

Activity 1 -- Water Everywhere?

Introduction:

This activity introduces the concept of limited water availability. The amount of fresh water available on land surfaces is a tiny fraction of the total amount in the world. Typically, people think that because water falls from the sky, it is an unlimited resource. The same water just keeps circulating around the water cycle. Even though water isn't abundant, it's perceived to be.

Objectives:

At the end of this lesson, students will be able to:

Differentiate various sources of water on our planet,

Identify where drinking water comes from, and

Compare freshwater availability to the total amount of water on earth.

ASD GLE's:

[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[4] SD1.2 describing the water cycle to show that water circulates through the crust, oceans, and atmosphere of Earth.

Grade Level: 4-6

Estimated time:

1 hour

Keywords:

Availability, resource, limited, freshwater, percentage, groundwater, rivers, glaciers, saltwater, ice caps, lakes, pollution, shortage, fraction, potable.

Materials:

20 liters of freshwater in a clear glass or plastic container, several small glass beakers, measuring cup, eye dropper.

Pose this question to the class:

Why should we be concerned about water? After all, 70% of the Earth's surface is covered by water. That should be enough for everyone! Water can be found almost everywhere on Earth - in the soil, rivers, oceans, lakes, underground, even in the atmosphere. But, how much of this water is actually available for human use?

Procedure:

1. Place 20 liters of fresh water into a large, clear container. This represents all the water in the world, including oceans, lakes, rivers, and ground water. Take predictions about how much is available for human use.
2. Remove 500 mL into a separate container. This represents the total amount of fresh water on the planet.
3. The remaining 19.5 liters in the large container represents the water in the oceans, too salty for humans to use as drinking water. It makes up 97.5 percent of the total water volume.
4. Pour out 375 mL of water from the 500 mL container. This represents all the fresh water in glaciers, ice caps, the soil, and the atmosphere. This is also unavailable for human use.

5. Remove 5 drops from the remaining 125 mL. Pour out the 125 ml - this represents all the water that is not readily available because it is deep in the ground, in remote places or polluted.
6. All that is left is 5 drops (out of 20 liters) of clean water that is available for human use - only .007 percent of all the water on the earth.

Discussion Questions:

- a. Where does our drinking water come from?
- b. What do you use water for?
- c. How much water do you use each day? (How could you measure this?)
- d. What evidence do you see of water problems in Anchorage? (Shortages?, pollution of local creeks, rivers, lakes?)
- e. How has your own behavior added to these problems?
- f. What can you do to preserve this precious natural resource?

Follow-up Activity:

Following the discussion, make a class list of things you can do to use less water.

Assessment: (Quizzes posted in Socrative also.)

1. List 3 sources of freshwater on our planet. _____
(rivers, lakes, streams, creeks, glaciers, groundwater, ice caps.)

2. Where does our drinking water come from?

- a. Water in the atmosphere.
- b. Glaciers & ice caps.
- c. Water in the soil.
- d. Lakes and rivers.
- e. Oceans

3. If this container shows all the water on our planet, which choice best shows the total amount of water available for human use?

a. 

b. 

c. 

d. .

4. Circle One. New water can be added to our water cycle. True False

5. Name one thing you've done to waste water. _____
How could you do this differently?

Extension Activities:

Students can use the glossary provided and one of the following free sites to create flash cards for unit vocabulary. Divide students into groups of 4-5 and assign the appropriate number of vocabulary words to each group.

<http://www.timeforkids.com/homework-helper/flashcards>

<http://www.cram.com/flashcards/create>

Alternately, students can look up definitions to vocabulary words using traditional methods. Then post their definitions to a common Google Doc for everyone to share.

Teacher/Student Resources:

A great document summarizing the problem, the players, and the restoration efforts of Little Campbell Creek in Anchorage. Includes maps of the catchment, photos of point and non-point source pollution, and economic impact of a healthy vs. dying creek. <http://anchoragecreeks.org/media/publications/WAG%20Report%20FINAL.pdf>

What the Alaska Zoo is doing about the Little Campbell Creek restoration. <http://alaskazoo.org/little-campbell-creek-restoration>

U.S. Fish and Wildlife Service News Release about the Little Campbell Creek restoration effort. <http://www.fws.gov/news/ShowNews.cfm?ID=A11C3DA1-AC20-11D4-A179009027B6B5D3>

Water Conservation ideas - <http://www.thewaterpage.com/water-conservation-kids.htm>

Teacher Tube:

Many great video resources are available on TeacherTube. Check out these.

Water Cycle Song - <http://www.teachertube.com/video/water-cycle-song-7708>

Water Cycle Music Video (appropriate and pretty funny) - <http://www.teachertube.com/video/water-cycle-music-video-69855>

The Water Cycle - How Rain is Formed - <http://www.teachertube.com/video/thewatercycle-howrainisformed-369528>

Water Activities and Resources - <http://www.thewaterpage.com/water-conservation-kids.htm>

Activity 2 -- A day in the life of Campbell Creek

Introduction:

This activity graphically introduces students to various human behaviors that can contribute to stormwater pollution in an urban setting as a creek makes its journey from the headwaters of the catchment to the sea. The water quality of the local waterway will be affected by human activities within the catchment. Chemicals, sediment, sewage, litter, and fertilizers enter the waterway through stormwater runoff.

Objectives:

At the end of this lesson, students will be able to:

Explain how individual contributions of pollution lead to cumulative diminished water quality along a catchment,

Investigate the home environment, and

Create a list of things your family can do to modify your pollution/waste footprint.

Alaska GLE's:

[5] SA1.2 using quantitative and qualitative observations to create inferences and predictions

[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive

Grade Level:

4-6

Estimated Time:

2 hours

Keywords:

Catchment, erosion, stormwater, pollution, residential, industrial, sewage, vegetation, topsoil, storm drain, impervious

Materials:

Large transparent container (aquarium or clear plastic box)

25 film containers (or other small tub)

Various materials to represent pollution as outline in the list below

Two large glasses

Paper towels, filters, scoops, strainers and milk cartons with soil to ensure correct disposal of polluted water and clean up.

Process:

1. Fill the aquarium with clear, clean water and place it in a prominent, visible and accessible position.
2. Label each of the small containers with a characters name from the story. Duplicate containers can be prepared so all members of the class can participate in dumping.
3. Place or pour the appropriate materials into each container according to the Table.
4. Pass the labelled containers out to students. Make sure they know their character and listen for their part in the story.
5. Introduce the Catchment Story.

5. Fill one large glass with water out of the aquarium, demonstrate its cleanliness by pouring from one glass to another. leave the glass aside for comparison at the end of the story.

Table of Characters

Name	Position	Substance	Amount
Sparky Finger	Electrification	Vinegar (acid rain)	1/2 Tub
Scree Mud	Concrete	Thick muddy water	1/2 Tub
Scotty Level	Bricklayer	Muddy water w/red paint	1/2 Tub
Tim Turf	Landscaper	Baking powder	1/2 Teaspoon
Violet Magenta	Painter	Water colored w/blue paint	1/2 Tub
Bob Buildit	Contractor	Soil and leaves	1 Cup
Col Constructor	Homeowner	Soil	2 Cups
Lilly Gardener	Landscaper	Baking soda (pesticides)	1/2 Cup
Hugo Couch	Sod Layer	Grass clippings	1/2 Tub
Ron Rancher	Farm Owner	Soil	1/2 Tub
Glen Greedy	Industry	Detergent	1 drop in full Tub
Allen Wrench	Auto Repair	Used oil	1/2 Tub
Cameron Caughtsome	Fisherman	Nylon string	Tangle of line
Mickey Slicky	Water Skier	Vegetable oil	1/4 Tub
Barbie Que	Picnicker	Litter	Cup of litter
Demo Dave	Tannery	Water and red coloring	1/2 Tub
Lazy Larry	Tour Boat	Litter	Cans, paper
Dung Aversion	Dog Owner	Thick muddy water	1/2 Tub
Elementary School	School	Litter	Chip bags, etc
Gerald Glutton	Student	Litter	Candy wrappers
Philmore Pollutee	Driver	Vegetable oil and mud, butts	1/2 Tub
Rhonda Tinkle	Homeowner	Muddy water & Toilet paper	1/2 Tub

Catchment Story

I am going to tell you a story about a very important part of our environment - it is about Campbell Creek, right here in Anchorage. The story talks about how each of us affects the creek's health.

A catchment includes all of the creeks and streams which run into a waterway. But the catchment also includes the land around the waterway. This means that although you and I may live 10 miles or more from the creek, we are still part of the catchment. Even from this distance, we can have an effect on the quality of the water in the creek.

Stormwater drains link to the local creeks. There are usually no filters in the stormwater drains and they do not go through the sewage treatment plant. This means that whatever ends up on the ground can get washed into the stormwater drain, whether it be leaves, dirt, litter, paint, or cleaning chemicals, it goes straight to our local water way. These are all forms of pollution and they can have a serious negative impact on the plants and animals that live in the water and result in the creek having an ugly and neglected appearance.

Campbell Creek begins way up in the hills and flows down and around farms, nurseries, industrial and residential areas. Everyone has an effect on the creek all the way along.

We will follow some rain as it washes over the catchment and into the creek. As the water travels down the mountain, it arrives at the valley where **Sparky Finger (1)** is connecting electricity to a new house. The power station that makes the electricity for the area burns large amounts of coal and can release pollutant gases into the air. These pollutants combine with moisture in the atmosphere to produce acids. Rainfall carries these acids back to the earth's surface and can pollute the river.

As the water travels down the catchment, it gathers speed and enters into a new housing development. As the water passes through, **Scree Mud (2)** is doing some concrete work and some of her unmixed concrete washes into the water.

The water, still flowing, travels by **Scotty Level (3)** while he is cutting bricks, and he leaves a trail of red brick dust which is washed into a drainage pipe and then into the creek. **Tim Turf (4)** is also working in the area laying some new grass sod. He waters the sod after applying fertilizer to it, leaving a trail of chemicals streaming into the storm drain. After finishing painting the exterior of a house, **Violet Magenta (5)** washes her paint brushes at a nearby tap, letting the paint wash into the drain and then into the creek.

The creek now begins to wind through the residential part of town where **Bob Buildit (6)** and **Col Constructor (7)** are each finishing their homes on a new street. Many of the trees and shrubs have been removed and when it rains the top layer of soil is eroded and adds to the silting up of the creek. This makes the water dirty and cloudy and can harm plant and animal life in the creek. Most houses like **Lilly Gardener (8)** in the developed parts of the town have a garden. To keep the insects away, Lilly uses a range of pesticides. When she has completed her spraying she turns on the sprinkler to water the plants and the pesticides wash off into the stormwater drains and into the creek. Lilly's neighbor, **Hugo Couch (9)** has just finished mowing his lawn for the third time this month and rather than putting the grass clippings on the garden for mulch, he puts them down the stormwater drain where they are washed into the creek.

As the water passes by the property of **Ron Rancher (10)**, soil is washed from his front yard and the water becomes even more muddy. The trees and other plants have been removed by the builders and there is nothing to trap the soil before it goes into the creek.

Further down the creek there is an industrial area. **Glen Greedy (11)** is one of the factory owners. He likes to use detergents to keep his equipment clean. Glen sometimes hoses out his factory, allowing the water and detergent to wash into a gutter, which flows to the creek. In the detergent there are phosphates which can cause algal blooms. Some algae are poisonous to humans and other animals. When the algae dies and begins to rot, it uses up oxygen, and the water animals that rely on it may suffocate as a result.

Just down the road from Glen is **Allen Wrench (12)**. Allen is doing a grease and oil change when he knocks over the drum of waste oil. This oil flows to the nearby drain and into the creek.

Look how our once clean water looks like now and it doesn't smell so good either.

But the journey isn't over yet. Coming up around the bend, the creek empties into Campbell Lake. **Cameron Caughtsome (13)** is fishing for Char from the bank. Unfortunately he leaves some fishing line behind, where it may get wrapped around a bird or animal. Also on the lake, **Mickey Slick (14)** is out water skiing. Mickey has not been maintaining her ski boat and, as a result, some oil is leaking from the boat directly into the lake.

Barbie Que (15) is having a picnic with her family in the park at one end of the lake. They are having a great time, playing frisbee, relaxing and splashing in the lake. Then suddenly, a big gust of wind comes along and blows their litter into the water. There are plastic bags, a plastic ring from the milk container which birds can get stuck around their necks, and bottles which fish and other small creatures like frogs may swim into and may not be able to get out of.

Not only is this harmful to the animals, but what do you think about the appearance of the water?

Remodeling is happening on the opposite side of the creek. **Demo Dave (16)** found a few drums of something that he wasn't sure of. He couldn't sell it and he would have to pay to take it to a landfill or to a hazardous waste dump so he emptied it into the old creek. The waste was chemicals from an old tannery.

Further down the catchment there is a boat out on the creek for the day. **Lazy Larry (17)** throws his bottles into the water when he's finished. He does the same with the wrappers from the food he's eating.

Also in the area lives **Dung Aversion (18)**. Dung takes his dog for a walk every morning and the dog usually does his poo during the walk. Dung would rather not deal with the pile, so if nobody is looking he quickly walks away. The poo is washed into the stormwater drain when it rains and into the creek.

At the far edge of the lagoon, children from (your) **Elementary School (19)** are returning home after another field day. The playground is covered with litter and as they walk down the street **Gerald Glutton (20)** and his friends drop their candy and chip wrappers in the gutter.

Philmore Pollutee (21) is driving home from work. The roads are choked with traffic. Oil drips out of Phil's car and onto the road. Sometimes he has to brake suddenly and leaves rubber from his tires on the road. These pollutants are washed by rain down the stormwater drain and into

the creek. As he stops at the traffic lights, Phil flicks his cigarette butt out of the car window. He does this every morning and afternoon.

Our poor water is really starting to look very sick and the ocean still around the bend. There is one more pollutant that has been entering our dirty and unhealthy water - sewage. At **Ronda Tinkle's (22)** house, the roots of her big spruce tree have found their way into her sewer pipes, which have become badly cracked and are leaking. It is raining very heavily now and there is water leaking into the sewage pipes. The pipes get overfull and start to back up, causing raw sewage to flow out the sewer overflow point and into the creek.

Entering the sea, our water that used to be so clean is now full of oils, chemicals, litter, and sewage. It looks extremely unhealthy and it doesn't smell too good either. Can you imagine what it would be like to swim in that water? Can you imagine being a fish or plant living in that water all the time?

This is what happens to the water in our creek. There are many things we can do to reduce the pollution in the catchment and most of them are pretty easy. If we take a look at our day to day activities, I'm sure we can all make a small difference and a lot of small differences make up a big difference for the health of the catchment and the plants and animals living there - and for those of us who want to swim, fish or go boating.

Assessment: (Quizzes posted in Socrative also.)

1. Which of the following is an example of an impervious surface?

- a. Paved roads
- b. Farm fields
- c. Parking lots
- d. Forests
- e. Both A & C

2. Which of the following are materials that add to water pollution?

- a. Animal waste, including dog poop.
- b. Laundry detergent.
- c. Fertilizer.
- d. Leaves and soil.
- e. Garbage
- f. All of the above.

3. Circle One. A residential area is where many houses are built closely together. True / False

4. Select the choice that best describes storm drains.

- a. They have filters that remove leaves, soil, garbage, and other pollutants.
- b. They move water to treatment facilities before being released into waterways.
- c. They are found only in residential neighborhoods.
- d. They transport everything that enters directly and untreated to nearest waterway.

5. Using at least 3 sentences, describe what happened to make the water so unhealthy as it moved along the catchment to the ocean. _____

TeacherTube:

Storm Drain Awareness - <http://www.teachertube.com/video/storm-drain-awareness-91426>

Catchment Video - <http://www.teachertube.com/video/catchment-404285>

Plastic Bags Don't Biodegrade - <http://www.teachertube.com/video/the-majestic-plastic-bag-377221>

Follow-up Activity:

Students complete Home Environment Checklist with parental assistance as homework. Discussion and graphing to compare water use, energy use and car use across the class. Make a list of things your home could do to reduce environmental impact.

Writing Rubric

Assessment:

Using at least 3 sentences, describe what happened to make the water so unhealthy as it moved along the catchment to the ocean.

Point Value	1-2	3-4	5-6
Organization & Flow	Lacks introduction and/or conclusion. Has limited sequence of events (May include only one of the elements: beginning, middle, or end).	Has an effective introduction with topic sentence. Has a clear sequence with a beginning, middle, and end.	Has an engaging introduction with a topic sentence and satisfying conclusion. Has a clear sequence that enhances meaning with a beginning, middle, and end.
Ideas & Content	Contains minimal evidence that student understands cumulative impact of individual pollution. No main idea or details	Contains some evidence student understands cumulative impact of individual pollution. Limited details support this main idea.	Contains clear evidence that student understands cumulative impact of individual pollution. Examples and/or fully developed details support this main idea.
Voice	Uses basic vocabulary appropriately most of the time. Demonstrates little or no awareness of audience.	Includes some interesting words. Uses original, unique, and/or interesting voice. Demonstrates an awareness of audience.	Includes dynamic, vivid or challenging words, enhancing meaning and clarifying understanding. Uses original, unique, authoritative and/or interesting voice.
Mechanics	Fewer than 3 sentences used. More than 3 capitalization and punctuation errors.	3 sentences used. Fewer than 3 capitalization and punctuation errors.	More than 3 sentences used. Capitalization and punctuation always correct.

Home Environment Checklist

Investigate the impact that your home may be having on the environment by completing this quiz. The higher the number of 'yes' responses, the better you are at preventing pollution.

Table 1-1

Issue	Action	Yes	No
Water Use	Toilets are low-flush models (using 1.6 gallons of water per flush opposed to 3.5).		
	Leaking taps are promptly repaired.		
	Keep showers under 5 minutes. (Use a timer).		
	Low water use appliances dishwasher/washing machine are used.		
	Water-saving shower heads and low-flow faucet aerators are used.		
	Bottles of drinking water are available in the fridge.		
	Drop tissues in the trash instead of flushing them and save water every time.		
	Avoid recreational water toys that require a constant flow of water.		
	When cleaning out fish tanks, give the nutrient-rich water to your non-edible plants.		
Energy Use	Energy saving lights are installed in all outlets.		
	All household appliances have AAA energy rating.		
	Use of heaters and dryers is minimized.		
	Clean clothing is hung on racks to dry instead of using machine dryer.		
	Ceiling and wall insulation is installed.		
	Cold water washing of clothes.		
	Low energy rating appliances are used.		
	Green Power is used for energy supply (renewable energy).		
Transport	Car use is minimized.		
	Fuel efficient car/truck is used.		
	Biking or walking is used for local transportation.		
	Public transport is our preferred option for travel.		
Kitchen	Food waste is composted.		
	Reusable shopping bags are used for grocery shopping (cloth or heavy duty plastic).		
	Organic products are used whenever possible.		
	Alaska grown products are used whenever possible.		
	Collect the water you use while rinsing fruit and vegetables. Use it to water house plants.		

Cleaning	Outdoor surfaces are kept clean by sweeping with a broom, not washing with garden hose.		
	When outdoor surfaces are cleaned with a hose, no run-off escapes to the stormwater drains.		
	Least toxic alternatives are always used.		
	Paint brushes are cleaned away from stormwater drains and contaminated water is poured onto garden or lawn.		
	Roadside gutters are regularly swept clean. Leaves and grass are composted.		
	Use your dishwasher and clothes washer for only full loads		
	When washing dishes by hand, don't let the water run. Fill one basin with wash water and the other with rinse water.		
Car Maintenance	Car is serviced at a reputable center that implements best environment practices or at home where drains are protected.		
	Car is washed at a car wash that recycles water and protects stormwater system, or on the grass at home (no suds run to stormwater drains).		
	A pail of soapy water and spray nozzle fitted to hose is used to wash car at home. Don't let garden hose run while lathering vehicle.		
	Used oil is recycled.		
	Car is kept well tuned to minimize air pollution.		
Garden	Garden waste is composted or mulched.		
	Water use minimized by mulching gardens.		
	Fertilizer use is minimized by using compost.		
	Pesticide use is avoided.		
	Least toxic alternatives are always used.		
	Rainwater tanks are installed and used for watering gardens.		
	Mostly Alaska native plants are used.		
	Area of paved and hard surfaces kept to a minimum.		
	Run-off from paved surfaces is channelled into gardens or tanks for re-use.		
	Trees and plants have a layer of mulch around them to slow evaporation.		
Water during the early part of the day and avoid watering when it's windy.			
Clothing	Clothing is purchased according to need rather than fashion.		
	Organic cotton, hemp or recycled clothing is used whenever possible.		
	Locally made clothing used whenever possible.		
Renovations	Recycled or re-used materials are selected where possible.		
	Least toxic paints, floor sealers are used.		
	Builders implement effective erosion control measures.		
	Building waste is minimized or re-used on-site.		

Home Environment Checklist Discussion

- Compare water use, energy use and car use across the class.
- Make a list of activities your home could undertake to reduce environmental impact.

Water Use – Reducing water use is an important step to take to protect waterways. Reduced water use means less sewage is generated and fewer dams are needed to provide water supplies.

Energy Use – By reducing household energy use and converting to green power, air pollution is reduced, the impact of the ‘Greenhouse Effect’ and climate change is reduced. In addition air pollutants such as carbon dioxide dissolve in rain and wash into waterways through the stormwater.

Transport – It may surprise you that stormwater run-off from roads is contaminated with lead from fuel, oil, grease, brake linings and other toxic by-products of car driving. By minimising your family car usage, you are also reducing stormwater pollution as well as reducing the impacts of the ‘Greenhouse Effect’ and climate change.

Kitchen – Reducing solid waste and packaging will reduce the quantity of litter that enters the stormwater system. Buying organic products will reduce the amount of pesticides entering waterways.

Cleaning – Using a hose to clean outdoor surfaces can contaminate stormwater. Using a broom and keeping your street gutter free of leaves and dirt will greatly reduce stormwater pollution. Hosing down driveways and footpaths so that the run-off enters the stormwater system is against the law under the POEO Act.

Car Maintenance – Keeping your car well tuned will reduce the risk of oil and grease dripping onto the road. Wash your car on the grass or at a reputable car wash to avoid suds polluting stormwater. If you change your own oil, recycle the used oil to ensure it doesn’t end up down the drain. When choosing a car repairer, go to one that has good pollution prevention practices. If not sure, ask how they prevent stormwater pollution.

Garden – Avoiding using fertiliser and pesticides to reduce stormwater pollution. Composting food and garden waste and mulching gardens also helps to reduce stormwater pollution and water use. Some garden plants shed seeds which enter the stormwater system and cause weeds to grow along creek banks and bushland. Native plants need less water, no fertiliser and will encourage birds and other wildlife to come to your garden.

Clothing – Buying locally made clothes will reduce the pollution caused by transporting goods across the country. Using clothes made from hemp and organic cotton will reduce pollution of rivers.

Renovations – When building or renovating, make sure that your builder knows how to prevent stormwater pollution. Correctly installed and maintained sediment fences, maintaining vegetation cover during construction to minimise bare earth and early connection of stormwater pipes will help.

Activity 3 -- Water Quality Testing Field Trip

Introduction:

In this activity, students will evaluate the water quality of various sources through a series of indicator tests. Once data is collected they will combine the information and look for patterns and relationships between land use, community attitudes and behaviors and water quality.

Objectives:

At the end of this lesson, students will be able to:

Measure toxicity of water using test kits and
predict the health of aquarium fish if they lived in watershed.
Compare and contrast water quality from various sources

Alaska GLE's:

[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[5] SA1.2 using quantitative and qualitative observations to create inferences and predictions.

[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive.

Grade Level:

4-6

Estimated Time:

2 hours

Keywords:

pH, acidic, base, turbidity, phosphates, nitrate, nitrite, algae, nitrification cycle, pollution, dissolved oxygen, fertilizers, toxicity

Materials:

Class recording charts, test kits, non latex gloves for each student, Interpreting Water Quality Data Chart, cleaning-up supplies, water samples from: store aquarium, upper Campbell Creek, lower Campbell Creek, pond outside store, storm drain runoff

Process:

Introduction Activity

Prior to arrival student are provided a numbered index card representing a parcel of property. They are given the instructions "You have inherited 10 acres of riverfront property and 10 million dollars. On the numbered side of the card, draw a picture of your property after development. On the other side, describe what you did." The host teacher will collect these cards and bring them to the store on Field Trip day.

1. Teachers pass out cards upon arrival and students assemble cards in order, forming a model of a river.

2. I ask for volunteers to describe what they did to develop their property and any possible pollution produced as a result.
3. I hand out small bags of miscellaneous trash to each student.
4. The student closest to the headwater puts their trash in a clear plastic bin and passes the bin to the next student in line, who places their trash in the bin and passes it on. This continues until the bins have reached the ocean on both sides of the river.
5. Hold discussion about the cumulative effect of pollution.
 - ~How do the land owners at the middle or end of the river feel?
 - ~Will their new property have the same value with all the pollution?
 - ~Whose responsibility is the pile of trash? The last person didn't create it all.
 - ~Can students downstream be affected by the actions of students upstream?
 - ~Can upstream users alter the water quality of those downstream?

Water Testing Activity:

Display Recording Chart at front of room.

Display list of sample sources, don't indicate which sample goes with which source.

Bring attention to the containers with samples from 5 sources. Encourage students to interact with samples and predict which is the cleanest.

Tally individual predictions of the highest quality water on the chart.

Describe process of water testing, providing instructions, and answering questions.

Divide students into 5 groups and provide water sample.

First, the group describes smell, color, and turbidity, and predicts which sample they are working with.

Second, each group will conduct water chemistry tests for ammonia, nitrites, phosphate, dissolved oxygen, and pH according to the instructions provided.

Third, record results for each test and send a representative up to fill in your groups part of the class chart.

When all testing is complete, unveil the source of each sample and examine trends of the source.

Post "**Interpreting Water Quality Data Chart**" to make sense of the numbers. Hold discussion to identify pollution issues impacting on water quality and examine their potential source.

Lead tour of aquarium room, describing my job and the equipment used to mimic natural water purification processes and the chemicals used to buffer improper water chemistry.

Assessment: (Quizzes posted in Socrative also.)

1. Which test would you use to determine if a substance is acidic, neutral, or basic?
 - a. Phosphate
 - b. Dissolved Oxygen
 - c. pH
 - d. Nitrate
 - e. Turbidity

2. You would see an increase in which indicator test if laundry detergent was added to the test water?

- a. Phosphate
- b. Dissolved Oxygen
- c. pH
- d. Nitrate
- e. Turbidity

3. Fertilizers and animal waste add nutrients to the water. Plants and algae use nutrients to grow and multiply. When more and more plants and algae grow in the water, dissolved oxygen levels increase and more fish can survive in the water.

Is this statement: True or False

4. Indicator tests for turbidity measure what?

- a. How much algae is growing in water.
- b. How far you can see into water.
- c. How much salt is in water.
- d. How much oxygen is in water.
- e. How much pollution is in water.

5. Using 3 of the keywords and at least 3 sentences, describe which sample water you would **least** like to live in and **why**. _____

Video Resources:

Water Quality Testing - <http://www.swfwmd.state.fl.us/education/podcasts/index.php?yuurl=nJfwNqpW-Uk>

Project Wet Kids Resources - <http://www.discoverwater.org/investigate-freshwater/>

Writing Rubric

Assessment:

Using 3 of the keywords and at least 3 sentences, describe which sample water you would **least** like to live in and **why**.

Point Value	1-2	3-4	5-6
Organization & Flow	Lacks introduction and/or conclusion. Has limited sequence of events (May include only one of the elements: beginning, middle, or end).	Has an effective introduction with topic sentence. Has a clear sequence with a beginning, middle, and end.	Has an engaging introduction with a topic sentence and satisfying conclusion. Has a clear sequence that enhances meaning with a beginning, middle, and end.
Ideas & Content	Contains minimal evidence that student understands relationship between indicator tests and overall water quality. No main idea or details	Contains some evidence student understands relationship between indicator tests and overall water quality. Limited details support this main idea.	Contains clear evidence that student understands relationship of tests and water quality. Examples and/or fully developed details support this main idea.
Voice	Uses basic vocabulary appropriately most of the time. Demonstrates little or no awareness of audience.	Includes some interesting words. Uses original, unique, and/or interesting voice. Demonstrates an awareness of audience.	Includes dynamic, vivid or challenging words, enhancing meaning and clarifying understanding. Uses original, unique, authoritative and/or interesting voice.
Mechanics	Fewer than 3 sentences and 3 key words used. More than 3 capitalization and punctuation errors.	3 sentences and 3 key words used. Fewer than 3 capitalization and punctuation errors.	More than 3 sentences and 3 key words used. Capitalization and punctuation always correct.

Activity 4 -- Conservation in Action

Introduction:

In this activity, students will apply what they have learned about water conservation and pollution by creating a final project that demonstrates their own "conservation in action."

Objectives:

At the end of this lesson, students will be able to:

Choose a specific action/behavior and recommend how it can be modified/initiated to improve water quality

Create a final product, integrating concepts explored in the unit

Alaska GLE's:

[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive

5] SE2.1 investigating a problem or project over a specified period of time and identifying the tools and processes used in that project (L)

[5] SA1.2 using quantitative and qualitative observations to create inferences and predictions

Grade Level:

4-6

Estimated Time:

2-4 hours

Keywords:

conservation

Materials:

Access to computers for research and multimedia design, poster board, markers, pencils

Process:

Students will create a brochure or poster showcasing their idea of conservation in action.

Idea Prompts:

Show/tell what can 1 person do to improve the quality of local streams.

Design a storm drain stencil to spread the word that we must all monitor what flows down storm drains.

How would you teach someone to dispose of household chemicals?

How could you reduce the amount of trash that ends up in a creek?

How could you do something about the trash already in and near a creek?

How could you prevent erosion in your yard/neighborhood?

How could you reduce pet waste that washes into storm drains?

What are better alternatives to chemical fertilizers?

Final projects will be displayed at the store with permission from students and teachers.

Video Resources:

Campbell Creek Clean-up - <https://www.youtube.com/watch?v=qxPj12OC-8M>

Campbell Creek Restoration Project - <https://www.youtube.com/watch?v=1il6quGVfbQ#t=116>

Kenai River Restoration Project - <https://search.yahoo.com/search?ei=utf-8&fr=aaplw&p=alaska+watershed+restoration+video>

Anchor River Restoration Project - <https://search.yahoo.com/search?ei=utf-8&fr=aaplw&p=alaska+watershed+restoration+video>

Watershed Education - <http://www.swfwmd.state.fl.us/education/podcasts/index.php?yuurl=sqtl0zQzLaI>

Watershed Restoration - <http://www.swfwmd.state.fl.us/education/podcasts/index.php?yuurl=ngy5JeMgCWQ>

Water Conservation Project Ideas - <http://water.epa.gov/learn/kids/waterkids/kids.cfm>

Water Conservation Project Ideas - <http://www2.epa.gov/students/community-service-project-ideas-students-and-educators>

Optional Extension:

Research the regulations governing waterfront property in their communities. If they believe their waterways are being poorly treated, they may want to write letters to local government officials in support of environmentally sound land-use legislation.

Poster/Brochure Rubric

Score	1-2	3-4	5-6
Graphics	The graphic(s) does not relate to "Conservation in Action" OR there are too many/not enough graphics and/or the graphic(s) distract from the message	Graphic(s) is related to the topic: "Conservation in Action".	Graphic(s) is related to the topic "Conservation in Action" and add emphasis to the message being conveyed.
Layout & Design	The information on the poster is too small or unclear.	Most of the information on the document is in focus.	The document attracts attention. All information on the document is in focus.
Organization	The information appears to be disorganized. Titles or subtitles may be missing or they confuse the reader.	The document includes titles and subtitles, but the layout could be rearranged to make the content stand- out more.	Titles and subtitles are eye-catching.
Content	Details about the graphic have little or nothing to do with "Conservation in Action."	Details about the graphic include some important information, but the audience may need more explanation and/or details	Details about the graphic capture important information & increase the audience's understanding
Mechanics	3 or more grammar, spelling, and/or punctuation errors.	1-2 grammar, spelling, and/or punctuation errors.	No grammatical, spelling, or punctuation errors.

Note to Teachers:

If you would like to view and/or utilize the quizzes in Socrative, please sign up for a free Socrative account. Once logged in, select manage quizzes, then select import quizzes. Enter the soc-xxx number provided to import the quizzes into your account.

Water Quality Testing - soc-19025827

Water Availability - soc-19023441

A Day in the Life of Campbell Creek - soc-19025308

References:

Design ideas and content were inspired by the following sources.

Project Wet - Project Wet Foundation. (2011). Project Wet: Curriculum and Activity Guide 2.0. Bozeman, MT. Project Wet Foundation.

Project Wild - Council for Environmental Education. (2002). Science and Civics: Sustaining Wildlife. Houston, TX. Council for Environmental Education.

Southwest Florida Water Management District. (n.d.). Retrieved November 17, 2015, from <https://www.swfwmd.state.fl.us/education/resources/guides/MeasuringWaterQualityTG.pdf>

Office of Environment and Heritage - NSW. (n.d.). Retrieved November 17, 2015, from <http://www.environment.nsw.gov.au>

Adopt a Wetland. (n.d.). Retrieved November 17, 2015, from <http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Pages/AdoptaWetland.aspx>

Glossary

Activity 1

Availability - Able to be used or obtained; at someone's disposal.

Contaminants - Something that makes a place or a substance (such as water, air, or food) no longer suitable for use.

Freshwater - Water with less than 0.5 parts per thousand dissolved salts.

Glaciers - A large body of collected snow and ice formed over many years that slowly moves through a valley or down a mountain.

Groundwater - Water found in spaces between soil particles underground.

Ice caps - A glacier or thick layer of ice and snow that covers less than 19,000 square miles. Glacial ice covering more than 19,000 square miles is called an **Ice Sheet**.

Lakes - A natural or man-made body of fresh or salt water surrounded by land.

Limited Resource - A resource that is finite or slow to replenish such that there can be shortages of its availability.

Natural Resource - Anything that people can use which comes from nature. People do not make natural resources, but gather them from the earth.

Percentage - The portion of a whole based on a scale of 100. Expressed as a number between 0 and 100.

Pollution - The introduction of contaminants into the natural environment that cause negative changes.

Potable - Safe to drink.

Reusable Resource - A resource that can be used over again in its current form such as air and water.

Rivers - A natural stream of fresh water flowing through a channel towards the sea.

Saltwater - Water that contains a relatively high percentage (over .5 ppt) of salt minerals.

Shortage - A situation in which something needed cannot be obtained in sufficient amounts.

Surface Water - Water above the surface of the land, including lakes, rivers, streams, ponds, floodwater and runoff.

Water Cycle - The path water takes through its various states - vapor, liquid, and solid - as it moves throughout Earth's systems (Ocean, atmosphere, ground water, streams, etc.)

Activity 2

Aquatic - Something that is living or found in or near water.

Catchment - The land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water.

Chemical - Any substance (as an acid) that is formed when two or more other substances react one another or that is used to produce a change in another substance. Chemicals are man-made and do not break down in nature like wood or paper.

Detergent - A chemical substance, usually powder or liquid, used to clean clothes, dishes, etc.

Erosion - The wearing away of topsoil by the natural forces of water and wind or through man-made forces such as farming or construction.

Fertilizers - Substances added to the soil or sprayed on plants to keep them well nourished. High in nitrites, which cause algae blooms and oxygen depletion in waterways.

Hazardous Waste - A used or discarded material that can damage the environment and be harmful to health.

Impervious - A man-made surface through which water cannot pass, such as asphalt or concrete streets and parking lots, buildings, packed ground, etc.

Industrial - Business and factory part of town Where things are made.

Pesticide - A chemical used to destroy pests (insects or weeds). Can kill aquatic plants and animals when washed into stream by stormwater.

Pollution - The introduction of contaminants into the natural environment that cause negative changes.

Residential - Dense population of houses and human activity. Where you live.

Runoff - Precipitation that flows overland to surface streams, rivers, and lakes.

Sewage - Human or other animal waste (feces) that is suspended and moved in water.

Storm drain - Man-made opening in a road system where runoff from the road surface flows into an underground sewer system.

Stormwater - The water from rain or ice/snow melt that has run off impervious man-made surfaces such as streets and parking lots into nearby sewers or waterways.

Topsoil - The uppermost layer of soil that is rich in nutrients for plant growth. It is often only a few inches thick.

Activity 3

Acidic - Any substance that has a pH below 7. Sour tasting like lemon juice.

Algae - A living organism often found in or near water. Not a plant or animal...

Base - Any substance that has a pH level above 7. Vegetables, fruit, tea.

Clarity - A term that refers to how clear something appears. Opposite of turbidity.

Dissolved oxygen - A measure of the amount of oxygen that is available for use in a lake, river, or stream. All living things need oxygen to survive.

Nitrate - A naturally occurring form of nitrogen found in soil and fertilizers.

Nitrification cycle - A naturally occurring event in which bacteria turn harmful ammonia and nitrites into less harmful nitrates.

pH - A classification of acid or base materials on a scale of 0-14, with 7 representing neutrality. Numbers less than 7 indicate increasing acidity and numbers greater than 7 indicate increasing alkalinity (basic).

Phosphate - A mineral and nutrient found in nature. Added to fertilizer to help plant growth. Excess levels extremely harmful to waterways.

Pollution - The introduction of contaminants into the natural environment that cause negative changes.

Toxin - A substance that is poisonous to a living organisms health.

Turbidity - How clear water is or how deep one can see into the water.

Waste - 1. Unusable material left over from human activities (trash), manufacturing or other processes. 2. The materials excreted by humans and animals as a byproduct of digestion and metabolism.

Water Quality - A measure of the suitability of water for a particular use based on physical, chemical, and biological characteristics.

Activity 4

Conservation - The use of water-saving methods to reduce the amount of water needed for homes, lawns, farming and industry and thus increase water supplies for optimum long-term economic and social benefit.

Public service announcement - An advertisement or announcement delivered by mass media (television, radio, or internet) to publicize a message in the public interest.

Biodegradable - Any substance or product that has been created to break down into components that are harmless to the environment.

Compost - Decayed organic matter often found in topsoil.

Reduce - To use less of an item or resource as part of a conservation program.

Recycle - To process an item or the materials from which it is made so that it can be remade into something else and used again.

Reuse - To use an item or resource again so that it is not depleted.

Water Footprint - A term used to describe the water usage of an individual, company, or community.