Reading the River
What's in the Water?
6th, 7th, & 8th Grade Special Needs
Small Group Science

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Lesson Context

This activity is the culminating activity for the students' studies of the nature trail, **Naturally For Kids,** located on the school grounds. The students at the various grade levels have studied different aspects of factors in the environments located along the trail. The sixth graders identify the different types of habitats and learn about the native trees and plants. The seventh graders learn about biotic and abiotic factors and how these factors affect the habitats within the environment. The eighth graders observe and identify the cycles that occur naturally in nature and discuss human impact on those cycles. For the students who completed this activity in previous years, this activity serves as a review and reinforcement of the information. Students will discuss any changes that have occurred in his/her interactions with the environment as a result of previous studies and provide ideas and suggestions for the new students within the group.

The Licking River runs through the county. The students and their families impact and utilize the river in numerous ways. Teaching the students about the factors that affect the quality of the water and the aquatic life found within the river environment and his/her impact on those factors are the major goals of this lesson.

Choose a site that allows for studies of a riffle, a run, and a pool section of the river or stream. Observing the physical characteristics in the area provides background information about the types of organisms that may be present in this location. Testing the chemical composition of the area will allow the students to understand that human activities upstream from the site can affect the types of organisms they may find. Tests for bacteria and algal growth will be compared to similar studies completed with water environments located along the nature trail. Obtaining samples of the organisms in the area will allow the students to determine if the river at this location is considered to be poor, fair, good, or an excellent site for aquatic life based on the parameters established by the Kentucky Division of Water. Students will use the Biological Monitoring Assessment Report (modified from the original to meet the needs of the students with special needs), chemical testing for dissolved oxygen, pH levels, Physical Characterization/Water Quality Field Data Sheet (modified to meet the students' needs), and the Habitat Assessment Field Data Sheet – High Gradient Streams (modified to meet the students' needs).

Core Content for Assessment (Grades 5-7 with Assessment at Grade 7)

Physical Science

Properties of Matter

SC-M 1.1.1 A substance has characteristic physical properties (e.g., density, boiling point, solubility) that are independent of the amount of the sample. A mixture of substances often can be separated into the original substances by using one or more of these characteristic physical properties.

SC-M 1.1.2 The chemical properties of a substance cause it to react in predictable ways with other substances to form compounds with different characteristic properties. In chemical reactions, the total mass is conserved. Substances are often classified into groups if they react in similar ways.

SC-M 1.1.3 Chemical elements do not break down during normal laboratory reactions such as heating, exposure to electric currents, or reaction with acids. Elements combine in many ways to produce compounds.

Transfer of Energy

SC-M 1.3.3 Light energy interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).

SC-M 1.3.4 The Sun is a major source of energy for changes on Earth's surface. The Sun loses energy by emitting light. A tiny fraction of that light reaches Earth, transferring energy from the Sun to Earth.

Earth and Space Science

Structure of Earth

SC-M 2.1.5 Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water dissolves minerals and gases and may carry them to the oceans.

Earth in the Solar System

SC-M 2.3.4 The Sun is the major source of energy for Earth.

The water cycle, winds, ocean currents, and growth of plants are affected by the Sun's energy. Seasons result from variations in the amount of the Sun's energy hitting Earth's surface.

Life Science

Structure and Function

SC-M 3.1.1 Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, tissues, organs, organ systems, organisms (e.g., bacteria, protists, fungi, plants, animals), and ecosystems.

SC-M 3.1.2 All organisms are composed of cells, the fundamental unit of life. Most organisms are single cells; other organisms, including plants and animals are multicellular.

Regulation and Behavior

SC-M 3.2.1 All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.

Reproduction and Heredity

SC-M 3.3.1 Reproduction is a characteristic of all living systems and is essential to the continuation of every species. Some organisms reproduce asexually, others reproduce sexually. In species that reproduce sexually, including humans and plants, male and female sex cells carrying genetic information unite to begin the development of a new individual.

Diversity

SC-M 3.4.2 Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.

Populations and Ecosystems

SC-M 3.5.1 A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.

SC-M 3.5.2 Populations of organisms can be categorized by

the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

SC-M 3.5.3 For most ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.

SC-M 3.5.4 The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Scientific Inquiry

AE 2.1 Scientific Ways of Thinking and Working

- ✓ refine and refocus questions that can be answered through scientific investigation combined with scientific information.
- ✓ use appropriate equipment, tools, techniques, technology, and mathematics to gather, analyze, and interpret scientific data.
- ✓ use evidence (e.g., computer models), logic, and scientific knowledge to develop scientific explanations.
- ✓ design and conduct scientific investigations.
- ✓ communicate (e.g., write, graph) designs, procedures, observations, and results of scientific investigations.
- ✓ review and analyze scientific investigations and

explanations of other students.

Applications/Connections

Science and Technology
Science in Personal and Social Perspectives
History and Nature of Science

Student Objectives

Students will be able to:

- ✓ identify the effects of the Sun's energy on Earth's process (i.e., plant growth, water cycle)
- ✓ investigate how organisms obtain and use resources, grow, reproduce, and maintain stable internal conditions.
- ✓ analyze environmental stimuli and organisms' behavioral responses
- ✓ observe populations and determine the functions they serve in an ecosystem
- ✓ investigate energy flow in an ecosystem
- ✓ investigate factors that affect the number of organisms an ecosystem can support
- ✓ recognize how science is used to understand changes in populations, issues related to resources, and changes in environments
- ✓ recognize that elements do not break down during normal laboratory reactions
- ✓ examine evidence for changes in life and environmental conditions
- ✓ use science to evaluate the risks and benefits to society for common activities
- ✓ measure and represent forces on objects
- ✓ investigate transfer of energy
- ✓ investigate and analyze populations and ecosystems
- ✓ analyze diversity and adaptations
- ✓ identify and refine questions that can be answered through scientific investigations combined with scientific information
- ✓ use appropriate equipment, tools, technology, and mathematics in scientific investigations

- ✓ use evidence and scientific knowledge to develop scientific explanations
- ✓ communicate designs, procedures, and results of scientific investigations

List of Materials

- ✓ Calculators/Stop watches
- ✓ Nutrient Agar Plates (preferably 2 per student)
- ✓ Sterile cotton swabs
- ✓ Sharpie Markers
- ✓ Microscopes
- ✓ Water samples (2-3 different water sources)
- ✓ Thermometers (1 per group)
- ✓ Meter sticks (1 per group)
- ✓ Hand nets (2 per group)
- ✓ Clipboards (1 per group)
- ✓ Data Sheets (**Stream Insects & Crustaceans** (white paper), **Kentucky Water Watch Biological Monitoring Assessment Report** – modified (blue paper), **Physical Characterization/Water Quality Field Data** – modified (green paper) – **chemical tests included, Habitat Assessment Field Data Sheet** – modified (green paper) (Laminate 3 of each for use at site, then 1 copy for each student to transfer information)
- ✓ Minimum 2 water collecting tubes for each group
- ✓ Dissolved oxygen (DO) test kit
- ✓ pH test kit (you may chose to test for other minerals if test kits are available – these provide a background for the chemical tests completed on water samples.)
- ✓ Seine
- ✓ Collecting jars for macroinvertebrates (can use 5 gallon buckets)
- ✓ 3-4 pair of forceps per group
- ✓ Large trash bags
- ✓ Resource personnel from Kentucky Department of Fish and Wildlife (Make initial contact as soon as you begin planning. Be flexible with dates due to schedule conflicts and weather.)

Procedure

Background

****Be sure to contact your resource personnel at the Kentucky Department of Fish and Wildlife as soon as you can. They are more than willing to assist with this type of activity, but they are very busy and need enough notice to work the trip into their schedule. They often rely on volunteers to help with these types of field experiences and also need time to contact their volunteers. They will obtain permission for the site.**

Provide students with background information about the things he/she may find in his/her surroundings. My students have been studying, identifying, and collecting evidence of the various habitats, native trees, plants, animals, cycles – water, oxygen, nitrogen, biotic, and abiotic factors. Each level has collected information based on specifics related for his/her grade level. This activity allows the students from each grade level to apply his/her studies to this culminating activity.

The students are given background information about what he/she will be responsible for collecting at the assigned site. Handouts will be reviewed prior to the trip to answer any questions or concerns the students may have about the data to be collected. Complete this part 1 –2 days prior to the trip. This way the information will be fresh in the students mind and will help eliminate confusion during collection of data at the site.

Be sure to share the information with the other teachers who will be assisting with the trip. If parents are assisting, try to provide background information about the requirements and expectations for the students prior to the day of the trip. **(* Note**: Schedule an informal meeting if at all possible and go over the entire procedure with the other teachers and parents. This will give them the information they need and eliminates a lot of confusion about roles and responsibilities the day of the trip. This was a problem during the trip last year because not enough background information about requirements for the students was given to the other teachers assisting with the trip.)

Before the day of the trip, divide the students into 3 groups. This allows you, as the teacher, to develop groups that allow each student to develop and utilize skills that will enable the group to perform each task required efficiently. The groups can be a combination of 6^{th}, 7^{th}, and 8^{th}

graders based on the skill levels of the child. For the students who are unable to actually get into the water to collect samples, exhibit a fear of water, or whose parents do not give permission, those students can conduct the chemical tests on land, be official recorders of data, the designated reader, or the official photographer for the group. A minimum of 1 digital/video camera is a must. If you have access to more than 1, pictures can be taken from different perspectives for comparison at a later date.

This trip takes some planning and preparation, but it an excellent learning experience for the students. It provides information and a background experience that allows the students to observe, question, and define impact of human activity on the water environment. What my students identified as we first reached the site last year was all the garbage and litter that was found along the site we visited. They could not believe that people had left so much garbage at this site. They picked up the litter they found before we started our studies at the site. This year I plan to take plenty of large trash bags. **Also, remind the students for 2-3 days before the trip they will need a complete change of clothes and shoes.**

Prepare laminated copies of handouts several days ahead. If you have a resource person that does the copying and laminating, this gives them plenty of time to have them ready. Check with the resource person from the Department of Fish and Wildlife at periodic intervals to make sure the trip is still "a go." Collect the equipment and materials and divide into 3 groups 1-2 days ahead of time. If possible, allow the students to perform the chemical tests on water samples ahead of time or do a class demonstration so the students are familiar with the procedure he/she will need to follow.

Day of the Trip

- ✓ Check the site on your way to school
- ✓ Double check permission slips (sample included in handouts)
- ✓ Check with students for change of clothes (you have the option of not allowing them in the water without a change of shoes/clothes. Some may choose to wear wet shoes the remainder of the day.)
- ✓ Divide students into identified groups – assign 1 group to the riffle area, 1 group to the run area, and 1 group to the pool area of the site
- ✓ Provide each group with the equipment and handouts (see

- ✓ **Checklist of Equipment/Supplies** handout for each group).
- ✓ At the site – identify the riffle, run, and pool section for the groups
- ✓ Have students observe surroundings, check DO, pH, temperature and record on **Physical Characterization/Water Quality/Water Chemistry Field Data Sheet** – modified for each section.
- ✓ Use seine and gently kick rocks on bottom of section. Collect organisms and materials loosened in net for identification. Repeat this process 3-5 times at each section. Place any organisms found into collection jars.
- ✓ Measure depth of area at 3 different points – record deepest point.
- ✓ Measure width of stream at widest point in the section. Record data.
- ✓ Measure off 3 meters and time the rate of flow of an object floating downstream. Record data.
- ✓ Observe and record substrate for area based on size classifications on **Physical Characterization**...modified handout.
- ✓ Observe turbidity of water - *Clear *Stained *Opaque *Turbid *Slightly turbid *other_____. Record data on **Physical Characterization**…modified handout.
- ✓ Have students complete **Habitat Assessment Field Data Sheet** – modified for each section.
- ✓ You may identify species collected on site or back in the lab at school. Use **Stream Insects and Crustaceans Guide** for identification of aquatic macroinvertebrates. Record data on **Kentucky Water Watch Biological Monitoring Assessment Report** handout.
- ✓ Determine cumulative index value using formula provided on handout listed above.
- ✓ Review data and observations from the **Biological Monitoring, Physical Characterization/Water Chemistry,** and **Habitat Assessment** to determine overall quality of the water and stream at location.

Method of Assessment

Students at all grade levels will be assessed based on his/her responses to the Open-response question and rubric guidelines provided. The seventh grade students will prepare a thank you letter to the personnel from the Kentucky Department of Fish and Wildlife explaining what he/she learned during the trip and the importance of monitoring his/her impact on the surrounding environment. This letter makes an excellent portfolio piece from the science content area for the seventh graders. Last year's group found this to be one of the easiest entries for his/her portfolio. (Outline and rubric for the letter provided in the handouts.) Access to a word bank based on student request also benefits the students in my groups. All students will be assessed based on his/her group participation, behavior, and identification of organisms and water quality parameters.

Description of Concept/Skill

At the end of this activity the students will demonstrate knowledge of the following concepts/skills:

- ✓ environmental, physical, and chemical factors that impact diversity of species in the ecosystem studied
- ✓ appropriate use of equipment and tools for scientific investigations
- ✓ an understanding of his/her impact on the cycles that occur naturally in the environment
- ✓ the sun is the major source of energy for Earth
- ✓ understand how science is used to evaluate the risks and benefits to society for common activities
- ✓ how evidence and scientific knowledge is used for scientific explanations

After the Trip

The day after the trip agar plates, with smears from the river water collected, will be prepared for observation in 24-48 hours. The students will also prepare slides to locate and identify forms of algae that may be present in the water. A comparison will be made of the algal growth observed in the river to what the students observed in the pond and small stream on the nature trail.

Following this activity the students will complete the Open Response

question and write thank-you letters to the people from the Department of Fish and Wildlife. The rubrics will be used to assess the students' responses and provide them with the requirements to obtain a proficient or distinguished level. (*Note: This group of students is identified with having special needs. The needs vary from child to child as related to his/her specific disability.)

Special Note:

This trip requires a great deal of planning and preparation. There were some difficulties that occurred during last year's trip and this writer was not sure an activity of this scope was actually feasible with the students. Discussions with my peers, who participated and assisted with the activity, resulted in this curriculum plan and the courage to do this activity again. The students thoroughly enjoyed this activity last year and they learned a great deal. Meeting the needs of my students and providing them the opportunity to relate the concepts involved with a lesson of this scope are the basis for the development of this lesson/activity. This activity not only meets the core content identified earlier in this plan, but provides the information and background identified by the National Association for Environmental Education to assist my students as he/she becomes an environmentally literate adult of tomorrow.

"Stream Walk"
Thank You Letter – Friendly Block Letter Format

Return Address
Date

Recipient's Address

Greeting,

Paragraphs

1. Initial thank you for helping with the trip.
2. What was most interesting part of day?
3. What was most interesting thing you found?
4. Things you saw you did not like (organisms or behaviors)?
5. Would you like to do this kind of trip again? Why or why not?
6. What would you like to be done differently?
7. How have your studies affected your actions as they relate to taking care of your environment?
8. Conclusion – Final thank you and closing thoughts

Closing,

Signature

Sample Permission Letter

(Space provided to copy onto School Stationary/Letterhead)

Date

Dear Parent/Guardian,

A "Stream Walk" has been planned for the small group math, social studies, and science classes on Date_____. The students have been studying the Nature Trail and many of the factors that work in nature.

Vicki Rawe and several people with the Department of Fish and Wildlife are going to help us collect some of the species that are found in the small stream ecosystems in the area. The students will identify as many of the species as they can with assistance from the Department and teachers. Then the students will bring the organisms back to school to observe in the large aquarium in the science classroom.

Your child will need your permission to be in the stream that day, and they will need to wear old shoes and clothes to school. They should also bring dry shoes and a change of clothes (just in case someone slips). Your child will be well-chaperoned, and they do not have to get in the water. Those that do not want to get in will be able to listen and observe what is going on from the bank.

We will be taking a sack lunch and the cooler for drinks. If you have any questions or concerns, please feel free to contact me at school. Please sign in the spaces below: one gives your permission for your child to get in the stream, and the other gives your permission for them to go.
Sincerely,

Your Name	Name	Name	Name
Science Teacher	Math Teacher	SS Teacher	LA Teacher

1. My child, _____, has my permission to get into the stream to collect samples.

Parent/Guardian Signature: _____

2. My child, _____, has my permission to go on the "Stream Walk" field trip on Date_____.

Parent/Guardian Signature: _____

KENTUCKY WATER WATCH
BIOLOGICAL MONITORING ASSESSMENT REPORT
(Modified from the Original form from the Kentucky Division of Water)

River Basin:	Date: Time:
Stream Name:	Supervising Sampler:
Sampling Site (GPS Reading):	Organization:

MACROINVERTEBRATE TALLY

GROUP 1 TAXA	TALLY	GROUP 2 TAXA	TALLY	GROUP 3 TAXA	TALLY
WATER PENNY LARVAE		DAMSELFLY NYMPHS		BLACKFLY LARVAE	
MAYFLY NYMPHS		DRAGONFLY NYMPHS		AQUATIC WORMS	
STONEFLY NYMPHS		CRANE FLY LARVAE		MIDGE LARVAE	
DOBSONFLY LARVAE		BEETLE LARVAE		POUCH SNAILS	
CADDISFLY LARVAE		CRAYFISH		LEECHES	
RIFFLE BEETLE ADULTS		SCUDS			
OTHER SNAILS		CLAMS			
		SOW BUGS/ISOPODS			
Number of taxa present		Number of taxa present		Number of taxa present	
Times index value of (3)		Times index value of (2)		Times index value of (1)	
	Cumulative Index Value				

BIOLOGICAL ASSESSMENT SCALE

0 <11	POOR
11 – 16	FAIR
16 < 21	GOOD
21 – 30+	EXCELLENT

Refer to Stream Insects & Crustaceans handout for identification of macroinvertebrates. For more detailed pictures refer to New York State Department of Environmental Conservation – Key to Aquatic Macroinvertebrates – pages 1-6 from http://www.dec.state.ny.us click on Programs, then Division of Water, then Watershed Assessment and Research, and then Pictorial Key to Aquatic Macroinvertebrates.

PHYSICAL CHARACTERIZATION/WATER QUALITY (Chemistry)
FIELD DATA SHEET (FRONT)
(Modified from the original in Watershed Habitat Assessment Protocols)

Stream Name:	River Basin:
Lat:_____ Long:_____	Agency:
Form Completed By:	Date: _____ Time: _____AM PM

WEATHER CONDITIONS	Now Past 24 hours Has there been a heavy rain in the last ☐ ☐ storm (heavy) 7 days? Yes_____ No_____ ☐ ☐ rain (steady) ☐ ☐ showers Air Temperature_____ ☐ ☐ _____% cloud cover ☐ ☐ clear/sunny Other_____
SITE LOCATION/ MAP	Draw a map of the site and show the areas sampled (or attach a photograph
STREAM CHARACTERIZATION	Stream Origin ☐ Glacial ☐ Spring-fed ☐ Swamp and bog ☐ Mixture of origins ☐ Other _____ Stream Type ☐ Coldwater ☐ Warmwater

PHYSICAL CHARACTERIZATION/WATER QUALITY (Chemistry)
FIELD DATA SHEET (BACK)
(Modified from the original in Watershed Habitat Assessment Protocols)

WATERSHED FEATURES	Surrounding Land use □ Forest □ Commercial □ Field/Pasture □ Industrial □ Agricultural □ Other _____ □ Residential Local NPS Pollution □ No evidence □ Some potential sources □ Obvious sources Local Erosion □ None □ Moderate □ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Mark the dominate type and record the dominate species present □ Trees □ Shrubs □ Grasses □ Herbaceous dominate species present_____
INSTREAM FEATURES (RECORD THE DATA FOR YOUR SECTION)	Estimated width_____ High water mark_____m Estimated depth _____ Channelized □ Yes □ No Surface velocity _____m/sec Dam present □ Yes □ No Canopy Cover □ Partly open □ Partly shaded □ Shaded
AQUATIC VEGETATION	Mark the dominate type and record the dominate species present □ Rooted emergent □ Rooted submergent □ Rooted floating □ Free floating □ Floating algae □ Attached algae dominate species present _____ % of the reach with aquatic vegetation _____%
WATER QUALITY	Temperature _____°C Dissolved oxygen (DO) _____ppm pH _____ Water Odors □ Normal/none □ Sewage □ Petroleum □ Chemical □ Fishy □ Other_____ Turbidity (if not measured) □ Clear □ Slightly turbid □ Turbid □ Opaque □ Stained □ Other _____
SEDIMENT/SUBSTRATE	**Odors** □ Normal □ Sewage □ Petroleum □ Chemical □ None □ Other _____ **Oils** □ Absent □ Present – level _____ **Deposits** □ Sludge □ Sawdust □ Sand □ Other _____ **Are the rocks you see black on the bottom?** □ Yes □ No

PHYSICAL CHARACTERIZATION/WATER QUALITY (Chemistry)
FIELD DATA SHEET (BACK – cont.)
(Modified from the original in Watershed Habitat Assessment Protocols)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not need to add up to 100%)		
Substrate Type	**Diameter**	**% Composition**	**Substrate Type**	**Characteristics**	**% Composition**
Bedrock	Flat layer you can walk on		Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	>256 mm (10") (size of your skull)		Muck-Mud	black, very fine organic materials (FPOM)	
Cobble	64-256 mm (2.5-10") (golf ball sized – less than skull)		Marl	grey, shell fragments	
Gravel	2-64 mm (0.1 – 2.5") (size of a pea – less than golf ball)		**NOTES**		
Sand	0.06-2 mm (gritty) (sand on the beach)		**NOTES**		
Silt	0.004-0.06 mm (really fine)		**NOTES**		
Clay	<0.004 mm (slick and gooey)		**NOTES**		

HABITAT ASSESSMENT FIELD DATA SHEET – HIGH GRADIENT STREAM (FRONT 1-5; Back 6-10)

(Modified from the original in Watershed Habitat Assessment Protocols)

Stream Name:	River Basin:
Lat:_____ Long:_____	Agency:
Form Completed By:	Date: _____ Time: _____AM PM

_____Condition Category _____

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 70% favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks or other stable habitat.	40-70% mix of stable habitat, well suited for full colonization; some new substrate in the form of new fallen trees/bushes.	20-40% mix of stable habitat; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble allows for diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder are more than 75% surrounded by fine sediment.
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regimes (Regions)	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is <0.3 m/s; deep is >0.5m)	Only 3 of the 4 regimes are present (if fast-shallow is missing score lower than if others missing)	Only 2 of the 4 are present (score lower if fast-shallow or slow-shallow are missing)	Dominated by 1 velocity/depth region (usually slow-deep)
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment/ Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new deposits in bar formation mostly from gravel, sand, or fine sediment; 5-30% of bottom is affected, slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of bottom affected. Sediment deposits at obstructions.	Heavy deposits of fine material, increased bar development, more than 50% of bottom changing frequently; pools almost absent
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Add Scores Total for this page **_____**				

5. Channel Flow Status	Water reached base of both lower banks, and little of channel substrate is exposed.	Water fills >75% of channel (<25% of channel substrate exposed)	Water fills 25-75% of available channel (riffle substrates are mostly exposed)	Very little water in channel and mostly present as standing pools
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging (digging) absent or very small; stream has normal pattern.	Some channelization present usually in areas of bridge abutments; dredging (>20 years) is present but not new.	Channelization may be great; 40-80% of stream reach channelized or disrupted.	Banks shored with gabions or cement; >80% of stream reach channelized or disrupted. Instream habitat greatly altered or removed.
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles or bends	Riffles occur frequently; ratio of distance between riffles divided by width of stream is <7:1.	Riffles infrequent; distance between riffles divided by width of stream is 7-15.	Riffles once in awhile; some habitat on bottom; distance between riffles divided by width of stream is 15-25.	Mainly all flat water or very shallow riffles; poor habitat; distance between riffles divided by width of the stream is >25.
Score_____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (Score each bank) *Note: determine left bank from right bank by facing downstream.	Bank stable; evidence of erosion or bank falling minimal; future problems not likely to happen. <5% of bank affected	Moderately stable bank; a few small areas of erosion which are mostly healed over. 5-30% of bank reach has erosion.	Moderately unstable; 30-60% of bank reach has areas of erosion; erosion likely during flooding.	Unstable; many areas eroded; "raw" areas seen along straight sections; bank slipping apparent; 60-100% of bank has erosional scars.
Score _____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
Score _____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the stream bank surfaces and immediate riparian zone is covered by native plants, understory shrubs, trees; disruption by mowing or grazing in minimal; most plants grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one group not well represented; disruption evident but does not affect full plant growth.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation.	Less than 50% of the stream bank surfaces covered by vegetation. disruption of bank very high.
Score _____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
Score _____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities have not impacted zone.	Width of riparian zone 12-18 meters; human activities impact on zone minimal.	Width of riparian zone 6-12 meters; human activities impact zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
Score _____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
Score _____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____ (add all scores together)

Open Response Prompt
"Can I Play in the Stream?"

There is a farm for sale that your family is thinking about purchasing. A stream borders one side of the property. You are excited about the possibility of being able to play in the stream and maybe catch some fish.

a. What are three of the chemical factors of the stream you need to test to make sure it might be a good place to find fish and be a safe place to play?

b. What are five of the physical factors would you want to know about the stream?

c. What types of biological life would you expect to find based on the chemical and physical factors you identified?

Answer the questions above on the lined sheet provided.

What's in the Water?
Collaborative Work Skills Rubric
(Modified from rubistar)

CATEGORY	Excellent	Good	Satisfactory	Needs Improvement
Focus on the task	Consistently stays focused on the task and what needs to be completed. Self-directed.	Focuses on the task and what needs to be completed most of the time. Other group members can count on this person.	Focuses on the task and what needs to be completed some of the time. Other group members must sometimes remind this person to stay focused on task.	Rarely focuses on the task and what needs to be completed. Lets the other group members complete the tasks.
Working with Others	Almost always listens to, shares with, and supports the efforts of other group members. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of other group members. Does not disrupt work of other group members.	Often listens to, shares with, and supports the efforts of other group members, but sometimes is not a good group member.	Rarely listens to, shares with, and supports the efforts of other group members. Does not work well with other group members.
Attitude	Always has a positive attitude about the task at hand. Does not criticize work of others in the group.	Often has a positive attitude about the task at hand. Rarely criticizes the work of others in the group.	Usually has a positive attitude about the task at hand. Sometimes is critical of the work of others in the group.	Sometimes has a positive attitude about the task at hand. Usually critical of the work of others in the group.
Contributions	Routinely provides useful ideas about the task to complete. A definite leader who contributes much effort.	Usually provides useful ideas about the task to complete. A strong group member who works very hard.	Sometimes provides useful ideas about the task to complete. A group member who does what is required but does not volunteer.	Rarely provides useful ideas about the task to complete. Usually refuses to participate in group activities.
Pride	Work reflects best efforts of student.	Work reflects strong effort of student.	Work reflects some effort of student.	Work reflects little effort of student.

What's in the Water?
Friendly Letter Block Format Rubric
(modified from rubistar)

CATEGORY	Distinguished	Proficient	Apprentice	Novice
Format	Complies with all the requirements for a friendly block letter format.	Complies with almost all of the requirements for a friendly block letter format.	Complies with several of the requirements for a friendly block letter format.	Complies with less than 75% of the requirements for a friendly block letter format.
Sentences and Paragraphs	Sentences and paragraphs (6 or more sentences) are complete, well constructed, and varied sentence structure.	All sentences are complete and well constructed (no fragments or run-ons). Paragraphs are 4-5 sentences and focused.	Most sentences are complete and well constructed. Paragraphs are only 3-4 sentences.	Many run-on or fragmented sentences. Paragraphs are 3 sentences or fewer.
Content Accuracy	The letter contains at least 7 accurate facts about the stream activities.	The letter contains 5-6 accurate facts about the stream activities.	The letter contains 3-4 accurate facts about the stream activities.	The letter contains 1-2 accurate facts about the stream activities.
Length	The letter contains at least all 8 paragraphs identified in the format provided.	The letter contains only 7 of the paragraphs identified in the format provided.	The letter contains only 5-6 of the paragraphs identified in the format provided.	The letter contains fewer than 5 paragraphs identified in the format provided.
Ideas	Ideas were expressed in a clear and organized manner. Goals and experiences learned during the stream walk were easy to identify.	Ideas were expressed clearly, but organization could have been better.	Ideas were somewhat organized, but not clear. Letter had to be read at least twice to determine what was learned during the activity.	Ideas were not clear and sentences were unrelated. It was difficult to determine what learning had taken place during the activity.

What's in the Water?
Open Response Rubric
(modified from rubistar)

CATEGORY	Distinguished	Proficient	Apprentice	Novice
Focus on Assigned Topic	The entire response is related to the assigned questions and the prompt. Answers allow the reader to understand more about activity.	Most of the response is related to the assigned questions and prompt. The answers wander off at one point, but the reader can learn something about the activity.	Some of the response is related to the questions and prompt, but the reader does not learn much about the activity.	Response is not related to the questions or the prompt provided.
Organization	The response is well organized. One idea follows the next in a logical sequence with clear transitions.	The response is pretty well organized. One or two ideas may seem out of place, but transitions are clear.	The response is difficult to follow. Transitions are not always clear.	Ideas are not connected. Response is not related to the prompt or the questions.
Accuracy of Facts	All facts presented in the response are accurate.	90% of the facts presented in the response are accurate.	80% of the facts presented in the response are accurate.	There are several factual errors in the response. Accuracy is less than 70%.
Neatness	The final draft is readable, clean, neat, and free of crossed out words or erasures.	The final draft is readable, clean, neat, and has one or two erasures or crossed out words.	The final draft is readable and most is clean and neat. Some parts exhibit evidence that the author was careless.	The final draft is difficult to read and contains many (>10) errors.

References

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The Save Our Streams Teacher's Manual – September 1994. **Stream Insects & Crustaceans.** The Izaak Walton League of America. MD, Gaithersburg. Science on the River Workshop. July 2001. Presented by Thomas More College.

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Kentucky Water Watch Biological Monitoring Assessment Report. Kentucky Division of Water. KY, Frankfort. Science on the River Workshop. July 2001. Presented by Thomas More College.

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