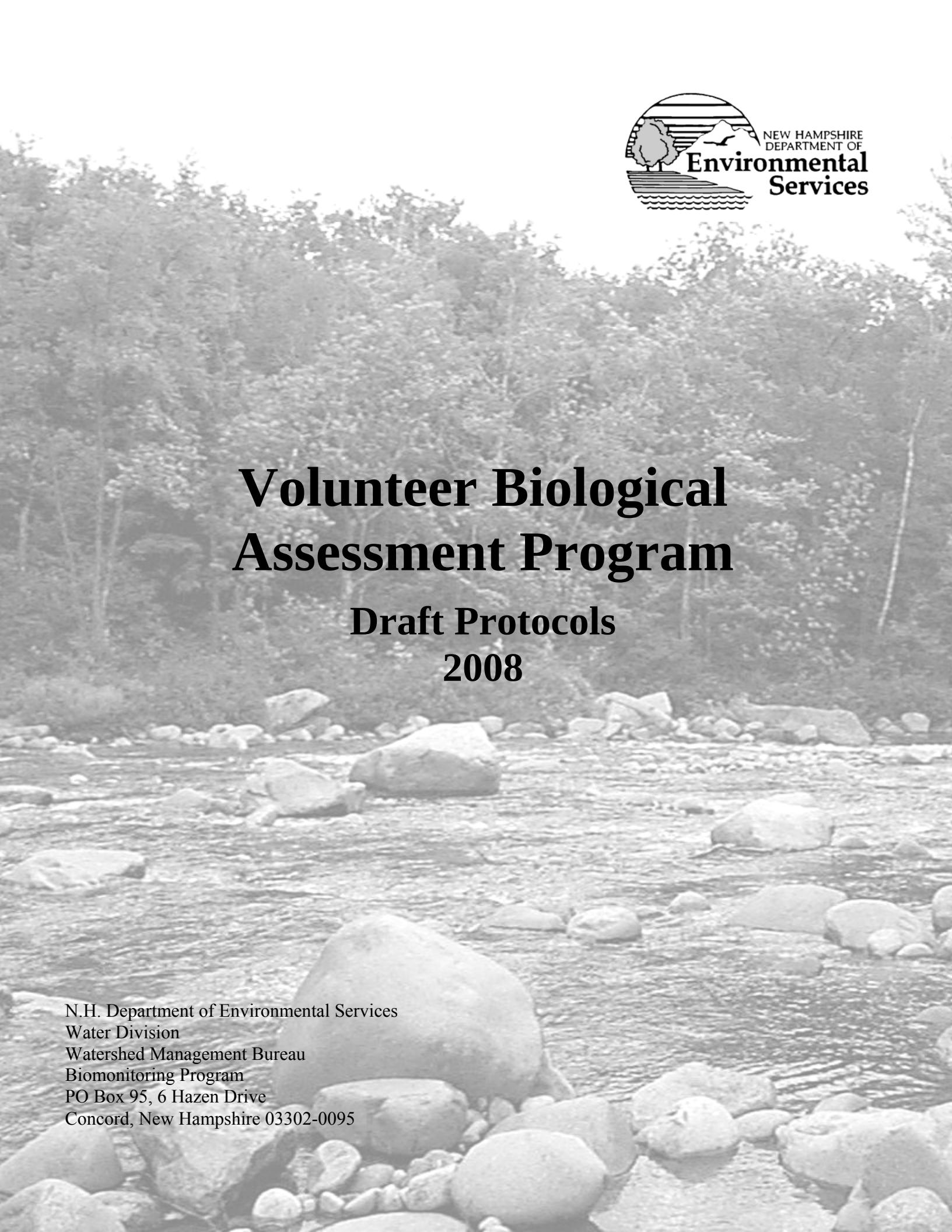


NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Volunteer Biological Assessment Program

Draft Protocols
2008

N.H. Department of Environmental Services
Water Division
Watershed Management Bureau
Biomonitoring Program
PO Box 95, 6 Hazen Drive
Concord, New Hampshire 03302-0095

Volunteer Biological Assessment Program (VBAP)

New Hampshire Department of Environmental Services (NHDES)

2008

Table of Contents

I. Program Overview

Current Efforts

The New Hampshire Department of Environmental Services (NHDES) Biomonitoring Program is coordinating efforts with volunteer organizations to develop a statewide screening protocol for documenting the biological condition of wadeable streams. The protocol is designed for individuals with or without professional training. The three major goals of the program are:

- To supplement biological data collected by NHDES staff.
- To educate the public about water quality issues as interpreted through biological assessments.
- To build a constituency of citizens to practice sound water quality management at a local level and build public support for water quality protection.

The program is limited to 1st through 4th order streams. All sampling takes place in summer to early fall by volunteers who have attended a required annual training session. Macroinvertebrates are the target biological assemblage. Methods for macroinvetebrate collection are outlined below and must be closely followed to ensure the data are comparable.

Data collected during this project will be used in annual summary reports for volunteer groups, which can assist in identifying potential water quality problems and areas that may require further examination. Data from this project will NOT be used in making formal water quality assessments.

The NHDES considers this project an important component of volunteer water quality sampling. These protocols are still being developed and may change slightly from year to year or during the actual sampling process. Volunteer organizations are encouraged to work with NHDES staff to initiate and complete sampling until further notice. For more information regarding this sampling protocol contact the NHDES Biomonitoring program at (603) 271-3503 or (603) 559-0032.

Thank-you for your interest in monitoring New Hampshire's streams.

Hope to see you outside!

Before Getting Started

Don't

- *Don't* monitor alone. A minimum of two people are required (3-5 preferred).
- *Don't* collect samples under hazardous conditions including steep banks, deep, swift flows, or inclement weather.
- *Don't* cross private property without the landowner's permission.
- *Don't* disturb streamside vegetation.
- *Don't* develop your own protocols.
- *Don't* litter.

Do

- *Do* let someone know where you are going and when you plan to return.
- *Do* work in groups of at least 2 (3-5 preferred).
- *Do* use public access points to approach the monitoring site.
- *Do* wear shoes rather than sandals or open-toed shoes.
- *Do* bring plenty of water to drink.
- *Do* be cautious of poison ivy on the stream bank.
- *Do* follow established protocol.
- And most importantly, *DO* ENJOY YOURSELVES!

II. Macroinvertebrate Sampling Guidelines

Recommended Time of Year to Perform Sampling

Sampling should occur in the summer & early fall (water levels are generally low and the timing corresponds with other NHDES biological monitoring efforts).

Staff Required

There should be 3 - 5 volunteers per sampling site, plus a NHDES staff member.

Time it Will Take to Complete Biological Sampling Activities per Site

It should take approximately 3 hours to complete all sampling at a single site. In general, sampling consists of a habitat assessment (~1/2 hour), macroinvertebrate collection (~1/2 hour), macroinvertebrate sorting (1 hour) and identification (~1/2 hour), and a simple physical/chemical site assessment (~1/2 hour).

Equipment: Description & Use

Item	Use
Kicknet (at least 500micron mesh size)	to collect the organisms
Dish-pans (i.e. sorting trays) and ice cube trays	to sort and view the organisms
Gridded, wire mesh dish-pan	to composite the kicknet samples and separate a fraction of them.
100' fiberglass measuring Tape	to measure average stream width
Yardstick	to measure average stream depth
Hand lenses	to identify invertebrates
Clipboards, pencils	to record data
Volunteer Biomonitoring Data Sheets:	to record data
Habitat Data Sheet	to record data
Macroinvertebrate Data Sheet	to record data
Biological Water Quality Score Sheet	to record data
Physical/Chemical Parameters	to record data
Pipettes	to transfer organisms from sorting tray to ice cube tray
Plastic spoons	to transfer organisms from sorting tray to ice cube tray
Waders	to keep you dry
Camera	for photo documentation
Chemical sampling equipment	to measure pH, dissolved oxygen, temperature, and conductivity
Wash bottle	to rinse the bugs out of the kicknet
Reagent grade Ethyl Alcohol & Voucher Vials (3)	to preserve bugs for Quality Control
Calculator	to calculate the number and percentages of invertebrates found
Gloves	To scrub rocks and debris while sampling in river/streambed
Folding Table & Chairs	To use for sorting and identification
Trash Bags	For any trash found at site
First Aid Kit	In case of an emergency
Reference Books & ID Keys	To identify organisms

III. Sampling Protocols

Step 1. Record Site Information

- First, record all general site information on the **Habitat Data Sheet** (Appendix B.1) including:
  - Stream Name
  - Town
  - Volunteer Group
  - Staff Present
  - Date
  - Weather for today and for the past three days
- Secondly, walk the stream bank along the section that will be sampled. Become familiar with the stream, its banks, and the riparian habitat. Now, fill in the rest of the information on the **Habitat Data Sheet.** Sketch the stream (riffle / pool prevalence, direction of flow, bank condition) and its surrounding habitat including unique, adjacent geographical indicators (trees, fences, bridges, culverts, homes, lawns, impervious cover, roads, invasive species, etc.).
- Lastly, take pictures (if possible) of the section selected for sampling. Label the pictures appropriately and note in top section of Data Sheet.

Step 2. Collect Macroinvertebrates

- Before collecting the bugs, prepare for invertebrate processing by filling one sorting pan (dish-pan) with just enough clear stream water to cover the bottom of the gridded wire mesh dish-pan, when placed inside the sorting pan. Achieving the correct water level will keep the sample wet, but not fully submerged and floating. Also, make sure that your kicknet is free of debris and invertebrates from previous sampling.

- Select the 1st of 5 macroinvertebrate sampling areas, starting with the one furthest downstream within your sampling reach. Work your way upstream to prevent disruption to your next sampling area. If space is limited, samples can be taken side by side. Begin sample collection by having one person position the net immediately downstream of the area to be sampled, perpendicular to the stream flow, and firmly against the bottom of the stream. While holding the net firmly in place, make sure to stand next to, not behind the net.

- With the net in position, have a second person begin collection by scrubbing the surfaces of large rocks and debris found within the sampling area for approximately 30 seconds. After scrubbing each rock or piece of debris, place it outside of the sampling area. Next, using your feet, disturb the substrate within the sampling area for 30 seconds. After a combined minute worth of hand

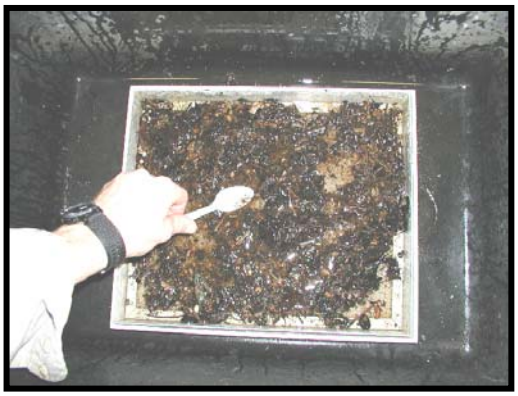
scrubbing and foot disruption, lift the net from the water being careful not to lose any organisms.

- Repeat this collection process for 4 more areas, moving upstream after each 1-minute sample. *If the kicknet becomes filled with excess debris before all 5 samples are collected, empty the contents of the net into the empty wire mesh dish-pan*.
- You should have plenty of invertebrates in your net after successfully taking 5 kicknet samples within your selected reach.

Step 3. Sample a Fraction of the Macroinvertebrates

- After completing the 5 1-minute collections, remove large debris (rocks and sticks) from the net and inspect each item for attached bugs. If any macroinvertebrates are found on the debris, place them in the wire mesh dish-pan.
- Empty the rest of the contents of the net into the wire mesh dish-pan and nest within the sorting pan with water, making sure debris and organisms are covered in water.

- With a spoon, stir the debris evenly across the wire mesh dish-pan for 15 seconds.
- Gently clump the debris and organism mixture on the wire mesh dish-pan into 4 even piles.



- Lift the wire mesh dish-pan from the sorting pan. Randomly select 1 of the 4 piles to sort.

Step 4: Sort Macroinvertebrates

- Using the spoon, transfer the entire contents of the selected pile to a separate sorting pan that contains just enough stream water to cover the bottom of the pan. Up to 2 people can use a single sorting pan (splitting the "selected" pile into multiple sorting trays may help speed up sample processing). The 3 remaining piles in the wire mesh dish-pan should be re-submerged in water while the sorting takes place.
- Once you have transferred the pile to the separate sorting tray, you are ready to begin sorting! Note your starting time and then keep track of the time during the sorting process. You will sort macroinvertebrates for exactly one hour.
- To sort, use the magnifying glass, pipettes, or forceps and carefully transfer all organisms from the debris pile to separate containers (ice cube trays, plastic bowls, etc.) filled with stream water. Organisms that look similar should be placed within the same container. DO NOT spend time trying to identify organisms at this point. It is important to pick both the small and large organisms. Many invertebrates are difficult to see so you will need to look very carefully.

- If you finish sorting the pile before one hour of sorting time has elapsed, select another pile for sorting. If the first pile is NOT completed before 1 hour of sorting time has elapsed, stop sorting. DO NOT spend more than 1 hour sorting organisms.
- After sorting is complete be sure you have recorded the following information on the **Macroinvertebrate Data Sheet** (C.2):
    - Number of people sorting
    - Total elapsed time-spent sorting (i.e. 4 people x 1-hour of sorting each = 4 hours sorting time)
    - Approximate fraction of total sample sorted (i.e. ¼ portion selected x 75% was sorted = 3/8 of total sample was sorted)

Step 5. Identify Sorted Macroinvertebrates

- Use the provided reference book and macroinvertebrate keys to identify the organisms collected and sorted.
- Tally the number of individuals in each group on the **Macroinvertebrate Data Sheet** (Appendix B.2). Refer to **Sample Macroinvertebrate Data Sheet** (Appendix A.1)
- Determine the number of invertebrates for each group and place this number in the **Totals** column.

Volunteer Biomonitoring Macroinvertebrate Data Sheet

Site Number 3 Stream Name Cohas Brook Town Manchester

Volunteer Group Merrimack Grp.

Staff Present John Doe, Jane Doe Date 7/2/03 Replicate Number 1 of 1

Group		# Individuals (Raw Tally)	Totals
Ephemeroptera	Mayfly Nymph	𝍸 𝍸 𝍸 𝍸 |||	23
Plecoptera	Stonefly Nymph	𝍸 𝍸 |	11

- Lastly, sum the **Totals** column and write this value at the bottom of the data sheet by the heading **Total # Individuals Counted for all Groups**.
- Once all the sorted organisms have been counted and identified, return them to the stream.

Step 6. Calculate the Biological Water Quality Score

- Record the total number of organisms found per group onto the **Biological Water Quality Score Sheet** (Appendix B.3) under the **Totals Found** section. Refer to **Sample Biological Water Quality Score Sheet** (Appendix A.2) for further assistance.
- Multiply the **Tolerance Value** by the **Totals Found** for each group of invertebrates and enter this value under the last column labeled **Biotic Score**.

Volunteer Biomonitoring Biological Water Quality Score Sheet - Biotic Index Calculation Worksheet

Site Number 3 Stream Name Cohas Brook Town Manchester

Volunteer Group Merrimack Grp.

Staff Present John Doe, Jane Doe Date 7/2/03 Replicate Number 1 of 1

The invertebrate Groups below have different sensitivities to pollution. These sensitivities have both a narrative and numeric ranking as summarized here. Calculate the Final Biotic Score by multiplying the Tolerance Value by the Totals Found. Sum each row in the Biotic Score column and place this value in the Total Biotic Score line. Calculate Final Biotic Score according to calculation below. This is your Biological Water Quality Score.

Group		Tolerance Value	*	Totals Found	=	Biotic Score
Ephemeroptera	Mayfly Nymph	3	*	23	=	69
Plecoptera	Stonefly Nymph	1	*	56	=	56

- Sum the **Biotic Score** column. Enter this value on the line **Total Biotic Score.**

Snails	7	*	0	=	0
Aquatic Worms	8	*	2	=	16
Scuds	8	*	0	=	0
Sowbugs	7	*	0	=	0
Clams and Mussels	7	*	0	=	0

Total Biotic Score 436

Final Biotic Score = Total Biotic Score / Total # Individuals Counted for all Groups

Final Biotic Score = 436 / 115 = 3.8

Circle the Water Quality Score that corresponds to the Final Biotic Score.

Water Quality Score	
0 - 3.5	Excellent
>3.5 - 4.8	Good
>4.8	Fairly Poor

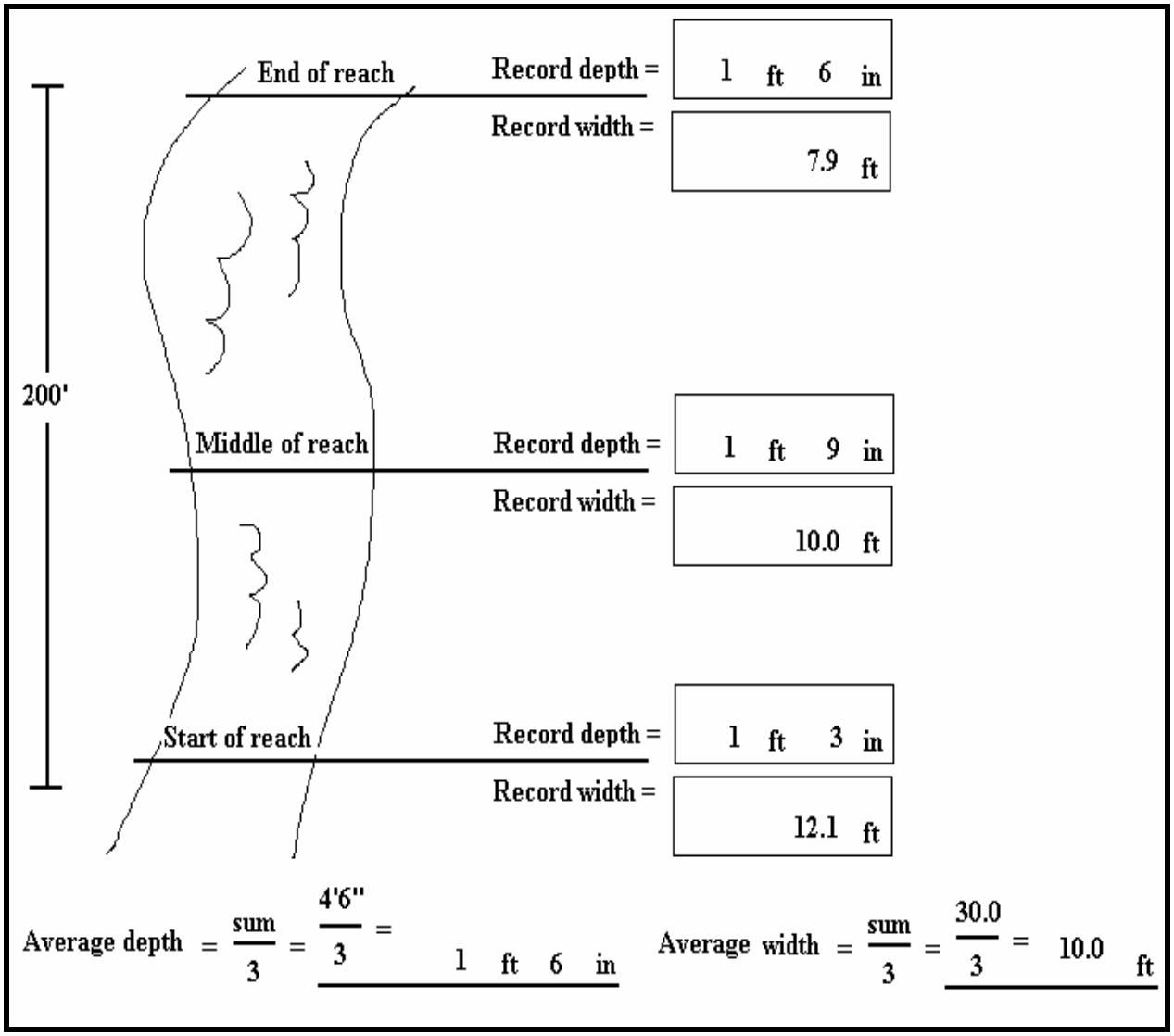
This is your Biological Water Quality Score
Enter this Score on the Site Sheet.

- Calculate the final **Biotic Score** by dividing the **Total Biotic Score** by the **Total # Individuals counted for all Groups**. Circle the Water Quality Score that corresponds to the **Final Biotic Score**.

This is your Biological Water Quality Score
Enter this value on the Site Sheet.

Step 7. Physical/Chemical Parameters

- Using the equipment provided, record both average stream depth and the wetted width of the stream. Take one measurement for each at the beginning, middle, and end of your sampling reach.
- For each of the three points, find the main channel of the stream where the flow is greatest, and measure the depth to the nearest tenths of a foot. After taking the depth measurements, determine the wetted width at each of the three points, by measuring the width of the water's surface from one side of the stream to the other, not from bank to bank. Record the wetted width to the nearest foot.
- Calculate and record the physical parameters as depicted below on the **Physical Parameters** data sheet (Appendix B.4).
- Record any additional chemical parameters separately on the **NH Volunteer River Assessment Program Field Data Sheet** provided by your VBAP staff person.



YOU HAVE COMPLETED ALL SAMPLING REQUIREMENTS FOR THIS SITE!

Step 8. Checklist before leaving the site

- Is all of the required information filled in on the following data sheets:

  ☐ Habitat Data Sheet (Appendix B.1)

  ☐ Macroinvertebrate Data Sheet (Appendix B.2)

  ☐ Biological Water Quality Score Sheet (Appendix B.3)

  ☐ Physical/Chemical Data Sheet (Appendix B.4)

- Has all equipment been collected and rinsed thoroughly in the stream?
- Have you left "No Trace" of your presence?
- Did you have fun?

Appendix

A. Sample Data Sheets

- A.1 Sample Volunteer Biomonitoring Macroinvertebrate Data Sheet
- A.2 Sample Volunteer Biomonitoring Biological Water Quality Score Sheet / Biotic Index Calculation Worksheet
- A.3 Sample Physical/Chemical Data Sheet

B. Blank Data Sheets

- B.1 Volunteer Biomonitoring Habitat Data Sheet
- B.2 Volunteer Biomonitoring Macroinvertebrate Data Sheet
- B.3 Volunteer Biomonitoring Biological Water Quality Score Sheet / Biotic Index Calculation Worksheet
- B.4 Volunteer Biomonitoring Physical/Chemical Data Sheet

Sample Volunteer Biomonitoring Macroinvertebrate Data Sheet

Additional Information:

__4___ Number of people sorting X __1__ Time spent sorting / person (hrs) = ___4____ Total elapsed time-spent sorting

_1/4__ Fraction of the sample selected for sorting X __75%__ Percentage (estimate) of fraction sorted = __3/8___ Total sample sorted

Site Number 3 Stream Name Cohas Brook Town Manchester

Volunteer Group Merrimack Grp.

Staff Present John Doe, Jane Doe Date 7/2/03 Replicate Number 1 of 1

	Group		# Individuals (Raw Tally)	Totals
Insects	Ephemeroptera	Mayfly Nymph	𝍸 𝍸 𝍸 𝍸 |||	23
	Plecoptera	Stonefly Nymph	𝍸 𝍸 |	11
	Trichoptera	Caddisfly Larvae	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |	56
	Odonata	Dragonfly Nymph	0	0
		Damselfly Nymph	0	0
	Diptera	Black fly larvae	0	0
		Midge larvae	𝍸 |||	8
		Most True Flies	|||	3
	Megaloptera	Alderfly	0	0
		Fishfly or Helgrammite	|	1
	Coleoptera	Riffle Beetle	𝍸	5
		Water Penny	||	2
		Beetle & Beetle-like	||||	4
Non-Insects	Others	Crayfish	0	0
		Snails	0	0
		Aquatic Worms	||	2
		Scuds	0	0
		Sowbugs	0	0
		Clams and Mussels	0	0

Sample Volunteer Biomonitoring Biological Water Quality Score Sheet - Biotic Index Calculation Worksheet

Site Number 3 Stream Name Cohas Brook Town Manchester

Volunteer Group Merrimack Grp.

Staff Present John Doe, Jane Doe Date 7/2/03 Replicate Number 1 of 1

The invertebrate Groups below have different sensitivities to pollution. These sensitivities have both a narrative and numeric ranking as summarized here. Calculate the Final Biotic Score by multiplying the Tolerance Value by the Totals Found. Sum each row in the Biotic Score column and place this value in the Total Biotic Score line. Calculate Final Biotic Score according to calculation below. This is your Biological Water Quality Score.

Group		Tolerance Value	*	Totals Found	=	Biotic Score
Ephemeroptera	Mayfly Nymph	3	*	23	=	69
Plecoptera	Stonefly Nymph	1	*	11	=	11
Trichoptera	Caddisfly Larvae	4	*	56	=	224
Odonata	Dragonfly Nymph	3	*	0	=	0
	Damselfly Nymph	7	*	0	=	0
Diptera	Black fly larvae	7	*	0	=	0
	Midge larvae	6	*	8	=	48
	Most True Flies	4	*	3	=	12
Megaloptera	Alderfly	4	*	0	=	0
	Fishfly or Helgrammite	0	*	1	=	0
Coleoptera	Riffle Beetle	4	*	5	=	20
	Water Penny	4	*	2	=	8
	Beetle & Beetle-like	7	*	4	=	28
Others	Crayfish	6	*	0	=	0
	Snails	7	*	0	=	0
	Aquatic Worms	8	*	2	=	16
	Scuds	8	*	0	=	0
	Sowbugs	7	*	0	=	0
	Clams	8	*	0	=	0

Total Biotic Score: 436

$$\text{Final Biotic Score} = \frac{\text{Total Biotic Score}}{\text{Total \# Individuals Counted for all Groups}}$$

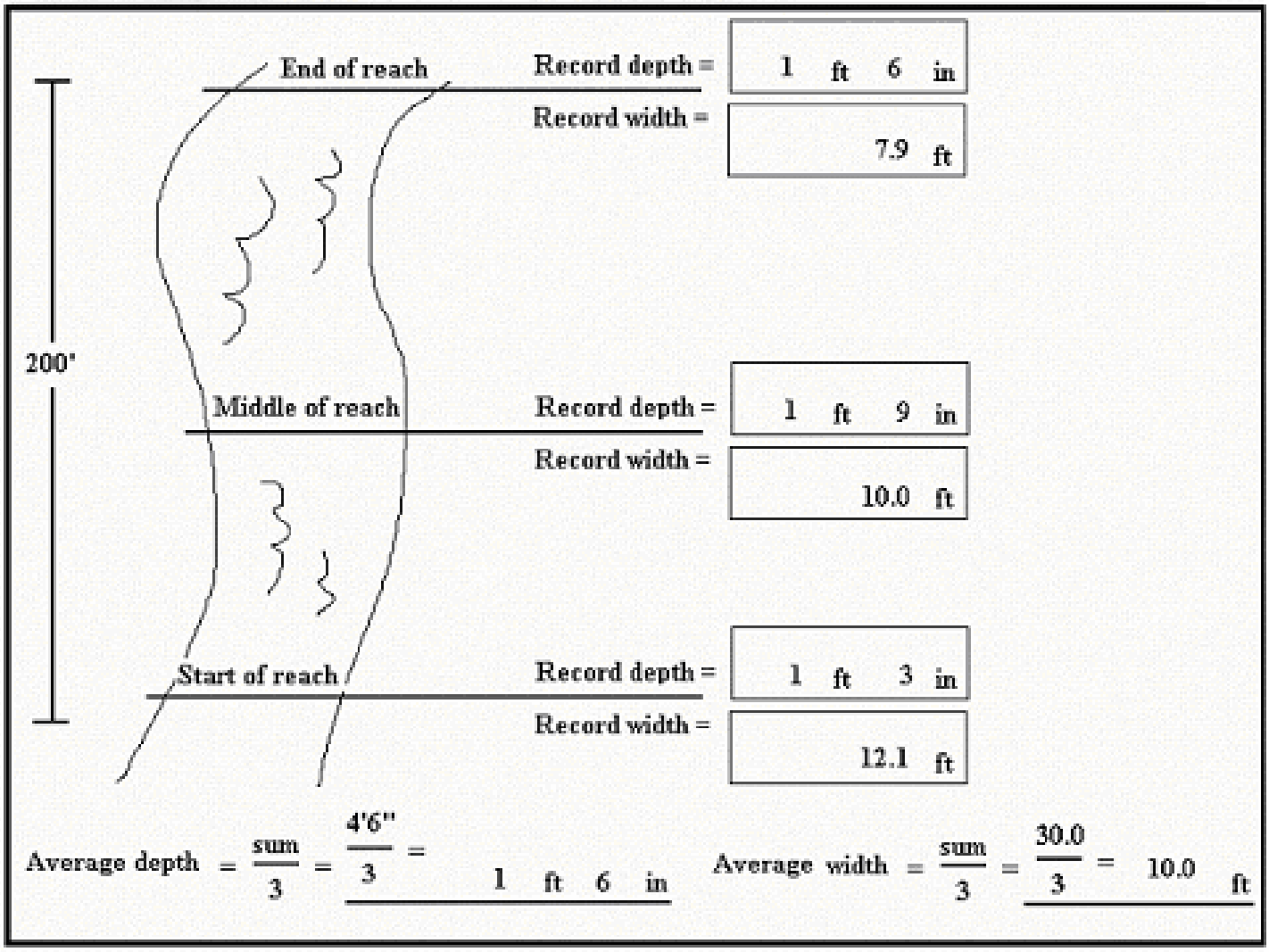
$$\text{Final Biotic Score} = \frac{436}{115} = 3.8$$

Circle the Water Quality Score that corresponds to the Final Biotic Score.

Water Quality Score	
0 - 3.5	Excellent
>3.5 - 4.8	Good
>4.8	Fairly Poor

This is your Biological Water Quality Score
Enter this Score on the Site Sheet.

Sample Volunteer Biomonitoring Physical/Chemical Data Sheet



*All chemical samples should be taken in an undisturbed area before performing all other in-stream sampling activities.

*These are the 4 required parameters. Others may be taken.

Chemical Parameter	Date	Value	Meter #
pH	7/2/03	6.8	16A
Dissolved Oxygen	7/2/03	8.2 mg/L	15B
Temperature	7/2/03	20.1 °C	10A
Conductivity	7/2/03	30 uS/cm	16C

Volunteer Biomonitoring Habitat Data Sheet

Stream Name_____ **Town**_____

Volunteer Group_____ **VBAP Staff**_____

Date and Time_____ **Photo #'s & Labels**_____

Weather Conditions

	Past 3 days	**Today**
Heavy rain/ downpour		
Steady rain		
Intermittent rain		
Overcast/ cloudy		
Clear/Sunny		
Air Temperature °F		

Surrounding Land Use (estimate % of each if multiple surrounding land uses)**:**

- ❑ Forest
- ❑ Field/Pasture
- ❑ Agricultural
- ❑ Residential
- ❑ Commercial
- ❑ Industrial
- ❑ Other_____

Riparian Vegetation (dominant vegetative type)**:**

- ❑ Trees
- ❑ Shrubs
- ❑ Grasses
- ❑ Herbaceous (non-woody, green and leaf-like)

Width of Riparian Zone:

-Left Bank _____0-20' _____20-100' _____100-500' _____>500'

-Right Bank _____0-20' _____20-100' _____100-500' _____>500'

Canopy Cover:

_____open _____<10% _____10-40% _____40-75% _____>75%

% of tree type (deciduous/coniferous) _____

Eroded or Disturbed Banks:

Left Bank

_____ None noticeable

_____ Slight (some areas of erosion, but no noticeable impacts to streambed)

_____ Moderate (frequent areas of erosion, with minor impacts to streambed)

_____ Heavy (erosion impacts streambed)

Right Bank

_____ None noticeable

_____ Slight (some areas of erosion, but no noticeable impacts to streambed)

_____ Moderate (frequent areas of erosion, with minor impacts to streambed)

_____ Heavy (erosion impacts streambed)

Flow (estimate requires general idea of water levels during sampling period)**:**

- ❑ Low (below average level for the time of the year)
- ❑ Moderate (approximate seasonal average)
- ❑ High (above average level for the time of the year)

Frequency of habitat type within Reach (Chose most prevalent habitat type):

_____Riffles _____Pools _____Run/Glide

Water Color:

- ❑ Clear
- ❑ Green
- ❑ Reddish/orange
- ❑ Cloudy
- ❑ Muddy

Presence Logs or Woody Debris:

_____None _____Occasional (present but not frequently encountered) _____Common (present and frequently encountered

Stream Substrate (Describe the substrate at the sampling site)**:**

- ❑ Clay (hard, slippery, muddy)
- ❑ Silt (smooth, fluffy, easily suspended in water)
- ❑ Sand (smaller than marble and gritty)
- ❑ Gravel (marble to tennis ball)
- ❑ Cobble (tennis ball to basketball)
- ❑ Boulder (basketball size or larger)
- ❑ Bedrock (solid surface)

Embeddedness:

- ❑ Cobble and boulder particles are 0-25% surrounded by sediment (sand, silt).
- ❑ Cobble and boulder particles are 25-50% surrounded by sediment (sand, silt).
- ❑ Cobble and boulder particles are 50-75% surrounded by sediment (sand, silt).
- ❑ Cobble and boulder particles are more than 75% surrounded by sediment (sand, silt).

Aquatic Vegetation:

- ❑ Algae (no stems, leaves or roots)
- ❑ Moss (small plant with stems, leaves and roots, often found in mat-like structures)
- ❑ Plants
- ❑ Invasive Species: _____

Comment Section (Note any unusual items such as water smell, streamside activities, garbage, storm water inputs, drainage pipes, etc.):

_____

_____

_____

Site Sketch:

Features to Include in Site Drawing
→ Direction of flow
~ Riffle
== Run
O Pool
× Location of each sample
Also include: Distance from road/bridge Woody debris/trees, Pipes, Any anthropogenic or unusual features

VBAP Protocol

Volunteer Biomonitoring Macroinvertebrate Data Sheet

Additional Information:

_____ Number of people sorting X 1 hour = _____ Total elapsed time-spent sorting

_____ Fraction of the portion selected X _____ Percentage of sample sorted = _____ Total sample sorted

Site Number_____Stream Name_____Town_____

Volunteer Group_____

Staff Present_____Date_____Replicate Number_____

	Group		# Individuals (Raw Tally)	Totals
Insects	Ephemeroptera	Mayfly Nymph		
	Plecoptera	Stonefly Nymph		
	Trichoptera	Caddisfly Larvae		
	Odonata	Dragonfly Nymph		
		Damselfly Nymph		
	Diptera	Black fly larvae		
		Midge larvae		
		Most True Flies		
	Megaloptera	Alderfly		
		Fishfly or Helgrammite		
	Coleoptera	Riffle Beetle		
		Water Penny		
		Beetle & Beetle-like		
Non-Insects	Others	Crayfish		
		Snails		
		Aquatic Worms		
		Scuds		
		Sowbugs		
		Clams and Mussels		

**Aim to identify >100 organisms.

Total # Individuals Counted for all Groups _____

Second sorter Quality Control (i.e. numbers found by second sorter)

Bugs found remaining in the kick net after emptying the net into the pan after 5 kicks_____

Bugs found in each debris pile after initial sort: Square1_____Square2_____Square3_____Square4_____

**Refer to instructions at Step 3 for these two sorting Quality Control recordings.*

Volunteer Biomonitoring Biological Water Quality Score Sheet - Biotic Index Calculation Worksheet

Site Number_____ **Stream Name**_____ **Town**_____

Volunteer Group_____

Staff Present_____ **Date**_____ **Replicate Number**_____

The invertebrate Groups below have different sensitivities to pollution. These sensitivities have both a narrative and numeric ranking as summarized here. Calculate the Final Biotic Score by multiplying the Tolerance Value by the Totals Found. Sum each row in the Biotic Score column and place this value in the Total Biotic Score line. Calculate Final Biotic Score according to calculation below. This is your Biological Water Quality Score.

	Group	Tolerance Value	*	Totals Found	=	Biotic Score
Ephemeroptera	Mayfly Nymph	3	*		=	
Plecoptera	Stonefly Nymph	1	*		=	
Trichoptera	Caddisfly Larvae	4	*		=	
Odonata	Dragonfly Nymph	3	*		=	
	Damselfly Nymph	7	*		=	
Diptera	Black fly larvae	7	*		=	
	Midge larvae	6	*		=	
	Most True Flies	4	*		=	
Megaloptera	Alderfly	4	*		=	
	Fishfly or Helgrammite	0	*		=	
Coleoptera	Riffle Beetle	4	*		=	
	Water Penny	4	*		=	
	Beetle & Beetle-like	7	*		=	
Others	Crayfish	6	*		=	
	Snails	7	*		=	
	Aquatic Worms	8	*		=	
	Scuds	8	*		=	
	Sowbugs	7	*		=	
	Clams and Mussels	7	*		=	

Total Biotic Score_____

Final Biotic Score = $\frac{\text{Total Biotic Score}}{\text{Total \# Individuals Counted for all Groups}}$

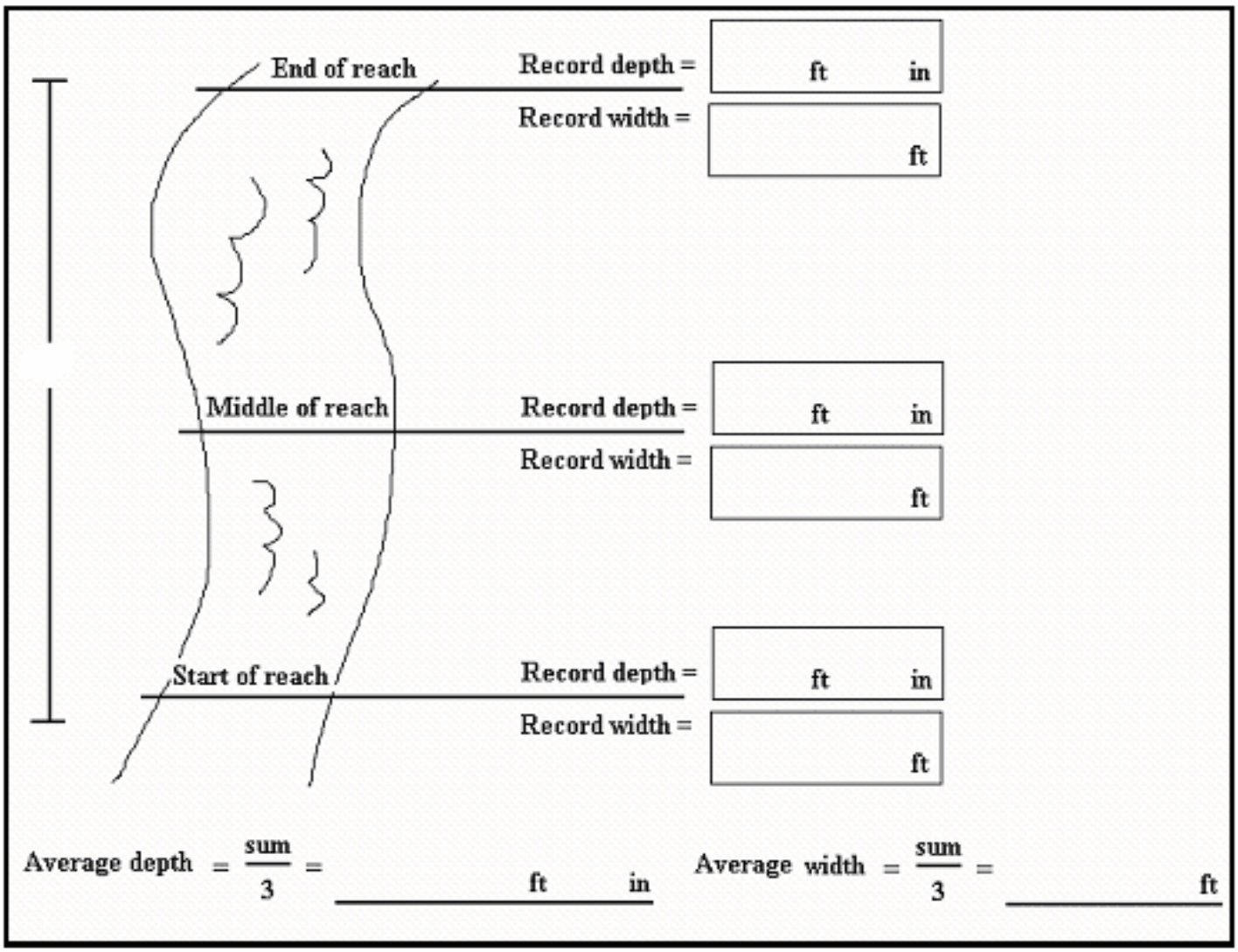
Final Biotic Score = _____ =

Circle the Water Quality Score that corresponds to the Final Biotic Score.

Water Quality Score	
0 - 3.5	Excellent
>3.5 - 4.8	Good
>4.8	Fairly Poor

This is your Biological Water Quality Score
Enter this Score on the Site Sheet.

Volunteer Biomonitoring Physical/Chemical Data Sheet



*All chemical samples should be taken in an undisturbed area before performing all other in-stream sampling activities.

*These are the 4 required parameters. Others may be taken.

Chemical Parameter	Date	Value	Meter #
pH			
Dissolved Oxygen			
Temperature			
Conductivity			