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**King County**

Department of  
Natural Resources and Parks  
**Wastewater Treatment Division**



**KING COUNTY**  
**FLOOD CONTROL**  
DISTRICT



WASHINGTON STATE  
Recreation and  
Conservation Office



**Moutains to Sound Greenway Trust**

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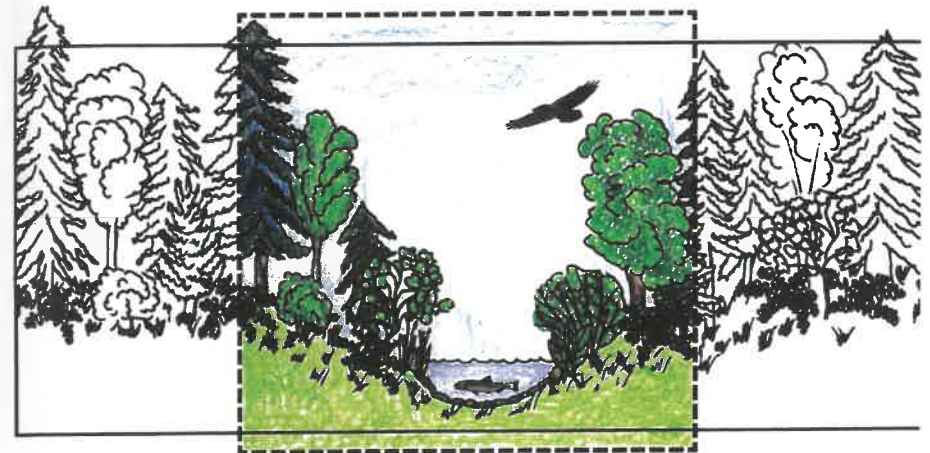
Printed in 2023



# Forests and Fins

## Science Journal

This journal belongs to:



My teacher is:

My school is:



## PICTURE THIS!

Draw the healthiest salmon stream habitat you can imagine.  
Label your drawing. Use both pages.

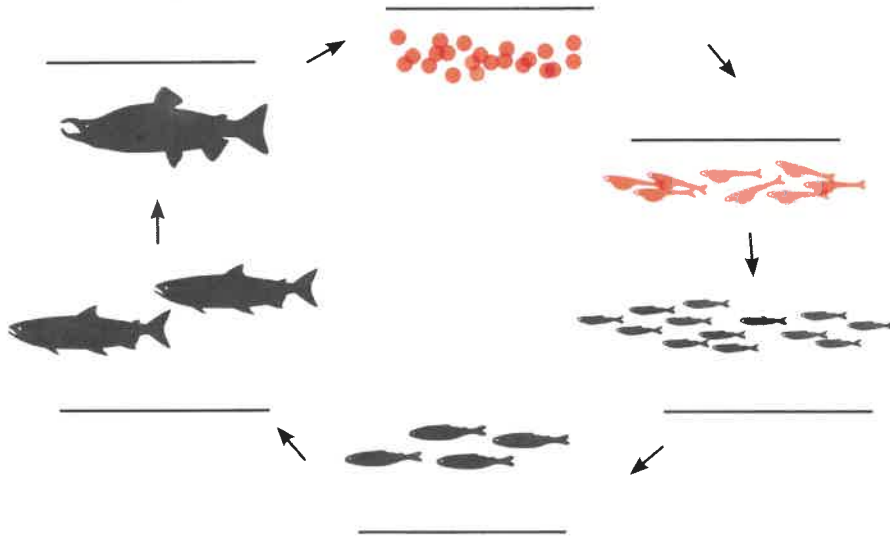
Date: \_\_\_\_\_

# SHOW US WHAT YOU KNOW!

This is not a test! Just do your best.

Date: \_\_\_\_\_

1. What are the life stages of salmon?



2. Fill in the blanks: "Salmon need water that is c\_\_\_\_\_,  
c\_\_\_\_\_, c\_\_\_\_\_, and c\_\_\_\_\_!"

3. Why are salmon important?

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4. Which shape is a healthy salmon stream? (Circle one):



5. Write an example of a native plant:

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6. Name two things that trees and shrubs hanging over the side of the stream provide for salmon:

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7. Fill in the blanks below with a macroinvertebrate group number (1, 2, or 3):

- Group \_\_\_\_ bugs are somewhat pollution tolerant.
- Group \_\_\_\_ bugs are pollution intolerant, meaning they can only live in high quality water.
- Group \_\_\_\_ bugs are pollution tolerant.

8. Name 3 things we can measure about water quality.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

9. Describe at least one thing you will do to help protect salmon:

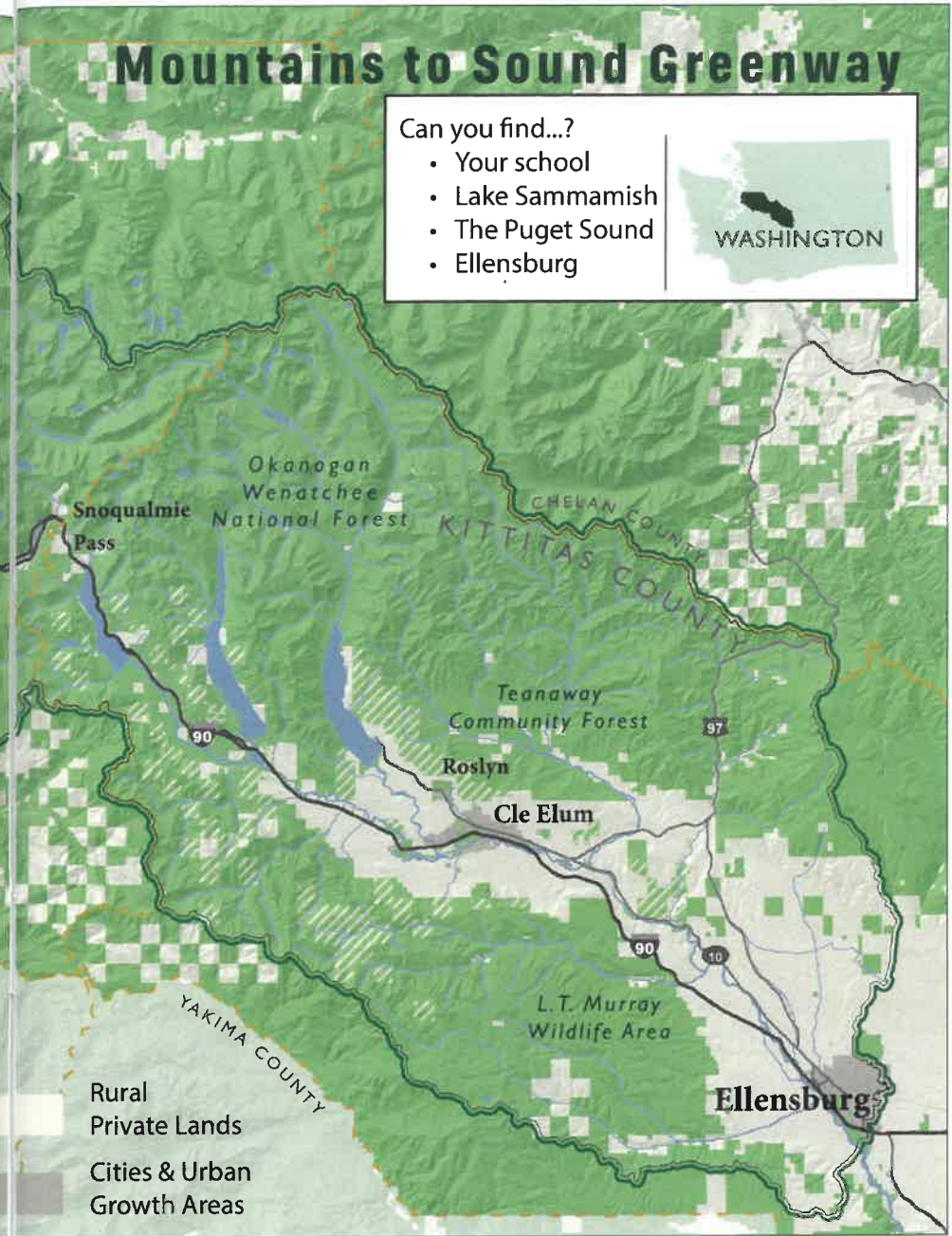
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# Welcome to the Greenway!

mtsgreenway.org





# Pacific NW Salmon Species



Ask your Greenway Educator how to remember the species using your hand.

Pink / Humpy



Sockeye / Red



Chum / Dog



Coho / Silver



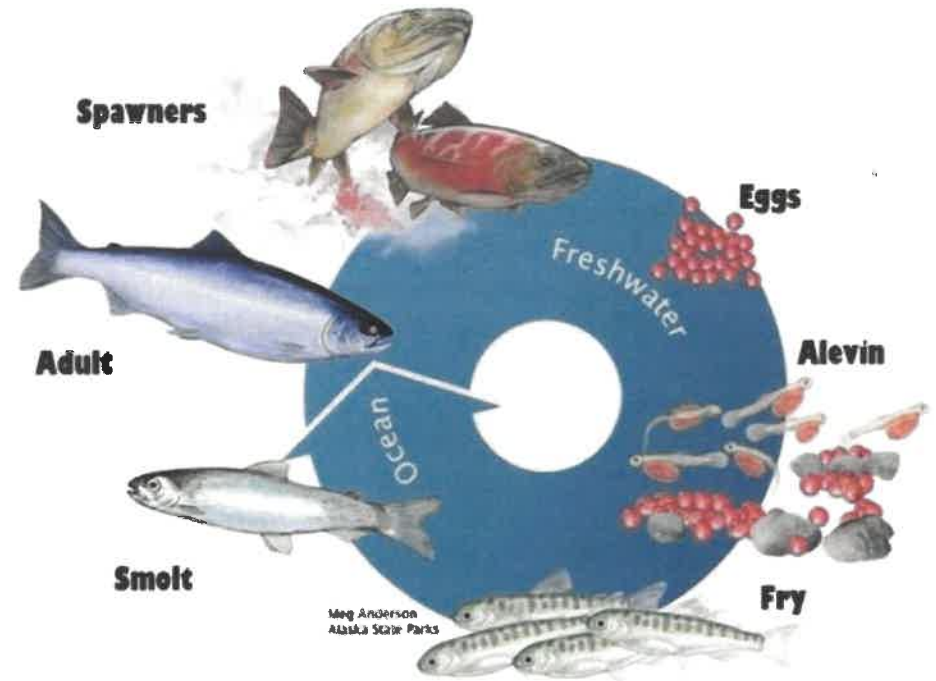
Chinook / King



Kokanee,  
the Little Red Fish



# Salmon Life Cycle



Salmon begin their life as **EGGS** in a freshwater stream. The baby fish that hatch from the eggs are called **ALEVIN**. They get all their nutrients from their yolk sac and stay in their nest (redd), safe in the gravel and cobble at the bottom of the stream. When their yolk sac is used up, they leave their redd as **FRY** and spend their time catching macro-invertebrates (bugs) and hiding from predators. Salmon swim downstream to the estuary as **SMOLT**; they are about 5 inches long, shiny and silvery. **ADULTS** live in the ocean for 2-5 years. Then they return to the stream as **SPAWNERS**, lay their own eggs, and the cycle starts all over again!



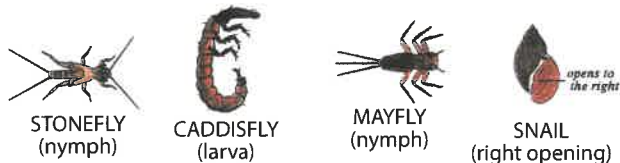
## MACROINVERTEBRATES

### Background Info

**Macroinvertebrates** are small animals that are big enough to see without a microscope (*macro* = “big”) and that have no backbone (*invertebrate* = “no backbone”). Macroinvertebrates include snails, insects, worms, and crayfish.

One way we can determine the health of the stream is by studying what kinds of macroinvertebrates live in the stream. They are called an **indicator species** because their presence shows how healthy the stream is. Some kinds of macroinvertebrates can live in polluted water and some can only live in very clean water.

**Group 1 macroinvertebrates** are pollution intolerant. They can only live in very clean water.



**Group 2 macroinvertebrates** are somewhat pollution tolerant, meaning they can handle some pollution.



**Group 3 macroinvertebrates** are pollution tolerant. They can live in a wide range of water quality.



Image source: Dieter Tracey, IAN Image Library ([ian.umces.edu/imagelibrary](http://ian.umces.edu/imagelibrary))



## MACROINVERTEBRATES

### Directions

Today, you are going to collect and identify macroinvertebrates to learn about the health of this stream. Remember: You are measuring the health of the stream habitat, not the health of the bugs.

**1. Practice:** You will need the “Macro Mania” poster and cards.

This is a matching game. Deal an equal number of cards to each group member. As a group, match the macroinvertebrates on the cards with the correct group on the poster: Group 1, Group 2 or Group 3.

How many bug cards are in each group? Talk about what that tells you about the health of the stream they came from.

**2. Collect and Identify:** You will need dip nets, ice trays, macroinvertebrate ID sheet.

Your Greenway Educator will show you where and how to collect real macroinvertebrates from the stream. Do your best to figure out what they are called and which group they are in.

Record your findings on page 11 (question 1).

**3. Analyze:** Use the table on page 11 (question 2) to analyze your data and determined the health of this stream.

**4. Get ready to present:** Work as a group to answer the Thinking Questions on page 12 and practice your group presentation.



## MACROINVERTEBRATES Data Analysis

Stream: \_\_\_\_\_ Date: \_\_\_\_\_

1. **Record your data:** How many did you find? What kinds?

Group #1 \_\_\_\_\_ Examples: \_\_\_\_\_

Group #2 \_\_\_\_\_ Examples: \_\_\_\_\_

Group #3 \_\_\_\_\_ Examples: \_\_\_\_\_

2. **Analyze your data** using the table below:

	Quantity	Multiply
Group 1		x3=
Group 2		x2=
Group 3		x1=
Total		

3. Based on your data, how healthy is this salmon stream? (Circle one):

**HIGH**  
(total: 25+)

**MEDIUM**  
(total: 13-25)

**LOW**  
(total: 0-12)

4. **Get ready to present:** Work as a group to answer the Thinking Questions on page 12 and practice your group presentation.



## MACROINVERTEBRATES Thinking Questions

1. What is a macroinvertebrate?

2. Explain the difference between Group 1, Group 2, and Group 3 macroinvertebrates.

3. Why are macroinvertebrates called an indicator species?

4. What was the most interesting thing you observed?

5. Based on your data, how healthy is this salmon stream?

6. Describe what could improve this salmon stream?



## RIPARIAN ZONE Background Info

A **riparian** (rie-PARE-ee-en) **zone** is where land and water meet, such as along stream banks and lake shores.

Healthy riparian zones are full of different kinds of **native trees and shrubs** that help keep the stream cold, clear, clean, and connected.



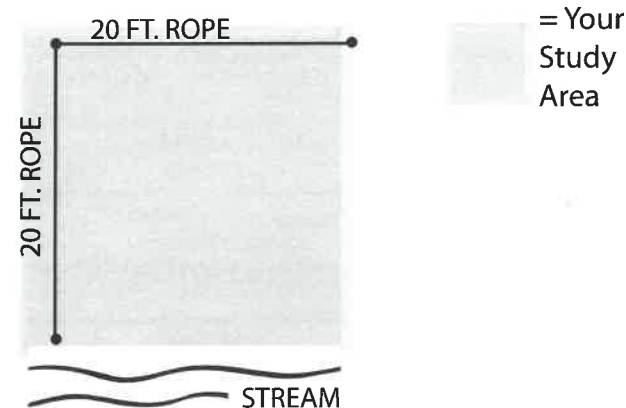
- Trees block the sun and provide shade to the stream, which helps maintain cold water temperatures.
- Woody material (logs and large branches) that have fallen into the stream capture gravel, create pools where salmon can rest, and provide protection from predators.
- Plant roots stabilize the stream bank by preventing erosion during floods and large storms. This helps keep sediment out of streams. (Extra sediment can smother salmon eggs).
- When it rains, plant roots help keep the stream water clean by collecting water like a sponge and filtering out sediment, toxic chemicals, and other pollutants.
- Leaves and stems from riparian plants fall into the stream and provide nutrients that support the salmon and stream bugs.

Damaged riparian zones usually have **introduced plants**, which are brought here from other ecosystems. They can outcompete native plants for water, nutrients, and sunlight. They are not as good as native plants at providing shade, creating pools and riffles, stabilizing the stream bank, filtering pollutants, or providing nutrients.



## RIPARIAN ZONE Directions

1. **Set up your transect:** You will need the two 20-foot long ropes. Set up a transect so that it matches the diagram below. Try to not step on plants!



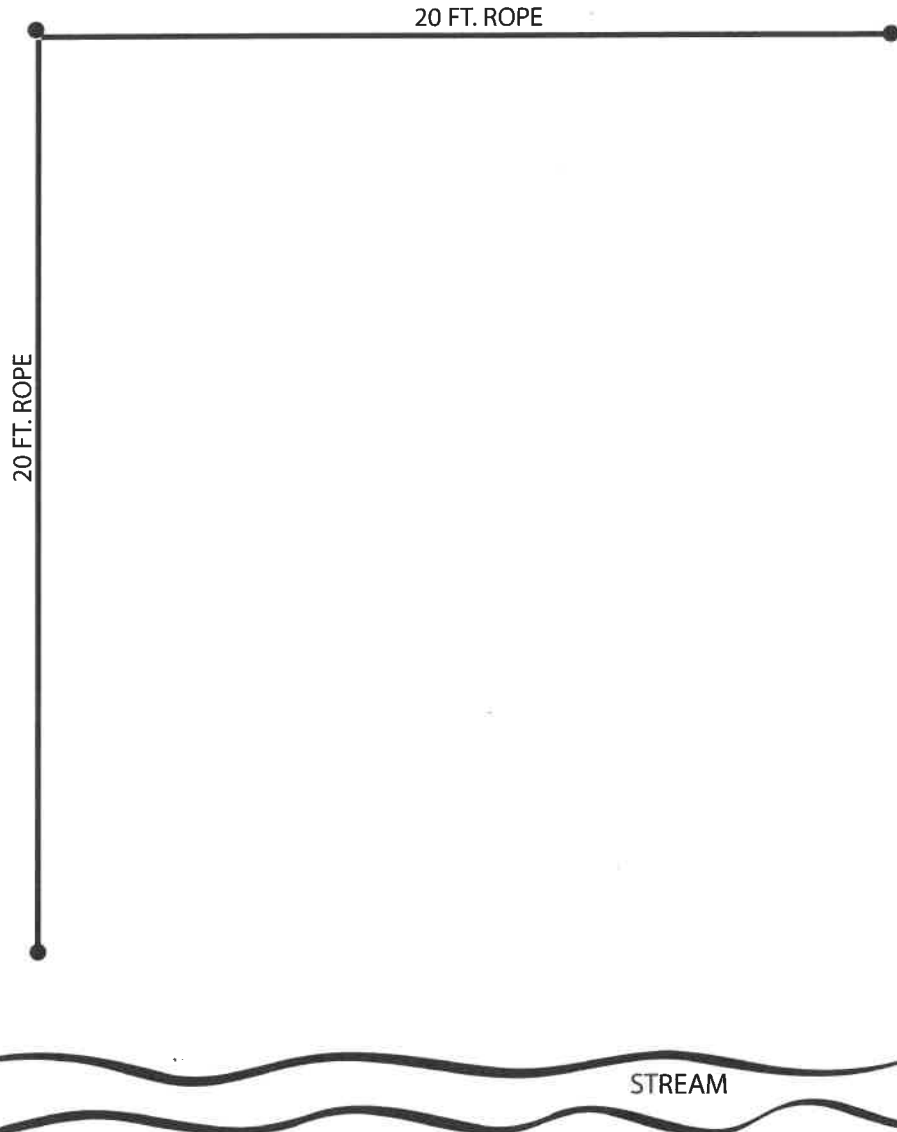
2. **Draw:** Spend about 10 minutes drawing the plants in your transect area on page 15.
3. **Identify:** You will need the plant ID cards. Do your best to identify the plants in your transect. Label them on page 15.
4. **Analyze:** Use the chart on page 16 to determine the quality of this riparian zone.
5. **Get ready to present:** Work as a group to answer the Thinking Questions on page 17 and practice your group presentation.





## RIPARIAN ZONE Drawing

Draw *and label* the plants in your area of study. You can choose to draw a map or individual plants. Do your best to identify them using the plant ID cards in your Greenway backpack.



## RIPARIAN ZONE Data Analysis

**Stream:** \_\_\_\_\_ **Date:** \_\_\_\_\_

- Write the names of three plants you identified:

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- Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
<b>a) Trees &amp; shrubs hanging over the stream</b>	Yes, on both sides of the stream	Yes, but only on one side	No
<b>b) Amount of woody material</b>	More than 10 logs	0 - 10 logs	None
<b>c) Native plants</b>	Mostly trees & shrubs	Some trees & some grass	All grass or bare soil
<b>d) Introduced plants</b>	None	A few	Lots

- Based on your data, what is the quality of this riparian zone? (Circle one):

**HIGH**

**MEDIUM**

**LOW**

- Get ready to present:** Work as a group to answer the Thinking Questions on page 17 and practice your group presentation.



## RIPARIAN ZONE Thinking Questions

1. Why are trees and shrubs hanging over the stream important for salmon habitat and stream health?

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2. Why are introduced plant species a problem for salmon and the ecosystem?

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3. Name 2 reasons that woody material is important for salmon:

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- ---

4. What was the most interesting thing you observed?

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5. Based on your data, how healthy is this riparian zone?

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6. Describe what could improve this riparian zone?

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## STREAM CHANNEL Background Info



**Pools** are deep places in the stream where water moves slowly. Salmon fry live in the pools after they leave their nest (redd) in the gravel bed. Fry can hide from predators in pools and find food here.




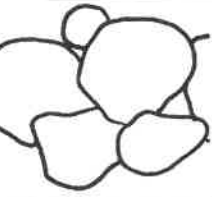
**Riffles** ("RIFF-ulz") are small rapids in the stream where water moves quickly and bubbles over gravel or logs. Riffles are excellent places for salmon to make their nests. The fast-moving water removes tiny sediment particles from the stream bed and adds oxygen to the water that salmon and their eggs breathe.

**Woody material** (logs and big branches) fall into the stream and help create pools and riffles. They also provide food for the stream bugs (macroinvertebrates) that the salmon eat.

The **velocity** of a stream is how fast the water is moving. If the water is flowing too quickly, spawning salmon might not be able to swim upstream, or their eggs could be washed away. If it is too slow, silt and sand could bury the eggs and suffocate them.

**Erosion** damages salmon habitat by carrying sediment from the stream bank into the stream, making the water cloudy and burying salmon redds. Evidence of erosion includes collapsing stream banks.

**Sediment** is rocks on the bottom of the stream. Here are what some of the different sizes look like:

Silt	Sand	Gravel	Cobble
			
Teeney tiny. Like mud.	Very small. Like at the beach.	Small. Like rocks in a fish tank.	The size of your fist.



## STREAM CHANNEL Directions & Data Collection

Stream: \_\_\_\_\_ Date: \_\_\_\_\_

Use the box below to draw the shape of your stream channel.

1. Which way is the stream flowing? How fast? Add arrows to your drawing to show the direction of flow.
2. Add any woody material (logs) you see. How many do you see?
3. Draw any pools and riffles you see. Which do you see more of?  
☐ Pools ☐ Riffles
4. Can you see the bottom? Draw how big the sediment is.
5. Do you see evidence of erosion, such as collapsing stream banks?
6. If you see any salmon, be sure to include them!



## STREAM CHANNEL Data Analysis

1. Find the "Velocity" directions card in your Greenway backpack and measure the velocity as a group 3 times:

Velocity 1: \_\_\_\_\_ Velocity 2: \_\_\_\_\_ Velocity 3: \_\_\_\_\_

2. Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
<b>a) Shape:</b>			
<b>b) Woody material:</b>	10 or more logs	0 - 10 logs	None
<b>c) Pools and riffles</b>	Many pools and riffles	Only a couple of riffles	No riffles or pools
<b>d) Sediment on the stream bottom</b>	Mostly cobble	Close to equal cobble/gravel/sand	Mostly sand
<b>e) Erosion (collapsing stream banks)</b>	None	Some	Lots
<b>g) Velocity</b>	2 - 3 feet/second	1 - 2 feet/second	0 - 1 or >3 ft/sec

Based on your data, what is the quality of this stream channel?  
(Circle one):

HIGH

MEDIUM

LOW

1. **Get ready to present:** Work as a group to answer the Thinking Questions on page 21 and practice your group presentation.





## STREAM CHANNEL Thinking Questions

1. Why is it important for salmon to have a curvy stream?

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2. Name two reasons that woody material is important for salmon habitat and stream health.

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3. Why is it important for a salmon stream to have lots of riffles?

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4. Why is it better for salmon to lay their eggs in gravel and cobble instead of sand or silt?

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5. What was the most interesting thing you observed?

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6. Based on your data, how healthy is this stream channel?

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7. Describe what could improve this stream channel?

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## WATER QUALITY Background Info



**What is Temperature?** Fish are ectothermic animals. This means they are the same temperature as the water they live in, so if the water temperature of their stream gets colder or warmer, so do they. Salmon need cold water so they don't get too hot. Also, cold water has lots of oxygen in it!

**What is pH?** When we measure pH of a liquid, we are measuring how acidic or basic it is. pH is measured on a scale from 0 to 14, where 0 is the most acidic (like lemon juice) and 14 is the most basic (like bleach). Our blood has a pH of about 7, which is neutral. Salmon need to live in water that is neutral with a pH between 6.5 and 8.5.

**What is Dissolved Oxygen (DO)?** We breathe oxygen from the air using our lungs. Salmon breathe oxygen dissolved in the water using their gills. Dissolved oxygen levels in stream water increase where the water bubbles over small rapids called riffles. Colder and fast-moving water has more oxygen in it than warmer water.

**What is Phosphate?** Phosphate is a nutrient that all plants and animals need to grow. It is added naturally from decomposing (dead) plants and animals. Sometimes, though, too much phosphate enters streams from sewage leaks or from fertilizers running into streams from people's lawns or farms. Too much phosphate in stream water can reduce the amount of dissolved oxygen in the water that is available to salmon.

**What is Turbidity?** The turbidity of water is how clear or cloudy it is. The cloudier the water, the more turbid it is. The cloudiness is caused by little particles of soil and plants in the water. The particles makes it harder for fish to breathe (imagine trying to breathe in a sandstorm). Particles that settle on the stream bottom can smother fish eggs and macroinvertebrates (stream bugs). Don't confuse water color with turbidity: water can be a dark color and be clear.

**What is ppm?** ppm, or parts per million, is a way to measure how much of a nutrient is present in the water. For example, if we find 10 ppm of phosphate, that means there are 10 drops of phosphate in every one million drops of stream water.



## WATER QUALITY Directions

1. You will be given a water quality testing kit. Circle what your team is going to measure:

Temperature  
pH  
Dissolved Oxygen  
Phosphate  
Turbidity

2. **Temperature Team:**

- Right away! **Collect** water from the stream using the white canister in the Greenway backpack.
- **Distribute** the water to your teammates, and then hand off the white canister to the Turbidity Team.
- Now, **read** your yellow directions card and take your measurements.

**All other teams:** While you wait for your water sample, read your section of the Background Info (page 22) and read your yellow directions card.

3. **Record** all teams' measurements on page 24 (question 1).

4. **Analyze:** Use the table on page 24 (question 2) to figure out if the water quality of this stream is poor, medium, or excellent.

5. **Get ready to present:** Work as a group to answer the Thinking Questions on page 25 and practice your group presentation.

## WATER QUALITY Data Analysis



Stream: \_\_\_\_\_ Date: \_\_\_\_\_

1. Record your group's data:

- Temperature: \_\_\_\_\_ °C
- Dissolved Oxygen: \_\_\_\_\_ ppm
- pH: \_\_\_\_\_
- Phosphate: \_\_\_\_\_ ppm
- Turbidity: \_\_\_\_\_ NTU

2. Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
a) Temperature	5-12°C	13-20°C	Above 20°C
b) DO (Dissolved Oxygen)	More than 9 ppm	6-8 ppm	Less than 6 ppm
c) pH	6.5-8.5	4.5-6.4 or 8.5-10	Less than 4.5 or higher than 10
e) Phosphate	0-2 ppm	3-4 ppm	Above 4 ppm
f) Turbidity	0-50 NTU	51-100 NTU	Above 100 NTU

ppm = parts per million

3. Based on your data, what is the quality of this water? (Circle one):

HIGH

MEDIUM

LOW

4. **Get ready to present:** Work as a group to answer the Thinking Questions on page 25 and practice your group presentation.



## WATER QUALITY Thinking Questions

1. Why do salmon prefer cold water?

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2. When you measure the pH of water, what are you measuring?

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3. Name one way that dissolved oxygen gets into stream water.

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4. How can too much phosphate impact a salmon stream?

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5. Why do salmon need their water to be clear (low turbidity)?

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6. Based on your data, how healthy is this salmon stream?

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7. Describe what could improve the water quality?

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## Take Action

What will you do to help protect salmon?



☐ Pick up your dog's poop and put it in the trash.



☐ Compost and recycle (at home and school).



☐ Flush only the 4 P's down the toilet: poop, pee, puke, toilet paper.



☐ Walk, bike, or take the bus.



☐ Share what you know! Tell your friends and family what you've learned about salmon.

What other ideas do you have?





## PICTURE THIS!

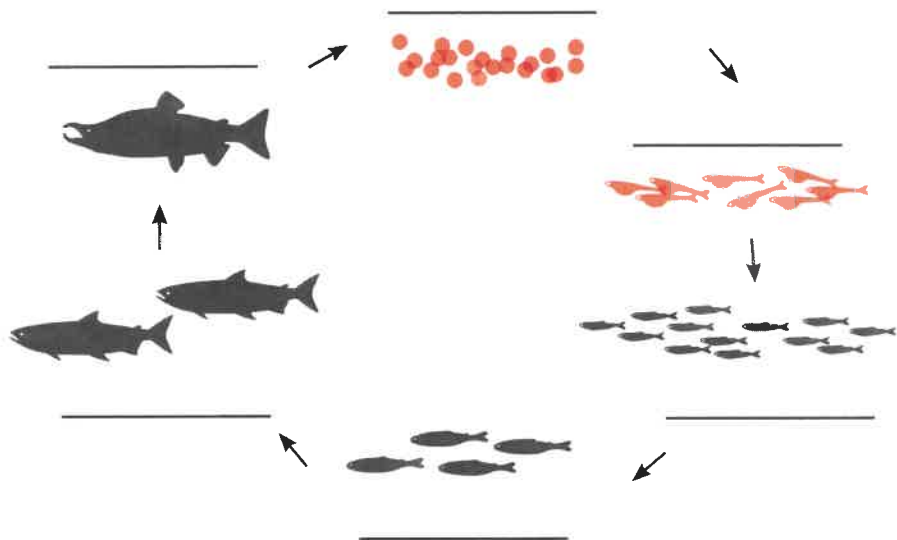
Draw the healthiest salmon stream habitat you can imagine.  
Label your drawing. Use both pages.  
Feel free to look back in your journal!

Date: \_\_\_\_\_

# SHOW US WHAT YOU KNOW... AGAIN!

Date: \_\_\_\_\_

1. What are the life stages of salmon?



2. Fill in the blanks: "Salmon need water that is c \_\_\_\_\_,

c \_\_\_\_\_, c \_\_\_\_\_, and c \_\_\_\_\_!"

3. Why are salmon important?

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4. Which shape is a healthy salmon stream? (Circle one):



This is not a test! Just do your best.

Date: \_\_\_\_\_

5. Write an example of a native plant:

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6. Name two things that trees and shrubs hanging over the side of the stream provide for salmon:

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7. Fill in the blanks below with a macro-invertebrate group number (1, 2, or 3):

- Group \_\_\_\_ bugs are somewhat pollution tolerant.
- Group \_\_\_\_ bugs are pollution intolerant, meaning they can only live in high quality water.
- Group \_\_\_\_ bugs are pollution tolerant.

8. Name 3 things we can measure about water quality.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

9. Describe at least one thing you will do to help protect salmon:

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