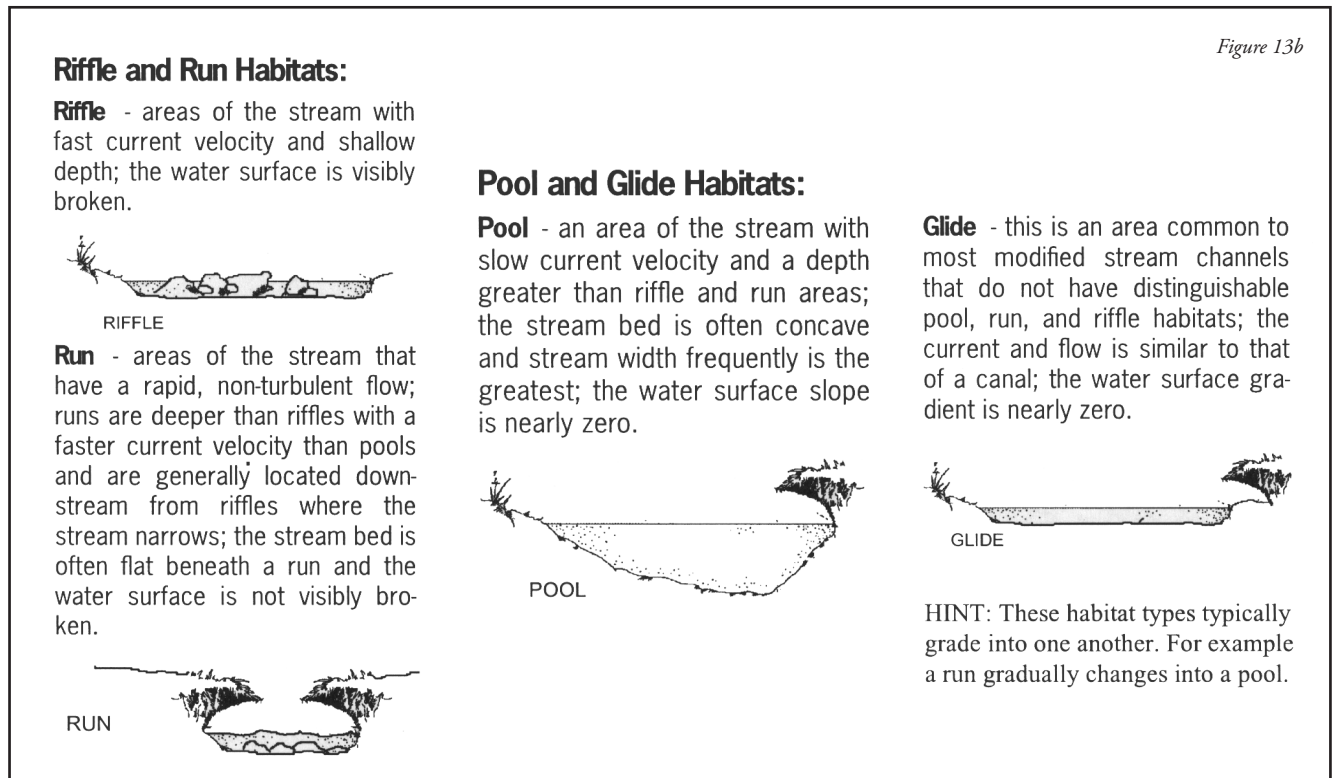
### **Maximum Total Points for the CQHEI is 114**

If the score is over 100, consider it “extra credit.” You have an exceptional high-quality stream. A set of ranges for Excellent, Medium, Poor, Very Poor has not yet been developed for this index - but, QHEI scores >60 have been found to be “*generally conducive to the existence of warmwater fauna.*”

**CQHEI Section II:  
Fish Cover  
“Hiding Places”**



**CQHEI Sections V & VI:  
Depth and Velocity and Riffles and Runs**



# Citizens Qualitative Habitat Evaluation Index (CQHEI)

Date: \_\_\_/\_\_\_/\_\_\_ Volunteer ID: \_\_\_\_\_ Site ID: \_\_\_\_\_  
 Stream Name: \_\_\_\_\_

CQHEI Total

## I. SUBSTRATE (bottom type)

Score:  

### a) Size

- |   |   |
|---|---|
| <input type="checkbox"/> 14 pt<br>Mostly Large<br>(Fist Size or Bigger)                           | <input type="checkbox"/> 6 pt<br>Mostly Small (Smaller<br>Than Fingernail, but<br>Coarse, or Bedrock) |
| <input type="checkbox"/> 10 pt<br>Mostly Medium<br>(Smaller than Fist,<br>larger than Fingernail) | <input type="checkbox"/> 0 pt<br>Mostly Very Fine (Not<br>Coarse, Sometimes<br>Greasy or Mucky)       |

### b) "Smothering"

Are Fist Size and Larger Pieces  
Smothered By Sands/Silts?

- 5 pt No
- 0 pt Yes

**Symptoms:**  
Hard to move pieces, often  
black on bottom.

### c) "Silting"

Are Silts and Clays Distributed  
Throughout Stream?

- 5 pt No
- 0 pt Yes

**Symptoms:**  
Light kicking  
results in  
substantial  
clouding for  
more than  
a minute.

## II. FISH COVER (hiding places) - Add 2 Points For Each One Present

Score:  

- |  |   |  |   |   |
|--|---|--|---|---|
| <input type="checkbox"/> 2 pt<br>Underwater Tree<br>Roots (Large)    | <input type="checkbox"/> 2 pt<br>Shrubs/Small Trees<br>Hang Over the Bank | <input type="checkbox"/> 2 pt<br>Downed Trees, Logs,<br>or Branches    | <input type="checkbox"/> 2 pt<br>Water Plants               | <input type="checkbox"/> 2 pt<br>Undercut Banks |
| <input type="checkbox"/> 2 pt<br>Underwater Tree<br>Rootlets (Small) | <input type="checkbox"/> 2 pt<br>Backwaters, Oxbows or<br>Side Channels   | <input type="checkbox"/> 2 pt<br>Shallow, Slow Areas<br>for Small Fish | <input type="checkbox"/> 2 pt<br>Deep Areas<br>(Chest Deep) | <input type="checkbox"/> 2 pt<br>Boulders       |

## III. STREAM SHAPE and HUMAN ALTERATIONS

Score:  

### a) "Curviness" or "Sinuosity" of Channel

- |  |   |
|--|---|
| <input type="checkbox"/> 8 pt<br>2 or More Good<br>Bends | <input type="checkbox"/> 3 pt<br>Mostly Straight<br>Some "Wiggle" |
| <input type="checkbox"/> 6 pt<br>1 or 2<br>Good Bends    | <input type="checkbox"/> 0 pt<br>Very Straight                    |

### b) How Natural Is The Site?

- |  |   |
|--|---|
| <input type="checkbox"/> 12 pt<br>Mostly Natural<br>Few Minor Man-<br>Made Changes<br>(e.g., a bridge) | <input type="checkbox"/> 6 pt<br>Many Man-Made Changes, but Some Natural<br>Conditions left (e.g., trees, meanders) |
| <input type="checkbox"/> 9 pt  | <input type="checkbox"/> 0 pt<br>Heavy, Man-made Changes (e.g.,<br>leveed or channelized)                           |

## IV. STREAM FORESTS & WETLANDS (riparian area) & EROSION

Score:  

### a) Riparian Width Mostly:

- 8 pt  
Wide (Can't throw  
a rock through it)
- 5 pt  
Narrow (can throw  
a rock through it)
- 0 pt  
None

### b) Land Use - Mostly:

- |  |  |
|--|--|
| <input type="checkbox"/> 5 pt<br>Forest/Wetland      | <input type="checkbox"/> 2 pt<br>Conservation<br>Tillage |
| <input type="checkbox"/> 4 pt<br>Shrubs              | <input type="checkbox"/> 1 pt<br>Suburban                |
| <input type="checkbox"/> 3 pt<br>Overgrown<br>Fields | <input type="checkbox"/> 1 pt<br>Row Crop                |
| <input type="checkbox"/> 2 pt<br>Fenced Pasture      | <input type="checkbox"/> 0 pt<br>Open Pasture            |
| <input type="checkbox"/> 2 pt<br>Park (Grass)        | <input type="checkbox"/> 0 pt<br>Urban/<br>Industrial    |

### c) Bank Erosion

- 4 pt  
Stable Hard or Well-  
Vegetated Banks
- 2 pt  
Combination of Stable and  
Eroding Banks
- 0 pt  
Raw, Collapsing  
Banks

### d) Stream Shading

- 3 pt  
Mostly
- 2 pt  
Partly
- 0 pt  
None

## V. DEPTH & VELOCITY

Score:  

### a) Deepest Pool is At Least:

- |   |   |
|---|---|
| <input type="checkbox"/> 8 pt<br>Chest Deep | <input type="checkbox"/> 4 pt<br>Knee Deep    |
| <input type="checkbox"/> 6 pt<br>Waist Deep | <input type="checkbox"/> 0 pt<br>Do Not Exist |

### b) Check ALL The Flow Types That You See (Add Points):

- |   |  |                                       |
|---|--|---------------------------------------|
| <input type="checkbox"/> 2 pt<br>Very Fast: Hard to<br>Stand in Current   | <input type="checkbox"/> 1 pt<br>Moderate: Slowly Takes<br>Object Downstream | <input type="checkbox"/> 0 pt<br>None |
| <input type="checkbox"/> 3 pt<br>Fast: Quickly Takes Object<br>Downstream | <input type="checkbox"/> 1 pt<br>Slow: Flow Nearly<br>Absent                 |                                       |

## VI. RIFFLES/RUNS (areas where current is fast/turbulent, surface may be broken)

Score:  

### a) Riffles/Runs Are:

- |  |   |
|--|---|
| <input type="checkbox"/> 8 pt<br>Knee Deep or<br>Deeper and Fast | <input type="checkbox"/> 4 pt<br>Ankle Deep or<br>Less and Slow |
| <input type="checkbox"/> 6 pt<br>Ankle/Calf Deep<br>and Fast     | <input type="checkbox"/> 0 pt<br>Do Not Exist                   |

### b) Riffle/Run Substrates Are:

- |  |   |
|--|---|
| <input type="checkbox"/> 7 pt<br>Fist Size or Larger                                   | <input type="checkbox"/> 0 pt<br>Smaller Than Your<br>Fingernails or Do Not Exist |
| <input type="checkbox"/> 4 pt<br>Smaller Than Fist Size, but<br>Larger Than Fingernail |   |



# Citizens Qualitative Habitat Evaluation Index (CQHEI)

Date: 10/04/2009 Volunteer ID: 1000 Site ID: 1000

83.5

Stream Name: Example Stream Indiana

CQHEI Total

## I. SUBSTRATE (bottom type) Score: 20

### a) Size

- |  |   |
|--|---|
| <input type="checkbox"/> Mostly Large (Fist Size or Bigger)<br>14 pt                                   | <input type="checkbox"/> Mostly Small (Smaller Than Fingernail, but Coarse, or Bedrock)<br>6 pt |
| <input checked="" type="checkbox"/> Mostly Medium (Smaller than Fist, larger than Fingernail)<br>10 pt | <input type="checkbox"/> Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)<br>0 pt       |

### b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- No  
5 pt
- Yes  
0 pt

**Symptoms:**  
Hard to move pieces, often black on bottom.

### c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- No  
5 pt
- Yes  
0 pt

**Symptoms:**  
Light kicking results in substantial clouding for more than a minute.

## II. FISH COVER (hiding places) - Add 2 Points For Each One Present Score: 14

- |  |   |  |   |  |
|--|---|--|---|--|
| <input checked="" type="checkbox"/> Underwater Tree Roots (Large)<br>2 pt    | <input type="checkbox"/> Shrubs/Small Trees Hang Over the Bank<br>2 pt          | <input checked="" type="checkbox"/> Downed Trees, Logs, or Branches<br>2 pt    | <input type="checkbox"/> Water Plants<br>2 pt                       | <input type="checkbox"/> Undercut Banks<br>2 pt      |
| <input checked="" type="checkbox"/> Underwater Tree Rootlets (Small)<br>2 pt | <input checked="" type="checkbox"/> Backwaters, Oxbows or Side Channels<br>2 pt | <input checked="" type="checkbox"/> Shallow, Slow Areas for Small Fish<br>2 pt | <input checked="" type="checkbox"/> Deep Areas (Chest Deep)<br>2 pt | <input checked="" type="checkbox"/> Boulders<br>2 pt |

## III. STREAM SHAPE and HUMAN ALTERATIONS Score: 15

### a) "Curviness" or "Sinuosity" of Channel

- |   |  |
|---|--|
| <input type="checkbox"/> 2 or More Good Bends<br>8 pt         | <input type="checkbox"/> Mostly Straight Some "Wiggle"<br>3 pt |
| <input checked="" type="checkbox"/> 1 or 2 Good Bends<br>6 pt | <input type="checkbox"/> Very Straight<br>0 pt                 |

### b) How Natural Is The Site?

- |   |  |
|---|--|
| <input type="checkbox"/> Mostly Natural<br>12 pt  | <input type="checkbox"/> Many Man-Made Changes, but Some Natural Conditions left (e.g., trees, meanders)<br>6 pt |
| <input checked="" type="checkbox"/> Few Minor Man-Made Changes (e.g., a bridge)<br>9 pt | <input type="checkbox"/> Heavy, Man-made Changes (e.g., leveed or channelized)<br>0 pt                           |

## IV. STREAM FORESTS & WETLANDS (riparian area) & EROSION Score: 13.5

### a) Riparian Width Mostly:

- Wide (Can't throw a rock through it)  
8 pt
- Narrow (can throw a rock through it)  
5 pt
- None  
0 pt

Average:  
4 pts

### b) Land Use - Mostly:

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Forest/Wetland<br>5 pt | <input type="checkbox"/> Conservation Tillage<br>2 pt |
| <input type="checkbox"/> Shrubs<br>4 pt                    | <input type="checkbox"/> Suburban<br>1 pt             |
| <input type="checkbox"/> Overgrown Fields<br>3 pt          | <input type="checkbox"/> Row Crop<br>1 pt             |
| <input type="checkbox"/> Fenced Pasture<br>2 pt            | <input type="checkbox"/> Open Pasture<br>0 pt         |
| <input checked="" type="checkbox"/> Park (Grass)<br>2 pt   | <input type="checkbox"/> Urban/Industrial<br>0 pt     |

Average:  
3.5 pts

### c) Bank Erosion

- Stable Hard or Well-Vegetated Banks  
4 pt
- Combination of Stable and Eroding Banks  
2 pt
- Raw, Collapsing Banks  
0 pt

### d) Stream Shading

- Mostly  
3 pt
- Partly  
2 pt
- None  
0 pt

## V. DEPTH & VELOCITY Score: 11

### a) Deepest Pool is At Least:

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Chest Deep<br>8 pt | <input type="checkbox"/> Knee Deep<br>4 pt    |
| <input type="checkbox"/> Waist Deep<br>6 pt            | <input type="checkbox"/> Do Not Exist<br>0 pt |

### b) Check ALL The Flow Types That You See (Add Points):

- |   |   |                                       |
|---|---|---------------------------------------|
| <input type="checkbox"/> Very Fast: Hard to Stand in Current<br>2 pt              | <input type="checkbox"/> Moderate: Slowly Takes Object Downstream<br>1 pt | <input type="checkbox"/> None<br>0 pt |
| <input checked="" type="checkbox"/> Fast: Quickly Takes Object Downstream<br>3 pt | <input type="checkbox"/> Slow: Flow Nearly Absent<br>1 pt                 |                                       |

## VI. RIFFLES/RUNS (areas where current is fast/turbulent, surface may be broken) Score: 10

### a) Riffles/Runs Are:

- |  |  |
|--|--|
| <input type="checkbox"/> Knee Deep or Deeper and Fast<br>8 pt        | <input type="checkbox"/> Ankle Deep or Less and Slow<br>4 pt |
| <input checked="" type="checkbox"/> Ankle/Calf Deep and Fast<br>6 pt | <input type="checkbox"/> Do Not Exist<br>0 pt                |

### b) Riffle/Run Substrates Are:

- |  |  |
|--|--|
| <input type="checkbox"/> Fist Size or Larger<br>7 pt   | <input type="checkbox"/> Smaller Than Your Fingernails or Do Not Exist<br>0 pt |
| <input checked="" type="checkbox"/> Smaller Than Fist Size, but Larger Than Fingernail<br>4 pt |  |

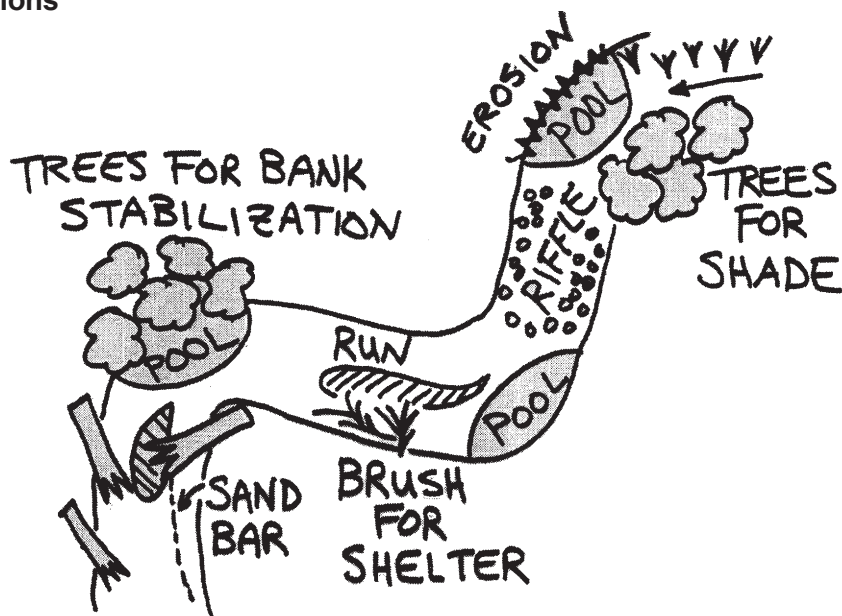
## Site Map & Stream Flow

### Site Map

Drawing a map of your site location is an excellent first step in getting to know your 200 foot stream segment. Looking at an aerial photograph before or during your visit may also help with familiarization. Continuing this tradition on an annual basis may also alert you to changes at your site that may not have been obvious during regular sampling visits. An example map is shown below (Figure 14). The stream map can now be scanned and uploaded to the Volunteer Monitoring Internet Database, as can any photos you take of the site or your sampling event.

### Stream Flow Calculations

Figure 14



A work sheet is provided on Page 29 to assist volunteers in determining the stream flow or discharge rate. (See page 30 for a completed example.) Discharge is the amount (volume) of water flowing in the stream per second. Riverwatch uses cubic feet per second as the standard unit of discharge. This measurement is important because it influences other physical, chemical, and biological factors in the stream (i.e., all of our other tests). A high discharge rate may indicate recent rainfall or snowmelt events. When a large amount of rain runs off the land, it often carries sediments and nutrients to the stream. Very low discharge rates may indicate drought conditions, which also affect water quality and aquatic life. The discharge rate is obtained by multiplying the average width, depth, and velocity of the stream. All measurements are taken (or converted) into feet. The data sheet includes a diagram and instructions. Stream flow calculations can be entered into the Volunteer Monitoring Internet Database (*See Chapter 7*).

**Average Width (W)** - width of the stream (the water itself) taken from where it touches the stream bank on one side to where it touches the stream bank on the other side - take three width measurements; when possible measure areas that appear most representative of the entire 200 foot stream section




















**Average Depth (Z)** - three depth measurements are taken (using a yardstick) across the stream on three transects - nine total measurements

**Average Velocity (V)** - how fast the water is moving - measure a distance and time how long it takes an apple or orange to float the distance - repeat three times

**Roughness Coefficient (n)** - select 0.8 for a gravel or rocky bottom; select 0.9 for sandy, muddy or bedrock

$$\text{Flow (D)} = W \times Z \times V \times n$$

# Stream Site Map

	Cobble		Debris/Dam		Rowcrop
	Riffle		Log		Grass
	Slabs/Boulder		Bridge		Pool
	Pipe/Outfall		Overhanging vegetation		
	Rip rap bank		Rootwad		
	Undercut bank		Severely eroded bank		
	Direction of flow		Forest		
	Sample location		Shrub		



# Hoosier Riverwatch

## Stream Flow (Discharge) Data Sheet

Date \_\_\_/\_\_\_/\_\_\_ Volunteer ID \_\_\_\_\_ Site ID \_\_\_\_\_ Stream Name \_\_\_\_\_

**Solving the equation:** **Where:**

**FLOW (D) = W x Z x V x n** **W** = Average Width

**Z** = Average Depth

**V** = Average Velocity

**n** = Coefficient - 0.8 for gravel/rocky bottom streams

.. 0.9 for muddy or bedrock bottom streams

**D** = Flow/Discharge

Convert measurements of feet + inches to 10<sup>ths</sup> of feet.

1 inch = 0.0833 feet

**W**  
**River Width**  
*(one measurement at each transect)*

Transect	Width (ft)
1	
2	
3	
Average	

**Z**  
**River Depth**  
*(three measurement along each transect)*

	Transect 1 (ft)	Transect 2 (ft)	Transect 3 (ft)	
1				Average of Averages
2				
3				
Average of Transects				

**V**  
**Surface Velocity = Length/Time**  
*(allow the object to attain velocity before timing)*

Transect	Length (ft)	Time (seconds)	Velocity (ft/sec)
1			
2			
3			
Average			

**D**  
**Stream Flow or Discharge**

				=			
<b>W</b>	x	<b>Z</b>	x	<b>V</b>	x	<b>n*</b>	<b>D (cfs)</b>

\*Coefficient (0.8 for gravel/rocky bottom streams, 0.9 for muddy or bedrock bottom streams)

# Hoosier Riverwatch Stream Flow (Discharge) Data Sheet

Date      /      /      Volunteer ID                      Site ID                      Stream Name                     

**Solving the equation:** **Where:**

**FLOW (D) = W x Z x V x n** **W** = Average Width

**Z** = Average Depth

**V** = Average Velocity

**n** = Coefficient - 0.8 for gravel/rocky bottom streams

..                   0.9 for muddy or bedrock bottom streams

**D** = Flow/Discharge

Convert measurements of feet + inches to 10<sup>ths</sup> of feet. 1 inch = 0.0833 feet

**W**  
**River Width**  
*(one measurement at each transect)*

Transect	Width (ft)
1	
2	
3	
Average	

**Z**  
**River Depth**  
*(three measurement along each transect)*

	Transect 1 (ft)	Transect 2 (ft)	Transect 3 (ft)	
1				
2				
3				
Average of Transects				Average of Averages

**V**  
**Surface Velocity = Length/Time**  
*(allow the object to attain velocity before timing)*

Transect	Length (ft)	Time (seconds)	Velocity (ft/sec)
1			
2			
3			
Average			

**D**  
**Stream Flow or Discharge**

				=				
<b>W</b>	x	<b>Z</b>	x	<b>V</b>	x	<b>n*</b>		<b>D (cfs)</b>

\*Coefficient (0.8 for gravel/rocky bottom streams, 0.9 for muddy or bedrock bottom streams)