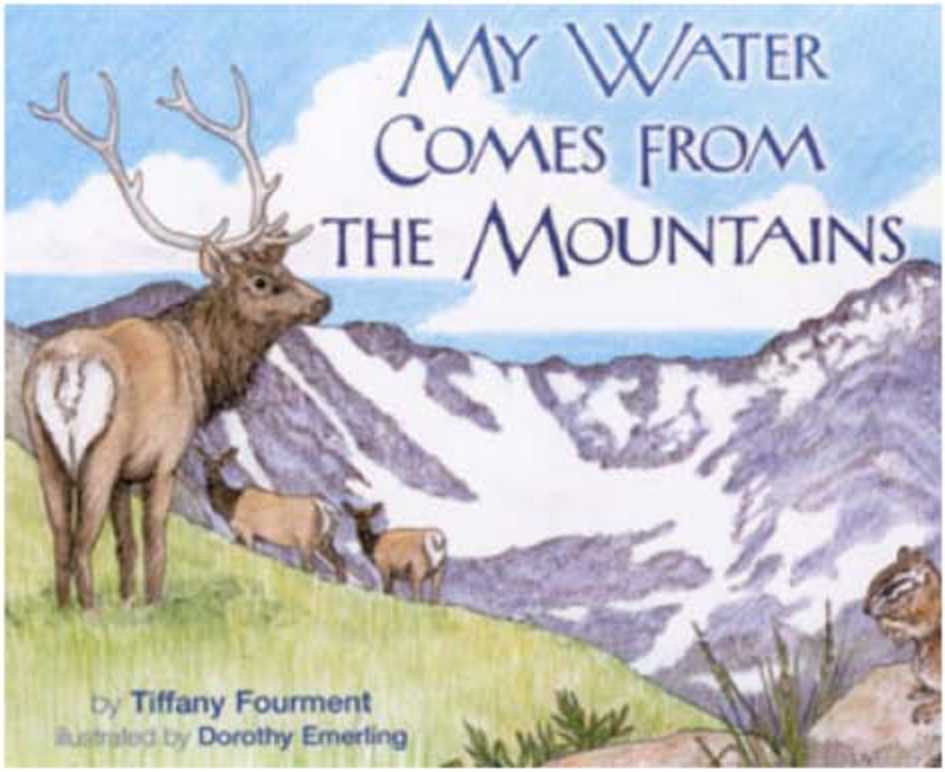
MY H2O

Teacher's Curriculum Guide and Kit

to the children's book

My Water Comes from the Mountains



Kenneth Nova
Colleen Flanagan

12 March 2006

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Welcome!

14 March 2006

Written by Tiffany Fourment and illustrated by Dorothy Emerling, *My Water Comes from the Mountains* takes children of ages 8-11 on an illustrative journey from glacial and snowpack sources high on the Continental Divide to the plains and water in their faucet tap. The narrative introduces them to the distinctive wildlife and ecosystems along the way, including the diverse uses and human impact of water in Boulder and St. Vrain Creek Watersheds. Supported by the National Science Foundation (NSF), with funding from the Niwot Ridge Long-Term Ecological Research station (NWT-LTER) and CU's Institute for Arctic and Alpine Research (INSTAAR), over 2,000 books were distributed to 54 area elementary schools in May 2004. Utilized in the classroom setting, the book has been very highly regarded and well received by local students and teachers.

While the book promotes awareness and attention to Front Range water, we found it useful to develop a Curriculum Guide that would enhance this important topic through accompanying lessons, incorporation of water-wise sustainability in the classroom and community, and improvement of environmental education teaching skills with exemplary projects and practical edification. Receiving funds from the Environmental Protection Agency (EPA) Environmental Education Division, Schoolyard-LTER program, CU-Boulder's Outreach Committee, City of Boulder and Watershed Approach to Stream Health (WASH), this endeavor began in June 2005.

Various versions of MY H2O have been distributed and reviewed by various local experts, teachers and executive directors, representing: Boulder Valley School District, St. Vrain Valley School District (SVSD), City of Boulder Water Education and WASH, Boulder County Parks and Open Space, Wild Bear Center for Nature Discovery, Thorne Ecological, and CU-Boulder's Environmental Center, Dept of Environmental Studies, Cooperative Institute for Research in Environmental Studies (CIRES), INSTAAR, Niwot Ridge LTER, Mountain Research Station, Dept of Ecology and Evolutionary Biology and Science Discovery. The project was also piloted in three area classrooms in during Winter '05-'06. Using feedback generated from these evaluations and tests, the MY H2O Guide and Kit has been finalized!

This edition will reach out to all Boulder County public schools, and other various private and/or non-formal education centers. The MY H2O guide and kit can be accessed through BVSD's FOSS Center, SVSD's STG Center, Bixby School, Friends' School, CU Science Discovery, CU Earth Education, Wild Bear Center for Nature Discovery, Thorne Ecological, and so on…….

Thank you very much for your interest in this project!

Sincerely,
Kenneth Nova and Colleen Flanagan

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Guide Key

The Guide encompasses four themes, each separated from each other by tab dividers: 1) The Water Cycle (WC), 2) Our Watershed (WS), 3) Boulder County's Flora, Fauna and Life Zones (F^2LZ), and 4) Human Impact on Water (HI). The Reading Comprehension (RC) activity is an over-arching assessment of *My Water Comes from the Mountains* book and guide. (Shorthand code is referred to in parentheses.) Blending Colorado State Science, Language Arts, Geography and Math Standards, the Guide is meant to establish an improved foundation for critical-thinking, problem-solving and decision-making skills. Students are challenged through age-appropriate group and individual models, educational games, story plots and community action tasks.

MY H20 "A Teacher's Curriculum Guide*: My Water Comes from the Mountains"* is meant to enhance and emphasize the countless resources already available, and therefore it is more like a recipe book adapted for Boulder Creek and St. Vrain Creek Watersheds than an original piece. We, Colleen Flanagan, Kenneth Nova and Tiffany Fourment, have adapted a number of projects from WASH (Watershed Approach to Stream Health Project) and their WatershED curricula, Project WET (Water Education for Teachers), and credit is given where due. The Guide is prescribed for use with 4th and 5th grade students, and we therefore geared the activities and projects toward 8–11 year olds. However… this curriculum is flexible! The information is meant to be a foundation but we encourage adaptation to fit the needs of every classroom. We've designed this teacher's edition as if a class were taught solely around "My Water Comes from the Mountains." Therefore the Guide may be used front to back, or as a teacher, you may decide to pick and choose particular activities that might enhance your lesson plans. The flexible nature allows teachers to consider applying the enclosed water education with any class activity or project.

Skills

Psychologist Howard Gardner's Seven Intelligences are also incorporated into the Curriculum Guide. Claiming that the seven intelligences rarely operate independently, Gardner asserted that they are used at the same time and tend to complement each other as people develop skills or solve problems. Represented as "Skills" within the curricula format, they are meant to give a broad overview of what abilities the activity focuses on. Here is a summary of The Seven Intelligence Theory, if you wish to read more see: http://www.infed.org/thinkers/gardner.htm. **Linguistic intelligence** involves sensitivity to spoken and written language, the ability to learn languages, the capacity to use language to accomplish certain goals, and the ability to effectively use language to express oneself rhetorically or poetically. **Logical-mathematical intelligence** consists of the capacity to analyze problems logically, carry out mathematical operations, investigate issues scientifically, detect patterns, reason deductively and think logically. **Musical intelligence** involves skill in the performance, composition, and appreciation of musical patterns, and it encompasses the capacity to recognize and compose musical pitches, tones, and rhythms. **Bodily-kinesthetic intelligence** entails the potential of using one's whole body or parts of the body to solve problems, and the ability to use mental abilities to coordinate bodily movements. **Spatial intelligence** involves the potential to recognize and use the patterns of wide space and more confined areas. **Interpersonal intelligence** is concerned with the capacity to understand the intentions, motivations and desires of other people, while allowing people to work effectively with others. **Intrapersonal intelligence** entails the capacity to understand oneself, to appreciate one's feelings, fears and motivations.

Standards
When uncertain about particular fulfillments, please refer to the complete State Standards in Appendix 1 (A-1). There you will also find how certain activities connect to particular standards.

Kit Materials
Other Materials
In addition to the aforementioned curricula, a complementary Materials Kit supplements the Guide and recommended activities by containing the majority of supplies needed to implement each activity. Those listed under "Kit Materials" can be found in the kit, while those supplies listed under "Other Materials" must be gathered by you, the educator.

Connections
For each activity, note a heading termed "Connections." Here we attempted to list other ideas that correspond with the subject matter presented. If referring to another activity existing in the Curriculum Guide, we used short-hand notation (e.g., *F²LZ 1* is the first activity in "Boulder County's Flora, Fauna and Life Zone" theme, The Life Zone Location).

Glossary
As you read bolded terms throughout the activities, refer to the glossary for definition.

Links
Boulder Valley School District (BVSD) and St. Vrain School District (SVSD) use science curriculum called FOSS, Full Option Science System, and Science-to-Go, respectively. Connections from *My Water Comes from the Mountains* to FOSS and Science-to-Go projects are listed in Appendix 2 (A-2) for teacher accessibility. Other curriculum connections are also included in A-2.

Resources
Because there is also a plethora of community resources, even some that welcome field trips or send guest speakers, we've added an all-inclusive "Resources" list in Appendix 4 (A-4). Be certain to check out all these wonderful opportunities, many of them for free! Of course, there are a number of web resources listed as well.

Evaluation
If you have feedback for MY H2O, please fill out a form in A-5 and mail back to:
INSTAAR, c/o Diane McKnight
450 UCB
Boulder, CO 80309-0450

Acknowledgements

FUNDERS

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BANANA SLUGS STRING BAND

WALKIN' JIM STOLTZ

LINDA BOOK

TWO OF A KIND

ALEX BEVAN

Credits

MUST STILL UPDATE!!!!

Project WET

Project WET (Water Education for Teachers) is an award-winning nonprofit water education program and publisher located in Bozeman, Montana. Established in 1984, project WET works with sponsors, educators, resource professionals, business leaders, policy makers, and citizens to develop and implement water education projects. Revenue from the sale of Project WET publications and products supports continued development of water education projects in the United States and internationally. MY H2O thanks Project WET for permission to use the following activities from the *Project WET Curriculum & Activity Guide,* © 1995 by the Project WET International Foundation: "Macroinvertebrate Mayhem" (pp 322—327), "A Drop in the Bucket" (pp 238—241), and "The Incredible Journey" (pp 161—165).

Project WILD

xxxxxxxxxxxxxxxxxxx

**INCLUDE COPYRIGHT INFORMATION, ALBUM NAME, WEBSITE, TITLES, PHONE* "USED WITH PERMISSION"

MUSIC

Banana Slug String Band: MY H2O CD tracks x and x: "The Water Cycle Boogie" and "River Song"
http://www.bananaslugsstringband.com
1-888-327-5847

Linda Book: MY H2O CD track x, "Where Does the Water Go?" from CD "Wrong Side Dog", © 2003, Words and Muse Productions, Davis, CA. Used with permission. http://www.lindabook.com

Two of a Kind?

Alex Bevan

Walkin' Jim Stoltz- MY H2O CD tracks x, x, x and x

IMAGES

WC 1

Behind the Scenes: Tracking the Water Cycle

Science Standards: 1.1, 2.1, 2.2, 3.2, 4.3, 6.3, 6.4, 6.5

Objectives

After students learn about the water cycle, they will then illustrate the series of hydrologic terms.

Skills

Musical, Spatial, Linguistic, Interpersonal

Background

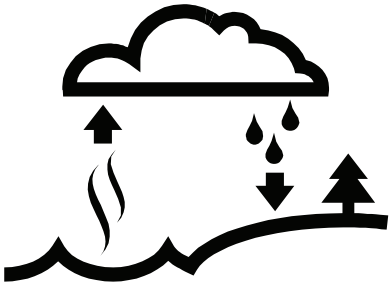
While water does circulate from one point or state to another in the water cycle, the paths it can take are variable. Heat energy directly influences the phase of water molecules. When the motion of the molecule increases because of an increase in heat energy, water will change from solid to liquid to gas. With each physical change in state, movement from one location to another usually follows. Glaciers **melt** and change water from a solid to a liquid, then pool up and overflow into streams, where water may **evaporate** into the atmosphere, changing from a liquid to a gas (water vapor).

One of the most visible states in which water moves is the liquid form, flowing in streams and rivers and tumbling in ocean waves. **Surface run-off** brings all the earth's surface water toward creeks and rivers, where **surface water**, essentially all water on the earth's surface comprises waterways and bodies. Surface water can also infiltrate into the soil, slowly seeping and filtering through particles of soil and pores within rocks, and collect underground in a process called **percolation**. **Groundwater** can travel slowly and flow laterally toward streams, lakes or oceans, or form **aquifers** which many people tap wells into for drinking water or irrigation purposes.

Although unseen, water's most dramatic movements take place during its gaseous phase. Water is constantly evaporating and as a vapor, it can travel through the atmosphere over Earth's surface. In fact, water vapor surrounds us all the time. Water **condensation** can be seen as dew on plants or water droplets on the outside of a glass of cold water. In clouds, water molecules collect on tiny dust particles. Eventually, the water droplets become too heavy and gravity pulls the water to Earth in the form of **precipitation**. If the surrounding air is cold, the liquid will **freeze** and change water into a solid form, resulting in hail or snow.

Living organisms also help move water. The greatest movers of water among living organisms are plants. The roots of plants absorb water. Some of this water is used within the body of the plant, but most of it travels up through the plant to the leaf surface. When water reaches the leaves, it is exposed to the air and the sun's energy and is easily evaporated. This process is called **transpiration**. Humans and other animals also carry water within their bodies, transporting it from one location to another. Water is either directly consumed by animals or is removed from foods during digestion. Water is excreted as a liquid or leaves as a gas, usually through respiration. When water is present on the skin of an animal (for example, as perspiration), evaporation may occur.

All of these processes, changing water from one state of matter, or phase, to another, work together to move water around, through, and over the earth.



Kit Materials

MY H2O CD—tracks 1, 9 and 11

Other Materials

Colored pencils, markers or crayons; or materials that represent water, clouds and mountains, such as blue cellophane, cotton balls, and corrugated cardboard; BVSD also has "Bill Nye The Science Guy" video: The Water Cycle, available for check-out through the DIMC.

Preparation

Get blank paper for students, either 8 ½ x 11 or construction paper. Use the water cycle diagram or see http://en.wikipedia.org/wiki/Water_cycle for reference.

Time: 30-45 min

Setting: classroom

The Activity

1. Refer to early pages in *My Water Comes from the Mountains* where snow falls and melts, beginning the journey of water through the watershed. Listen to water cycle songs on the CD. If possible, also watch "Bill Nye, The Science Guy" video: The Water Cycle. Afterward, discuss the above bolded terms.
2. After instruction about the water cycle (hydrologic cycle), the students will need to illustrate and label the following stages of the cycle:
   - Evaporation
   - Transpiration
   - Condensation
   - Precipitation
   - Surface run-off
   - Surface water
   - Percolation (also called Infiltration)
   - Ground water
3. When evaluating this activity, it is more important that the stages of the water cycle are accurately illustrated rather than the quality of the art work.
4. You might have students compare their drawings to the website: http://en.wikipedia.org/wiki/Water_cycle.
5. Afterward, consider splitting the class into groups of four, where each group must invent a play, dance or song to represent the water cycle. Use the included CD as an example.

Illustration courtesy of AIMS

Connections

- *WC 2 – The H_2O Dem-O*; *WC 3 – The Incredible Journey*; *WC 4 – A Watery Voyage*
- Consider our local seasons and subsequent effects upon the water cycle. In the Rocky Mountain Front Range, our surface run-off is dominated by snowmelt and is therefore highest between May and June. (Think of the high flows local streams experience in late spring/early summer.) Also think about other seasons. For instance, during what months is evaporation the highest? For activities and more information, see BASIN's *Understanding Water Budgets and Balances*: http://bcn.boulder.co.us/basin/learning/waterbudget.html.
- WASH *Get to Know Your H2O* and *Rain Rain Go Away* program. See brochure or call 303-413-7365
- Water educational resources available through the Longmont Conservation District: Call 303-776-4034 x3

The H_2O Dem-O

Science Standards 1.1, 2.2, 2.3, 4.2, 4.3, 5.4, 6.3, 6.4, 6.5

Objectives

Through this experiment, students will observe the processes of evaporation, condensation, and precipitation to broaden their view of the water cycle.

Skills

Spatial, Musical

Background

The rising steam (especially from the teapot) represents evaporating water vapor that forms clouds when it is cooled. Water vapor cannot be seen. Steam is a white mist that results when hot water vapor encounters the cooler, room temperature air, where some short-term condensation occurs. On the bottom of the ice container, water will condense. It won't actually form a cloud, but will show how water vapor condenses when it is cooled. The higher you go in our lower atmosphere (troposphere), the cooler it gets. So, when warm air rises, it will encounter cooler air and water vapor will condense onto dust particles and form clouds. When clouds get saturated enough, precipitation falls. In the demonstration, water droplets forming on the ice-cold surface will eventually get big enough to fall down from the surface, simulating precipitation.

See water cycle information in *WC 1 – Behind the Scenes*.

Safety

If you're working in small groups, the hot water must be handled safely.

Kit Materials

1000-mL (1-L) glass container

The Magic School Bus at the Water-works, by Joanna Coles

MY H2O CD—tracks 1 and 11

Other Materials

Boiling hot water and ice; if available, an electric teapot and cookie sheet

Preparation

Get boiling hot water, ice, and the one-liter container from this kit, and/or electric teapot, cookie sheet and ice.

Read this website for background information or have students see: http://en.wikipedia.org/wiki/Water_cycle

Time: 30 min

Setting: classroom

The Activity

1. Read-aloud *The Magic School Bus at the Waterworks,* by Joanna Cole, and listen to "Water Cycle Boogie" and "Adventures of a Water Drop" on the MY H2O CD. Refer to the water cycle diagram page in *My Water Comes from the Mountains*.
2. Then, as a classroom demonstration, you can use one of two methods. If you don't have a teapot, pour boiling hot water into 1/3 to 1/2 of the one-liter container and place the inverted cap with ice on the top. If you have a teapot, you can boil water and aim the vapor stream at the bottom of the cookie sheet with ice placed on top.
3. As the water vapor rises after it evaporates, it will encounter the cold surface of either the cap or the cookie sheet. In either case, explain what steam is to the students. Water vapor itself cannot be seen. Explain how when warm air with water vapor rises, it comes into contact with colder air and the water vapor condenses onto dust particles in the air. A cloud forms, and when it gets heavy and saturated enough with water, precipitation occurs. Water droplets forming on the cookie sheet or container cap simulate the condensation and water dripping down off of the cookie sheet or container cap simulates precipitation.

> "One day way up in the Rocky Mountains of Colorado, snow fell softly to the ground…"

> "All the water on Earth is part of one big cycle and the journey of water through our watershed is only a small part of that cycle."
>
> *My Water Comes from the Mountains*

Connections

- *WC 1 – Behind the Scenes: Tracking the Water Cycle*; *WC 3 – Aquatic Voyage*; *WC 4 – A Watery Journey*
- "Bill Nye The Science Guy" video: The Water Cycle, available for check-out at BVSD DIMC.
- For a simple demonstration of condensation, germinate bean seeds by placing a few seeds in a ziplock with wet paper towels. Seal the plastic bag and set on the windowsill. Observe over a week, keeping the paper towel moist, and notice water droplets that condense on the inside of the bag due to transpiration. This may also be illustrated with terrariums, or Bottle Ecosystems (See *F²LZ 4*). Perhaps easier yet is a cup filled with water. Mark the water line one day to the next. What is happening and where is the water going?
- Emphasizing Bodily-Kinesthetic and Interpersonal skills, enhance with "Water Freeze Tag." Students are all water molecules and start out moving very slowly as frozen molecules and then the "Heat" person tags each molecule – when tagged the student changes from solid to liquid and can move faster and then liquid to gas moving very fast and then back to ice.
- WASH Education Program and resources for loan: See brochure or call 303-413-7365
- Water educational resources available through the Longmont Conservation District: Call 303-776-4034 x3

The Incredible Journey

Science Standards: 1.3, 2.1, 2.2, 3.2, 4.3, 6.3, 6.4

Math Standards: 1, 3, 6

Objectives

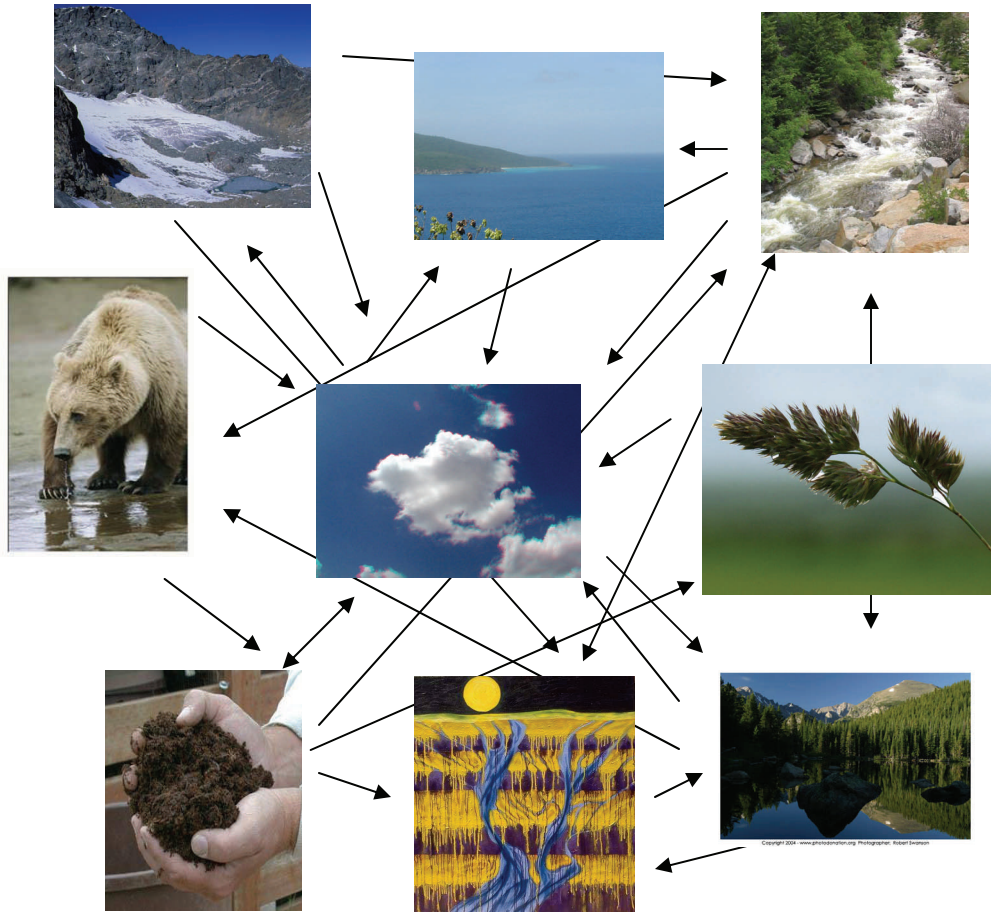
With the role of a die, students will simulate the movement of water within the water cycle, identifying the states of water along the journey. Afterward, it will be apparent that the largest reserves of water are in the ocean and in clouds.

Skills

Bodily-Kinesthetic, Spatial, Interpersonal, Logical-Mathematical, Musical

Background

See the information about the water cycle in *WC 1 – Behind the Scenes.*



Guide Materials

WC 3 *Incredible Journey* worksheet

Kit Materials

Dice (9) - WC 3 ziplock

Water Station Pictures—WC 3 envelope

MY H2O CD—Track 9

Preparation

Make copies of the worksheet for each student. Set out stations with appropriate place names and illustrations. Each station will also have one, 6-sided die. Each side depicts an illustration representing the location of water. Look at the dice enclosed in the kit. Each is different and each has its own corresponding station. To determine which die goes where, find the *"STAY"* illustration. Match that illustration with the appropriate station, and corresponding picture label.

Time: 45–60 min

Setting: indoor/ outdoor playing field or classroom

The Activity

1. Tell students that they are going to become water molecules moving through the water cycle. Refer to *My Water Comes from the Mountains*, the journey of water through the watershed.
2. Categorize the places water can move through into nine stations: clouds, plants, animals, rivers, oceans, lakes, ground water, soil, and glaciers. Set the station illustrations and place names in locations around the room.
3. Tell students they will be demonstrating water's movement from one location to another, assign an equal number of students to each station.
4. Have students identify the different places water can go in the water cycle. Discuss the conditions that cause the water to move. If appropriate, students should think about the form in which water moves from one location to another.
5. In this game, the roll of the die determines what station location the water droplet, as represented by each individual student, will go to next. Students should roll the die and go to the appropriately-labeled location. For instance, a student is at the "Soil" station. She rolls the die and the "Animal" side faces up. She moves to the "Animal" station, then proceeds to roll the "Animal" die, and continues in her water droplet journey.
6. However, a student may be at the "Ocean" station and roll the die only to discover the word "STAY." This often occurs where there are huge reservoirs of water. At these particular stations ("Cloud" and "Ocean"), advise students to line up if waiting to roll the die at one station. If they roll stay, and there is a number of students waiting at that station, they move to the back of the line.
7. With copies of the attached chart, have students record their movement through the water cycle for a determined number of turns, and discuss results. If time allows, depict the journey through a drawing (*WC 4*), illustrating the cycle they went through.
8. Apply math and count people at each station. If so inclined, figure out the percentage of total students at each station. Write the numbers in front of the class, asking why are so many people in the ocean? clouds? And why so few at other stations?
9. Play "Where does the Water Go" (track 9) on repeat during the game.

Did you know?

In a 100-year period, a water molecule spends 98 years in the ocean, 20 months as ice, about 2 weeks in lakes and rivers, and less than a week in the atmosphere.

Connections

- *WC 1 – Behind the Scenes*; *WC 4 – A Watery Voyage*
- Project WET *The Incredible Journey* kit, KIDs activity booklets, and *Discover a Watershed: the Colorado Educators Guide.* Visit http://www.projectwet.org for more information.
- "Bill Nye The Science Guy" video: The Water Cycle, available for check-out at BVSD DIMC.
- WASH Education Program and resources for loan: See brochure or call 303-413-7365
- Water educational resources available through the Longmont Conservation District: Call 303-776-4034 x3

A Watery Voyage

Science Standards: 4.1, 4.2, 4.3, 5.1, 6.3, 6.4, 6.5

Language Arts Standards: 2, 3, 4, 5, 6

Objectives

By writing a first person story as a personified water droplet, students will demonstrate their understanding of the water cycle and local watersheds.

Skills

Linguistic, Intrapersonal, Musical

Background

See the activity *WC 1 – Behind the Scenes* for information about the water cycle.

The Activity

Refer to *My Water Comes from the Mountains*, the journey of water through the watershed. Students will write a story from the viewpoint of a drop of water, including water cycle stages in the story. Inspiration could be drawn from WC 3 or WC 4, or you may also choose to listen to water cycle songs on the CD for ideas. Display this prompt on an overhead or on the board:

> *Prompt:* You are a drop of water. Describe your journey through the water cycle, starting with falling as snow on the eastern side of the Continental Divide in the Boulder or St. Vrain Creek watershed, then melting and entering a stream.

Connections

- *WC 1 – Behind the Scenes*; *WC 3 – The Incredible Journey*; *WS 3 – Our Backyard Drinking Water Supply*
- *The Magic School Bus at the Waterworks,* by Joanna Cole
- Project WET Curriculum & Activity Guide © 1995, "Imagine," p 157.
- *A Drop in My Drink: The Story of Water on Our Planet*, by Hooper and Coady
- See the website: http://en.wikipedia.org/wiki/Water_cycle
- "Bill Nye The Science Guy" video: The Water Cycle, available for check-out at BVSD DIMC.
- Enter your story or poem through the Colorado Foundation for Water Education's Poetry of Rivers program, http://www.cfwe.org or River of Words, http://www.riverofwords.org
- WASH Education Program and resources for loan: See brochure or call 303-413-7365
- Longmont Conservation District water educational resources: Call 303-776-4034 x3

Materials

None required;

Students could use the *WS 3 – Our Backyard Drinking Water Supply* "Protect Your Drinking Water" maps, *WC 3 – Incredible Journey* worksheet, or MY H2O CD tracks 1, 6, 7, 9, 11 for ideas.

Preparation

Prepare overhead of the prompt or write on the board, being sure that students have a good knowledge of the water cycle and the flow of water in Boulder County so that they may successfully complete this activity.

Time: Variable

Setting: classroom

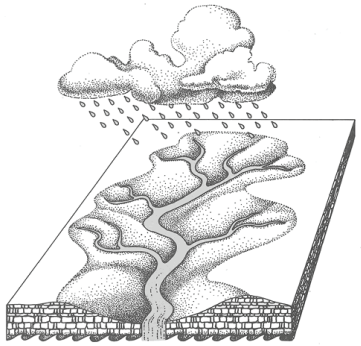
The Confluence Course

Science Standards: 1.3, 4.1, 4.3, 5.1, 6.5

Geography Standards: 1.1, 1.2, 1.3, 3.1, 3.2, 5.1

Objectives

In order to understand the scale of local, regional and national watersheds, using atlases and the blank map of the United States, students will trace and label the flow of water from the sources of Boulder Creek and St. Vrain Creek to the Gulf of Mexico.



Skills

Spatial, Logical-Mathematical, Interpersonal, Musical

Background

A **watershed** is an area of land in which all rain and snow runoff and small tributaries drain into a body of water, commonly known as a **river basin**. There are four major river basins in Colorado: Arkansas, Colorado, Rio Grande, and Missouri. Traversing the state of Colorado (and continuing north through Canada and south to Mexico), the **Continental Divide** separates these river basins, where all water flowing west of the Divide empties into the Pacific Ocean and all water flowing east of the Divide empties into the Atlantic Ocean, via the Gulf of Mexico. Much of the Continental Divide in the United States follows the crests of the Rocky Mountains and, interestingly, the Divide is at its most easterly point in Boulder County.

Boulder County is located on the eastern slope of the Divide, and lies within the St. Vrain Watershed. Originating in at the western boundary of the county, Boulder Creek and St. Vrain Creek are sub-watersheds of the larger South Platte River Basin, which is nested within the Missouri/Mississippi River Basins. This basin is bordered on the west by the Continental Divide, between Longs Peak and James Peak, and extends to Colorado's northeastern border. The headwater tributaries provide a significant portion of the drinking water supply for those living in the basin. Boulder County accounts for 75% of the 993 square-mile area, with the remainder extending into portions of Gilpin, Jefferson, Adams and Weld counties. The 440-square-mile Boulder Creek watershed is the major "sub" basin within the St. Vrain watershed.

There are many **confluences** within watersheds. For instance, the North Fork Middle Boulder Creek meets and merges with the Middle Fork Middle Boulder Creek, and at some location downstream South Boulder and North Boulder Creeks meet and merge with Middle Boulder Creek. This pattern continues on until the creeks and rivers eventually lead to the sea…or in this case, the Gulf of Mexico and the Atlantic Ocean.

Preparation

Make copies of WS 1 blank United States map (consider enlarging worksheet to 8.5x14 or 11x14), and obtain MAP envelope from kit

Guide Materials

WS 1 blank U.S. map worksheet

WS 1 U.S. answer map and sheet

Kit Materials

MAP envelope, containing Central & Western U.S. road map, USGS topographic maps, Latitude 40 maps

My H2O CD—Tracks 6 & 7

Other Materials

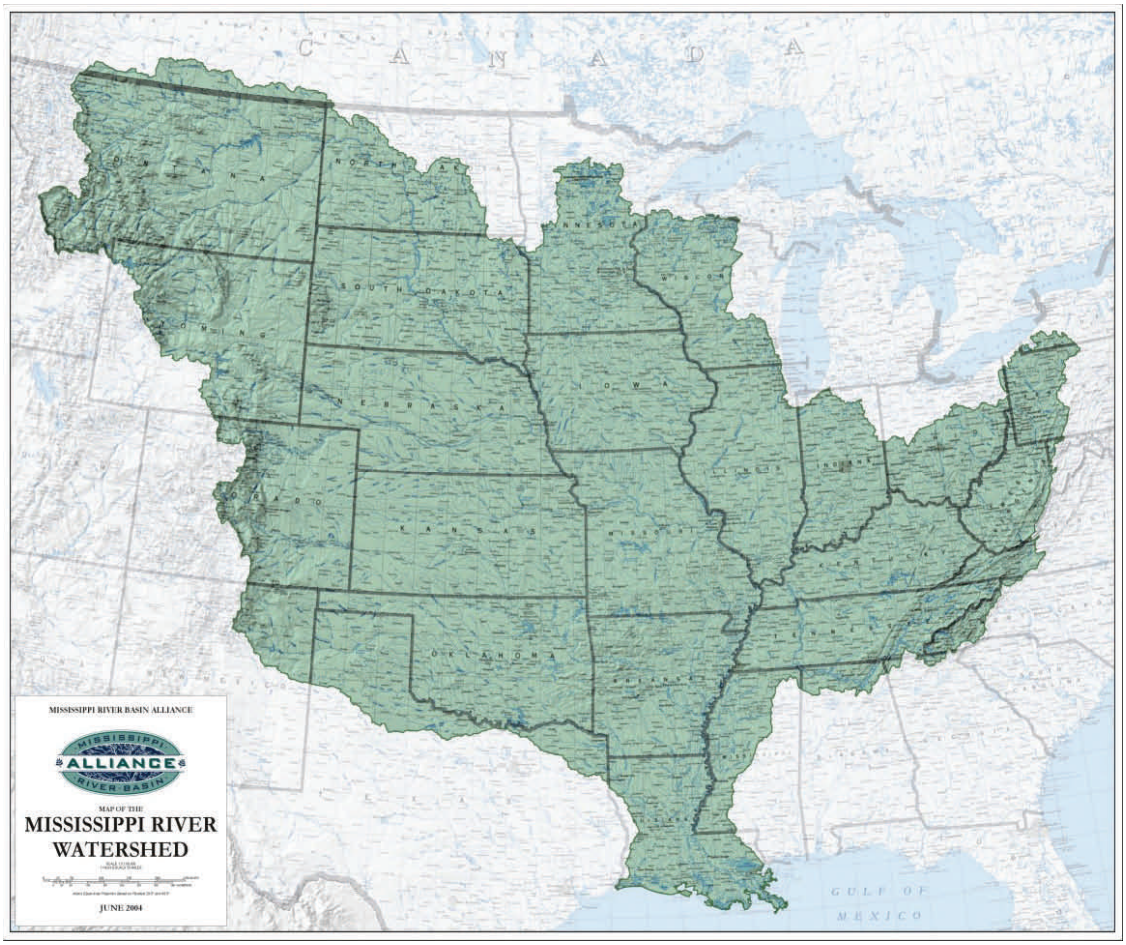
colored pencils

Time: 30-45 min

Setting: classroom

The Activity

- Refer to *My Water Comes from the Mountains* where early in the book, the narrative discusses "what exactly is a watershed," the middle depicts our local watershed, and the last page putting the journey of Boulder and St. Vrain Creek in a larger perspective. Listen to songs about rivers and watersheds on the MY H2O CD: "All the Rivers Run" and "River Song."
- Using road maps, students will use colored pencils to draw the complete path of water flowing from the headwaters of Boulder Creek and/or the St. Vrain Creek to the Gulf of Mexico. The students will label the Pacific and Atlantic Oceans, Gulf of Mexico, Continental Divide, and the following rivers: Boulder Creek and/or St. Vrain Creek, South Platte River, North Platte River, Platte River, Missouri River, Mississippi River. They will also mark the major cities near **confluences** of rivers.



Connections

- To enhance geographical skills, students could also label the states the rivers flow through.
- Project WET Curriculum & Activity Guide © 1995, "Missouri River Routes" p 142, and "Streams of Data" p 124.
- *WS 2 – Map Your Shed, WS 3 – Our Backyard Drinking Water Supply*

Map Your Shed

Science Standards: 1.3, 4.1, 4.3, 5.1, 6.5

Geography Standards: 1.1, 1.2, 1.3, 3.1, 3.2, 5.1

Objectives

Through this map-reading activity where students trace the origins of local waterways and locate watershed boundaries, they will gain an understanding of the Boulder Creek and St. Vrain Creek Watersheds.

Skills

Logical-Mathematical, Spatial, Interpersonal, Intrapersonal

Background

When asked to define who we are, we often will say where we are from. In order to understand ourselves, it is important that we understand the place we live. This mapping exercise will provide students with the opportunity to become familiar with the watershed in which the school is located.

A **watershed** is an area of land in which all rain and snow runoff and small tributaries drain into a common body of water such as a creek or lake. Everyone lives in a watershed, and most of us live near a river or stream. The size of a watershed can vary from the land that surrounds and drains into Bear Canyon Creek in South Boulder, to the Mississippi River Basin which collects water from lands to the east and west of the river. The Mississippi River watershed is composed of several thousand smaller watersheds, including the Boulder and St. Vrain Creek watersheds, which eventually contributes water to the Mississippi. Watersheds are a unique framework from which to study water resources issues. Everything that occurs in the watershed affects both the land and the water. By focusing on small, local watersheds like Boulder and St.Vrain Creek with **topographic** and **relief maps**, we can bring the focus of water quality and quantity issues, which are impacted and affected by the people of Boulder County region, and provide a framework from which relevant management and action can be taken.

Preparation

Collect supplies and paper for *Crumplesheds* (Activity C). A background lesson on topographic maps would also be of great benefit. For users of the FOSS Modules, Landforms Lesson #4 and #5 would be sufficient. Others may consider using the web resources: http://members.aol.com/bowermanb/teach.html or http://k6educators.about.com/cs/languageartsless/a/lpss46a.htm.

> "...MUCH LIKE WHEN A DOG SHEDS ITS HAIR...THE MOUNTAINS AND HILLS "SHED" WATER AFTER IT SNOWS OR RAINS."
>
> *My Water Comes from the Mountains*

Kit Materials

MAP envelope (i.e., 1980 USGS and Latitude 40 topographic maps)

"Denver's Playground" 3-D Satellite Relief Map

spray bottles

sticky notes

water-soluble markers

Other Materials

clean, white paper, tap water

Time: 45–60 min

Setting: classroom

The Activity

Refer to the depictions and discussions of our local watershed in *My Water Comes from the Mountains*.

A) Relief Mapping

1. Relief maps are 3-D maps that illustrate depth and altitude of a region. The enclosed relief map is titled "Denver's Playground," here we will be highlighting the Front Range.
2. Visually depicting the Continental Divide, ridgelines, valleys and canyons, discuss with the class the potential effects of rain or snow along the Continental Divide. Predict where water might collect and why. Remember that the gradient, or slope of a mountain stream, and the width, will vary, and these features play a large role in "shaping" the land.
3. Using the spray water bottle to simulate precipitation or snowmelt, instruct students to observe how water runs through valleys and canyons, and try to identify which streams these are.
4. If sprayed vigorously, it seems as if the city of Boulder would be inundated and flood. Describe how this much water in so little time is equivalent to a flash flood. However, most often the release of water is controlled by floodgates, or in this case, at Barker Dam and Silver Lake.

B) Topography Mapping

1. Topographic maps show land contours and curves that represent altitude. As mentioned above, a basic understanding of topography would be helpful. The enclosed 1980 USGS topographic map of Boulder County may be somewhat difficult to read because of all the curves, but also included is a 2000 Latitude 40 3-D map on a 2-D surface.
2. Dividing the class into 6 small groups, divide the 3-USGS and 3-Latitude 40 maps accordingly. Instruct students to find out what body of water (creek, wetland, pond) is near your school; find the headwaters and note with a yellow sticky.
3. Once you locate the creek or pond, mark (approximately) your school on the map with a pink sticky (this will help keep everyone oriented).
4. Locate all main forks of Boulder Creek and St. Vrain Creek. Identify with a blue sticky. Where is the boundary between both watersheds? Mark the ridgeline with a green sticky. Find the confluence of North and Middle Boulder, then Middle and South Boulder Creeks, and finally Boulder Creek with St. Vrain Creek. Mark confluences with a purple sticky.

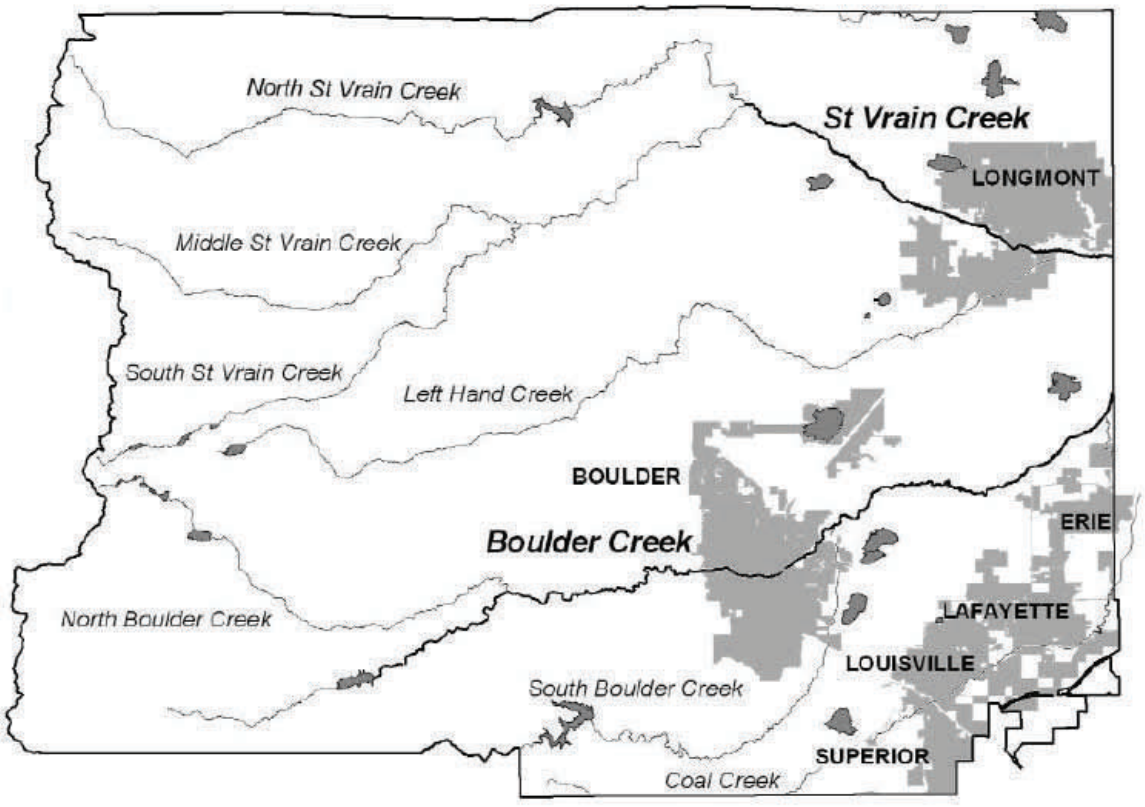
> "The journey of water through our watershed begins way up in the mountains west of Boulder."
>
> *My Water Comes from the Mountains*

The Activity, cont.

C) Crumplesheds

1. Building off the background of the two prior mapping activities, pass out a piece of paper to individual students, have each crunch their piece into the smallest size, and then unfold. Do not iron out creases but allow paper to rest on surface with relief, similar to a watershed.
2. With water-soluble markers, use brown to follow ridges and blue to mark valleys where water might travel in and around. Draw in lakes or reservoirs in obvious basins. Draw communities where they seem safest from flooding, remembering there are advantages to living along waterways.
3. As students finish, the teacher (or other adult) should visit each crumpleshed, spraying water over the make-shift watershed and observing the aftermath.
4. Discuss how your crumpleshed is both different from, and similar to, Boulder and St. Vrain watersheds.
   - What changes do you observe in the map?
   - Where does most of the rain fall? What path does the water follow?
   - Where does erosion occur? What happens to the human settlements?
   - How does the flow of water through the watershed affect our choice of building sites?
   - How does this map demonstrate the idea of a watershed?

Boulder Creek and St. Vrain Creek Watersheds



Map courtesy of City of Boulder

Connections

- Construct an all-class mural showing each student's house in relation to the watershed.
- Build a relief model of your watershed out of papier mache. Use chicken wire, newspaper, cardboard, or other material, to make a model watershed. Cut newspaper strings and use a 60:40 flour – water – salt dash mixture to cover the foundation. Later paint and add detail like toothpick forests or clay animals.
- *WS 1 – The Confluence Course, WS 3 – Our Backyard Drinking Water Supply*

WS 3

Our Backyard Drinking Water Supply

Science Standards: 4.3, 5.1, 6.5

Geography Standards: 1.1, 1.2, 1.3, 3.1, 3.2, 4.3, 4.5, 5.1, 5.3, 6.2

Objectives

In this map-reading activity, students will search the "Protect Your Drinking Water Sources" map and answer the questions.

Skills

Spatial, Linguistic, Interpersonal, Logical-Mathematical

Background

Boulder's drinking water comes from three main sources. About 40% of the city's water supply comes from the Silver Lake/Lakewood Watershed on North Boulder Creek, another 40% from Barker Reservoir on Middle Boulder Creek, and 20% from Boulder Reservoir sources (which includes water carried from the western slope to the eastern slope through the Adams Tunnel). By protecting the **headwaters** and upstream waters, our drinking water sources will remain clean and of high quality. The City of Boulder attempts to do just so by prohibiting public entry into particular sections of the watershed (i.e., upper Silver Lake watershed).

Like Boulder, the City of Longmont's drinking water comes from streams, lakes and reservoirs that are fed by snowmelt and rainfall. About 60% of Longmont's drinking water comes from the St. Vrain Creek watershed and Ralph Price Reservoir. The Colorado-Big Thompson Project, through Adams Tunnel from the Colorado and Fraser Rivers in Grand County, delivers water to Longmont via Carter Lake and St. Vrain Supply Canal. In 2004, 36% of water to the city came from CBT. And last, approximately 5% of water comes from Burch Lake. Burch Lake is supplied St. Vrain Creek below the Town of Lyons, conveying by the Highland Canal or the Palmerton Ditch.

Mountain towns in Boulder County usually obtain their drinking water from water supplies that flow through the town itself. For instance, drinking water in Nederland is supplied by Middle Boulder Creek just before the creek runs through town. Other rural areas or homes are supplied by wells that obtain groundwater.

The accompanying City of Boulder map shows the watersheds providing Boulder's drinking water, and divides Boulder's drinking water watershed sources into six regions denoted by different color shadings. It attempts to illustrate a 3-D image on a two-dimensional page of paper and therefore cannot use a constant scale, but rather combines a longer horizon with a somewhat shorter foreground. The map also indicates the **Continental Divide** in a white-dotted line with a white label. Longmont's Drinking Water Supply is also illustrated on separate maps.

See *WS 2* for more background information about the Continental Divide.

Guide Materials

WS 3 student worksheet—Our Backyard Drinking Water Supply

WS 3 answer sheet

Kit Materials

WS 3 envelope—including Boulder's "Protect Your Drinking Water Sources" maps and Longmont's equivalent

Video: *Boulder Water Story*

Preparation

Ready a TV/VCR to watch the *Boulder Water Story* Video

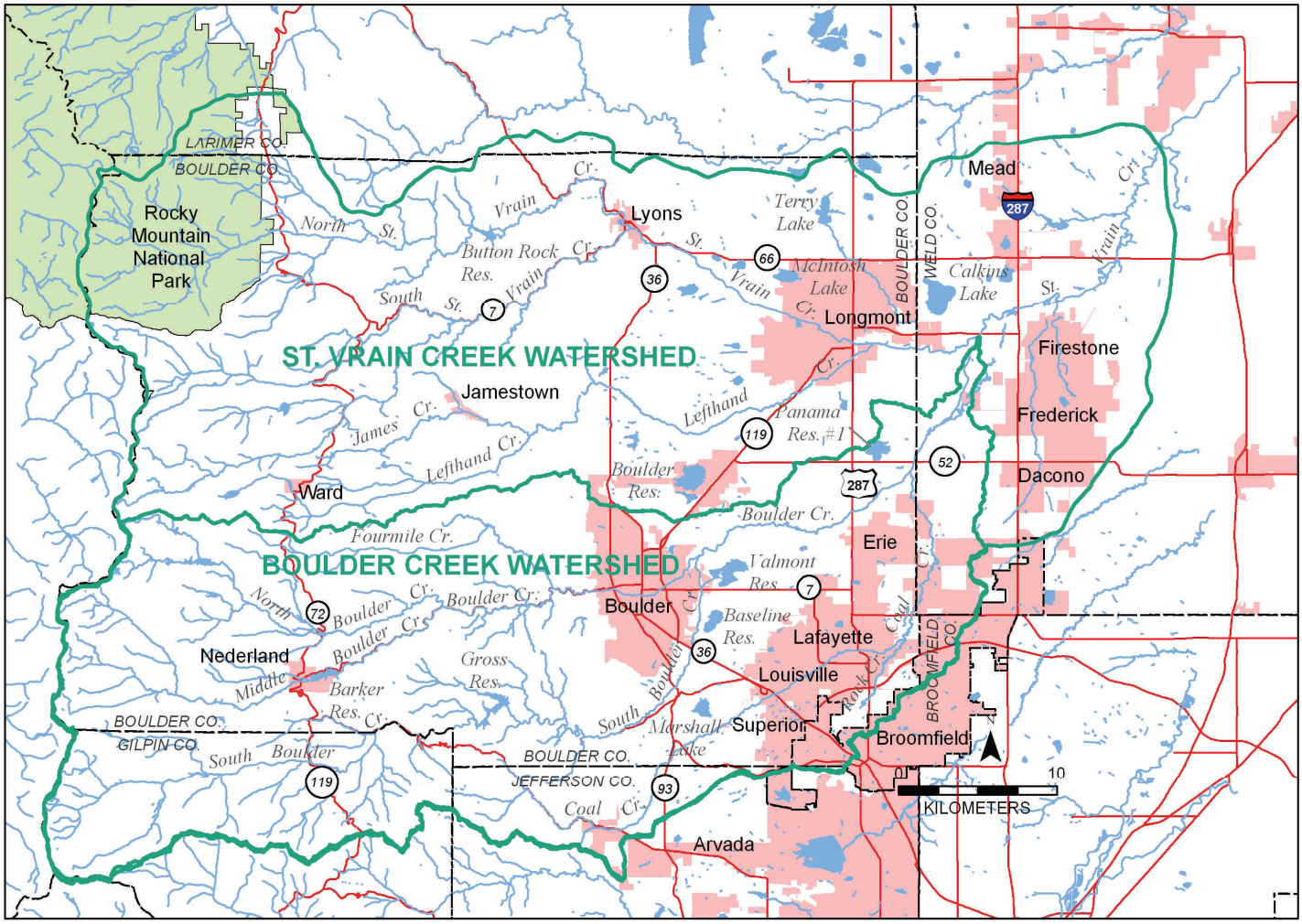
Decide whether to use the St. Vrain watershed or Boulder Creek. Then make a copy of the appropriate student worksheet for each group or pair of students, and pass out the corresponding map. Students will work in small groups with one map per group to complete this activity.

Time: 50 min

Setting: classroom

The Activity

1. Visualize the "snow cap to water tap" journey by referring to *My Water Comes from the Mountains* and watching the *Boulder Water Story* Video (20 min.)
2. Divide the class into 6 groups. Pass out a copy of the "Protect your Drinking Water Sources" map, or Longmont equivalent, to each group.
3. Have students look over the map, and ask critical thinking questions (i.e., Why are there so many dams? pipelines?) to aid students' construction of deeper conceptual understanding of the watershed. Discuss the importance of snowmelt to Boulder County drinking water supplies. Encourage them to visualize the consequences of headwater pollution.
4. Then pass out the question sheet, and have students complete the assignment.



Map courtesy of Sheila Murphy
USGS Boulder, CO

Connections

- Discussion: How can we protect the headwaters? See background *HI 2: The Six H's and pH*
- *WS 1 – The Long, Long Journey, WS 2 – Map Your Shed*
- *Boulder Water Supply Story: Snow Caps to Water Taps and Beyond,* Activity 1.3 in *WatershED,* See http://bcn.boulder.co.us/basin/learning/supply.html

We All Live Downstream

Science Standards: 4.1, 4.3, 5.1, 6.5

Adapted from ????

Objectives

By artistically illustrating the different ways property owners may chose to develop riverfront property around an imaginative river and being introduced to types of pollution, students will discuss and therefore gain understanding how humans and land use affect water quality.

Skills

Linguistic, Spatial, Interpersonal, Intrapersonal

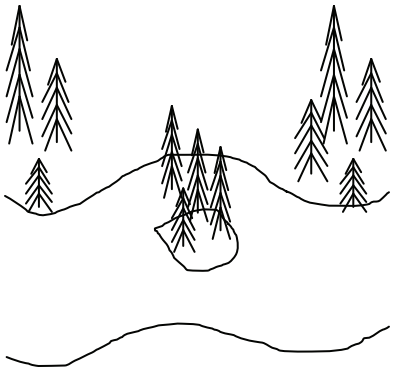
Background

Land use changes can have significant impact on a region's water resources. Streams, lakes, and other bodies of water collect water drained from the surrounding land area. Influences on the waterway upstream will inevitably affect those downstream. Human impacts to the Boulder Creek/St. Vrain Watersheds are many and varied. Historical mining activity in the upper reaches of the watershed introduced metal contaminants into creeks. More recent impacts to our waterways include building reservoirs for water supply and hydropower; straightening and channeling steams for flood protection; developing towns and cities along the primary waterways; taking water for irrigated agriculture; and **thermopollution**, the alteration of natural water temperatures after utilized in man-made industrial purposes. The combined results of these uses have been the reduction of stream side vegetation; degradation of water quality from agriculture and urban pollution; loss of native aquatic species; and a general degradation of aquatic and **riparian** ecosystems.

Pollution to a watershed is often defined as either point-source or non-point source. **Point source pollution** is discharged from a stationary location or fixed facility. It is attributable to any single identifiable source of pollution; such as a pipe or factory smokestack. **Non-point source pollution** has no single point of origin; this is generally carried off the land by storm water. Common non-point sources in Boulder County are agricultural pesticides and fertilizers, **urban stew**, acid mine drainage, construction, and dog waste. This can enter the watershed along any point, but these pollutants magnify downstream and therefore affect water quality. Like the State of Colorado's National Public Service message: "Keep it clean, 'cause we're all downstream!"

Preparation

Copy river sections, Students should work individually unless there is not space for many rivers to be taped together, in which case students can work in pairs. Or, if space is an issue, consider using the school hallway or cafeteria wall. Have students collect markers, colored pencils, or crayons; find tape. Using enclosed powerpoint CD, set up slide show and LCD projector for all-class viewing, if possible. Otherwise, review beforehand for background lecture material, then consider using terms and illustrations designed for HI 3 and/or print off PowerPoint slides as handouts to students.



Guide Materials

WS 4 river section worksheets

Kit Materials

MY H2O PowerPoint CD, File "Water Pollution"

Other Materials

colored pencils, markers, or crayons; scotch tape; computer, and LCD projector if possible

Time: 45–60 min

Setting: classroom

The Activity

1. Copy the 3 "healthy-looking" river sections, distribute randomly to each student, or pair. Keep the fourth, "polluted" section for later presentation.
2. Instruct each to visually depict how their riverfront property will be used if given one million dollars. Emphasize that if they wish to preserve the property, money could be given to an environmental organization who would manage the land.
3. When finished drawing, present the "Water Pollution" slide show for an interactive discussion of point source and non-point source pollution. Refer to the depictions and discussions of our local watershed and possible pollution sources in *My Water Comes from the Mountains*.
4. Tape all sections together from upstream to downstream in the classroom, school hallway or cafeteria, placing the "polluted" section within the river's flow. Have students present their section and discuss the effects of their property on their neighbors, using terms such as point source and non-point source pollution.
5. Determine any water quality problems caused from the land use in the watershed, and how could these issues be fixed? Identify sources of contamination/pollution, then brainstorm appropriate solutions/corrections/treatments.

"All things are connected like the blood that unites us, We did not weave the web of life. We are merely a strand in it. Whatever we do to the web, we do to ourselves."

Chief Seattle

Connections

- Project WET Curriculum & Activity Guide © 1995, "Rainy-Day Hike" p 186.
- Have students look at their schoolyard, backyards and around the community to define sources of non-point and point pollution.
- Contact City of Boulder Water Quality and/or City of Longmont to discuss research regarding effluent from the wastewater treatment plant.
- Visit http://www.basin.org for updated water quality information on endocrine disruptors and more.
- Watch xxx section of the *Boulder Water Story* Video
- Stream Table and other water educational resources from the Longmont Conservation District clearly depict the influence of land use on watersheds. Call 303-776-4034 x3 for availability.
- Locate and read the book *Where the River Begins* by Thomas Locker (1984)
- All *HI* activities, and all other *WS* activities

The Life Zone Location

Science Standards: 2.1, 3.1, 3.4, 4.1, 4.2, 4.3, 4.4, 5.1

Objectives

Through this clue-matching mystery, students will recognize adaptations to life zones and characteristics of representative plants and animals.

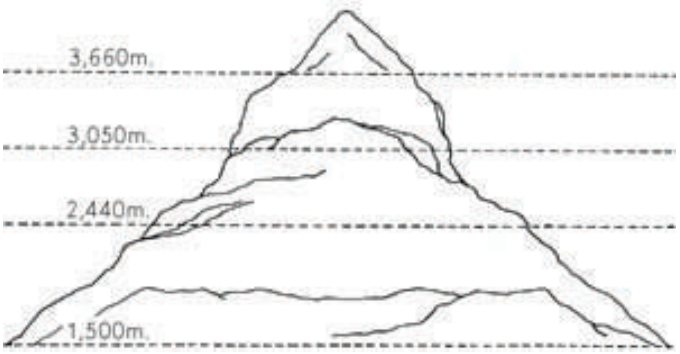
Skills

Linguistic, Logical-Mathematical, Interpersonal

Background

In order to survive in a particular habitat, living beings have special features, or **adaptations**. Developed over time, these adaptations help flora and fauna make full use of available nutrients and energy, protect their species against enemies, and cope with different climates. The different Rocky Mountain **life zones** each have varying levels of precipitation and threats of wind and freezing temperatures that might hinder survival. For the purposes of *My Water Comes from the Mountains*, 4 life zones are introduced: 1) **Alpine** – treeless plains above ~11,500 feet elevation; (**Krummholz** – twisted forests at **timberline**); 2) **Subalpine** – typically spruce-fir forests at ~9,000 – 11,500 feet; 3) **Montane** – At elevations between 5,600 – 9,000 feet, Douglas fir/ponderosa pine forests with aspen and lodgepole pine as secondary forests; and 4) **Plains** – grasslands below 5,600 feet elevation. Although not discussed, another life zone classification, Foothills, is often interjected between Montane and Plains at an elevation of 6,000 – 8,000 ft, dominated by Ponderosa Pine forests. There are examples of each life zone right here in Boulder County.

There are many examples of how animals and plants are suited to live in these various conditions in the Boulder and St. Vrain Creek Watersheds. They may have different **morphological** characteristics, such as body shape or length of needle. Behavior patterns, such as migration and hibernation are also examples of ways **biota** have adjusted to these constraints.



Guide Materials

F2LZ 1—LZ Location student worksheet

F2LZ 1 answer sheet

Kit Materials

F2LZ 1—LZ Location envelope

F2LZ—Life Zone Fact Sheets

MY H20 CD—Track 4 "Habitat" and Track 5 "Pika, Pika"

Preparation

Students should have a general understanding of what a life zone is, and the difference between Boulder County's four life zones. Have them refer to depictions of animals and plants that live within these zones in *My Water Comes from the Mountains*. Discuss the term "Life Zones," and consider making available the included "Life Zone Fact Sheets" prior to the activity so the students will have the proper background for the activity. They could also research on the web. Otherwise, if the students seem comfortable with the concept, with the class split into 6 small groups, pass out the fact sheets and copies of the *LZ Location* worksheet in conjunction with 1 clue packet per group.

Time: 45–60 min

Setting: classroom

The Activity

1. Tell students they're going to play a riddle game in which they are given clues and they have to try and guess an organism's identity and "life zone location."
2. Hand out a set of the clue cards, one set of fact sheets and a LZ Location Worksheet to each group. Instruct students not to look at the cards before the game starts.
3. Explain that each card lists four adaptations, characteristic features, or trivia facts about a certain plant or animal that lives in one of the four life zones along the Boulder Creek or St. Vrain Creek Watersheds. Based on the clues, students will organize and categorize their thoughts to make an educated guess on the plant or animal and the life zone location in which it is usually found.
4. Each clue will have a letter code on the backside. They will use this code to track the LZ Location and their corresponding guesses for each biota on the Worksheet included. Advise groups to use pencils (with erasers) and wait until the tenth clue to fill in the LZ Location as it will likely change as more clues are read.
5. For each life zone, there is one mystery plant and one mystery animal. Therefore, there is a total of four faunal organisms and four floral organisms to solve, with four clues (four letter codes) for each answer.
6. Each group should pick one student to start as their reader, then rotate around to assume group readership. The group should work together, cooperatively discussing and guessing both the name of the organisms and its life zones address.
7. As groups finish the LZ Locations and corresponding solutions to the mystery Flora and Fauna, work through answers as a class or write the correct LZ Location and solution on the board. Have students summarize the adaptations encountered in the game. Listen to "Pika, Pika" and "Habitat" on the CD. Discuss how these particular traits enable organisms to live in their life zone.
8. Remind students that there are thousands of plants, animals, and other organisms not included in this activity, even outside of the local Boulder County environment, and each one has many adaptations. Visit *My Water Comes from the Mountains* and view pages that speak of each life zone, or particular plant or animal.

"…AS THE WATER CONTINUES DOWNHILL FROM THE ALPINE…"

My Water Comes from the Mountains

Connections

- Using butcher paper, create an all-class mural that depicts each life zone with corresponding plants and animals. Start by drawing an outline of the mountain range.
- Call Longmont Conservation District at 303-776-4034 x3 for availability of River Riparian Trailer.
- Take a class field trip to the Rocky Mountain Life Zones. To see and visit: Prairie, check out Beech COB Open Space or Leftand Trailhead off Lee Hill, or Plains Conservation Center in Aurora; Foothills-Montane, go to Chautauqua, NCAR Trailheads, Red Rocks, Mt Sanitus, Boulder Canyon; Montane-Subalpine, tour the Peak-to-Peak region from Indian Peaks Wilderness Hessie Trailhead and Nederland Open Space at Mud Lake and Caribou Ranch, to Gold Hill, Jamestown, and Rocky Mountain National Park; if interested in the Alpine and not so interested in the long hike, call INSTAAR to reach the Niwot Ridge LTER, where summertime tours to the alpine can be arranged.
- All other *F²LZ* activities.

Reporting on Wildlife

Science Standards: 1.1, 3.1, 3.2, 3.3, 3.4, 4.3, 5.1

Language Arts Standards: 1, 2, 3, 4, 5, 6

Objectives

Because local wildlife is featured in the illustrations and captions of *My Water Comes from the Mountains,* this assignment encourages students – through researching and report writing – to gain a clear understanding of a number of aspects of an animal's life in the wild.

Skills

Linguistic, Spatial, Intrapersonal, Musical

Background

Investigative and detective projects bring about curiosity and excitement in elementary-aged students. Exploring the life of local fauna will encourage awareness of their immediate surroundings, while a characterization of the wild world will enhance identification to and understanding of our natural environment, helping children to develop a sense of place. Moreover, research projects such as this will introduce students to the innumerable amount of resources present both in the local library and on the web.

Each animal has special features allowing it to live and survive in one or several of the **life zones** featured in *My Water Comes from the Mountains.* They are adapted to the weather conditions, terrain, availability of water, and the food sources within that life zone. They live in a particular **habitat** (listen to CD track 4) within the life zone and fulfill a particular **niche** within their habitat. This report allows students to research an animal and discover where and how it survives.

The Activity

1. Each student will write a report about an animal that lives in one or more of the following ecosystems in the Boulder Creek and St. Vrain Creek watersheds: the **alpine tundra**, the **subalpine zone**, the **montane zone**, and/or the **plains zone**.
2. The report should answer the following essential questions:
   - Which ecosystem(s) does the animal live within? How is it adapted to its habitat? Include physical characteristics and behaviors.
   - What is the animal's place in the food chain and what is its niche within its ecosystem(s)?
   - If this animal became extinct, what would be the effects on the ecosystem (s) in which it lives?
   - How do humans impact the life of this animal? Is it endangered, as a result?
3. Each teacher can decide on time frames, report length, style of report, etc. For example, students could write the report from a first person point of view, as if the animal were telling the audience about itself. The report could be written as if it were a newspaper article, or the report could be presented in a Power Point format.

Kit Materials

MY H2O CD—Track 4 "Habitat"

Other Materials

Writing utensil, paper; books, computer

Preparation

Have resources available in the classroom, in the school library, and/or bookmarked online (unless you want students to search online). There are many resources for students to research their animals. Your school's library will have many suitable books. The series of *Fact Files* is excellent and easy to use, as is *My Water Comes from the Mountains*. There are also many websites that have good information about animals. Use the Yahooligans search engine or use Google if students can be adequately supervised. Students could also interview parents, teachers or Boulder County Mountain Parks and Open Space for information. Discuss the above bolded terms and again, students should have an understanding of the Life Zones to sufficiently complete this report. See *F²LZ 1* for more information.

Time: variable

Setting: classroom

Rocky Mountain Life Zones

Illustration courtesy of www.blm.gov

Alpine - above 3,660m (12,000 ft):
(1) yellow-bellied marmot; (2) weasel; (3) moss gentian; (4) bog sedge; (5) alpine anemone; (6) dwarf clover; (7) moss campion; (8) scarlet paintbrush; (9) pika; (10) white-tailed ptarmigan.

Subalpine - 3,050 to 3,660m (10,000 to 12,000 ft):
(11) Engelmann spruce; (12) snowshoe hare; (13) mountain goat; (14) lynx; (15) subalpine fir; (16) aspen, also common in montane; (17) bristlecone pine; (18) black elderberry; (19) yellow glacier lily; (20) red-tailed hawk; (21) yellow columbine; (22) bighorn sheep

Montane - 2,440 to 3,050m (8,000 to 10,000 ft):
(23) moose; (24) bearberry; (25) mountain mahogany; (26) mule deer; (27) wild turkey; (28) pine squirrel; (29) grand fir; (30) Douglas fir; (31) western larch; (32) lodgepole pine; (33) grizzly bear; (34) ponderosa pine; (35) Gambel oak; (36) elk; (37) cougar; (38) Stellar's jay.

Foothills - 1,500 to 2,440m (4,900 to 8,000 ft):
(39) juniper tree; (40) pronghorn antelope; (41) Idaho fescue; (42) jackrabbit; (43) arrow-leaved balsamroot; (44) Pinon pine; (45) blue grama; (46) larkspur; (47) collared lizard; (48) sagebrush; (49) western bluebird.

Riparian areas (INSET) (throughout the zones):
(50) trumpeter swan; (51) water birch; (52) mallard duck; (53) cottonwood; (54) beaver; (55) mountain alder; (56) wood duck; (57) boreal toad.

Connections

- All other *F²LZ* activities.
- Position reports promote thinking, not fact reporting. Consider current topics such as: Should lynx or other rare animals be reintroduced? Should climbing be banned on rocks where endangered birds nest? Should nuisance bears be shot and killed? Use local newspapers as a resource for ideas.
- Call City of Boulder for a program on wildlife.
- Call Longmont Conservation District at 303-776-4034 x3 for availability of River Riparian Trailer.

Boulder County Cornucopia

Science Standards: 3.1, 3.2, 3.4

Objectives

These activities allow students to become more familiar with the general characteristics and interdependence of animals and plants referred to in *My Water Comes from the Mountains* and common to Boulder County. They can be taught separately or combined.

A) *Mix It Up!* is a "20 questions" game introducing the biota;

B) *Creature Craze* is a game of tag that illustrates how prey and predator rely upon each other and how their relationships affect wildlife populations; and

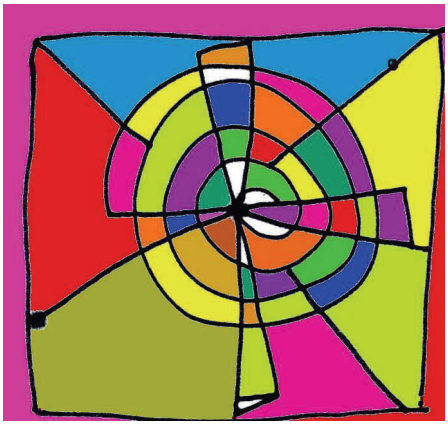
C) *Web of Life* is a calming, yet overarching assessment that illustrates the interconnectedness of biota living in the Boulder Creek and St. Vrain Watersheds.

Skills

Bodily-Kinesthetic, Logical-Mathematical, Spatial, Interpersonal, Intrapersonal

Background

Because of varying environmental factors, certain animals and plants, called **biota**, have adapted to live in different life zones. Each then plays an important role, manifested in **predator** and **prey** relationships, in natural life cycles. The abundant presence of an herbivore, for example, directly reflects the abundance of the carnivore that eats it, or the plant it prefers to graze upon. By first associating oneself with the **flora** and **fauna** of Boulder County, the accompanying lessons then focus on animal habitats and survival techniques, and ecosystem interdependence and food chain links.



Kit Materials

A) F²LZ 3 Flora & Fauna Tags

B) ball of yarn, F²LZ 3 Flora & Fauna Tags

C) Marbles (food tokens), bandanas (to mark predators)

MY H2O—Tracks 2—5

Other Materials

four hula hoops (picnic tables, cones, court boundaries, etc.) for temporary shelters in *Creature Craze*

Preparation

A) Gather materials; each student will be assigned an animal without knowing who he or she represents.

B) Set up playing area.

C) Collect ball of yarn, organize group into a circle, each child still representing that animal.

Time: 90 min total; 30 min each

Setting: large space, inside or outside

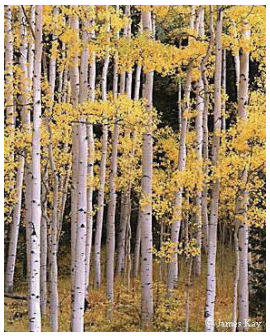
The Activity

A) *Mix It Up!*

1. Introduce the activity with a brief discussion of some of the common plants and animals of Boulder County – ask students and allow them to brainstorm names. Be sure to emphasize the variety and diversity – all the way down to the insects, etc., so that they don't focus too much on the mega -fauna or -flora.
2. It might be helpful before the game starts to make ask for suggestions of good Yes/No questions to ask about Boulder County biota, i.e. "Is it a plant?" "Does it have fur?" "Does it fly?", "Does it make its own food?" "Is it a carnivore?" etc.
3. Each student will receive a picture of an animal or plant, on a string around his/her neck, with the picture on his/her back so that s/he can't see it. The instructor puts pictures around each student's neck, and when everyone is ready, the students may mix and mingle, asking Yes/No questions about their own animals, while looking at the pictures and answering the questions of others. Each student may guess as s/he thinks s/he knows what his/her animal is.
4. Evaluation: When everyone in the group has identified his/her animal, come together and have the students arrange themselves into each representative life zone. Then discuss various characteristics of the biota, according to learning goals specific to the class. For example, "What were particular adaptations used to survive?" "Why are there many more biota at lower elevations than at higher elevations?"

B) *Creature Craze*

1. Select one of the following predator-prey relationships, dependent upon the life zone being studied: long-tailed weasel – pika (alpine), lynx – snowshoe hare (subalpine), coyote – elk calf (montane), golden eagle – prairie dog (plains). Listen to MY H2O tracks 2 ("Prairie Dog") or 5 ("Pika, Pika)!
2. Identify students as prey or predator (one predator for every 4 – 6 prey). Predators should wear bandanas so they are clearly represented.
3. Set up playing area – for a class size of 25, ideally the size of a basketball court—with hula hoop "shelters" and marble "food" tokens scattered further off in the food source area.
4. Use a signal to start the 5 – 7 minutes round. Prey will begin moving from their shelter toward the "food" (marbles). They will collect 1 marble on each trip and return to their primary shelter. To survive, the prey must obtain 3 food marbles.
5. While traveling, prey may use survival techniques including:
   - Warning other prey that a predator is near.
   - Freeze without moving when a predator is within 5 feet. They may remain frozen for as long as they like, but if they do not have 3 tokens at the end of the round, they will starve to death.
   - Run to cover with at least 1 foot inside of a hula hoop.
6. Predators should be evenly distributed within the playing area. Predators must tag prey who are moving. Predators must capture 2 prey in order to survive. Captured prey are taken to the sidelines by their captor.
7. Discuss with the students the following questions:
   - How did you escape capture? Which method was the easiest? Most effective? How were you successful in capturing prey? Which were best? What did you do when a prey froze?
   - In what ways are adaptations important to both predator and prey?
   - How does this relationship affect the predator/prey population in a habitat?



The Activity, cont.

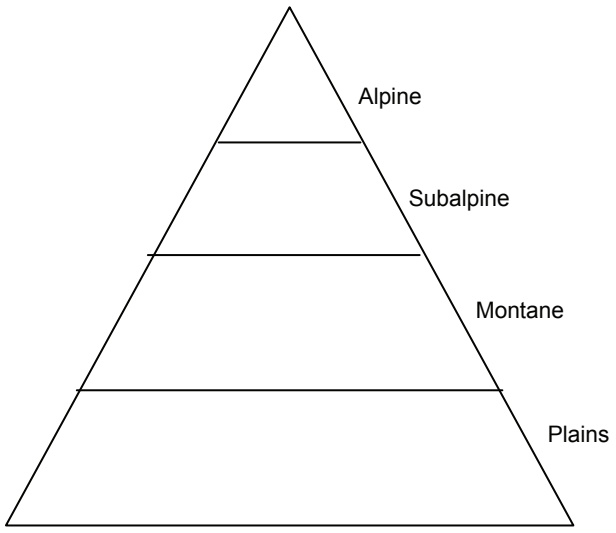
C) Web of Life

1. Have students sit in a circle. Using laminated photos from the above activity, *Mix It Up!*, each student randomly picks an animal or plant illustration from the pile.
2. The leader starts by holding the end of the yarn and announcing what s/he is. Then, someone from the group who has an organism that interacts in some way with that of the leader speaks up, (i.e. the leader says "I am a pine tree", and someone in the circle says "I'm a squirrel and I eat the seeds from the pine cones"). The leader then passes the ball of yarn to the student who is a squirrel. Then someone else says something that relates to the squirrel, ("I'm a hawk who likes to eat squirrels"), and each student holds the string of yarn in one place, and passes it on to another.
3. As the ball of yarn is passed around from one "member" of the ecosystem to the next, each person holds onto it, creating a web of yarn when it has been passed back and forth to everyone. Soon, the yarn is criss-crossed back and forth across the circle, and when everyone has a piece of it, there can be discussion about the interdependence of organisms in an ecosystem.
4. Listen to MY H2O Track 3—"Web of Life" by Walkin' Jim Stoltz. This web symbolizes the web of life – the way by which everything is connected and depends on everything else. This activity exemplifies lessons learned in *Creature Craze.* The point is even clearer when one person is asked to drop their yarn piece, then to observe and discuss how the web responded to that section falling.

Connections

- MY H2O music by Walkin' Jim Stoltz are great supporting songs for this activity: "Pika, Pika," "Web of Life, "Prairie Dog" and "Habitat".
- All other *F²LZ* activities.
- A thorough evaluation of life zones could involve the life zone groups established during *Mixer Party*. Emphasizing Bodily-Kinesthetics, have each student group representing a life zone assemble a play or presentation to educate each other on the local fauna, flora and related life zones of Boulder County.
- Take a guided tour of a local life zone! See programs presented by City of Boulder, Wild Bear, or Thorne Ecological.
- Call Longmont Conservation District at 303-776-4034 x3 for availability of River Riparian Trailer.
- Using the side tool as an idea, design a "map" of the life zone ecosystems, drawing in the characteristics of each ecosystem.

Life Zone Map



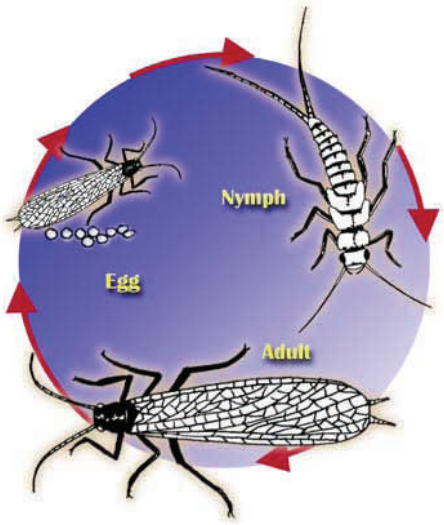
Macroinvertebrate Mania!

Objectives

Macroinvertebrates are not only enjoyable for students to study, their presence or absence tells us a lot about the health of a stream. Here are two activities focusing on the study of macroinvertebrates. You may choose to use each separately, or to combine.

A) *"Kick and Pick" Sampling* explores the collection of macroinvertebrates from stream environments, while

B) *Macroinvertebrate Mayhem* (International Project WET, © 1995, *Project WET Curriculum & Activity Guide*, "Macroinvertebrate Mayhem" pp 322—327) is a kinesthetic activity simulating the ability of certain macros to live in particular stream environments and levels of water quality.



Background

Macroinvertebrates (aquatic organisms that lack an internal skeleton and are large enough to be seen with the naked eye) are an integral part of stream ecosystems. Examples of macroinvertebrates include mayflies, stoneflies, dragonflies, scuds, snails and leeches. These organisms may spend all or part of their lives in water; usually their immature phases (larvae and nymphs) are spent entirely in water. Larvae do not show wing buds and are usually very different in appearance from the adult versions of the insects. Nymphs generally resemble adults, but have no developed wings and are usually smaller.

A variety of **environmental stressors** can impact macroinvertebrate populations. Urban and/or agricultural runoff can produce conditions that some macroinvertebrates cannot tolerate. Sewage and fertilizers added to streams induce the growth of algae and bacteria that consume oxygen and make it unavailable for macroinvertebrates. Changes in land use from natural vegetation to a construction site or to poorly protected cropland may add sediment to the water. Sedimentation destroys habitats by smothering the rocky areas of the stream where macros live. The removal of trees along the banks of a river and alteration of stream velocity can both alter normal water temperature patterns in the stream. Some organisms depend on certain temperature patterns to regulate changes in their life cycles. Other stressors include the introduction of alien species such as the New Zealand mud snail, **acid mine drainage** as is common in the St. Vrain watershed, and the straightening of rivers and streams to enhance land area, called **channelization**.

Some macros, such as the mayfly and stonefly nymphs and caddisfly larvae, are **sensitive** (intolerant) to changes in stream conditions brought about by pollutants. Some of these organisms will leave to find more favorable habitats, but others will be killed or will be unable to reproduce. Macroinvertebrates that thrive in polluted conditions are called **tolerant** organisms (e.g. midge larvae). Other organisms, called **facultative** organisms (e.g. dragonfly and damselfly nymphs), prefer good stream quality but can survive polluted conditions.

Water quality researchers often sample macroinvertebrate populations to monitor changes in stream conditions over time and to assess the cumulative effects of environmental stressors. If the environmental stressor is severe enough, species of intolerant macroinvertebrates may disappear altogether. For example, if a sample of macroinvertebrates in a stream consists of snails and dragonfly nymphs, the water-quality conditions of that stream are probably poor (i.e., low oxygen level, increased sediment, contaminants). If, on the other hand, the sample contains a diversity of organisms, the stream conditions are likely good. In this way, macroinvertebrates are **bio-indicators**. However, baseline data is essential because some healthy streams may contain only a few macro species. A variety of food sources, adequate oxygen levels, and temperatures conducive to growth all characterize a healthy stream.

"Kick and Pick" Sampling

Science Standards: 1.1, 1.2, 3.1, 3.2, 3.3, 3.4, 5.1, 5.3, 6.1, 6.2, 6.4

Math Standards: 1, 2, 3, 6

This activity can be found on the website: http://bcn.boulder.co.us/basin/learning/fifthgrade.html

Objectives

Collecting macroinvertebrates from a stream is a motivating activity for upper elementary school students. The quantity, types, and diversity of the "bugs" collected can reveal a lot about the health of a stream. The purpose of aquatic sampling is to increase awareness of the whole new world of life uncovered. This can be done in even the smallest of flowing streams or irrigation ditches, but is often most productive during late spring and summer.

Skills

Spatial, Bodily-Kinesthetic, Logical, Mathematical, Interpersonal

Safety

There is a significant amount of preparation that students should receive in the classroom before undertaking this activity. Safety and management concerns must be addressed with the students. It is ideal to have adult volunteers along to supervise each group. If "kicking and picking," have each group member take turns either holding the net or disturbing the river bottom. Figure out a way to decide which students will actually collect specimens if they're wading into the stream. Consider the danger of rapidly changing flows. When you arrive at the collection area, establish the limits of the area that students will be working, including how far out they may enter the stream.

Preparation

1. Determine where you are going to do your sampling. Access must be either in public areas or on private land with permission of the owner. Do not choose a dangerous area; for example, a stream running very high during spring snowmelt would not be a good idea. You might want to visit the site first to scope out collection areas that are safe, accessible, and have plenty of rocks under which students will find specimens.

2. Study the website http://bcn.boulder.co.us/basin/learning/fifthgrade.html to teach students how to collect macroinvertebrates. Familiarize yourself with the "bugs" on the **taxonomy** chart, which sorts them into levels of how much pollution they can tolerate.

3. Assemble materials – every 3-4 students should receive at least 1 net, 1 pipette, 1 hand lens, 1 ice tray and a taxonomy chart. If you want a more extensive set of materials than the kit provides, you can reserve a "Bug Investigation Kit" from the City of Boulder Water Resource Educator (WASH) 303-413-7365 . Leave plenty of time in advance to reserve the kit and obtain it.

4. Tell your students to wear shoes that are OK to get wet. You could suggest they bring wading boots, if they have them.

5. If necessary, take care of transportation needs, whether it's a school bus or parent drivers, and permission forms, if you need to travel off the school grounds.

Kit Materials

F²LZ 4 Taxonomy Charts envelope

Nets (6)

Pipettes (12), in ziplock

Hand lenses (6), in ziplock

Ice tray

Other Materials

Although not absolutely necessary, waders, tweezers, Petri dishes, microscopes are some materials that could be of benefit.

Time: in the field, 45-90 min

Setting: alongside a stream

The Activity

1. Samples can be collected in a variety of ways. A common technique is to place the net in the stream and then use a stick, your feet, or hands to stir gravel up-stream from the net. Macroinvertebrates will be dislodged and washed into the net downstream from the disruption. Empty the net into a container and use the pipette to draw individuals from the specimen jar. For illustrations of this so-called "kicking and picking" see the following sites: http://www.people.Virginia.EDU/~sos-iwla/Stream-Study/Methods/Procedures.HTML and http://www.epa.gov/OWOW/monitoring/volunteer/stream/66.html
2. Another method is simply to collect a few submerged rocks, and either observe the macroinvertebrates in the field or place the rocks in a bucket and return to analyze them back in the classroom. The bottom of the rocks can be scrubbed with a soft dishwashing brush or old toothbrush to dislodge macroinvertebrates.
3. Specimens can be classified using a variety of taxonomy guides. There is a guide included in the *My Water Comes from the Mountains* materials kit, which comes from the Izaak Walton League http://www.people.Virginia.EDU?~sos-iwla/StreamStudy/StreamStudyHomePage/StreamStudy.HTML, which divides commonly found invertebrates into 3 classifications, depending upon the type of water quality they can tolerate.
4. Have each group tally organisms in each category and estimate the percentage of sensitive to non-sensitive groups, writing a summary of results, evaluating what type of water quality they think exists, the diversity of organisms, etc.
5. This activity can be done in a pond, where the water is not running. However, because of differences in water temperature, oxygen content, current, etc., you will likely find different types and numbers of organisms in a pond ecosystem than in a river.
6. Specimens should always be treated with respect and if removed from their natural habitat, be sure to return them, discussing why that is important.

While nymph mayflies may live for years in the stream, emerging, adult mayflies live from 1–2 hours to 14 days.

Connections

- Mathematical diversity models and “Virtual” studies of macroinvertebrates: http://bcn.boulder.co.us/basin/learning/fifthgrade.html
- WatershED Activity 3.4 – *Assessing Your Waterway: Macroinvertebrates-Long Term Ecosystem Health*, http://bcn.boulder.co.us/basin/learning/macroinvert.html
- Discuss the impact of invasive, non-native species such as the mud snail. How might an exotic organism affect the natural ecosystem and the native species that live within it? Could this cascade to higher trophic levels?
- WASH Education Program and Resources for loan, such as the Macro Investigation Kit. See brochure or call 303-413-7365.

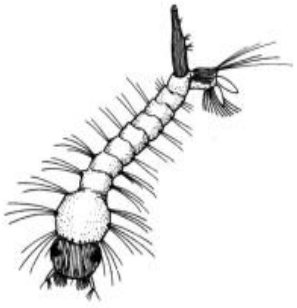
Macroinvertebrate Mayhem

Science Standards: 3.1, 3.2, 3.4, 4.3

This activity is used with permission from International Project WET, © 1995, Project WET Curriculum & Activity Guide, "Macroinvertebrate Mayhem" pp 322—327

Objectives

Through a game of tag, the effects of environmental stressors on macroinvertebrate populations is simulated, illustrating how tolerance to water quality conditions varies among macroinvertebrate organisms and explaining how population diversity provides insight into the health of an ecosystem.

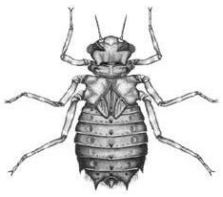


Skills

Bodily-kinesthetic, Spatial, Logical-Mathematical, Interpersonal

The Activity

1. Introduce the practice of sampling macroinvertebrate populations to monitor stream quality. Show students pictures of macros used to monitor stream quality. Tell students they are going to play a game that simulates changes in a stream when an environmental stressor, such as a pollutant, is introduced. Show students the playing field and indicate the boundaries.
2. Have 20% of the students volunteer to be environmental stressors (e.g. Fertilizer, Construction Site, Acid Mine Drainage). Discuss the ways that a stream can become polluted and how this can alter stream conditions.
3. Divide the rest of the class into groups representing each of the following:
    a. Caddisfly larva
    b. Mayfly larva
    c. Stonefly larva
    d. Dragonfly larva
    e. Midge larva
    f. Mosquito larva
4. Evenly distribute appropriate identification labels to all players
5. (Continued on next page)



Kit Materials

F²LZ 4 Bioindication Tags, in ziplock

Preparation

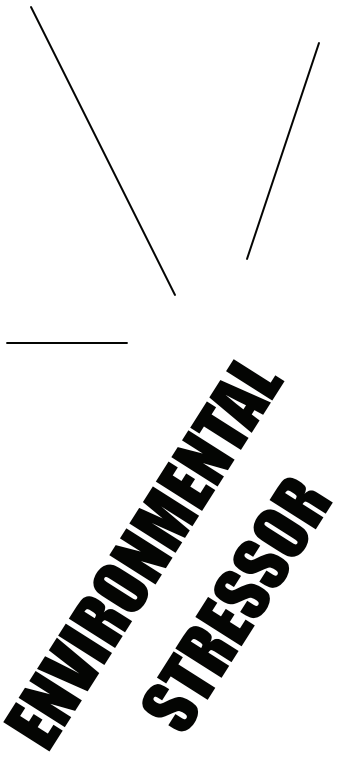
Discuss the role of **bio-indication** in stream ecosystems. Arrange playing field and boundaries. Assign students to representative role; pass out tags for each to wear.

Time: 30-45 min

Setting: indoor/ outdoor playing field

The Activity, cont.

5. Inform students that some macroinvertebrates have hindrances to crossing the field. These obstacles symbolize sensitive organisms' intolerance to pollutants.
   a. Because caddisfly larvae are intolerant of low oxygen levels, they must tie feet together (or place both feet in a bag) and hop across field, stopping to gasp for breath every five hops.
   b. Because as oxygen levels drop, stoneflies undulate their abdomens to increase the flow of water over their bodies, they must do a push-up every ten steps.
   c. Because mayflies often increase oxygen absorption by moving gills, they must flap arms and spin in circles when crossing the field.
   d. Because dragonfly, midge, and mosquito larvae are more tolerant to environmental stressors, they may run without hindrances when crossing the field.
6. Assemble the macroinvertebrates at one end of the playing field and the environmental stressors at midfield. When a round starts, macroinvertebrates will move toward the opposite end of the field and the stressor will try to tag them. To "survive," the macroinvertebrates must reach the opposite end of the field (downstream) without being tagged by the environmental stressor. The e-stressor can try to tag any of the macroinvertebrates, but will find it easier to catch those with hindered movements.
   a. Begin the first round of the game. Tagged macros must go to the sidelines and flip their identification labels to display the more tolerant species. Tagged players who are already in a tolerant species group do not flip their labels.
   b. The round ends when all the macroinvertebrates have either been tagged or have reached the opposite end of the playing field. Record the new number of members in each species.
   c. Complete two more rounds, with all tagged players rejoining the macroinvertebrates who successfully survived the previous round. Record the number of members in each species of macroinvertebrates at the conclusion of each round. Because some players have flipped their identification labels, there will be a larger number of tolerant species in each successive round.
   d. Discuss the outcome with the students. Emphasize the changes in the distribution of organisms among groups. Have students compare population sizes of groups at the beginning and end of the game and provide reasons for the changes. Review why some organisms are more tolerant of poor environmental conditions than others. Have students compare the stream environment at the beginning of the game to the environment at the end of the game.



Connections

- WatershED Activity 3.3 – *Nutrients: Building Ecosystems in a Bottle*, http://bcn.boulder.co.us/basin/learning/nutrientsteacher.html
- Explore the *River Watch* program for more hands-on biological assessments of your local creek.
- *HI 1 – A Drop in the Bucket (© Project WET), F²LZ 1 – The Life Zone Location, F²LZ 3 – Boulder County Cornucopia*

A Drop in the Bucket

Science Standards: 1.4, 4.1, 4.3, 5.1

Math Standards: 1, 3, 6

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Objectives

Students will demonstrate and use cumulative bar graphs to illustrate the percentage of freshwater available for human use, and then explain why water is a limited resource. Learning that water is a limited resource helps students appreciate the need to use water resources wisely, including protection of wetlands and watersheds.

Skills

Logical-mathematical, Interpersonal, Spatial

Background

Students may know Earth is covered mainly by water, but they may not realize that only a small fraction is available for human consumption. Ironically, on a planet extensively (71%) covered with water, this resource is one of the main limiting factors for life on Earth. If all the clean, fresh water was distributed equally among people, there would be about 7.0 million liters per person. Amazingly, this is only about 0.00003 percent of the total water on Earth. On a global scale, only a small percentage of water is available, but this percentage represents a large amount per individual. The paradox is that for some, water may appear plentiful, but for others it is a scarce commodity. Geography, climate, and weather affect water distribution. Land and water use for agriculture, industry, and homes affect the quality and quantity of available fresh water. These uses can have cumulative effects on soils, watersheds, and wetlands, hindering their ability to hold and filter water.

Guide Materials

HI 1 "Water Table Fable" student worksheet

Kit Materials

1000-mL (1-L) glass container

100-mL graduated cylinder

1 Pipette (in ziplock)

Salt

Other Materials

water, globe or world map; colored pencils; ice in bucket, large can, small dish

Preparation

Collect 1-L beaker with H_2O, 100-mL cylinder, pipette. Locate a globe or world map in your classroom. Get a bucket of ice and carton of salt. Make copies of the "Water Table Fable" activity sheet for each student. Have them also find their red, yellow, green, and blue colored pencils (or thin markers)

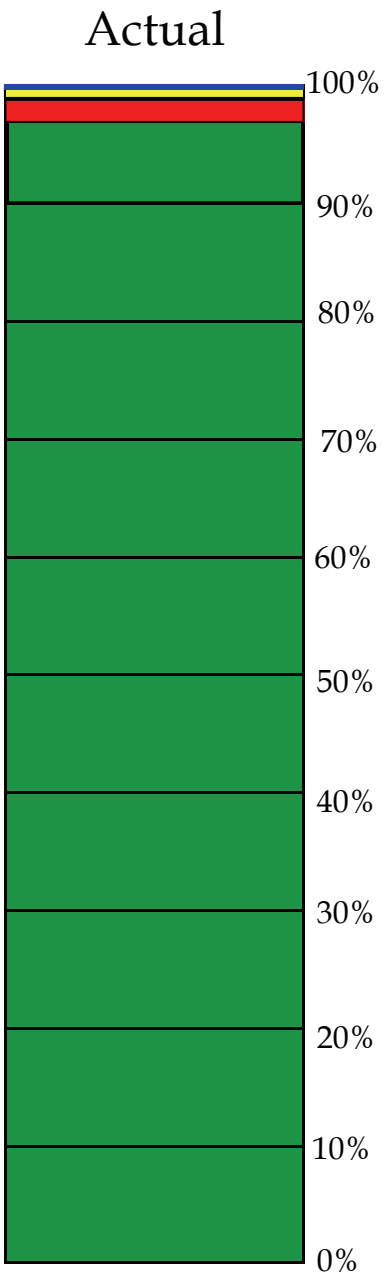
Time: 60—90 min

Setting: classroom

The Activity

A) *Water Table Fable*

1. Show a globe to the students. Ask them to look at what they see and compare the areas of water and land. About 70% of the surface of the Earth is covered with water.
2. Now, ask the students to think about the different forms of water on Earth. There is salt water in the oceans (and a few lakes) and fresh water in a number of forms (frozen in glaciers and ice caps, under the ground, lakes and rivers, and water vapor in the air and clouds).
3. The students will then estimate what percentage of the total amount of water on Earth falls into these four categories: salt water, glaciers, groundwater, and surface freshwater. Using the key, they will fill in the "Prediction " graph on the "Water Table" activity sheet using colored pencils. (Note: thin markers can be used, but colored pencils are neater, and easier to work and fix errors with than markers.)
4. Instruct your students that the four percentages have to add up to 100%, since the four categories of water represent all of the water on Earth, meaning 100%. Suggest that students turn over their papers and work out the math to make sure the four percentages add up to 100%.
5. The graph is a cumulative bar graph . The bottom of the graph is 0% and the top is 100%.
6. So that it's easier to assess the students' work, have them color the four sections in the order mentioned in the key, starting from the 0% line and coloring up. Let's say a student predicts that saltwater is 50% of the water. She should then color green from the bottom up to the 50% line. Then if she guessed 25% for glaciers, she should then color red from that 50% line up to 75% of the cumulative graph. If groundwater was another 15%, she'd color from 75% to 90% with yellow. The final blue 10% would be from 90% to the very top (100%) of the cumulative graph. **To reflect the fact that the four percentages must add up to 100%, the entire graph must be filled with the four colors stacked on one another, green at the bottom and blue at the top.**
7. Have the students shade their colors lightly, to save time and to allow them, if they wish, to write the percentage in darker writing over the light shading (in the example above, "50%" would be written within the green section).
8. After your students have completed their guesses and their shadings, it's time to demonstrate and share the actual percentages.
9. (Continues on next page.)



The Activity, cont.

B) A Drop in the Bucket

1. Show the class a liter (1000-mL) of water and tell them it represents all the water on Earth.
2. Ask where most of the water on Earth is located, referring to a globe or map. Pour 30-mL of the water into a 100-mL graduated cylinder. This represents Earth's fresh water, about 3 percent of the total. Put salt into the remaining 970 mL to simulate water found in oceans, unsuitable for human consumption.
   a. On the actual bar graph, represent 97.2% salt water (green) …Yes, almost the entire "Actual" graph should be green!
3. Ask students what is at the Earth's poles. Almost 80 percent of Earth's fresh water is frozen in ice caps and glaciers (e.g., Arapaho Glacier, Arikaree Glacier). Pour 6 mL of fresh water into a small dish and place the rest (24 mL) in an ice bucket. The water in the dish (around 0.6 percent of the total) represents non-frozen fresh water. Only about 1.4 mL of this water is surface water, the rest is underground.
   a. The actual bar graph will then have a very thin line of red to represent 2% of the earth's water frozen in glaciers and ice caps, and almost impossibly thin yellow line that signifies water underground, 0.6% groundwater
4. Use the pipette to remove a single drop of water (0.003 mL). Release this one drop into a small metal bucket. Make sure the students are very quiet so they can hear the sound of the drop hitting the bottom of the bucket.
   a. The thinnest of lines will then be blue, symbolizing clean, surface fresh water which is not polluted or otherwise unavailable for use, just 0.00003% of the total!
5. This precious drop must be managed properly.
   a. Demonstrating how less than 1% of the earth's water is readily available for human use, the importance of maintaining clean groundwater and surface water supplies is well-illustrated by this graph. While there are a few operational desalinization plants in the world today, they are not cost-effective and practical enough to use worldwide. The message is that to protect our drinking water, we must protect our groundwater and surface freshwater supplies from further pollution.
6. Think about earlier estimates to the amount of potable water on earth. Why does more than one-third of the world's population not have access to clean water? Discuss the main factors affecting water distribution on Earth (e.g. climate). Other environmental influences affect availability of water (drought, contamination, flooding). In addition, wetlands and watershed integrity contribute to the retention of water, making more water available for use. Students can also consider that other organisms use water, not just humans.

Connections

- Fifth Grade Children's Water Festival.
- See http://bcn.boulder.co.us/basin/learning/fifthgrade.html#background or http://www.ci.boulder.co.us/comm/pressrelease/2005/0504.htm for information.
- Watch xxx section of the *Boulder Water Story* Video
- Project WET *A Drop in the Bucket* kit, containing all supplies! Visit http://www.projectwet.org for more information.
- See all *WC* activities, all *WS* activities, and all other *HI* activities

The Six H's and pH

Science Standards: 1.1, 2.1, 2.3, 3.1, 3.4

Objectives

Through experimentation and simulation, students learn about the pH scale and how too much of one chemical can change water quality in Boulder Creek and St. Vrain Creek Watersheds.

Skills

Linguistic, Logical-Mathematical, Interpersonal

Background

When studying the environment, researchers must learn how to explore and unearth answers to scientific questions. The Six H's – who, what, when, where, why and how – are basic, foundational inquiries that can provide clues to problems in Boulder County watersheds, one of which is **acid precipitation**. Although it is most common in the northeastern U.S., it is also prevalent among Boulder County mountaintops at the headwaters of both Boulder Creek and St. Vrain Creek, and in the City of Boulder's drinking water supply. The addition of acid to waters will lower the pH and subsequently affect what life can grow there. It can also cause what's called "**acidification**," where fish can die and even treated water won't be safe to drink.

Water is made up of two hydrogen atoms and one oxygen atom (H_2O). The addition of certain elemental compounds encourages water molecules, to separate or dissociate into **hydrogen (H+)** and **hydroxide (OH-) ions**. The solution is **acidic** if there are excess hydrogen ions (H+). If more hydroxide ions (OH-) remain, the solution is basic or **alkaline**.

The level or amount of hydrogen ions in solution is measured by a **pH scale**. The scale ranges from 0 to 14. A solution with a pH of 7 is said to be neutral, because it has equal amounts of hydrogen and hydroxide ions. Bases have pH levels ranging from 8 to 14. A pH of 12 indicates a very strong base. Antacids, baking soda, and limestone are all basic species. Acids have a pH ranging from 1 to 6. Vinegar and lemon juice are acidic, as can be nitrogen and sulfur when dissociated with water to form nitric acid and sulfuric acid. The pH range of natural systems under normal circumstances is typically between 6.0 and 8.0. This is the most favorable, or optimal, range for life.

Nitrogen (N) and phosphorus (P) are nutrients required for life to grow. However, too much of a good thing can be a bad thing. Humans are increasing the amount of N and P available in the Boulder Creek watershed, even along the headwaters. For example, air pollution from automobiles and fossil fuel-burning utilities contributes to acid wind, rain, snow, hail or fog that affects high altitudes along the Front Range, even if the source is hundreds of miles away. Other unnatural nitrogen inputs come from such products as fertilizers and pesticides, even dog waste and confined animal feeding operations (CAFOs).

Remnants of mining for gold, silver, tungsten and other precious minerals in Colorado have also affected the pH of streams of the Front Range, particularly Lefthand Creek in the St. Vrain Watershed. As the miners blasted rock with dynamite, gleaning valuable rock and leaving waste rock behind, these **tailings** continue to **leach** pollutants into nearby streams and rivers. Pyrite, a very common but not worthy mineral in the Rocky Mountains, when exposed to air and water binds with hydroxide ions, leaving behind H+ ions and forming a very acidic compound called sulfuric acid. This type of pollution is called **acid mine drainage**, and results in waterways with a pH as low as 2 or 3. Very few life actually survives in a pH lower than 4.5.

Guide Materials

HI 2 pH scale student worksheet and answer sheet

Kit Materials

vinegar, lemon juice, baking soda, antacids, salt, liquid soap

8 Dropper bottles

6 Pipettes (in ziplock)

3 Ice Trays

HI 2 envelope—Color-coded pH scale and pH litmus paper

PowerPoint CD, File "Six H's and pH"

Other Materials

tap water, goggles; suitable chemistry equipment, if any; computer and LCD projector, if possible

Preparation

Divide the class into six groups. Make copies of HI 2 worksheet. Separate solutions into appropriate dropper bottles. While lemon juice and vinegar are already prepared, liquid soap, antacid tablets, and salt must each be added to water in the other dropper bottles. Also fill 2 bottles with water: 1 labeled "tap" and the other "rinse." Scoop baking soda into the bottom of ice tray cube #8. Pass out a pH scale, worksheets, litmus paper and a pipette. Distribute the ice trays, each 1 will be shared by 2 groups. If you have access to goggles, it would be good practice to use them. Using the enclosed CD, set up the PowerPoint slide show and LCD projector, or review beforehand and print off slides as handouts to students.

Time: 30 min

Setting: classroom

Safety

Warn students to not mix any solution without the teacher's consent! Also do not allow any students to taste test substances. Further, glasses, goggles, or other protective eyewear should be worn at all times.

The Activity

1. Show the PowerPoint slide show entitled "Six H's and pH" for an interactive discussion of pH chemistry, briefing students on issues such as acid precipitation and acid mine drainage in the Rocky Mountains. Refer to *My Water Comes from the Mountains* and have students page through the book, predicting where acid precipitation and acid mine drainage likely have the largest influences.
2. Using the appropriate pH scale, ask students to color their worksheet scale to match.
3. While students are coloring, send the bottles around and ask a representative from each group to use the map and place the appropriate solution in the 7 different cubes, being careful not to mix solutions. In the 8th cube, assign a solution for each group to add to and dissolve the baking soda. Each group should use a different liquid, for instance group 1 use lemon juice with baking soda and group 2 use vinegar with baking soda.
4. Using the pipette and litmus paper, have students test and compare the substances found in the labeled cups. They must take turns, being careful not to mix solutions, and place only 1 drop on the litmus paper! Also be sure to rinse the pipette with "rinse water" (cube #4) between each substance! Use the "tap water" (cube #3) last and prior to testing, have students guess where it might lie on the pH scale.
5. After each solution test, students mark the corresponding litmus paper color and pH on the worksheet. In addition, you could draw a pH scale on the chalkboard and afterward, have a representative from each group come forward to denote where a particular substance fits on the scale.
6. Discuss the results of baking soda solutions. What has happened? These solutions should be more neutral than those without baking soda. This is called a **buffer**, a substance that neutralizes acids and bases in solution. There are natural buffers against acid rain such as limestone rock (which is basic), but most rock in the Boulder Creek and St. Vrain Watersheds is granite, having no buffering capacities.
7. Investigating problems can help scientists solve environmental issues. The Six H's are meant to increase students' capacities to be inquisitive. Discuss the Six H's: who, what, when, where, why and how, and afterward, ask students to answer the Six H's on the pH scale worksheet. Later students may want to design their own Six H questions to ask each other.

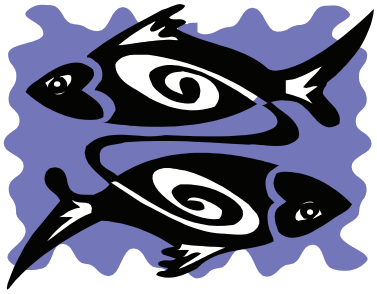
Connections

- You might also consider trying other substances not listed, such as soda, orange juice and milk.
- Visit http://www.epa.gov/acidrain/site_students/index.html to view other activities and animations about acid rain. Also see http://www.ec.gc.ca/acidrain/kids.html.
- Red cabbage or the petals of hydrangea also work similar to litmus paper. See http://www.disknet.com/indiana_biolab/kids104.htm for more information.
- Research the pH tolerances of Boulder or St. Vrain Creek flora and fauna. Test the pH of water in a local creek, lake or irrigation ditch, and note what lives there. Measure other physical properties of the waterway such as temperature and velocity.
- Explore the *River Watch* program for more hands-on physical, chemical and biological assessments of your local creek.
- WASH Education Program and Resources for loan, in particular: creek clean up kit and water quality kit. See brochure or call 303-413-7365
- Watch xxx section of the *Boulder Water Story* Video

Something's Fishy...

Science Standards: 1.1, 3.1, 4.3, 5.1

This activity is adapted from Texas I and WASH.



Objectives

This engaging activity gives students a visual understanding of some of the consequences of storm water pollution. Students actively participate in a hands-on activity regarding potential water pollution sources in creeks and rivers.

Skills

Spatial, Logical-mathematical, Interpersonal

Background

Storm water is the water that is produced by rainstorms or snowmelt. When storm water falls or runs through urban areas, it often washes nutrients and toxic substances from streets, parking lots and lawns into storm drains. The water that enters the storm drains is piped into the nearest stream or river. In most cases, the storm water never is treated at a sewage treatment facility. The result of polluted storm water or **urban stew** entering streams is damage to ecosystems. When streams are polluted, plants, aquatic insects, birds and other animals that depend on the streams for survival will inevitably suffer.

When aquatic biota encounter physical environments that are not suitable for survival, they **drift**. Here they inadvertently or intentionally travel downstream, or upstream, away from inhospitable conditions. In the case of human impacted streams, benthic macroinvertebrates are succumbed to **catastrophic drift**. The introduction of environmental stressors essentially induces a catastrophe, and thereby the aquatic habitat is forever changed due to toxic chemicals, increased sediment load, etc.

Preparation

1. Obtain Relief Map from the kit (or call for Stream Table availability)
2. Also from the kit, gather the HI 3 envelope containing Script & Pollution Pictures
3. Pull the HI 3 Pollution Shakers. There are 5 different Pollution Shakers (= 5 colors), therefore consider switching up the shaker for varying "pollutants."
4. Copy the HI 3 student worksheet, 1 per student.
5. Arrange classroom in groups of 4 – 5

Safety

Perhaps do not mention the use of Kool-Aid, as the students will likely want to taste, and inevitably spread germs. Also be weary of staining.

Guide Materials

HI 3 worksheet and answer sheet

Kit Materials

"Denver's Playground" 3D Relief Map

HI 3 Script & Pollution Pictures, in envelope

HI 3 Pollution Shakers (Kool-Aid

spray bottles

MAP envelope (i.e., 1980 USGS Boulder County topos to depict your local stream)

Other Materials

Pencils;
The Stream Table, available through the Longmont Conservation District, is the ideal alternative to the Relief Map. Call 303-776-4034 x3

Time: 45–60 min

Setting: classroom

The Activity

1. Give each student an observation activity sheet.
2. Ask prompting questions: Has anyone explored a creek or pond? What lives in a creek or pond?
3. Inform students they will observe the effects of land use on the watershed. Using *My Water Comes from the Mountains* and the location of your local creek on the topographic map, discuss where possible pollution sources may enter.
4. Pass the script to student volunteers in various groups. Instruct and lead the students to read the scripts chronologically. After each script is read, pass around the corresponding non-point source laminated illustration, and give a volunteer in the group a Pollution Shaker. Ask the representative to "shake" the pollutant on a counterpart area on the relief map or stream table. For instance, if the script refers to cars leaking oil on a parking lot, pass around the corresponding illustration and have a volunteer shake "oil" on hypothetical parking lots across the Front Range.
5. Remember to use different shakers to add varying colors to the enviroscape, effectively enhancing the effects of pollution. After all the ingredients have been dumped, have volunteers use the spray bottles to "rain" on the land. Observe what happens to all the different human projects. See where most of the pollution collects, and have students answer the questions on the observation activity sheet.
6. Recap with students the sources of the water pollution in the story. Ask the students to brainstorm others specific to their area. Ask the students to list ways in which each form of pollution in the story and those from their list could be prevented.
7. If using the 3-D Relief Map, please be certain to wash clean of Kool-Aid stains prior to putting away. Thank you.

Connections

- Have students go on a storm drain walk to observe the types of pollution that enters the storm drains in their neighborhoods.
- Have students research the types of fish that might be affected by various pollution sources. What kinds of habitat do they need, and how might that habitat be compromised by various environmental stressors?
- *WS 2 – Map your Shed*, *WS 3 – Our Backyard Drinking Water Supply*, *WS 4 – We All Live Downstream*; *F²LZ 3 – Boulder County Cornucopia*, *F²LZ 4 – Macroinvertebrate Mania!*; All other *HI* activities.
- WASH Education Program and Resources for loan (e.g., storm drain marking kits): See brochure or call 303-413-7365
- Project WET Storm Water booklet. Visit http://www.projectwet.org for more information.
- Watch xxx section of the *Boulder Water Story* Video

Action!

Objectives

The following three tasks—Water Conservation, Protecting Places and Stream Team—are designed to actively engage students in measures to change patterns of water use and stewardship. Doing so will affect all those represented in *My Water Comes from the Mountains*. In this activity, students will:

A) Catalog their water habits and learn to appreciate how often water is used daily,

B) Perform civic responsibilities looking after local waterways; and

C) Write letters to their families and/or to government agencies or corporations about changing water usage patterns in their homes. These activities can be completed separately or together.

"In towns, there are pollutants that can get into creeks like Boulder Creek."

My Water Comes from the Mountains

Connections to all *Action!* items

- All other *HI* activities.
- Longmont's Green Up Clean Up
- Fifth Grade Children's Water Festival. See http://bcn.boulder.co.us/basin/learning/fifthgrade.html#background or http://www.ci.boulder.co.us/comm/pressrelease/2005/0504.htm for information.
- WASH Education Program— Check out the storm drain stenciling/marking, creek clean up or water quality kits. Develop your own school, neighborhood or family stream steam. Call 303-413-7365, see brochure, or visit basin.org/wash to learn more.
- Also see an interactive water conservation resource, the kid-friendly web site http://www.h2ouse.org.
- Watch xxx section of the *Boulder Water Story* Video

A) Water Conservation

Science Standards: 5.3, 6.2. 6.3

From WASH, WatershED Activity 1.5 – Water Conservation

Skills

Logical-mathematical, Intrapersonal, Interpersonal

Background

Boulder County receives an average of 18 inches of rain a year which is not enough precipitation to meet all of our water needs. Living in a semi-arid environment, it is necessary to conserve an already stressed resource. In Colorado, roughly 80% of our water supply comes from snow and we therefore rely heavily on the snow that falls in the mountains. Because snow melts quickly in the spring, we have developed extensive reservoir systems throughout the mountains and plains to store water for year-round use. The average Boulder Creek Watershed resident uses about 80 gallons of water a day. This amount fluctuates throughout the year. The highest demand for water falls in the summer months—June, July, and August. Indoors, water use is highest in the bathroom. Taking showers or baths, flushing the toilet and even brushing your teeth all add up to lots of water. The highest water use outdoors is for landscape irrigation, mainly because many residents want to keep their grass green. However, because water is a precious resource in Colorado, we must find ways to **conserve** it.

There are many things we can do indoors to reduce the amount of water we use including putting in low-flow showers and toilets, turning off the water when we brush teeth or shave, and taking shorter showers. Much of the water we use is for outdoor watering. One way to reduce our watering is to plant a **xeriscape** landscape that incorporates native, drought resistant plants, trees and grass species. In Boulder County, our houses and apartment buildings have water meters that measure household water use. The only residences that do not have water meters obtain water from a well that pumps underlying groundwater. If obtaining water from the city, The Public Utility Department takes monthly readings from our water meters to prepare household water bills and to calculate a community's water use.

According to the 2000 census, over 291,000 people were living in Boulder County. That number is expected to increase 15% to bring the total population to 335,000 by 2010. The cities of Nederland, Boulder, Louisville, Lafayette and Superior are the largest cities in the watershed. The larger watershed that *contains* the Boulder Creek watershed is the St. Vrain Watershed, and St. Vrain Creek is the main source of water for the towns north of Boulder such as Lyons and Longmont. As population in the basin grows, development and the associated water quality impacts will also increase.

Guide Materials

HI 4 "Personal Water Use" and "Water Conservation Chart" Student Worksheets

Other Materials

2 or 3 empty gallon jugs

Preparation

make copies of worksheets and collect gallon jugs

Time: 1 week

Setting: classroom/ home

The Activity

1. Personal Water Use worksheet
   a. Discuss daily water uses with students. Talk about how much water it takes for different activities (e.g., flushing the toilet used between 1-5 gallons of water/flush).
   b. Pass out copies of the Personal Water Use worksheet and explain to the students that for the next week they are to keep track of their water use.
   c. At the end of the week, have students figure out their average daily water use in gallons/day. How can students reduce their average gallons/day? Have students make a conservation pledge listing ways that they can reduce the amount of water they use.
2. Gallon Jug project
   a. Tell students that for one week the only water the class can use is what is kept in the gallon jugs in the classroom. They have to use it for their drinking water, to wash their hands, for water classroom plants, etc.
   b. Designate a spot in the school to be the "well" where students will go to "draw" water when the gallon jugs go dry. The well should be located somewhere far from the classroom, such as a faucet in the basement or across the school.
3. Discussion – Ask provoking thought questions: Do students use less water when they know they have a limited supply? Is it a pain to have to fill it up at the "well" each time they run out of water? What things would they do differently if they had to physically draw water from a well instead of easily turning on the tap in the kitchen?

B) Protecting Places

Science Standards: 1.2, 1.3, 1.4, 5.1, 5.3, 6.4

Skills

Interpersonal, Spatial, Bodily-Kinesthetic

Background

This activity gives students a direct opportunity to decrease litter and help their community. Litter, even if miles away from the nearest stream, often eventually ends up in waterways by way of the wind or rain and drainage ditches. Just as students have fun on playgrounds, biota residing in the nearby creek consider the water the place where they, as living flora and fauna, enjoy living. When students pick up litter, whether on school grounds or on a creek, they can help decrease water pollution, preserving and protecting places for living creatures big and small.

Preparation

1. Discuss the local watershed (see *WS 1,2*) and draw up or devise a plan on how you will cover the area or what stream you will clean. (If the latter, obtain proper permission from the county or landowner, and arrange for parental slips and transportation to and from the stream site. Ideally the stream, or drainage ditch, will be close by to school grounds and the class could walk there, or perhaps the site is on school grounds.)
2. Organize students into groups of 3—5.
3. If you need or want them, line up parent volunteers.
4. You can divide the campus, or creek, into sections for each group to cover. Perhaps even other classes would like to participate and it can be an all-school activity. If you are doing it all yourself, try to get two or three helpers.
5. Do this activity very close to the end of the school year. Leave the school grounds clean at the end of the school year, a nice legacy for outgoing students. For any age group, it's a positive activity for the local environment and for school community spirit and morale.
6. Contact the education and/or environment writer(s) from your local newspaper and/or television news department. Let your school and parents know you're doing this for your community.

Safety

Suggest that your students bring garden gloves if you're going to be encountering glass or metal objects. Have some parent volunteers accompany you if there is any danger from traffic. Assign particular small student groups to each parent volunteer.

Kit Materials

none

Other Materials

Plastic garbage bags, garden gloves

Call WASH at 303-414-7365 or see brochure if you wish to borrow a creek clean up kit, or be part of a Stream Team.

Day Before

Time: 15—20 min

Setting: classroom

Day Of

Time: 45—60 min

Setting: outside on school grounds or alongside a nearby stream

B) The Activity

Part A: Day Before

1. Brainstorm with the students about different kinds of littering they've observed and heard about. Make a list. Then, discuss litter they've seen on the grounds of their school, around their homes or floating in a nearby creek or pond. Ask them to look for the kinds of litter they observe when they next go out for recess.
2. Next, discuss how litter can affect natural waterways and riparian habitat. How could litter from the grounds of their school or backyard get into the waterways? (Storm sewers, if you have them there; litter could blow into the nearest waterway—if you haven't already discussed the local watershed, see if the students can figure out the nearest waterways and tell or confirm with them what those are).
3. Inform the students that they will be picking up all of the litter from the entire area of their school grounds, or a nearby stream. Suggest that for safety that they bring garden gloves and that they bring in a bag to collect trash (a supermarket-sized plastic bag works well).

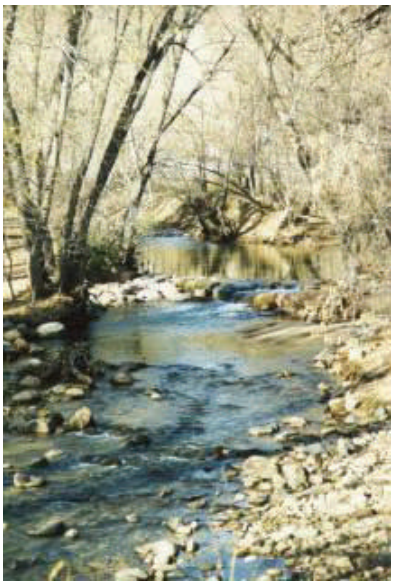
Part B: Day Of

1. Break up your students into teams of three or four, preferably so that someone in each team has garden gloves for sharp or metallic objects and someone has a bag for collection. Explain which part of the school grounds or creek each group or classroom will be picking up litter. If you're doing the activity with parent volunteers, assign teams to each parent. Students must stay within a short distance of adults. Suggest that students especially look in places where the wind might collect litter, such as along fences.
2. As a follow-up, you could have students sort and weigh the trash. Sort out the recyclables and make sure they get recycled.
3. You could offer small prizes for the group that locates the largest piece of trash, weirdest, heaviest, etc.
4. Another follow-up could be students writing a letter (in their collecting groups, as a class with your guidance, or individually) to their local newspaper or to their school community about the importance of not littering.

C) Stream Team

Science Standards: 1.2, 1.3, 1.4, 5.1, 5.3, 6.4

Language Arts Standards: 2, 3, 4, 5



Skills

Intrapersonal, Linguistic

Background

This activity gives students a chance to write persuasive letters that can have a positive benefit for themselves and the aquatic society. Here are some online resources that can help make this activity work:

1. *Global Response* organizes international letter writing campaigns about environmental issues. See http://www.globalresponse.org/ or contact them locally: phone 303-444-0306 Global Response, PO Box 7490, Boulder, CO 80306
2. *The Earth's Birthday Project* organizes national and international efforts to protect tropical rainforest lands, as well as sponsoring insect and sunflower projects. See http://www.earthsbirthday.org/
3. *The Youth Ambassadors for Peace* organize letter-writing programs that sometimes are environmentally-oriented. See http://www.freethechildren.org/peace/letterwriting.html
4. *Children of the Earth* has information about writing to local businesses. See http://www.childrenoftheearth.org/Business%20Connection.htm
5. The *Clean Water Network* has information about the Clean Water Act. See http://www.cwn.org/cwn/howtocenter/index.cfm
6. Visit http://www.basin.org/wash and develop your own school, neighborhood or family StreamTeam.

The Activity

1. The students will brainstorm a list of ways that people pollute wetlands such as rivers, lakes and oceans. This list will be recorded on an overhead and/or large piece of construction or chart paper.
2. The students will then discuss which issues they could work on within their homes and families. After brainstorming actions they could take to change day-to-day habits, the students will write a letter to their parents about the some of the issues and actions they'd like to see their families take. They will do this within the context of a lesson about persuasive writing. Remind your students about your previous lessons about persuasive writing, and bring them to this context.
3. Students can begin by writing "I'm on the Water Team!" and list ways by which they have worked to protect local waterways, in an effort to encourage global protection.
4. The students can then discuss issues about which they would write to governmental agencies and/or corporations to advocate changes in policies or all together new policies to help the environment. The issues could be researched online before writing the letter. Lessons, new or reviewed, about effective persuasive writing would also apply here.

Kit Materials

none

Other Materials

computers

Preparation

Schedule access to computers so that students can explore the websites mentioned here.

Time: variable

Setting: classroom

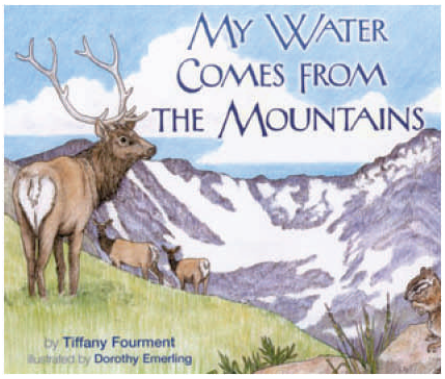
I Understand My H_2O

Science Standards: 3.1, 3.2, 3.4, 4.1, 4.2, 4.3, 5.1, 6.3, 6.4, 6.5

Language Arts Standards: 1, 4

Objectives

This reading comprehension activity is a thorough overview of the *My Water Comes from the Mountains* book that challenges recall and understanding, encompassing all four themes of this guide, and can be used in conjunction with another relevant unit or as an assessment to the series of activities within this teacher's guide.



Skills

Linguistic; Interpersonal or Intrapersonal

Background

My Water Comes from the Mountains, written by Tiffany Fourment and illustrated by Dorothy Emerling.

Preparation

Get the class set of books from the material kit or location in your building; make copies of the student worksheet.

The Activity

This activity is not necessarily meant to solely emphasize memorization; the book may be used as a reference guide while completing this activity. The questions can be answered as the teacher reads the book aloud, or it may be more research-directed as students, either individually, in pairs or small groups, silently read and answer the questions accordingly.

Guide Materials

RC—I Understand My H_2O worksheet and answer sheet

Kit Materials

My Water Comes from the Mountains class sets

Other Materials

Writing utensils

Time: 45–60 min

Setting: classroom

Incredible Journey

Name:

starting place		
turn ##	moved to	water phase

The Confluence Course

Name:

WS 1

Our Backyard Drinking Water Supply

Name:

BOULDER

1. The Silver Lake Pipeline flows into the_____Reservoir.

2. The pipeline from Grand Lake ends up in _____Lake.

3. The Windy Gap Pump Plant is near the town of _____.

4. The white-dotted line where water flowing east goes to the Atlantic Ocean and flowing west goes to the Pacific Ocean is called the _____.

5. Middle Boulder Creek and _____ Creek flow into Barker Reservoir.

6. The reservoir up above Ward is the _____.

7. The two water treatment facilities (WTFs) for Boulder are _____WTF and_____WTF.

8. Boulder Reservoir is fed by _____Creek, _____Creek, and the _____Canal.

9. The town near Barker Reservoir is _____.

10. The canal going from Carter Lake to Lyons is the _____.

11. Melting waters from the Winter Park skiing area empty into the _____River.

12. Boulder Creek is connected to the Boulder Reservoir by the _____.

13. The two towns in the green #6 region on the map are Ward and _____.

14. The _____ Tunnel brings water from the Western Slope to the Front Range.

15. The _____Reservoir is uphill from Carter Lake.

Our Backyard Drinking Water Supply

Name:

Longmont

1. The C-BT & Windy Gap Project flows into _____Lake.

2. The _____Reservoir is above Lyons.

3. The three water treatment facilities (WTFs) for Longmont are _____WTF,

_____WTF and _____WTF.

4. The Windy Gap Pump Plant is near the town of _____.

5. The canal going from Carter Lake to Lyons is the_____.

6. Melting waters from the Winter Park skiing area empty into the _____River.

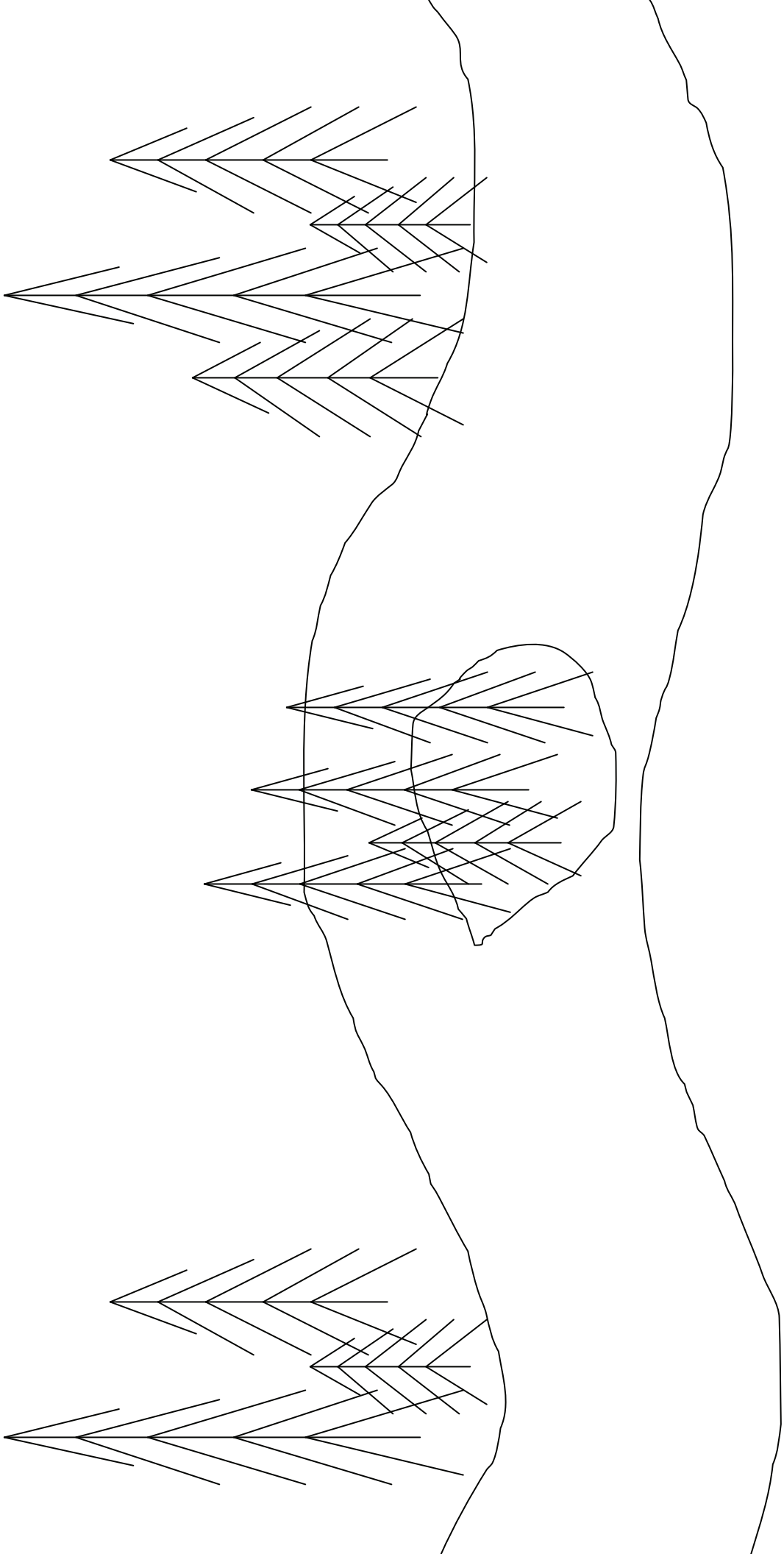
7. The _____ Tunnel brings water from the Western Slope to the Front Range.

8. Snowmelt from Rocky Mountain National Park ends up in _____ Creek and _____

_____ Creek.

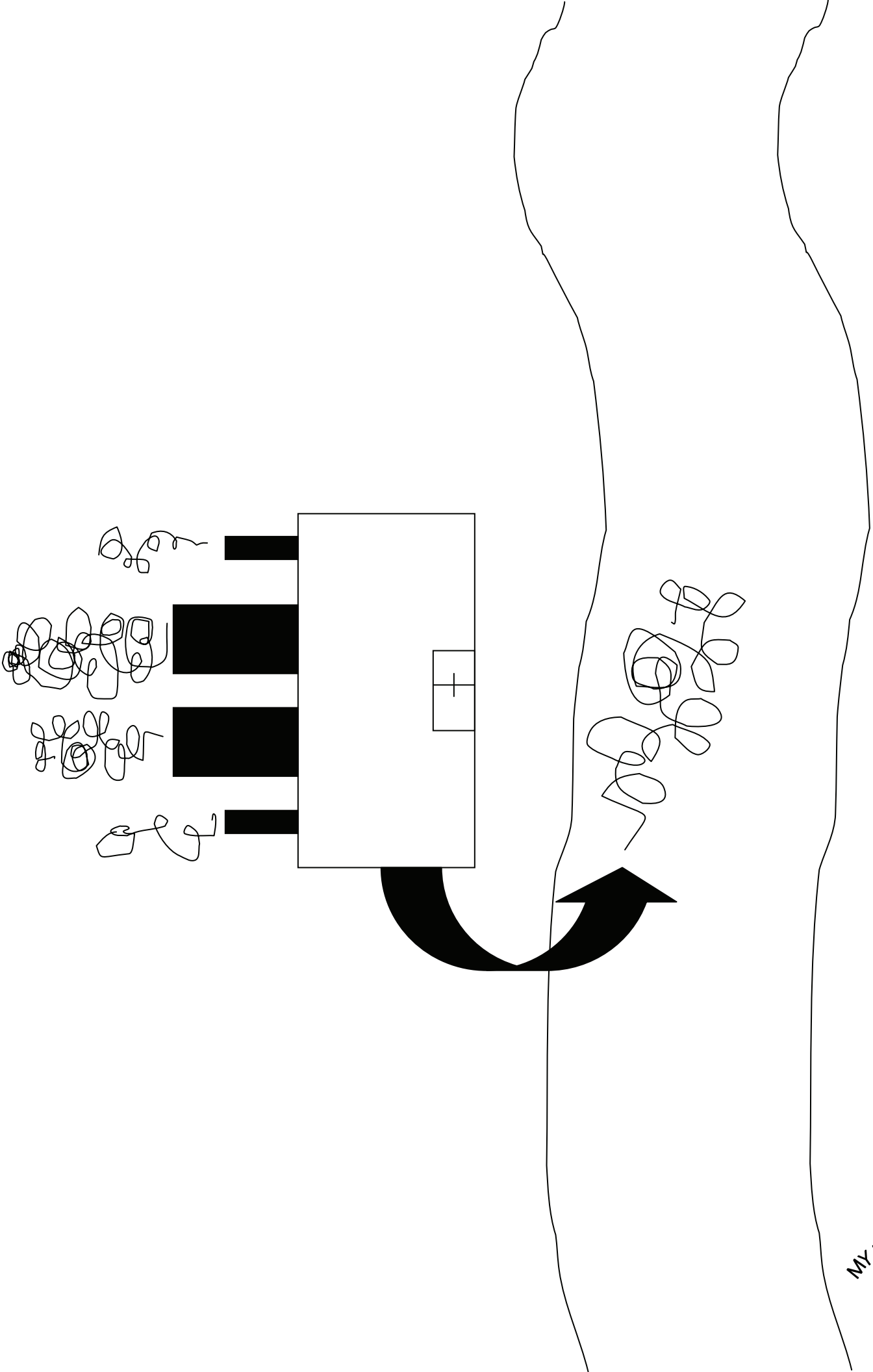
9. The "BT" in C-BT & Windy Gap Project stands for the Big Thompson River which flows from Rocky Mountain National Park toward Fort Collins. The "C" stands for _____River.

10. The _____ Glaciers feed the St. Vrain Creeks.



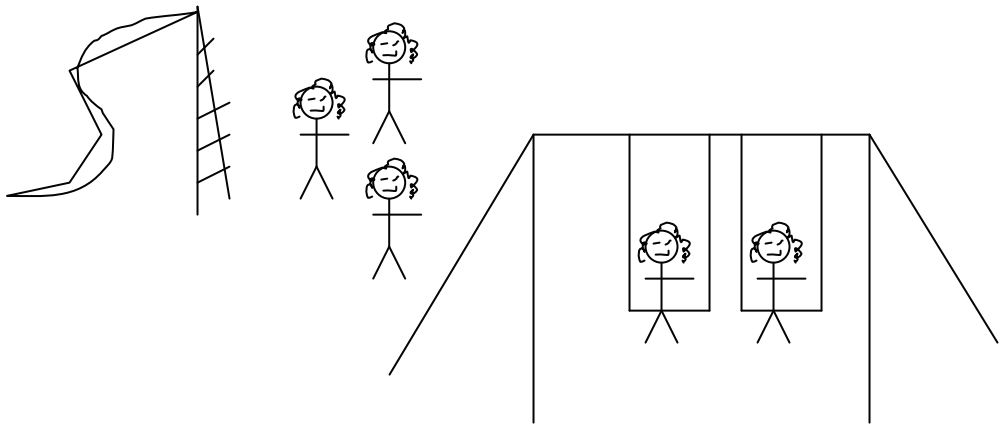
MY H2O

WS 4



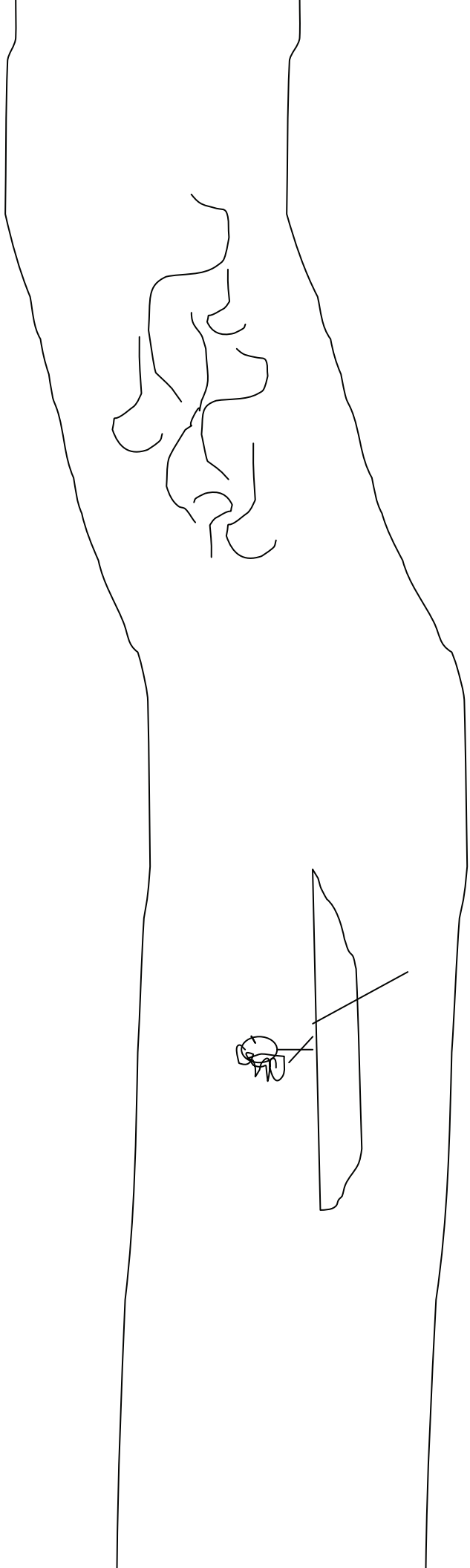
MY H2O

WS 4



MY H2O

WS 4



MY H2O
WS 4

Life Zone Location

Group Name:

Students: Write what you believe is the correct flora or fauna for each life zone. It will be the name of either a plant or animal we've studied in the book or that's listed on the fact sheet. Then, using the letter codes on each clue, list the 4-letter "Location" for each flora and fauna in each life zone.

	Flora (Plants) PREDICTION?	**Fauna (Animals) PRE-DICTION?**
Alpine		
What's the Location?		
Subalpine		
What's the Location?		
Montane		
What's the Location?		
Plains		
What's the Location?		

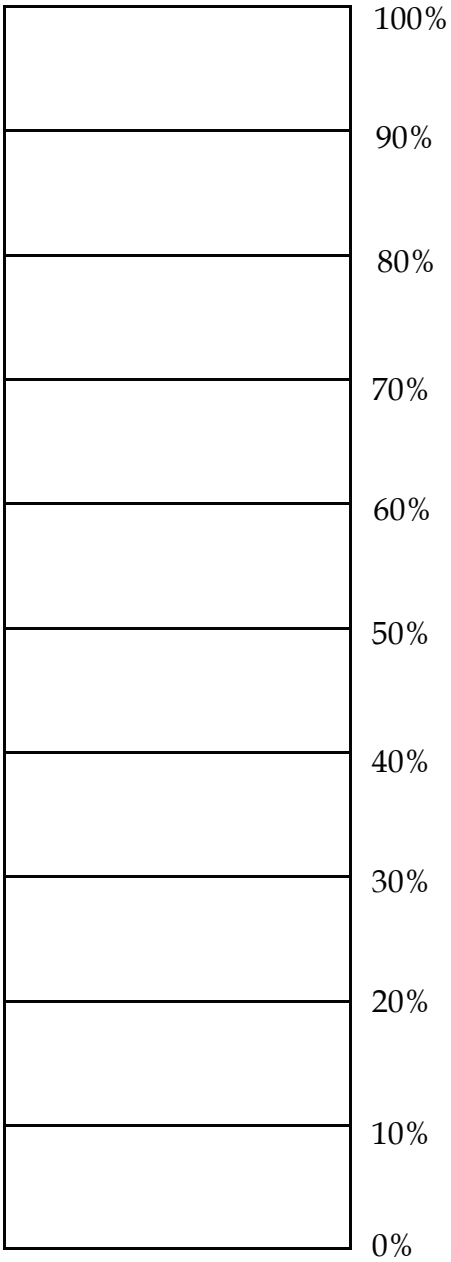
Water Table Fable

Name:

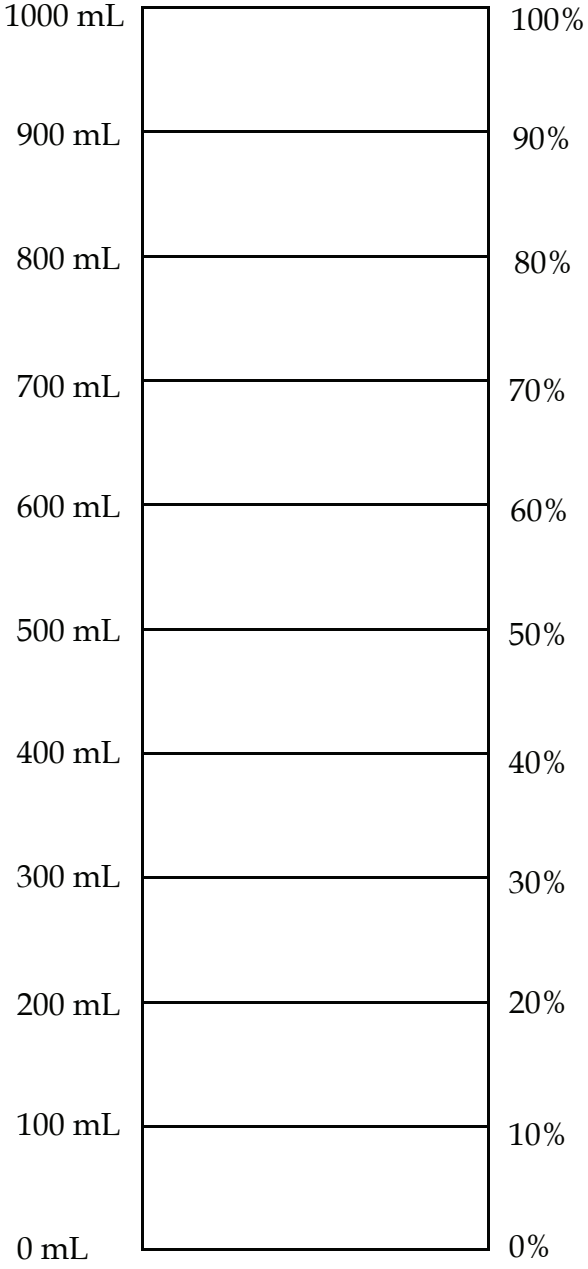
Make predictions about how much of each type of water there is on Earth. There are four types to choose from: salt water, glaciers, groundwater, and suface freshwater (including lakes, rivers, wetlands, and water vapor). Use the colors in the key to make your predictions. Follow along in the water demonstration and fill in the actual percentages on the right bar graph.

Key
Salt Water: Green
Glaciers: Red
Groundwater: Yellow
Surface Freshwater: Blue

Prediction



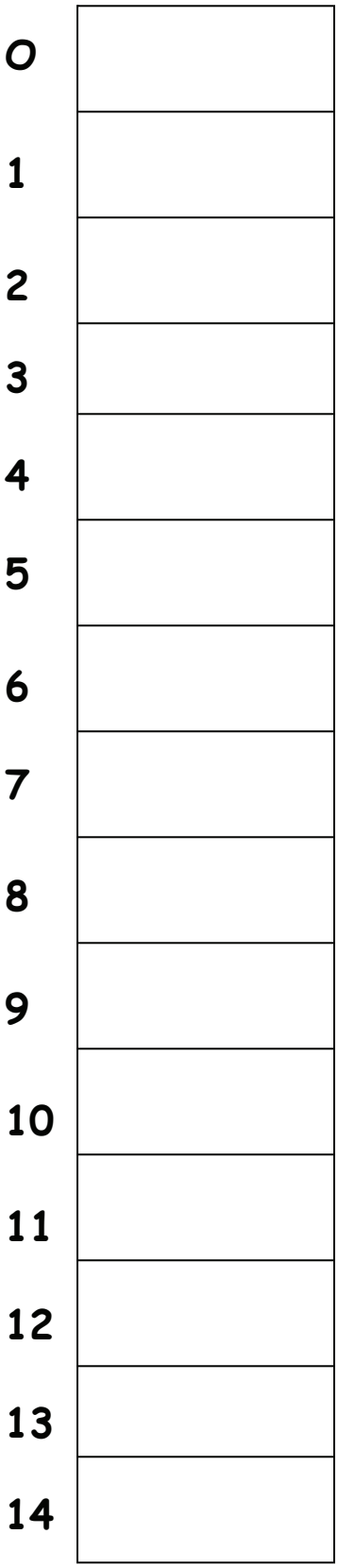
Actual



The Six H's and pH

Name:

Color the pH scale



Color in the pH scale according to the example. Then using litmus paper, figure out the pH of each solution you test. Draw lines out from the scale and write the solution name next to the correct pH. Using what you gained in the slideshow, answer the below questions.

1. **Who** can help reduce acid rain?

2. **What** color on the litmus paper is basic (alkaline)?

3. **When** was the pH most acidic?

4. **Where** in Boulder County are there problems with waters having low pH?

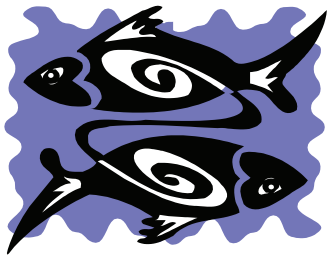
5. **Why** are some streams acidic?

6. **How** did the solutions become more neutral?

MY H2O

Name:

Something's Fishy...



1. Name three (3) non-point pollution sources that were added to this environment. Also be sure to write where it came from.
    1. _____ From _____.
    2. _____ From _____.
    3. _____ From _____.

2. What can nitrogen from fertilizers do to water in the creek?

_____

_____

3. Name two (2) things you can do to prevent an "urban stew."
    1. _____
    2. _____

4. Name three (3) living organisms living in the creek that could be harmed by pollution.
    1. _____
    2. _____
    3. _____

5. A _____ is like a gutter. When rain falls, it collects everything in the street. Because it eventually leads to the river, this is source of much of the pollution, or urban stew, that can harm aquatic ecosystems. (Fill in the blank.)

Name:

Personal Water Use

WatershED Student Worksheet 1.5

For each water use, write the estimated number of gallons used. Keep track of your water use for each day, for a week. At the end of the week you will be asked to figure out your average daily use.

WATER USES	Monday	Tuesday	Wednesday	Thursday	Friday
shower/bath					
flushing toilet					
brushing teeth					
drinking water					
washing hands					
washing clothes					
washing dishes					
dishwasher					
outdoor watering					
Daily Total:					

Average water amounts for each use:

shower/bath ~ 2.5-10 gallons/minute
washing dishes ~ 30 gallons (water running)
flushing toilet ~1-5 gallons/flush
brushing teeth ~ 1-5 gallons (water running)
drinking water ~ 1/8 gallon/cup of water
washing hands ~ 1-5 gallons/minute
dishwasher ~ 20 gallons (÷ number in household)
washing clothes ~ 50 gallons/load (÷ number in household)
outdoor watering about 8 gallons/minute (÷ number in household)

To find daily average water use: Add Daily Totals ÷ 5 = average gallons/day

_____ ÷ 5 = _____ average gallons/day

WatershED
Activity 1.5

Name:

Water Conservation Chart

WatershED Student Worksheet 1.5

Water Use	Water Amounts (No Conservation)	Conservation Methods	Water Amounts (With Conservation)
shower/bath	~5 gallons/minute or 25 gallons for 5 minutes	Install low flow shower head. Wet & soap, rinse off.	~5-10 gallons for quick shower
flushing toilet	~5 gallons/flush	use tank displacement. Flush less frequently.	~2-3 gallons/flush
brushing teeth	~2 gallons (water running)	use glass to wet brush and rinse	1 pint
washing hands	~2 gallons (water running)	wet hands, turn off water, lather, rinse	1 quart
washing clothes	~40 gallons/load (top water level)	use minimum water level	25 gallons
washing dishes	~30 gallons (water running)	wash, rinse in tub	5 gallons
dishwasher	~20 gallons/load (full cycle)	use short cycle	7 gallons
outdoor watering	~8 gallons/minute	water less	

Monthly Water Use Average Before Conservation Methods _____

Monthly Water Use Average After Conservation Methods_____

Total Water Conservation_____

WatershED
Activity 1.5

I Understand My H_2O

Name:

Answer the following in complete sentences, unless there is a list.

1. What is a watershed and what happens there?

2. Describe the stages of the water cycle.

3. What is an unusual fact about Boulder mentioned in the book?

4. Where do glaciers form? Be sure to explain your reasoning.

5. Why can't trees grow in the alpine ecosystem?

6. Name one wild animal that lives year-round in the alpine tundra, scurrying among the rocks, making a high-pitched call that sounds like a bird chirping.

7. What is *flagging* and why do krummholz trees exhibit this trait?

8. True or False. Fewer animals live in the alpine tundra than the prairie. Explain your choice.

9. Water is stored in which two reservoirs for use in Boulder?

RC

10. What happens to North Boulder Creek before it flows into Middle Boulder Creek?

_____

_____

11. Name the life zone where the following wild animals can be found. Put a "P" for prairie, "M" for montane, "S" for subalpine and "A" for alpine.

1. Burrowing Owl_____
2. White-tailed Ptarmigan _____
3. Black-footed Ferrets _____
4. Mountain Lion_____
5. Mule Deer _____
6. Pine Marten_____

12. How can some animals live only in the alpine and others live only in the prairie? Name one special feature an animal might have in order to live in the snow.

_____

_____

_____

13. It doesn't often rain enough for farmers to grow crops near Boulder and Longmont. How do they get enough water?

_____

_____

_____

14. Name four possible sources of pollution that drain into Boulder and St. Vrain Creeks.

1._____
2._____
3._____
4._____

15. If water melted off of the edge of the Arapahoe Glacier and traveled all of the way down Boulder Creek and through the system of rivers beyond, where would it end up?

_____

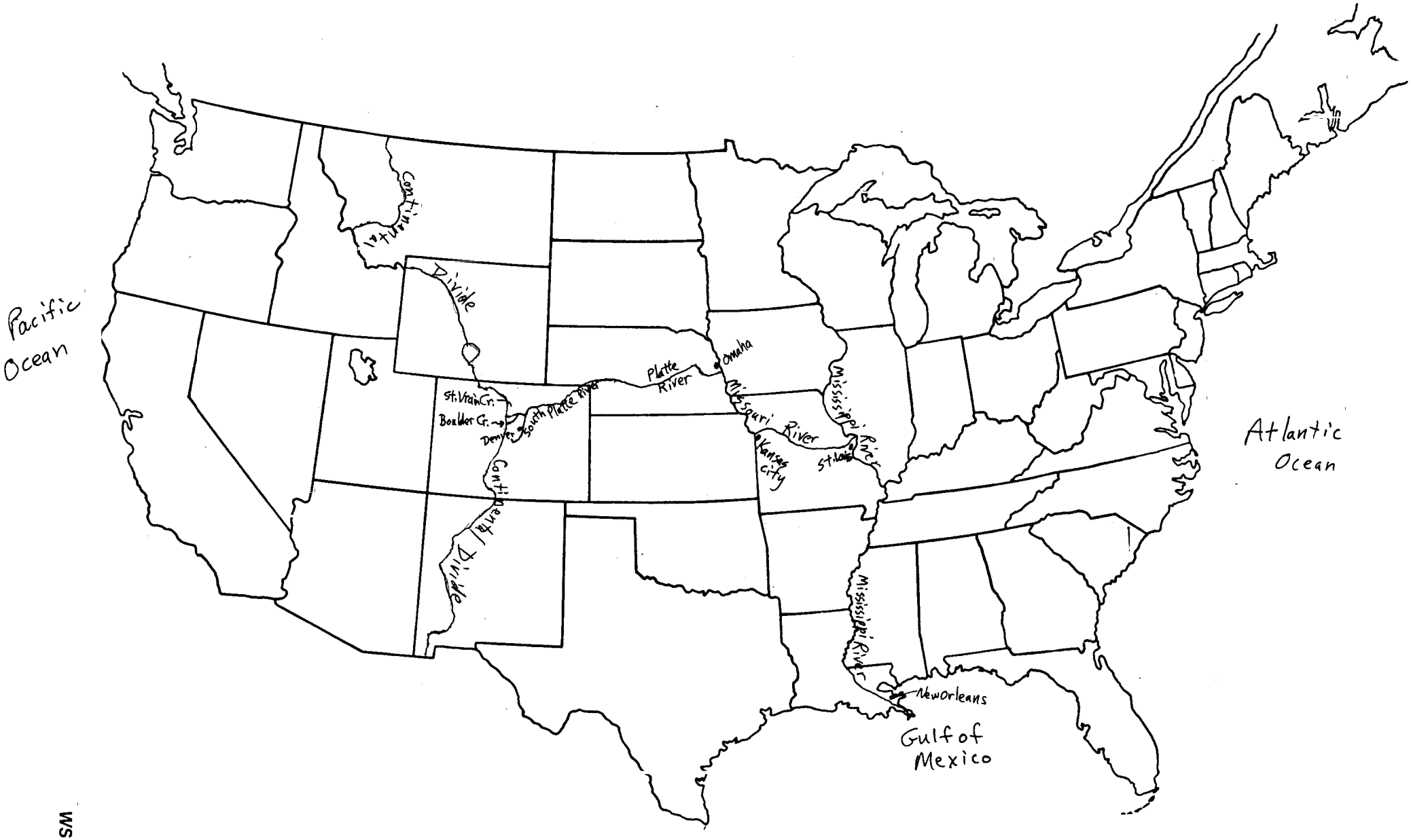
_____

Also see map key.

- Boulder Creek originates in three main branches, North Boulder Creek (Silver Lake to Lakewood Reservoir and down over Boulder Falls into Boulder Canyon), Middle Boulder Creek (above Hessie trailhead in Nederland to the Barker Reservoir, down Boulder Canyon), and South Boulder Creek (Heart Lake above Moffat Tunnel through Rollinsville, then meeting Boulder Creek just east of Boulder).
- The St. Vrain Creek originates in the mountains north of the Boulder Creek watershed. The branches converge in Lyons and the river flows south of Longmont.
- Boulder Creek flows into the St. Vrain Creek east of Longmont, near Highway 119 a couple of miles west of I-25.
- The St. Vrain Creek flows into the South Platte River a few miles north of Platteville and east of I-25.
- The South Platte River flows north to near Milliken, turns east to Brush, and goes northeast exiting Colorado very close to the northeast point of Colorado (from Brush I-76 follows the South Platte).
- I-80 follows the South Platte River in Nebraska, and then it converges with the North Platte River near the town of North Platte to form the Platte River. I-80 follows the Platte River until near Grand Island, Nebraska. At that point, the river arcs north of I-80, but then goes south of Omaha.
- The Platte River joins the Missouri River, which flows southward, forming the borders between Nebraska and Iowa, then Nebraska and Missouri, and then Kansas and Missouri until Kansas City.
- The Missouri River flows eastward across Missouri from Kansas City to just north of St. Louis, where it joins the Mississippi River.
- The Mississippi River flows south, forming the borders between Missouri and Illinois, then Kentucky, then Tennessee, then Arkansas and Tennessee, then Mississippi, and then Louisiana and Mississippi until Louisiana's border heads straight east.
- The Mississippi River then heads through Baton Rouge, New Orleans, and then out to the Gulf of Mexico through the long southeast peninsula out of Louisiana.

The Confluence Course

Name: **ANSWER SHEET**



Our Backyard Drinking Water Supply

Name: **ANSWER KEY**

BOULDER

1. The Silver Lake Pipeline flows into the *Lakewood* Reservoir.
2. The pipeline from Grand Lake ends up in *Carter* Lake.
3. The Windy Gap Pump Plant is near the town of *Granby*.
4. The white-dotted line where water flowing east goes to the Atlantic Ocean and flowing west goes to the Pacific Ocean is called the *Continental Divide*.
5. Middle Boulder Creek and *North Beaver* Creek flow into Barker Reservoir.
6. The reservoir up above Ward is the *Left Hand Reservoir*.
7. The two water treatment facilities (WTFs) for Boulder are *Betasso* WTF and *Boulder Reservoir* WTF.
8. Boulder Reservoir is fed by *Little Dry* Creek, *Dry* Creek, and the *Boulder Feeder* Canal.
9. The canal going from Carter Lake to Lyons is the *St. Vrain Supply Canal*.
10. The town near Barker Reservoir is *Nederland*.
11. Melting waters from the Winter Park skiing area empty into the *Fraser* River.
12. Boulder Creek is connected to the Boulder Reservoir by the *Farmers Ditch*.
13. The two towns in the green #6 region on the map are Ward and *Jamestown*.
14. The *Adams* Tunnel brings water from the Western Slope to the Front Range.
15. The *Pinewood* Reservoir is uphill from Carter Lake.

LONGMONT

1. The C-BT & Windy Gap Project flows into *Carter* Lake.
2. The *Ralph Price* Reservoir is above Lyons.
3. The three water treatment facilities (WTFs) for Longmont are *North* WTF, *South* *WTF and* *Wade Gaddis* WTF.
4. The Windy Gap Pump Plant is near the town of *Granby*.
5. The canal going from Carter Lake to Lyons is the *St. Vrain Supply Canal*.
6. Melting waters from the Winter Park skiing area empty into the *Fraser* River.
7. The *Adams* Tunnel brings water from the Western Slope to the Front Range.
8. Snowmelt from Rocky Mountain National Park ends up in *North St. Vrain* Creek and *South St. Vrain* Creek.
9. The "BT" in C-BT & Windy Gap Project stands for the Big Thompson River which flows from Rocky Mountain National Park toward Fort Collins. The "C" stands for *Colorado* River.
10. The *St Vrain* Glaciers feed the St. Vrain Creeks.

Life Zone Location

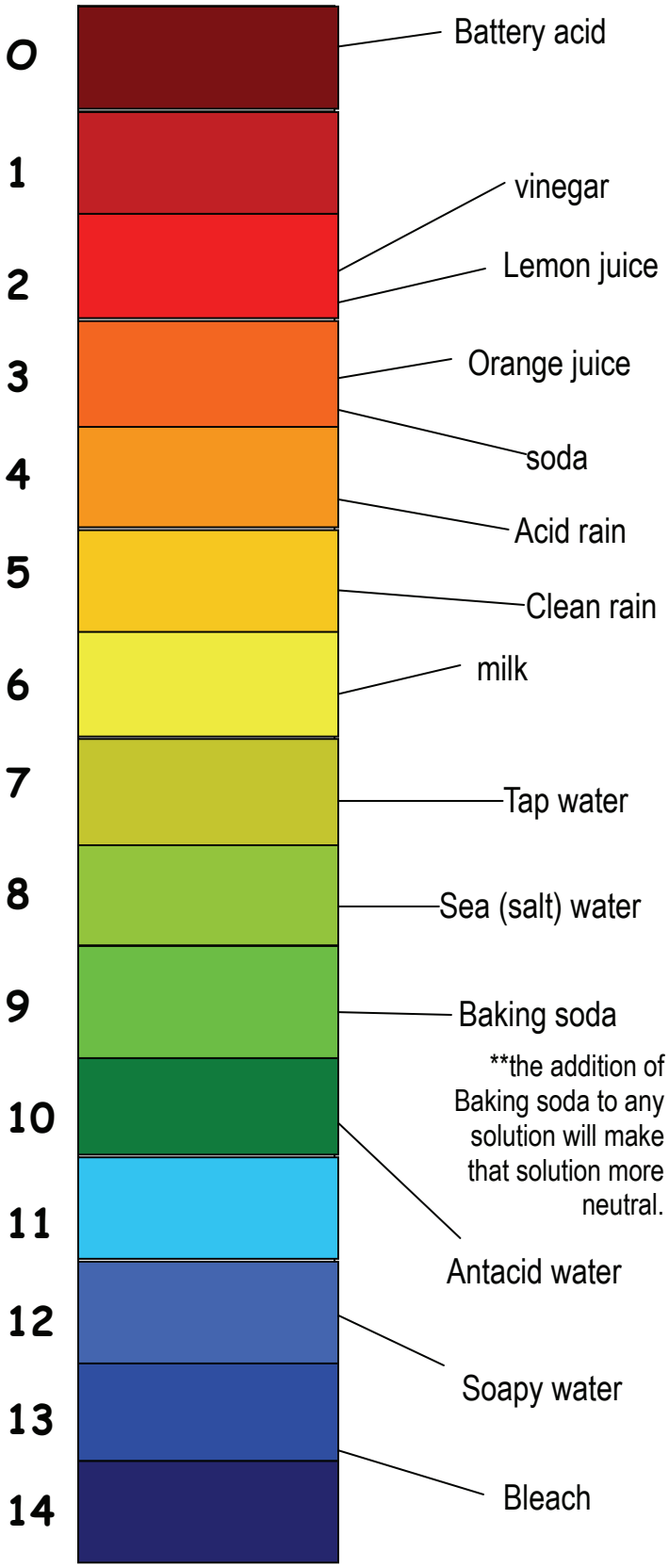
Group Name: **ANSWER SHEET**

	Flora (Plants) PREDICTION?	**Fauna (Animals) PREDICTION?**
Alpine	Moss campion	Pika
What's the Location?	**PINK**	**pink**
Subalpine	Krummholz	Snowshoe hare
What's the Location?	**COLD**	**cold**
Montane	Douglas fir	Beaver
What's the Location?	**WEST**	**west**
Plains	Big bluestem	Burrowing Owl
What's the Location?	**GARB**	**garb**

The Six H's and pH

Name: **ANSWER KEY**

Color the pH scale



Color in the pH scale according to the example. Then using litmus paper, figure out the pH of each solution you test. Draw lines out from the scale and write the solution name next to the correct pH. Using what you gained in the slideshow, answer the below questions.

1. **Who** can help reduce acid rain?
POWER PLANTS THAT POLLUTE, EMISSIONS FROM VEHICLES, PEOPLE

2. **What** color on the litmus paper is basic (alkaline)?
BLUE

3. **When** was the pH most acidic?
WHEN VINEGAR OR LEMON JUICE WAS ADDED

4. **Where** in Boulder County are there problems with waters having low pH?
LEFTHAND WATERSHED, JAMES CREEK, LEFTHAND CREEK

5. **Why** are some streams acidic?
ABANDONED MINE SHAFTS HAVE PILES ("TAILINGS") OF WASTE ROCK, MOSTLY PYRITE. WHEN WATER RUNS OVER PYRITE IT CREATES ACIDIC WATERS THAT DRAIN INTO STREAMS

6. **How** did the solutions become more neutral?
ADD BAKING SODA

Something's Fishy...

Name: **ANSWER KEY**

1. Name three (3) non-point pollution sources that were added to this environment. Also be sure to write where it came from.
   1. DIRT From CONSTRUCTION .
   2. MOTOR OIL From PARKING LOT .
   3. ROAD SALT From DE-ICER .

2. What can nitrogen from fertilizers do to water in the creek?
NITROGEN WILL ADD NUTRIENTS TO THE STREAM, INCREASING ALGAL GROWTH , EVENTUALLY SUFFOCATING FISH

3. Name two (2) things you can do to prevent an "urban stew."
   1. PROPERLY DISPOSE OF WASTE (I.E., DON'T POUR ANY THING DOWN THE STORM DRAIN!)
   2. "SCOOP THE POOP", WASH CAR WITH BIODEGRADABLE SOAP OR AT CAR WASH, MINIMIZE USE OF LAWN CHEMICALS

4. Name three (3) living organisms living in the creek that could be harmed by pollution.
   1. MACROINVERTEBRATES
   2. FISH
   3. BIRDS, FROGS, SALAMANDERS, ETC.

5. A STORM DRAIN is like a gutter. When rain falls, it collects everything in the street. Because it eventually leads to the river, this is source of much of the pollution, or urban stew, that can harm aquatic ecosystems. (Fill in the blank.)

I Understand My H_2O

Name: **ANSWER SHEET**

1. What is a watershed and what happens there?
A watershed is an area of land where water runs down mountains and hills and collects in valley bottoms. The watershed includes all of the water and the land through which it runs and is collected.

2. Describe the stages of the water cycle.
In the book, the stages discussed include evaporation, the water vapor cooling off and forming clouds (condensation), water falling back to Earth (precipitation), and collecting in bodies of water (accumulation). Other parts of the cycle include transpiration, run-off, and percolation (see Activity WC 1).

3. What is an unusual fact about Boulder mentioned in the book?
Boulder is the only city in the United States that owns a glacier.

4. Where do glaciers form? Be sure to explain your reasoning.
Glaciers form in very cold areas where more lots of snow falls, and with ice, build up, melting very little during the summers.

5. Why can't trees grow in the alpine ecosystem?
The winds are too strong and temperatures are too low for trees to grow. The conditions in the alpine tundra are not right for trees to grow and survive.

6. Name one wild animal that lives year-round in the alpine tundra, scurrying among the rocks, making a high-pitched call that sounds like a bird chirping.
Pika (or marmot)

7. What is *flagging* and why do krummholz trees exhibit this trait?
Krummholz (a German word for "twisted wood") trees grow on the edge of the alpine tundra, where it is very cold and windy. They grow close to the ground. All of their branches grow on the one side of the tree that does not get hit by the wind. This is called flagging.

8. True or False. Fewer animals live in the alpine tundra than the prairie. Explain your choice.
True. Because environmental conditions are very harsh at high-altitudes, not many types of animals can live there.

9. Water is stored in which two reservoirs for use in Boulder?
Two reservoirs where water is stored for use in Boulder are the Barker Reservoir and the Lakewood Reservoir.

10. What happens to North Boulder Creek before it flows into Middle Boulder Creek?
North Boulder Creek flows over Boulder Falls before it flows into Middle Boulder Creek. Together, they form Boulder Creek.

11. Name the life zone where the following wild animals can be found. Put a "P" for prairie, "M" for montane, "S" for subalpine and "A" for alpine.

1. Burrowing Owl *(P)*
2. White-tailed Ptarmigan *(A)*
3. Black-footed Ferrets *(P)*
4. Mountain Lion *(S)*
5. Mule Deer *(M)*
6. Pine Marten *(S)*

12. How can some animals live only in the alpine and others live only in the prairie? Name one special feature an animal might have in order to live in the snow.
Animals have adaptations that allow them to survive in a particular environment. In order to live in the snow, an animal might have thick skin and fur, big feet to walk across the snow, or it may molt (change color) in the wintertime to blend in with the white snow.

13. It doesn't often rain enough for farmers to grow crops near Boulder and Longmont. How do they get enough water?
Farmers bring water from the creeks and rivers to their crops. This is called irrigation.

14. Name four possible sources of pollution that drain into Boulder and St. Vrain Creeks.

1. *Fertilizers that help crops grow get into irrigation water.*
2. *Chemicals that kill bugs or keep them from eating corn get into irrigation water.*
3. *Run-off from roads (e.g. oil, ice-melt salt, sediment) gets into creeks and rivers.*
4. *Chemicals that people put on their lawns get into creeks and rivers.*

15. If water dripped off of the edge of the Arapahoe Glacier and traveled all of the way down Boulder Creek and through the system of rivers beyond, where would it end up?
Water from Boulder Creek ends up in the Gulf of Mexico, which is part of the Atlantic Ocean. {See WS 2 for an illustrated map key}

Glossary

Acid precipitation: air pollution resulting from emissions of sulfur and nitrogen compounds and other substances that is transformed by chemical processes in the atmosphere, often far from the original sources, and is then deposited on earth in either wet (i.e., rain, snow, fog) or dry (i.e., gases, particulates) form

Acidic: a solution in excess of hydrogen ions (H+); the condition of water or soil that contains a sufficient amount of acid substances to lower the pH below 7.0

Acidification: acidic waters that cannot support life, possibly a result of nitrogen deposition

Acid Mine Drainage (AMD): the outflow of acidic waters from abandoned mines

Adaptations: special features living beings have that encourage survival in a particular habitat

Alpine: a treeless life zone that includes the highest altitudes of the mountains, usually above 11,000 to 12,000 feet

Alkaline: or basic; a solution in excess of hydroxide ions (OH-); the condition of water or soil which contains a sufficient amount of alkali substance to raise the pH above 7.0

Aquifer: an underground water collection

Bio-indicators (Bioindication): organisms that have the ability to indicate the environmental condition of a particular ecosystem, likely because of their ability (or inability) to survive there

Biota: living organisms such as plants (flora) and animals (fauna)

Bracts: a modified leaf, usually green, from which a flower stalk arises

Buffer: solutions which resist change in pH upon addition of small amounts of acid or base

Carnivore: an animal that eats only other animals (including insects)

Catastrophic Drift: the shifting or transferal of aquatic micro- and macro-organisms due to an unusually severe disaster, such as the introduction of pollutants to a stream

Channelization: to form an artificial course for a river

Chinook winds: warm, dry, usually irregularly occurring winds that come down the eastern slopes of the Rocky Mountains into the plains of eastern Colorado, and are famous for "snow-eating"

Condensation: the process where water vapor cools and changes into tiny liquid water droplets on pieces of dust, which eventually turn into clouds

Confluence: the meeting of two rivers; a point of juncture

Conservation: changing behavioral practices to reduce consumption of resources, in particular, water

Continental Divide: line of elevated terrain which forms a border between two watersheds such that water falling on one side of the line eventually travels to one ocean or body of water, and water on the other side travels to another, generally on the opposite side of the continent

Drought: a severe lack in water resources due to a loss in precipitation or over-consumption of water

Environmental Stressors: physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health

Evaporation: the process where water changes from a liquid to a gas (water vapor)

Evapo-transpiration: the process of transferring liquid water to water vapor in the atmosphere through evaporation and transpiration

Glossary

Facultative: organisms semi-tolerant of pollution

Fauna: animals

Flagging: trees in the krummholz that have no limbs on the side that faces the wind and therefore all limbs then growing in one direction

Flora: plants

Freezing: when water changes from a liquid to a solid

Fusion: when water changes directly from a gas to a solid

Glacier: a large, long-lasting body of snow and ice that builds up over a number of years and never entirely melts

Ground water: water that has collected under the ground over impermeable rock. It then flows laterally toward streams, lakes, or oceans and its upper surface is called the "water table"

Habitat: the area or type of environment in which an animal typically lives

Headwaters: the source of a river or stream, often located at the beginning of a watershed

Herbivore: an animal that eats only plants

Hydrogen ions: H+, resulting from the dissociation of a water molecule (H_20)

Hydrologic Cycle: the water cycle

Hydroxide ions: OH-, resulting from the dissociation of a water molecule (H_20)

Inflorescence: a group or cluster of flowers on a branch of a plant

Krummholz: German for "twisted wood"; stunted forests located just below treeline, at the transition between the subalpine forest and alpine tundra

Leaching: an environmental concern that contributes to contaminated water when rain or snowmelt, seeps into the ground, dissolving chemicals and carrying them into the water supply

Life Zones: often defined by elevation and subsequently environmental conditions, these are areas with similar plant and animal communities

Macroinvertebrates: organisms that lack an internal skeleton and are large enough to be seen with the naked eye

Melting: when water changes from a solid to a liquid

Montane: the life zone that extends from an elevation of about 5,600 to 9,000 feet

Morphological: the structure and form of an organism, such as body shape and size

Niche: the "job" or relationship an animal has with its environment (for example, the niche of an owl could be "predator or eater of rodents in the montane area")

Non-point source pollution: a source with no single point of origin; this is generally carried off the land by storm water; common non-point sources in Boulder County are agricultural pesticides and fertilizers, urban stew, acid mine drainage, construction, and dog excrement

Omnivore: an animal that eats both plants and other animals

Glossary

Percolation (Infiltration): the process where water infiltrates into the soil to collect underground

Perennial: a plant that lives for more than two years, therefore growing deep roots capable of withstanding drought

pH scale: An expression of the intensity of the basic or acid condition of a liquid; may range from 0 to 14, where 0 is the most acid and 7 is neutral

Plains/Prairie: the life zone below 5,600 ft elevation that is flat and extends from the foothills of the Rocky Mountains eastward

Point source pollution: discharge from a stationary location or fixed facility; attributable to any single identifiable source of pollution; such as a pipe or factory smokestack

Precipitation: water that falls to the earth's surface as rain, sleet, hail, or snow from saturated clouds

Predator: an animal or other organism that hunts and kills other organisms for food

Prey: an animal eaten by a predator

Relief Maps: 3-D maps that illustrate depth and altitude of a region

Riparian: zones that are the interface between land or water, often quality habitat areas

River Basin: a watershed that drains into a river

Sensitive: organisms intolerant of pollution

Storm Water: the water that is produced by rainstorms or snowmelt

Subalpine: from 9,000 – 11,000 or 11,500 feet, the life zone that is immediately below the alpine zone

Sublimation: when water changes directly from a solid to a gas (when the temperature of snow is higher than the surrounding air temperature, it slowly changes to water vapor)

Surface Run-off: precipitation that flows across the earth's surface to creeks, rivers, lakes, and oceans

Surface Water: water that is on the earth's surface, such as in creeks, rivers, lakes, oceans, or reservoirs

Tailings: often contaminated with heavy metals, these are the rejected materials from mining operations, often visible as large grayish or golden "piles"

Taxonomy: a hierarchical classification of organisms

Thermopollution: industrial pollution that results from temperature differences, usually caused by factories that intake water to cool off their machines and then return the scalding water to the ecosystem

Tolerant: organisms tolerant to pollution

Topographic Maps: maps that show land contours, curves that represent altitude

Transpiration: the process of plants giving off water vapor containing waste products through their pores.

Timberline/Treeline: the highest altitude at which trees can grow, usually between 11,000 and 11,500 feet

Tundra: a treeless plain at high altitudes

Urban Stew: polluted storm water entering streams from storm drains originating in cities; may include runoff from parking lots or constructions sites, hazardous chemicals, etc.

Watershed: an area of land in which all rain and snow runoff and small tributaries drain into a common body of water such as a creek or lake

Xeriscape: a landscaping method that uses drought-tolerant, native plants

Colorado State Standards

REFERENCE KEY

SCIENCE

1. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
    - 1.1 Asking questions and stating predictions that can be addressed through a scientific investigation.
    - 1.2 Selecting and using simple devices to gather data related to an investigation
    - 1.3 Using data based on observations to construct a reasonable explanation.
    - 1.4 Communicating about investigations and explanations.
2. Physical Science: Students know and understand common properties, forms, and changes in matter and energy.
    - 2.1 Students know that matter has characteristic properties, which are related to its composition and structure.
    - 2.2 Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).
    - 2.3 Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.
3. Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.
    - 3.1 Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.
    - 3.2 Students know and understand interrelationships of matter and energy in living systems.
    - 3.3 Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms.
    - 3.4 Students know and understand how organisms change over time in terms of biological evolution and genetics.
4. Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.
    - 4.1 Students know and understand the composition of Earth, its history, and the natural processes that shape it.
    - 4.2 Students know and understand the general characteristics of the atmosphere and fundamental processes of weather.
    - 4.3 Students know major sources of water, its uses, importance, and cyclic patterns of movement through the environment.
    - 4.4 Students know the structure of the solar system, composition and interactions of objects in the universe, and how space is explored.
5. Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.
    - 5.1 Recognizing the diversity of resources provided by the Earth and Sun.
    - 5.2 Inventing a device that addresses an everyday problem and communicating the problem, design, and solution.
    - 5.3 Describing resource-related activities in which they could participate that can benefit their communities.
    - 5.4 Identifying careers that use science and technology.
6. Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.
    - 6.1 Recognizing that when a science experiment is repeated with the same conditions the experiment generally works that same way.
    - 6.2 Comparing knowledge gained from direct experience to knowledge gained indirectly.
    - 6.3 Identifying observable patterns and changes in their lives and predicting future events based on those patterns.
    - 6.4 Describing and comparing the components and interrelationships of a simple system.
    - 6.5 Comparing a model with what it represents.

Colorado State Standards

REFERENCE KEY

GEOGRAPHY

1. Students know how to use and construct maps, globes, and other geographic tools to locate and derive information about people, places, and environments.
    1.1 Students know how to use maps, globes, and other geographic tools to acquire, process, and report information from a spatial perspective.
    1.2 Students develop knowledge of Earth to locate people, places, and environments.
    1.3 Students know how to analyze the dynamic spatial organization of people, places, and environments.
2. Students know the physical and human characteristics of places, and use this knowledge to define and study regions and their patterns of change.
3. Students understand how physical processes shape Earth's surface patterns and systems.
    3.1 Students know the physical processes that shape Earth's surface patterns.
    3.2 Students know the characteristics and distributions of physical systems of land, air, water, plants, and animals.
4. Students understand how economic, political, cultural, and social processes interact to shape patterns of human populations, interdependence, cooperation, and conflict.
    4.3 Students know the patterns and networks of economic interdependence.
5. Students understand the effects of interactions between human and physical systems and the changes in meaning, use, distribution, and importance of resources.
    5.1 Students know how human actions modify the physical environment.
    5.3 Students know the changes that occur in the meaning, use, location, distribution, and importance of resources.
6. Students apply knowledge of people, places, and environments to understand the past and present and to plan for the future.
    6.2 Students know how to apply geography to understand the present and plan for the future.

MATHEMATICS

1. Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.
2. Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.
3. Students use data collection and analysis, statistics, and probability in problem-solving situations and communicate the reasoning used in solving these problems.
4. Students use geometric concepts, properties, and relationships in problem-solving situations and communicate the reasoning used in solving these problems.
5. Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
6. Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic, paper-and-pencil, calculators, and computers, in problem-solving situations and communicate the reasoning used in solving these problems.

LANGUAGE ARTS

1. Students read and understand a variety of materials.
2. Students write and speak for a variety of purposes and for diverse audiences.
3. Students write and speak using conventional grammar, usage, sentence structure, punctuation, capitalization, and spelling.
4. Students apply thinking skills to their reading, writing, speaking, listening, and viewing.
5. Students read to locate, select, and make use of relevant information from a variety of media, reference, and technological sources.
6. Students read and recognize literature as an expression of human experience.

FOSS MODULES

ENVIRONMENTS (5th Grade)

Reading Comprehension
RC: I Understand My H_20

Boulder County's Flora, Fauna and Life Zones
F^2LZ 1: The Life Zone Address
F^2LZ 2: Reporting on Wildlife
F^2LZ 3: Boulder County Cocktail
F^2LZ 4: Macroinvertebrate Mania!

The Water Cycle
WC 1: Behind the Scenes: Tracking the Water Cycle
WC 2: The H_20 Dem-O
WC 3: Aquatic Voyage
WC 4: A Watery Journey

Human Impact on Water
HI 2: The Six H's and pH
HI 3: Something's Fishy…
HI 4: Action!

LANDFORMS (5th Grade)

Reading Comprehension
RC: I Understand My H_20

Our Watersheds
WS 1: The Long, Long Journey
WS 2: Map your Shed
WS 3: Our Backyard Drinking Water Supply
WS 4: We All Live Downstream

The Water Cycle
WC 3: Aquatic Voyage
WC 4: A Watery Journey

WATER (4th Grade)

Reading Comprehension
RC: I Understand My H_20

The Water Cycle
WC 1: Behind the Scenes: Tracking the Water Cycle
WC 2: The H_20 Dem-O
WC 3: Aquatic Voyage
WC 4: A Watery Journey

SCIENCE TO GO KITS

ACID RAIN (SK-0085)

Human Impact on Water
HI 2: The Six H's and pH

WEATHER WISE (SK-0013)

Reading Comprehension
RC: I Understand My H_20

The Water Cycle
WC 1: Behind the Scenes: Tracking the Water Cycle
WC 2: The H_20 Dem-O
WC 3: Aquatic Voyage
WC 4: A Watery Journey

REDUCE, REUSE, RECYCLE (SK-0094)

Our Watersheds
WS 3: Our Backyard Drinking Water Supply
WS 4: We All Live Downstream

Human Impact on Water
HI 1: A Precious Resource
HI 2: The Six H's and pH
HI 3: Something's Fishy…
HI 4: Action!

MICROSCOPE KIT (SK-0001)

Boulder County's Flora, Fauna and Life Zones
F^2LZ 4: Macroinvertebrate Mania!

HOW THE WASTE WAS WON (SK-0093)

Human Impact on Water
HI 4: Action!

See contact information in A-4.

Boulder County Open Space and Mountain Parks

City of Boulder Open Space and Mountain Parks

Colorado History
Although not directly related, the book and some of the activities could be connected to the study of Colorado history. Call WASH for more information on the Water History Trunk.

EPA Watershed Handbook

Fifth Grade Water Festival
The book *My Water Comes From the Mountains* and any of the activities in the MY H2O can be integrated with attendance at the annual Fifth Grade Water Festival both on the University of Colorado campus and in Longmont, usually in May.

Fifth Grade Outdoor Education Trips
The book *My Water Comes from the Mountains* and any of the activities in the Teacher's Guide can be integrated with Outdoor Education trips. Boulder County's Flora, Fauna and Life Zones -themed activities are especially applicable.

Girl Scout "Water Drop Patch"
The EPA and Girl Scout Council have developed a new patch to encourage girls to make a difference in their community by becoming watershed and wetlands stewards. Exploring the natural world to gain interest in science and math, Scouts can earn their Water Drop Patch by educating others in their community about the need to protect the nation's valuable water resources. Visit http://www.epa.gov/adopt/patch for more information.

Global Learning and Observations to Benefit the Environment (GLOBE)
GLOBE is a worldwide hands-on, primary and secondary school-based education and science program. The program gives students the opportunity to learn by taking scientific measurements, reporting their data, publishing their research projects, creating maps and graphs, and working with other GLOBE students around the world. Teachers can be trained at workshops and receive continuing support from the program.

Longmont Conservation District
There are a variety of resources available free from LCD on a first come first served basis. The *Stream Table* and *Groundwater Display* are usually left in the classroom for 2 weeks at a time. Each teaching tool observes the movement of water, either above or below ground. Also consider the *River Riparian Trailer*, however it is borrowed from another conservation district, so availability is more limited. This is pulled behind a pickup truck and usually an outdoor demonstration given by district staff. It is a larger version of the stream table and will usually have several classes visit the demonstration on the same day.

Longmont Green Up Clean Up

Niwot Ridge Long-Term Ecological Research (LTER) station
Thanks to the Schoolyard-LTER program, Niwot Ridge LTER has carried out a K-12 outreach program from 1998 through the present time by collaborating with existing programs for children in the Denver/Boulder area and by working specifically with the Boulder Valley School District. The conceptual theme of the outreach is the connection between the alpine systems in the mountains and the communities of the Rocky Mountain Front Range. These communities are located at the intersection of the Great Plains and the Rocky Mountains, and have been expanding in population and development. We have found that in elementary and middle school years, children are particularly receptive to environmental education that emphasizes discovery, exploration and empathy with their local environment.

Also look for *The Lost Seal* by Diane McKnight and other LTER Children's Books from varying ecosystems across the world!!

See contact information in A-4.

River Watch

Developed by the Colorado Division of Wildlife, this exciting and far-reaching program involves volunteers in protecting the quality of Colorado rivers. It links environmental protection with education in a meaningful, hands-on project for Colorado residents. The program provides an educational opportunity for students to understand and value our river ecosystems. The students, with supervision and support from their teachers and schools, monitor a portion of a river near their community, collecting biological, physical, and chemical data over time. After data collection, the kids learn how these three parameters interact to produce the river ecosystem. Data collected is used by federal, state and local agencies to make decisions about river/water management.

Thorne Ecological

Founded in 1954, Thorne Ecological Institute builds Earth stewardship by "connecting kids to nature" through hands-on environmental education. Thorne is located at Sombrero Marsh Environmental Education Center in Boulder.

The Watershed Approach to Stream Health (WASH) Project

WASH is a partnership of Colorado communities in the Boulder and St. Vrain watersheds, and includes Boulder County; the cities of Boulder, Longmont, and Louisville; and the towns of Erie and Superior. WASH offers free educational programs to students throughout Boulder County, bringing water to life with fun and fascinating classroom programs and field activities. The primary goal of the WASH Project is to implement a regional stormwater management program, not only to comply with the federal Phase II stormwater regulations, but to also address broader water quality watershed issues. The WASH Project uses a unique, collaborative approach to involve various levels of government, placing significant emphasis on cost-effectiveness by sharing programs and by using common strategies throughout the watershed.

Wild Bear Center for Nature Discovery

Located in the mountains of Nederland, Colorado, the Wild Bear Center for Nature Discovery offers year round hands-on educational programs to people of all ages to foster a life long appreciation of the environment and to promote an environmentally aware, responsible and ecologically sound community.

Kit List

NON-CONSUMABLES

CDs
MY H20 MUSIC (1): WC, WS, F^2LZ
MY H2O PRESENTATIONS (1): HI 3, HI 2

VIDEO
Channel 8: *Boulder Water Story*

Envelopes
WC 3: The Incredible Journey— water station pictures & labels (9)
WS 3: Our Backyard Drinking Water Supply— Boulder maps (6), Longmont maps (6) and addendum (6)
F^2LZ Fact Sheets (6 sets, 4 pages each)
F^2LZ 1: Life Zone Location— laminated clues (6 envelopes) and laminated answers (1 envelope)
F^2LZ 4: Kick n' Pick Macroinvertebrate Sampling— laminated taxonomy charts (6)
HI 2: The Six H's and pH—laminated, color-coded pH scale (6)
HI 3: Something's Fishy— script (1) with laminated pollution pictures (11)
MAPS = 1980 USGS topographic maps (3): WS 2, WS 1, HI 3; Latitude 40 topographic maps (3): WS 2, WS 1, HI 3; Central/Western U.S. Road Map (1): WS 1

Ziplocks
WC 3: Incredible Journey Dice (9)
Marble sac (1): F^2LZ 3
Bandanas (6): F^2LZ 3
Pipettes (12): F^2LZ 4, HI 1, HI 2
F^2LZ 4 hand lenses (6)
F^2LZ 3: Boulder County Cornucopia—Flora & Fauna Tags (28) *laminated pictures with string attached*
F^2LZ 4: Macroinvertebrate Mayhem—Bioindicator Tags (28) *laminated game pieces with string attached*
HI 3 Pollution Shakers (5)

Not contained
"Denver's Playground" 3-D Satellite Relief Map (1): WS 2 [**outside of kit!**]
The Magic School Bus at the Waterworks, by Joanna Cole (1): WC 1—4
spray bottle (2): WS 2, HI 3
water soluble markers (8): WS 2
ball of yarn (1): F^2LZ 3
nets (6): F^2LZ 4
ice trays (3?): F^2LZ 4
1000-mL container (1): HI 1, WC 2
100-mL graduated cylinder (1): HI 1

CONSUMABLES

Non-perishable
*Dixie cups (100): HI 2
*sticky notes (5 colors): WS 2
*pH litmus paper (100): HI 2

Perishable
*powdered Kool-Aid (5 packets): *within the HI 3 Pollution Shakers*
*vinegar (1 bottle): HI 2
*lemon juice (1 bottle): HI 2
*salt (1 canister): HI 2
*liquid soap (1 bottle): HI 2
*baking soda (1 box): HI 2
*antacids (1 container): HI 2

Educational Programs for Children	Phone Number	Can a guest speaker visit my classroom?	Can my classroom visit their field site, or will they lead a field trip?	Is there a fee for their programs?
Agricultural Heritage Center	303-776-8848	No	Yes	No
Boulder County Parks and Open Space	303-441-3899	Yes	Yes	No
City of Boulder Open Space/Mountain Parks	720-564-2058	Yes	Yes	No
City of Boulder Watershed Outreach Program	303-413-7365	Yes	Yes**	No
Watershed Approach to Stream Health (WASH) Education Program	303-413-7365	Yes	Yes	No
http://bcn.boulder.co.us/basin/WASH/				
CalWood	303-499-0603	No	Yes	Yes
http://www.calwood.org				
Environmental Center at CU-Boulder, Earth Education	303-492-8308	Yes	No	No
http://ecenter.colorado.edu/earthed/index.html				
Lefthand Watershed Oversight Group	720-938-5438	Yes	Yes	No
http://www.lwog.org				
James Creek Watershed Initiative	303-449-2621	No	n/a	n/a
Niwot Ridge Long-Term Ecological Research (LTER) station	303-492-1867	No?	Yes	No
http://culter.colorado.edu/NWT/outreach/outreach.html				
Plains Conservation Center (Aurora)	303-693-3621	No	Yes	Yes
http://www.plainsconservationcenter.org				
Science Discovery CU-Boulder	303-492-7188	Yes	Yes	Yes
http://www.colorado.edu/ScienceDiscovery/				
Thorne Ecological Institute	303-499-3647	Yes	Yes	Yes
http://www.thorne-eco.org				
Wild Bear Center for Nature Discovery	303-258-0495	Yes	Yes	Yes
http://www.wildbear.org				
YMCA of the Rockies - Estes Park Center	970-586-3341 x1106	No	Yes	Yes
YMCA of the Rockies - Snow Mountain Ranch	970-887-2152 x4131	No	Yes	Yes
http://www.ymcarockies.org				

Local Resources

Water Treatment Facilities that Offer Free Tours	Phone Number
City of Boulder Wastewater Treatment Plant** (5th grade +)	303-413-7340
Boulder Drinking Water Treatment Plant	303-441-3248
Longmont Drinking Water Treatment Plant	303-651-8481
Longmont Wastewater Treatment Plant	303-651-8382
Louisville Drinking Water Treatment Plant	303-335-4792
Louisville Wastewater Treatment Plant	303-335-4780
Town of Erie Drinking Water Plant	303-665-6933
Town of Erie Wastewater Treatment Plant	303-926-2895
Town of Nederland Drinking Water Treatment Plant	303-258-7985
Town of Nederland Wastewater Treatment Plant	303-258-3266

**Under heavy construction, no tours until 2008 (at the earliest)

Informational Resources	Phone Number
BVSD Science Coordinator/FOSS Center	303-447-5106
SVVSD Science Coordinator	303-682-7246
Longmont Conservation District	303-776-4034 x3
City of Boulder (COB) Water Conservation Office	303-413-7407
COB Stormwater Quality Office	303-413-7350
COB Drinking Water Program	303-413-7400
GLOBE	303-497-3580
	303-497-2581
River Watch	303-291-7412

Web Resources

American Ground Water Trust	www.agwt.org
BASIN (Boulder Area Sustainability Information Network)	www.basin.org
Boulder County Audubon Society	www.boulderaudubon.org/
Boulder County Nature Association	www.bcna.org/
Boulder Creek Watershed Initiative	bcn.boulder.co.us/basin/bcwi/
Boulder Saves Water	www.bouldersaveswater.net/
Clean Water Action Colorado	www.cleanwateraction.org/co/
Colorado Alliance for Environmental Education	www.caee.org
Colorado Foundation for Water Education	cfwe.org
Colorado Geological Survey	geosurvey.state.co.us
Colorado Division of Water Resources	water.state.co.us
Colorado Source Water Assessment and Protection	www.cdphe.state.co.us/wq/sw/swaphom.html
Colorado Water Congress	www.cowatercongress.org/
Colorado Water Conservation Board	www.cwcb.state.co.us
Channel 7, Interactive Environment: Watersheds	http://kmgh.iewatershed.com/
Colorado Water Protection Project	www.ourwater.org
Colorado Water Quality Control Commission	www.cdphe.state.co.us/op/wqcc/wqcchom.asp
Colorado Water Quality Control Division	www.cdphe.state.co.us/wq/wqhom.asp
Colorado Watershed Protection Fund	www.coloradowater.org/cwpf.htm
CSU's Water Knowledge Page Water Knowledge	waterknowledge.colostate.edu/default.htm
Drought Response Information Project	www.thedripwebsite.com/
Environmental Concern, Inc.	www.wetland.org
Healthy Water Healthy People	www.healthywater.org
H2ouse Water Saver Home	www.h2ouse.org
EPA Water for Kids	www.epa.gov/water/kids/waterforkids.html
EPA Office of Water	www.epa.gov/owow/nps.kids
EPA Watershed Handbook	www.epa.gov/owow/nps/watershed_handbook
The Groundwater Foundation	www.groundwater.org
Kidfish	www.kidfish.bc.ca
Lefthand Water District	www.lefthandwater.dst.co.us
Lefthand Watershed Oversight Group	www.lwog.org
Native Waters	www.nativewaters.org/
The Nature Conservancy	www.nature.org
Project WET	www.projectwet.org
River of Words	www.riverofwords.org
River Watch	wildlife.state.co.us/riverwatch/
Sierra Club, Indian Peaks	rockymtn.sierraclub.org/ipg/
Sinapu Carnivore Restoration, Boulder	www.sinapu.org/
USGS Water Science for Schools	ga.water.usgs.gov/edu
WASH	www.basin.org/wash

Kit Checklist

PLEASE BE SURE THAT EACH ITEM IS ACCOUNTED FOR!
Thank You :)

Inside the Kit:

1- Curriculum Guide

6– Bottles/containers
Please be very cautious that these items stand upright and are tightly sealed!
*vinegar (1 bottle)
*lemon juice (1 bottle)
*salt (1 canister)
*liquid soap (1 bottle)
*baking soda (1 box)
*antacids (1 container)

2– CDs
MY H20 MUSIC CD
MY H2O POWERPOINT CD

8- Envelopes
WC 3 Aquatic Voyage
WS 3 Our Backyard Drinking Water Supply
F^2LZ Fact Sheet
F^2LZ 1 Life Zone Location
F^2LZ 4 Kick n' Pick Macroinvertebrate Sampling
HI 2 The Six H's and pH
HI 3 Something's Fishy
MAPS

10- Ziplocks
WC 3 Aquatic Voyage Dice (9)
Marble sac (40)
Bandanas (6)
Pipettes (12)
F^2LZ 4 hand lenses (6)
F^2LZ 3 Flora & Fauna Tags (28)
F^2LZ 4 Bioindicator Tags (28)
HI 3 Pollution Shakers (5)
WS 2 sticky notes (5 colors)

pH litmus paper
water soluble markers (1 pack of 8)

spray bottle (2)
ball of yarn (1)
nets (6)
ice tray (1)
1000-mL glass container (1)
100-mL graduated cylinder (1)
Dixie cups
The Magic School Bus at the Waterworks, by Joanna Cole

1 item outside the kit
"Denver's Playground" 3-D Satellite Relief Map

Evaluation Form

Name/Organization: _____

PLEASE FILL OUT ONE (1) FORM, FRONT AND BACKSIDE.
This is an overall assessment.

Please rate the following on a scale of 5 (highest) to 1 (lowest). Include comments.

1. Fairness and Accuracy 5 4 3 2 1
The teacher's guide is a fair and accurate presentation of activities describing environmental problems, issues, and conditions.
Comments:

2. Depth 5 4 3 2 1
The teacher's guide focuses concepts around themes and presents activities within a context of fostering local and global environmental awareness in students.
Comments:

3. Emphasis on Skills Building 5 4 3 2 1
The teacher's guide gives students a chance to use critical and creative thinking and apply their knowledge to resolve environmental problems.
Comments:

4. Action Orientation 5 4 3 2 1
The teacher's guide promotes civic responsibility by encouraging students to use their knowledge of environmental issues for problem solving and action.
Comments:

5. Instructional Soundness 5 4 3 2 1
The teacher's guide relies on instructional methods that create an effective learning environment, including learner-centered instruction, different ways of learning, developmentally appropriate and interdisciplinary activities, and connect to learners' everyday lives.
Comments:

6. Usability 5 4 3 2 1
The teacher's guide is well designed and easy to use. The activities are clear, adaptable to a range of learning situations, include sufficient background information, fit with state standards, and diverse.
Comments:

Activity Evaluation Form

IF YOU HAVE COMMENTS ON A PARTICULAR ACTIVITY, PLEASE FILL OUT THIS FORM.

Evaluator _____

Class Age/Grade _____

School _____

Activity _____

Please rate the following on a scale of 5 (highest) to 1 (lowest). Include comments.

1. EFFECTIVENESS OF CONTENT 1 2 3 4 5
Objectives, skills and standards were met and considered important.
Comments:

2. STUDENT INTEREST 1 2 3 4 5
The activity was age-appropriate and the class was engaged in the project. Students were motivated and eager to discuss.
Comments:

3. APPLICABILITY TO EXISTING CURRICULUM 1 2 3 4 5
The activity integrated well with language arts, geography, math and/or science standards. Suggested links to FOSS Modules or Science-to-Go kits were useful
Comments:

4. TEACHER FRIENDLINESS OF LESSON PRESENTATION 1 2 3 4 5
The background provided sufficient information, and the activity was easy to follow and implement.
Comments:

5. SUPPLEMENTAL MATERIALS INCLUDED 1 2 3 4 5
Kit supplies were helpful and necessary. They were easy to find. There were sufficient materials for each student. If associated, included musical CD songs were relevant and well-liked, and/or the Powerpoint presentation was of use.
Comments:

6. PLEASE INCLUDE ANY OTHER COMMENTS.