

## EXTREME STREAMS PREVISIT MATERIAL



One of the most important features of Mill Creek Park is the Creek! We will explore a key tributary Bear Creek. Students will be introduced to how to perform scientific inquiry to determine the health of a creek or stream by examining the macroinvertebrates living on the bottom.

We believe that hands-on learning is both effective and fun. An important part of the program will be student teams actually entering Bear Creek with a net to collect macroinvertebrates. **We recommend that students wear old shoes and clothing that they don't mind getting wet.**

Please use the following material to help prepare your class for their visit.

### BACKGROUND:

When pollution enters a stream, it becomes less healthy. Unfortunately, pollution gets into water in many ways. Water pollution is classified into two main categories: point and nonpoint sources. Point sources start from a specific point or place, such as a discharge pipe from a factory or sewage treatment plant. Nonpoint sources originate over a widespread area and it is thus difficult to determine exactly where the pollution comes from. Anything that lessens water quality can be considered a pollutant—even some things not commonly thought of as pollutants. For example, fertilizers running off farm land or lawns can cause pollution problems.

**Macroinvertebrate** may be a new term for both teachers and students. Macroinvertebrates are animals that have no backbone and are visible without magnification. Some examples of aquatic macroinvertebrates are adult insects such as water beetles, immature insects including mayfly nymphs, stonefly nymphs, dragonfly & damselfly larvae, and midge larvae, along with crayfish, leeches, aquatic worms, and many others.

Some stream-bottom macroinvertebrates cannot survive in polluted water. Others can survive or even thrive in polluted water. In a healthy stream, the stream-bottom community will include a variety of pollution-sensitive macroinvertebrates. In an unhealthy stream, there may be only a few types of nonsensitive, macroinvertebrates present. \*Some of this text is excerpted from *The Stream Study* by the University of Virginia which is based on *Save Our Streams* produced by the Izaak Walton League of America.

### ACTIVITIES:

#### **Matching Macroinvertebrates**

Help students to become familiar with some of the common macroinvertebrates. Photocopy the enclosed sheet and have your students match the adult insects with their larva.

#### **Creek Word Search**

Use copies of the enclosed sheet to help students learn or review vocabulary words.

#### **Fred the Fish**

We've enclosed this classic lesson that allows students to learn more about water pollution.

## VOCABULARY:

**Abdomen** – the rear body section of some invertebrates.

**Antennae** – flexible sensory appendages (occurring in pairs) on the heads of some invertebrates.

**Appendage** – any extension or outgrowth from the body.

**Bacteria** – single-celled microorganisms (largely responsible for decay and decomposition of organic matter).

**Black fly** – small, blackish, stout-bodied biting fly having aquatic larvae; sucks the blood of birds as well as humans and other mammals.

**Caddisfly** – small, moth-like insect having two pairs of hairy, membranous wings and aquatic larvae.

**Carnivorous** – meat eating.

**Clarity** – clearness or transparency.

**Crayfish** – small freshwater crustacean that resembles a lobster.

**Creek** – a small stream, often a shallow or intermittent tributary to a river.

**Damselfly** – slender, non-stinging insect similar to, but smaller than, the dragonfly, but having wings folded when at rest.

**Data** – facts or pieces of information.

**Dragonfly** – slender-bodied, non-stinging insect having iridescent wings that are outspread at rest; adults and nymphs feed on mosquitoes.

**Fresh water** – water that is not salty.

**Gills** –breathing apparatus for aquatic organisms (may appear as filaments, tufts, or plates).

**Invertebrates** – organisms without a backbone.

**Larva** – (larvae plural) – juvenile form of many insects and other organisms that become different in form when changed into adults.

**Leech** – carnivorous or bloodsucking aquatic worms typically having a sucker at each end.

**Macroinvertebrates** – animals that have no backbone and are visible without magnification.

**Midge** – tiny, two-winged, mosquito-like fly; appear in dancing swarms especially near water.

**Monitoring** – the repeated observation of condition, especially to detect and give warning of change.

**Nonpoint source pollution** – pollution originating over a widespread area.

**Nutrient** – a material that serves as food or provides nourishment.

**Nymph** – the larval form of certain insects, with incomplete metamorphosis, usually resembles the adult form but smaller and lacking fully developed wings.

**Organic**- derived from living organisms.

**Oxygen** – a colorless gas in the atmosphere that is essential for animal respiration.

**Parasites** – organisms that live on or in the body of different organisms from which they obtain nutrients.

**Point source pollution** – pollution originating from a specific point or place.

**Predator**- an organism that captures and feeds on other organisms.

**Retractable** – capable of being drawn or pulled back.

**Riffle** – shallow area of a stream where water flows rapidly over a rocky or gravelly stream bed.

**Scavengers** – animals that feed on dead or decaying organic matter.

**Secrete** – to generate and release a fluid or substance.

**Snail** – any of various gastropod mollusks and especially those having an external enclosing spiral shell.

**Stonefly** – primitive winged insect with a flattened body; used as bait by fishermen; aquatic gilled larvae are carnivorous and live beneath stones.

**Stream bed** – the stream bottom or surface over which a stream flows.

**Stream** – a flow of water in a channel or bed, as a brook, rivulet, or small river.

**Tapered** – a shape that is gradually narrower or thinner toward one end.

**Velocity** – rapidity or speed of motion; swiftness.



# Creek Puzzle

D D U T X J V L I W R U O J R T E C C Y  
B P J B Q Y G H A P E W W R H T E R I M  
U R E C I W J T L N T Y G W A E V A T E  
S B B Z Y I E A R W A L L R Z N X Y A F  
M W H W F R N Z L C W P B F Q D L F U T  
Z V F E P A W V H L W E A X L M N I Q R  
L N P E R H I A E A T Z V Z S E F S A F  
V J N I H E L L G R A M M I T E S H Z W  
Z N A R Y A J D E V T R X H Q I O M R Y  
Y L O E L F M V A A A E G N I N O H A M  
F G Q E E T N Y N D W P B T F K V L C D  
E O E S N I L E M I L L C R E E K A M M  
L C H K O Z P L C T J F Y G A H P M Y N  
H N X R G G F L N E N T S H Y T T P Q J  
L I C P A T M O B W O E R T R T E P P V  
R A F C R S I W Y L F S I D D A C T A V  
M H F S D T T C L S A R B R I F F L E Z  
O D D D U G X R O I A C W I T F K G N O  
S N L L B S F E E L A H K X H U D X H Q  
Y G L F G L X E C A V N C F C U N A C J  
K O E W V D A K N G M R S D L D Z C G X  
P P S E B U O R R M V Y B I V Y U Z C A  
V N Y H A B D P K G V U F U L Q Y W P G  
F G J N Z K O B G C J H R W J R P D N J  
J M Q A X Y V G N D A U W I D N P O E K

AQUATIC  
CLARITY  
DRAGONFLY  
LARVA  
MAHONING  
NYMPH  
RIFFLE  
WATER

BLACKFLY  
CRAYFISH  
HELLGRAMMITE  
LEECH  
MILLCREEK  
PLANARIA  
SNAIL  
WATERPENNY

CADDISFLY  
DAMSELFLY  
INVERTEBRATE  
MACROINVERTEBRATE  
NUTRIENT  
POLLUTION  
STREAM  
YELLOWCREEK

VOCABULARY (continued):

- bacteria**—single-celled microorganisms (largely responsible for decay and decomposition of organic matter).
- black fly**—small, blackish, stout-bodied biting fly having aquatic larvae; sucks the blood of birds as well as humans and other mammals.
- caddisfly**—small, moth-like insect having two pairs of hairy, membranous wings and aquatic larvae.
- carnivorous**—meat eating.
- clarity**—clearness or transparency.
- crayfish**—small freshwater crustacean that resembles a lobster.
- creek**—a small stream, often a shallow or intermittent tributary to a river.
- damselfly**—slender, non-stinging insect similar to, but smaller than, the dragonfly, but having wings folded when at rest.
- data**—facts or pieces of information.
- dragonfly**—slender-bodied, non-stinging insect having iridescent wings that are outspread at rest; adults and nymphs feed on mosquitoes, etc.
- fresh water**—water that is not salty.
- gills**—breathing apparatus for aquatic organisms (may appear as filaments, tufts, or plates).
- invertebrates**—organisms without a backbone.
- larva** (larvae plural)—juvenile form of many insects and other organisms that become different in form when changed into adults.
- leech**—carnivorous or bloodsucking aquatic worms typically having a sucker at each end.
- macroinvertebrates**—animals that have no backbone and are visible without magnification.
- midge**—tiny, two-winged, mosquito-like fly; appear in dancing swarms especially near water.
- monitoring**—the repeated observation of condition, especially to detect and give warning of change.
- nonpoint source pollution**—pollution originating over a widespread area.
- nutrient**—a material that serves as food or provides nourishment.
- nymph**—the larval form of certain insects, with incomplete metamorphosis, usually resembling the adult form but smaller and lacking fully developed wings.
- organic**—derived from living organisms.
- oxygen**—a colorless gas in the atmosphere that is essential for animal respiration.
- parasites**—organisms that live on or in the body of different organisms from which they obtain nutrients.
- point source pollution**—pollution originating from a specific point or place.
- predator**—an organism that captures and feeds on other organisms.
- retractable**—capable of being drawn or pulled back.
- riffle**—shallow area of a stream where water flows rapidly over a rocky or gravelly stream bed.
- scavengers**—animals that feed on dead or decaying organic matter.
- secrete**—to generate and release a fluid or substance.
- snail**—any of various gastropod mollusks and especially those having an external enclosing spiral shell.
- stonefly**—primitive winged insect with a flattened body; used as bait by fishermen; aquatic gilled larvae are carnivorous and live beneath stones.
- stream bed**—the stream bottom or surface over which a stream flows.
- stream**—a flow of water in a channel or bed, as a brook, rivulet, or small river.
- tapered**—a shape that is gradually narrower or thinner toward one end.
- velocity**—rapidity or speed of motion; swiftness.

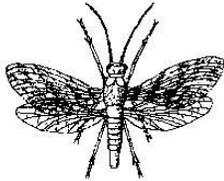
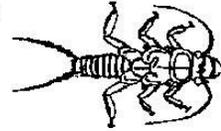


If you visit a creek you may see insects flying close to the surface of the water. These insects can help us to determine how clean or polluted the creek is. Believe it or not, these insects look very different when they are young. See if you can match the adults to their larvae.



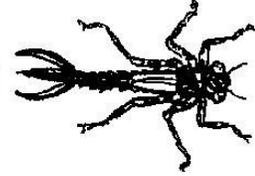
Blackfly

I'm really not as hard as a rock



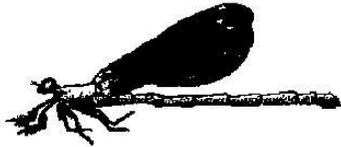
Caddisfly

In a polluted stream, I'm very distressed



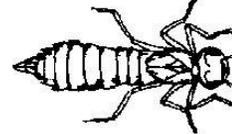
Diving Beetle

I'm as dark as night



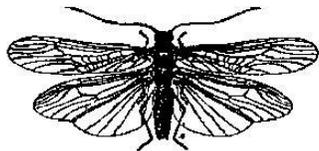
Damselfly

I hope to breathe fire when I grow up



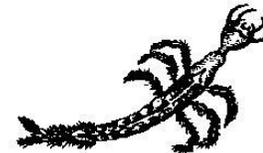
Dragonfly

I'll fly when I'm older



Stonefly

I can hold my breath for a long time





## **FRED THE FISH – A RIVER RAN WILD**

In this activity children will participate in a simulation of a stream becoming polluted. They follow Fred the Fish as he travels down stream and while various pollutants are added to Fred's water habitat. The pollutants come from numerous real-life sources ("cause"), resulting in an increasingly polluted environment for Fred ("effect"). The book, *A River Ran Wild* by Lynne Cherry, 1992, a true story describing the deterioration of the Nashua River and its subsequent revitalization, is used in accompaniment so that students can see the real world applications of this activity.

### **TO SET-UP:**

**Script**– One copy of the whole script per student is needed.

Enlarge and laminate individual parts to make numbered "script cards" for those chosen to read parts.

#### **For Fred and his water habitat–**

You will need: a light colored sponge, permanent marker, thin fishing line, large-eye needle, weight (washer or lead sinker), clear gallon jar or container, ruler or flat dowel longer than the mouth of the container, tape, water.

Cut a small fish shape from the sponge. Draw on a face for Fred.

Cut a piece of fishing line approximately 60 cm long. Thread the line onto the needle and draw the line through the fish shape. The line should stick out below the belly of the fish, as well as above the fish.

Fill the container with water, allowing some space at the top. Tie the weight to the line below the fish.

Tie the line above the fish to the middle of the ruler. You will need to adjust the line so Fred is suspended in the middle of the container.

**FRED AND HIS HABITAT ARE NOW READY!!!**

#### **For simulating pollution–**

You will need: Long-handled spoon or stick to stir the contents

3 plastic spoons

Two sets of index cards, numbered 2-9, one set folded so they will stand in front of the pollutants, the other set for 8 children who will add that pollutant to the container

Garden soil - "eroded soil" (Script card 2)

Powdered milk - "fertilizer" (Script card 3)

Cooking oil - "car oil" (Script card 4)

Rock salt - "road salt" (Script card 5)

Small pieces of foil, plastic wrap, paper, etc. - "trash" (Script card 6)

Liquid laundry detergent - "factory stuff" (Script card 7)

Red food coloring - "sewage" (Script card 8)

Green food coloring - "hazardous waste" (Script card 9)

Arrange the "pollutants" beside Fred's habitat, placing the corresponding numbered index cards in front of the containers.

Put plastic spoons in the soil (#2), fertilizer (#3), and road salt (#4).

Have paper towels nearby for possible messes!

### **PROCEDURE:**

The teacher will introduce the activity by introducing Fred. An introduction might read: "Students, I would like you to meet a little friend of mine named Fred. Fred is a fish who spent most of his life in a clean, mountain lake, until one day he decided to venture from his lake, downstream. He's lucky, and so are you, because he lived to share his adventure with you."

Distribute the script cards, and the index cards to students. Script card #10 can be optional. If it is used, resulting discussion can include what the children think happens to Fred, what Fred should do, and how the described environmental problems can affect humans.

Begin reading the script cards and adding the pollutants to Fred's habitat. Pick some students to read the cards and others to add the "pollutants." The question, "HOW IS FRED?" should be used to initiate class discussion after each pollutant is introduced to Fred's habitat.

The book, *A River Ran Wild*, can be used to introduce or as a closure to this activity. The book attaches reality through the revitalization of the Nashua River to the simulation. Not only COULD Fred's adventure take place, but it HAS!!!

**CARE SHOULD BE TAKEN WHEN DISCARDING THE WATER USED IN THIS ACTIVITY. THE CONTENTS SHOULD BE Poured THROUGH A STRAINER SO THE SOLID MATERIALS AND OIL DO NOT CLOG THE DRAIN.**

## **Fred The Fish Script**

- 1** Imagine a clean stream, as it meanders from a mountaintop lake through protected wilderness. Meet Fred. **HOW IS FRED?** He has lived here all of his life, but now he is going on an adventure downstream.
- 2** Fred swims into some farm country. He passes a freshly plowed riverbank. It begins to rain and some soil erodes into the river. (Dump some soil into Fred's habitat.) **HOW IS FRED?**
- 3** Fred nears a suburban housing development. Fertilizer and pesticides from nearby farms and lawns washed into the river awhile back. (Put the powdered milk into Fred's habitat.) The fertilizer made the plants in the river grow very fast and thick. Eventually the river couldn't furnish the plants with the nutrients they needed, so they died and are starting to decay. Their decomposition is using Fred's oxygen. **HOW IS FRED?**
- 4** Fred swims under a highway bridge that goes over the river and a dirt road. To keep the dust from the dirt road under control, the residents spread oil on the road. (Pour the oil into Fred's habitat.) At spots, the oil ran into the river. It also seeped into the ground water and ended up in the river. **HOW IS FRED?**
- 5** As Fred continues on his journey, he passes under another bridge. During a recent cold spell, ice formed on the bridge. The county trucks spread salt on the bridge to prevent accidents. Rain is now washing salty slush into the river. (Put salt into Fred's habitat.) **HOW IS FRED?**
- 6** Fred swims past a city park. Some picnickers didn't throw their trash into the garbage can. The wind is blowing the trash into the river. (Sprinkle trash into Fred's habitat.) **HOW IS FRED?**
- 7** Several factories are located downstream from the city. Regulations limit the amount of pollution the factories are allowed to dump into the river, but the factory owners don't always abide by them. (Pour laundry detergent into Fred's habitat.) **HOW IS FRED?**
- 8** The city's sewage treatment plant is also located along this stretch of the river. The pollution regulations for the plant aren't as strict as they should be. Also a section of the plant has broken down, allowing untreated sewage to run into the river. (Squirt two drops of red food coloring into Fred's habitat.) **HOW IS FRED?**
- 9** Fred swims past a hazardous waste dump located on the bank of the river. Several rusty barrels of toxic chemicals are leaking. The rain is washing these poisons into the river. (For each leaking barrel, squeeze one drop of green food coloring into Fred's habitat.) **HOW IS FRED?**
- 10** **HOW IS FRED?** Fred feels weak. He can't breath. He can't see through the water. His fins will barely move. **WHAT SHOULD FRED DO? WHAT IS THE FATE OF FRED, THE FISH???? WHAT IS OUR FATE????**