

2004 Children's Water Festival



Activity Notebook

Teacher Copy

Week 1: April 5-9
Water: Essential for Life
 Week 2: April 12-16
Droplet Contest
 Week 3: April 19-23
 Week 4: April 26-30
Flashflood: climb to safety
 Week 5: May 3-7
 Week 6: May 10-14
Take Action
 Classroom Time: 45-60 minutes

Objective:
 Choose an outdoor project to help your class understand the connection between water quality and the urban setting.

Background:
 1. Why good water is important. Discuss why good water quality is important for humans, wildlife and the land.

Activity 1 - Before or After Water
The Water Cycle, a Drop of History
 Classroom Time: 10 minutes prep time
 (Adapted from the USGS site: <http://www.gso.org/education/>)

Activity 2--Before or After
 Activity 3--Before or After
 Activity 4--Before or After
Mapping Your Watershed
 Classroom Time: 45 minutes

Objective:
 To discuss the definition of a 'watershed', to identify watersheds, and to discuss the importance of water quality.

Definition:
 Watershed: (n) 1. Water pouring and draining to a common body of water, river or ocean. (Remember if water from these areas generally connect to the same body of water, they are in the same watershed.)

Instruction for Class Activity:
 1. Have students look at several types of maps surrounding the body of water in your watershed.

2. Identify where the water in your watershed body of water, river or ocean. (Remember if water from these areas generally connect to the same body of water, they are in the same watershed.)

3. Discuss the geography of your watershed. List sources of pollutants.

4. Draw on large map of your watershed. Landmarks, etc. Don't forget to include the city of Boulder.

Materials Needed:
 Poster board or other large sheet of paper
 Markers and/or paints
 Maps (state, local maps, Boulder County map)
 Call 303-441-7345 to check out

Instruction for Class:
 Adapt a section of stream or creek in Boulder. 303-441-7345.

Reference
 Watery World
 Water Wizards
 Boulder District

Before or After Festival
 Activity 1: The Water Cycle and Evaporation
 Activity 2: Boulder Water Story
 Activity 3: Collecting Macroinvertebrates
 Activity 4: Mapping Your Watershed

Day of Festival
 1. Have Fun
 2. Wear your T-shirt
 3. Help teachers find classrooms and stay on schedule. Look for the water drop on each classroom door.

Children's Water Festival
 Tuesday, May 17
Ambassador Responsibilities

Before Water Festival
 1. Make preparations to take about the Water Festival. (Worksheet on back will help.)
 What is the festival and its purpose?
 Where and when is it?
 What is the class to do?
 What are the T-shirt forms?
 What do we wear them?

2. Coordinate weekly activities with your teacher from the Water Festival Activity Notebook.
 Water Festival Activity Notebook contains the following activities:
 Week 1: Water - Essential for Life
 Week 2: Water - Essential for Life
 Week 3: Water - Essential for Life
 Week 4: Flash Flood
 Week 5: Use Water Wisely
 Week 6: Take Action

Week 1: April 5-9
Water: Essential for Life
Classroom Time: 45-60 minutes

 **Objective:**

To get you and your students excited about WATER! This lesson is to learn how and why water is essential for life. Students will learn where their drinking water comes from, how much water they are made of and why drinking plenty of water will help keep you healthy. By becoming aware of their close relationship to water we hope the students will develop respect for this precious resource and take an active role in conserving and preserving it.

 **Background:**

1. **Water is the world's most precious resource.** To keep our planet and its creatures alive and healthy, clean water is essential. Pollution can contaminate our drinking water sources and it presents a danger to fish and other creatures that live in our streams, rivers and lakes.

2. **The earth is about 75% water!** But, we cannot use all of the water for drinking, growing crops, manufacturing goods and so forth, because much of the water has salt in it or is frozen.

Watery World Work Sheet: All the Water in the World

A fun way for the students to think about how much fresh water is available for their use is to imagine that all the water on Earth equaled 100 gallons, in that case:

97 gallons would be salt water

2 gallons would be ice (glaciers, ice caps)

.8 of a gallon would be groundwater

.2 of a gallon would be surface water (all the rivers, lakes, wetlands and clouds/vapor) on Earth

Since the fresh water available for our use and for all creatures that live in it or depend on it, is less than 1% of all water in the world, it is important that we use it wisely and protect it from pollution.

3. **Where does our drinking water come from?** It is important for people to know where their drinking water comes from so that they can protect it from pollutants and have a "better sense of place." Provided is information about the sources of your drinking water and how it is treated. (If your town is not listed, please contact us, or your water provider.)

Boulder: Silver Lake/Lakewood watershed on North Boulder Creek, Barker Reservoir on Middle Boulder Creek and Boulder Reservoir sources.

Louisville: South Boulder Creek and water from the Northern Colorado Water Conservancy District.

Check www.ci.louisville.co.us/publicworks/watertreat.htm for more information.

Lafayette: South Boulder Creek.

Superior: Lake Granby, Carter Lake and Terminal Reservoir.

Nederland: Middle Boulder Creek.

Broomfield: Carter Lake.

Jamestown: Surface water from James Creek.

Gold Hill: Private wells owned by individuals.

4. **How is our drinking water treated?** Each city has a water treatment plant that cleans and disinfects the water, making it safe to drink. Remind students that they should never drink water directly from a creek because the water can carry many diseases including giardia (from animal waste), bacteria, and pathogens (nasty micro-organisms that can make you very sick). To clean water for drinking, it goes through a process of filtration and sedimentation to remove particulates (like dirt). Chlorine is added to kill micro-organisms like giardia. The city of Boulder's Consumer Confidence Report (CCR) included in this packet provides information about water treatment in general and will work for describing the treatments process regardless of where you live. Our drinking water tastes great, is high quality and a good value. It costs \$1.60 per thousand gallons.

5. **What good water means for you.** Our bodies are more than 60% water. To stay healthy, you should drink between 6 and 8 (8 oz) glasses of water a day.

Over

Instruction for Class Activity:

Have Student Ambassador(s) introduce the Water Festival to your class--what, when and where. Pass out t-shirts and explain that you have selected a Water Day each week and that they are to wear their t-shirts on that day. Each Water Day they will learn something new about water. Tell them the different activities the class will be involved in between now and May 17.

Week 1: Water: Essential for Life

Week 2: Water: "Every Drop Counts" Poster Contest

Week 3: Water Wizards

Week 4: Flood! Climb to Safety

Week 5: Water: Enough to use, not enough to waste

Week 6: Take Action.

1. **Discussion:** Have students name all the different ways water is essential to life. List these on the board.

2. **Pass out copies of the Watery World worksheet.**

Have students predict how much of the earth's water is salt, ice, ground water and surface water. (Answer on other side.)

Questions: What percent of the the earth's water is available for drinking? (less than 1%)

What does that tell us? (We need to protect and conserve water. Discuss how.)

3. **Drinking water sources.**

Question: Where does your drinking water come from? (answer on other side)

Question: Why is it important to know this?

A map is located in the packet for students to locate your city's drinking water source(s).

4. **Drinking water treatment.**

Question: How is drinking water treated? (answer on other side)

Question: Why is important to treat water before drinking it? (answer on other side)

Question: How much does it cost to treat your water? (answer on other side)

Remind students that it is not okay to drink water directly from a creek.

5. **Water and you.**

Question: What percentage of your body is water? (answer on other side)

Question: How many glasses of water should you drink a day? (answer on other side)

Materials Needed:

Watery World Work Sheet (One is provided in reference materials, you will need to copy it for students.)

Colored Pencils

Boulder County Map (provided)

Boulder CCR (provided)

To Learn More about your drinking water call:

Boulder 303-413-7400

Louisville 303-666-6565

Lafayette 303-665-5588

Nederland 303-258-3266

Jamestown and Gold Hill 303-441-1190 (Boulder County Health Department)

Superior 720-304-6797

Or check out www.waterdata.com.

Week 2: April 12-16

Poster Contest

Classroom Time: 45-60 minutes plus additional time if needed

🍷 Objective:

To creatively express ideas about "Keep it clean, 'cause we're all down stream" by making a poster.

🍷 Instruction for Class Activity:

1. Have students create posters based on the theme "Keep it clean, 'cause we're all down stream". Students are encouraged to draw an image with this theme, they don't necessarily need to use these words.
2. If possible display posters in classroom and/or in your halls.
3. After display, send posters to Water Quality Office no later than Friday, April 30.

🍷 Rules:

Winning posters will be displayed at the Festival!

Theme: "Keep it clean, 'cause we're all down stream"

Submittal: Posters should be submitted on plain, white paper, no larger than 11x17. Posters can be done in pencil, ink, watercolor, crayon or markers. The more colorful and imaginative, the better. Computer generated artwork will not be accepted.

Clearly write student name, teacher and school on the back of entry.

Posters must be received at the Water Quality Office no later than Friday, April 30.

🍷 Materials Needed:

White paper, no larger than 11x17

Markers, paint, crayons, wildlife pictures, cutouts, construction paper, etc.

Student Ambassadors: Send in posters no later than Friday, April 30 to:
Children's Water Festival
4049 N. 75th St.
Boulder, CO 80301

Week 3: April 19-23
Water Wizards Trivia
Classroom Time: 45 minutes

 **Objective:**

To educate students about water resources in Boulder County in a fun trivia game.

 **Background:**

1. **Water Wizards Trivia Contest.** There will be a Water Wizards Trivia contest at the Water Festival on May 13. Four students from your school will compete against four students from another school. All 5th grade students from your school will attend the contest to cheer on their classmates.

 **Instruction for Class Activity:**

1. **Team Selection:** Each school is responsible for selecting a four-student team to represent their school (note: if you have more than one class attending, you may want to select a couple of students from each class). The process used to select the students is up to the teachers.
2. **Water Wizards Trivia.** Water Wizards Trivia questions and answers are included in this packet. It is important for your team to study the questions and answers prior to the trivia contest at the Festival.
3. **Practice.** Practice on the BASIN interactive quiz at: <http://bcn.boulder.co.us/basin/quizes/index.shtml>.

Materials Needed:

 Water Wizards Trivia Questions and Answers (One is provided in reference materials, you will need to copy it for students.)

Week 4: April 26-30

Flashflood: climb to safety

Classroom Time: 45-60 minutes

Objective:

To teach students about the danger of floods, that Boulder is the #1 flood risk community in Colorado and how they can stay safe during a flood.

Background:

1. **Boulder #1 in flood risk.** Because Boulder is situated at the base of the mountains, there is an ever-present threat of flooding, particularly when spring rains or cloud bursts combine with melting snow from the mountains. Creeks can quickly turn into raging rivers, especially if they are already full from melting snow. Floods have always been a part of Boulder's history. Floods have been recorded every few years. The last 100-year major flood occurred in 1894.

2. **Rivers are measured by rate of flow.** The rate of flow of a river or flood is measured by the quantity of water over time. This is often referred to as discharge: "the rate at which a volume of water passes a given point in a given amount of time." Common units are cubic feet per second (cfs) and cubic meter per second (cms). A cubic foot is like a box of water measuring 1 foot by 1 foot by 1 foot. The USGS defines cubic foot per second (cfs) as "the flow rate or discharge equal to one cubic foot of water per second or about 7.5 gallons per second."

3. **What is Boulder Creek's CFS?** The discharge of Boulder Creek near the Public Library can range from 2 to 3 cfs in the winter and 15 to 120 cfs or more in summer depending on run-off from snowmelt and rain storms in the foothills. The spring run off often times closes parts of the Boulder Creek bike path. In the case of a 500-year flood the cfs for Boulder Creek would be an estimated 29,600!

4. Important Terms.

Flood Probabilities--The terms 10-year, 50-year, 100-year and 500-year floods are used to describe the estimated probability of a flood event happening in any given year. A 10-year flood has a 10% probability of occurring in any given year, a 50-year flood has a 2% probability, a 100-year as a 1% chance and a 500-year has a .2% probability.

Flood Watch or Flash Flood Watch--Flooding may happen soon. Stay tuned to the radio or television.

Flood Warning--A flood may be happening or will be very soon. You may be asked to leave the area.

Flash Flood Warning--A flash flood is happening. Get to higher ground right away.

Check out the BASIN website at www.BASIN.org for local flood information.

Instruction for Class Activity:

1. Using the Boulder County map discuss which creek is nearest your school and/or which creek students live near. Explain to students that the question is not if there will be a major flood in Boulder, but when.

2. Review the terms above.

3. Do the flood exercise located in the reference materials.

Materials Needed:

Calculators

Boulder County Map (provided)

Flood Work Sheet (One is provided in reference materials, you will need to copy it for students.)

For a class set of maps, contact 303-413-7365

Week 5: May 3-7
Use Water Wisely
Classroom Time: 45-60 minutes

Objective:

To look at the numerous ways we use water on a daily basis. This activity will help your students explore which uses are essential and which activities may waste water.

Background:

1. **How is water wasted.** As we learned in week 1, less than 1% of the earth's water is good for people to use. Therefore we need to use it wisely. Water is wasted in a variety of ways. It's surprising how much water we use in our daily activities, such as when we brush our teeth, wash our hands, take a shower and so on. By leaving the water on while we brush our teeth, we waste between one to five gallons of water per minute. A leaky toilet can waste up to 500 gallons a day. A 5-minute shower can use between 10 and 50 gallons less water than a 10-minute shower.

Instruction for Class Activity:

1. Brainstorm all the different things we use water for during the day. Talk about which ones are essential and which uses might waste water.

2. Brainstorm conservation ideas. Here are a few:

Bathroom--75% of water used in a house is used in the bathroom. If you turn off the water while washing your face or brushing your teeth, you can save about four to ten gallons per day.

Eating out--For every glass of water brought to the table it required 2 more glasses of water to wash and rinse the used cup. Therefore, if you don't want a glass of water, let the server know and avoid a total of three glasses water wasted.

Faucets--A slow dripping faucet can waste approximately 2700 gallons of water per year. Be sure to turn faucets off all the way and fix leaky ones.

Drinking fountain--It's nice to have a drinking fountain nearby when you are thirsty, but did you ever notice how much water doesn't actually make it into your mouth but into the drain? One solution is to carry a water bottle, fill it up once and not waste a drop down the drain.

Leaky toilet--Leaky toilets can waste up to 500 gallons of water per day. One way to detect a toilet leak is to add food coloring to the tank (where the float is) and wait 15 minutes. If any of the coloring leaks into the toilet bowl, the stopper valve is leaking. To fix, try re-adjusting the stopper or replacing it.

Outdoor watering--Garden hoses can release 600 gallons of water or more in only a few hours. To make this excessive use even more problematic is the fact that here in Colorado we live in an arid region, where water is a scarce resource. There are alternative methods for having a beautiful yard while not using an excessive amount of water. Read through the Xeriscaping description in the reference materials.

Materials Needed:

Student Water use worksheet (One is provided in reference materials, you will need to copy it for students.)

Xeriscaping Handout (One is provided in reference materials, you will need to copy it for students.)

Discover Xeriscape Brochure

Seeds

Over

Instruction for Class Activity/Student Homework:

1. Hand out the Student Water Use Worksheet. Students will keep track of all the times they use water during the day, beginning when they wake in the morning until they go to bed.

The sheet is split into two columns. The left side is for students to specify their water use. The right side is for the students to indicate how necessary each water use is and in what ways. If possible, they could reduce the water used.

2. At home, with permission, have students test their toilets for leaks. The easiest way to do this is to put a couple of drops of food coloring into the tank and wait 30 minutes. If water in the bowl is colored, the stopper valve is leaking and needs to be readjusted or replaced.

3. Plant some seeds of Xeriscape plants somewhere in the school yard and maintain them.

Week 6: May 10-14
Take Action
Classroom Time: 45-60 minutes

Objective:

Choose an outdoor project to help your class understand the connection between water quality and the urban setting.

Background:

1. **Why good water is important.** Discuss why good water quality is important for humans, wildlife and the land. Discuss what types of things may pollute our water (e.g. car oil, garbage, pet waste, spilled paint).

Motor oil causes a slick on top of water and it creates a barrier between the air and the water making it hard for fish to breath. Pet waste introduces nutrients in the water and can cause plants to grow. If too many plants grow, they can clog a waterway and take the oxygen that fish and aquatic insects need to live. It can also carry organisms that could make people or other animals sick.

Instruction for Class Activity:

1. Brainstorm things kids do that may pollute water. Come up with things they can do to stop polluting (i.e. scoop the poop, don't be a litter bug, etc.)

2. Choose an outdoor project to be done in one class period that will help improve water quality. Suggested ideas include a schoolyard or creek cleanup or storm drain stenciling (stencil above storm drains "Dispose No Waste, Drains to Creek").

Materials Needed:

For clean-up--gloves, garbage bags, good shoes.

For Storm Drain Stenciling--Storm Drain Stenciling (SDS) kits.

Call Curry Rosato at 303-413-7365 for SDS kits or garbage bags.

Children's Water Festival

Tuesday, May 17

Ambassador Responsibilities

Before Water Festival

1. Make Presentation to class about the Water Festival. (Worksheet on back will help.)
 - What is the Festival and it's purpose?
 - What is this year's theme?
 - Where and when is it?
 - What is the class going to be doing for the next 6 weeks?
 - What are the T-shirts for?
 - When do we wear them?
2. Coordinate weekly activities with your teacher from the Water Festival Activity Notebook. Water Festival Activity Notebook contains the following activities:
 - Week 1: Water--Essential for Life
 - Week 2: Poster Contest
 - Week 3: Water Wizards Trivia
 - Week 4: Flashfloods
 - Week 5: Use Water Wisely
 - Week 6: Take Action

Before or After Festival

- Activity 1: The Water Cycle and Evaporation
- Activity 2: Boulder Water Story
- Activity 3: Collecting Macroinvertebrates
- Activity 4: Mapping Your Watershed

Day of Festival

1. Have Fun
2. Wear your T-shirt
3. Help teacher find classrooms and stay on schedule. Look for the water drop on each classroom door.

Ambassador Presentation to Class Worksheet

Before the Children's Water Festival, you will make a presentation to your class about the Festival. Here are some questions to answer and present to your class. You can use the worksheet when you talk to your class.

What is the Festival and its purpose?

What is this year's theme?

Where and when is it?

What will the class do over the next six weeks to prepare for the Festival?

What are the T-shirts for?

When do we wear them?

Reference Materials

(provided in teacher packet)

Watery World Student Worksheet

Water Wizards Trivia Questions/Answers

Flood Worksheet

Water Use Worksheet

Boulder Drinking Water Quality Report

Boulder County Map

Xeriscape Flyer & Brochure

Animals in Creek Checklist

Stream Insects & Crustaceans Identification Sheet

Protect Your Drinking Water Sources Map

AWWA Drinking Water Treatment Handout

**Additional Resources Available for Checkout from the
City of Boulder Watershed Outreach Program (call 303-413-7365)**

Water Quality Testing Kit

Bug Investigation Kit

Water History Trunk

Storm Drain Stenciling Kit

Mapping Your Watershed Kit

Activity 1 - Before or After Water Festival

The Water Cycle, a Demonstration

Classroom Time: 10 minutes prep time, 30 minutes class time

(Adapted from the USGS site: <http://www.ga.usgs.gov/edu/watercyclegraphic.>)

Objective:

Students will....

- o become familiar with the complex water cycle system
- o label the major parts of the water cycle on a diagram.

Background:

The Earth is a closed ecosystem. All the water we have is on the planet; as it goes through the water cycle, it is changed from one form to another. The three states of water are solid, liquid and vapor. Most of the precipitation that we get in Colorado falls in the form of snow in the mountains. Coloradans rely heavily on the snowfall not only for recreation but also for water supply. We get 80% of our drinking water from snowpack.

The water cycle or hydrologic cycle is a complex system. The hydrologic cycle and its major parts are defined below:

Hydrologic Cycle (Water Cycle): Water in its various manifestations: as vapor evaporated from oceans, lakes, streams, and plants; rain and snow; snowpack or glacier; groundwater or surface runoff; and finally as streams and rivers returning to the sea.

Surface water: Water that is on the Earth's surface, such as in a creek, stream, river, lake, ocean, or reservoir.

Evaporation: The sun evaporates water from ponds, lakes and the ocean and converts it to vapor or gas, which eventually cools and turns into clouds.

Precipitation: Water that falls in the form of rain or snow from saturated clouds.

Infiltration: Water that reaches the earth, either runs off the surface, falls into a surface water body, or infiltrates into the soil to collect underground.

Transpiration: Underground water may be soaked up by plant roots and carried into their leaves. Water vapor is a by-product of plant transpiration, which uses solar energy, water and nutrients to create nutrients.

Respiration: When we breathe, small amounts of water vapor are released from our lungs.

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

Groundwater: Water that sinks into the ground and collects over impermeable rock. It then flows laterally toward a stream, lake, or ocean. Wells tap it for our use. Its surface is called the "water table."

Water Table: The upper surface of the groundwater; the level below which the soil is saturated with water. Its depth is influenced by rainfall and by human development (wells, drainage ditches, loss of wetlands, etc.).

Instruction for Class Activity:

Demonstration: Provide a blank hydrologic cycle diagram and have students label the major parts of the water cycle. Once finished, have the students make a list of all the places that water goes once it reaches the ground and describe each location. Then, have students choose two of the following locations and describe what happens to a drop of water (precipitation) after it lands on the chosen location. Have the students include a sketch or drawing with their description.

Questions for Discussion:

1. What are the three states of water?
2. List at least three kinds of precipitation.
3. Where does most of the precipitation fall in Colorado? What form is it in?
4. What happens to precipitation once it reaches the ground?
5. List two ways that water is naturally stored (not by people).
6. Are you drinking the same water as the dinosaurs?
7. If water enters a storm drain, where does it go?

Materials Needed:

The Hydrologic Cycle diagram that illustrates the major parts of the water cycle. (One is provided in reference materials, you will need to copy it for students.)

Activity 2--Before or After the Festival

Boulder Water Study

Classroom Time: 20 minutes prep time, 50 minutes class time

Objective:

Students learn about Boulder's Water resources and the history of water in Colorado.

Instruction for Class Activity:

1. Check out the city of Boulder Water History Trunk. This trunk contains many old artifacts related to water. It is a great hands on way to discuss Colorado's water history. (It comes with an information notebook).

Materials Needed:

Water History Trunk (Call 303-413-7365 to check out the kit)

or

visit www.basin.org and click on "history." The history section includes historical photos and journal entries from early settlers in Boulder.

Activity 3--Before or After Festival

Collecting Macroinvertebrates

Classroom Time: 20 minutes prep time and one class

Objective:

To learn about the quality of water in a stream near your school by collecting aquatic insects.

Background:

1. **A great field activity.** The following can be done in the smallest of flowing streams or irrigation ditches. Collecting macroinvertebrates from a stream is a fun and 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. Students will be surprised and amazed by the whole new world of life they uncover in this activity.

Instruction for Class 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.
2. Empty net into buckets or shallow plastic tub.
3. Using your check list, identify the insects.
4. For information on stream monitoring: visit <http://www.roaring fork.org/sitepaggers/pid25.php>.

Materials Needed:

Nets

Buckets or shallow plastic tubs

Animals in the Creek Checklist (One is provided in reference materials, you will need to copy it for students.)

Stream Insects and Crustaceans Identification Sheet (One is provided in reference materials, you will need to copy it for students.)

or

call 303-413-7365 to check out the city of Boulder "Bug Investigation Kit".

This activity was provided by Kenneth Nova, Douglas Elementary School

Activity 4--Before or After Water Festival

Mapping Your Watershed

Classroom Time: 45 minutes, Optional 2-hour field trip

Objective:

To discuss the definition of a "watershed", to identify the water body closest to your school and to identify sources of pollutants.

Definition:

Watershed--(n) 1. Water parting and draining to a particular watercourse or body of water.

Instruction for Class Activity:

1. Have students look at several types of maps and identify the body of water closest to the school. The land surrounding the body of water is your watershed. (Call 303-413-7365 to check out a "class set" of maps.)
2. Identify where the water in your watershed comes from. Now trace the water body's course to the next largest body of water, river or ocean. (Remember if your water body is standing water, a wetland, reservoir or lake--ground water from these areas generally connect to a flowing surface waters.)
3. Discuss the geography of your watershed (topography, major land marks--natural and manmade--and land uses. Discuss sources of pollutants.
4. Draw one large map of your watershed. Include the items you discussed: boundaries, features, pollutant sources, landmarks, etc. Don't forget to include your school.

Materials Needed:

Poster board or other large sheet of paper

Markers and or paints

Maps (atlas, local maps, Boulder County map included in your Activity Notebook)

Call 303-413-7365 to check out the "Mapping Your Watershed Kit" which includes a class set of maps.

Instruction for Class Activity:

Adopt a section of stream or creek near your school and help keep it clean. To register call Curry Rosato at the city of Boulder, 303-413-7365.

Flood Worksheet

Name: _____

PART 1.

Define the following Flood Terms:

Flood or Flash flood Watch: _____

Flood Warning: _____

Flash flood Warning: _____

100-year flood: _____

Cubic foot per second (cfs): _____

PART 2:

Flood Waters Figuring: You will need a calculator to answer some of these questions.

1. Flood stage for the Acorn River is 22 feet.

A. On Tuesday, the river was three feet below flood stage. How high was the river? _____

B. On Wednesday, the river was four feet above flood stage. How high was the river? _____

C. On Saturday, the river was another 9 feet above flood stage. Now how high was the river? _____

2. In Femaville, 60 percent of the households have flood insurance policies.

A. There are 2,000 households in Femaville. How many flood insurance policies are there? _____

3. Three towns along the Acorn River have had to evacuate because of flood waters. The towns are: Shelbyville (population 8,922), Bigburg (population 3,007) and Castor (population 571).

A. How many people were evacuated? _____

4. Exactly one-fourth of the people who were evacuated went to the Red Cross shelters.

A. How many people were in shelters? _____

5. The Acorn River flooded in 1891, 1922, 1954, 1975 and 1991.

A. What is the average number of years between floods? _____

PART 3:

Boulder Information:

Find out how much water is anticipated for a tributary of Boulder Creek in the event of a 100 year flood.



Go to the Internet site: www.BASIN.org - look under the Watershed Address.

1. What creek did you look up? _____

2. How much water will be in the creek in a 100-year flood? _____

3. How much water was there in Boulder Creek in 1894, the last 100-year flood to hit Boulder?

What should you do if you are near a flood, or a potential flash flood?

Watery World

Name: _____

Instructions: Predict how much of each type of water exists in the world. The four types to choose from are: salt water, ice, groundwater and surface water. Use the appropriate colors found in the key to make your predictions.

KEY:

Salt water: green

Ice: red

Ice (glaciers/ice caps): blue

Surface water (rivers, lakes, wetlands, and clouds/vapor) : yellow

Prediction

Actual

(100 gallons or 100% of Earth's Water)

The diagram consists of a large rectangle divided into three vertical sections. The left section is labeled 'Prediction' and the right section is labeled 'Actual'. The central section is labeled '(100 gallons or 100% of Earth's Water)'. The sections are currently empty, intended for students to draw and color their predictions and actual knowledge of water types.

Student Water Use Worksheet

Name: _____

Instructions: Keep track of all your water use for one entire day. Track your water use from the moment you wake-up until you go to bed. Bring your worksheet to school the next day and talk about ways that you can reduce the amount of water you use every day.

Water Use:

1. _____

2. _____

3. _____

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Conservation Idea:

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Xeriscape

What is Xeriscaping?

Xeriscaping comes from the Greek word "xeros" meaning dry, and is a conscious attempt to develop a low water demanding landscape that is compatible with the environment. Since we live in an arid region, this is a great way to save water. There are seven pillars to xeriscaping. They include appropriate garden planning and design, soil improvement, efficient irrigation, practical turf areas, appropriate plant selection, use of mulches and maintenance.

Why Xeriscape?

For most of the country, over 50% of residential water used is applied to landscape and lawns. Xeriscape can reduce landscape water use by 70% or more.

How?

Xeriscaping uses native and drought-tolerant plants. It also involves using mulch to hold in moisture as well as grouping plants according to their water and light needs. Plants native to a particular area are well adapted to those soil and climatic conditions. They also resist pest insects and diseases common in that area.

Plants requiring the most water are usually placed grouped together near the house in a "mini-oasis". The most drought-tolerant plants are positioned on the side of the prevailing winds, to the north and west, so that they will shelter the less tolerant plants.

Examples

Native shrubs—Lilac, beauty bush, apache plume, blue mist spirea, mountain mahogany, new mexico privet, rabbitbrush, chokecherry, three-leaf sumac, potentilla, fernbush, gambel oak sagebrush.

April-June perennial plants for shady spots—columbine, bleeding heart, candytuft, primrose, sweet violet.

April-June perennials for sunny spots—alyssum (golden), sweet William, Iceland poppy, oriental poppy, veronica.

For more information other water conservation ideas or to get a FREE Landscape Consultation call the city of Boulder Water Conservation Office at (303) 413-7407 or visit www.boulderdrought.net.

Aquatic Safari — Insect Observation

Name: _____

Date: _____

Choose one of the insects you find at your creek to observe more closely, and use your observations to answer the following questions:

1. What is it? Use your insect identification sheet to determine the name of your insect.
2. Describe or draw how it looks.
3. Describe or draw how it moves.
4. What adaptations does it have that allow it to live in the creek?
5. What do you think it eats? How does it eat? Is it a shredder, collector, scraper, or predator?
6. Where in the water did you find it? (surface, middle, bottom) How does its body shape, legs, or some other special feature help you to determine where it lives in the creek?

Animals in the Creek Checklist

Check off the animals you find in your creek.

Tolerate Pollution

- Blackfly Larvae
- Blackfly Adult
- Water Snail eggs
- Water Snails
- Midge Larvae
- Midge Adult
- Mosquito Larvae
- Mosquito Adult
- Flatworm
- Leeches

Tolerate Some Pollution

- Dragonfly Larvae
- Dragonfly Adult
- Damselfly Larvae
- Damselfly Adult
- Water Beetle Larvae
- Water Beetle
- Amphipod (scud)
- Crane-fly Nymph
- Waterboatman
- Backswimmer

Do Not Tolerate Pollution

- Stonefly Larvae
- Stonefly Adult
- Caddisfly Larvae
- Caddisfly Adult
- Mayfly Nymph
- Mayfly Adult
- Alderfly Nymph
- Alderfly Adult
- Dobsonfly Larvae
- Water Penny Larvae

Tally the number of insects you found in each column:

Tolerate
Pollution _____

Tolerate Some
Pollution _____

Do NOT Tolerate
Pollution _____

How many different kinds of insects did you find? _____

Which insects did you find the most of? _____

What do these insects tell you about the health of your creek?

GROUP TWO TAXA continued

10 *Scud: Order Amphipoda*. 1/4", white to grey, body higher than it is wide, swims sideways, more than legs, resembles small shrimp.

11 *Alderfly larva: Family Sialidae*. 1" long. Looks like small hellgrammite but has 1 long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 *Fishfly larva: Family Corydalidae*. Up to 1 1/2" long. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 *Damselfly: Suborder Zygoptera*. 1/2" - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails positioned like a tripod. Smooth (no gills) on side of lower half of body. (See arrow.)

14 *Watersnipe Fly Larva: Family Athericidae (Atherix)*. 1/4" - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 *Crane Fly: Suborder Nematocera*. 1/3" - 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 *Beetle Larva: Order Coleoptera*. 1/4" - 1", light-colored, 6 legs on upper half of body, feelers, antennae.

17 *Dragon Fly: Suborder Anisoptera*. 1/2" - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 *Clam: Class Bivalvia*.

GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 *Aquatic Worm: Class Oligochaeta*. 1/4" - 2", can be very tiny; thin worm-like body.

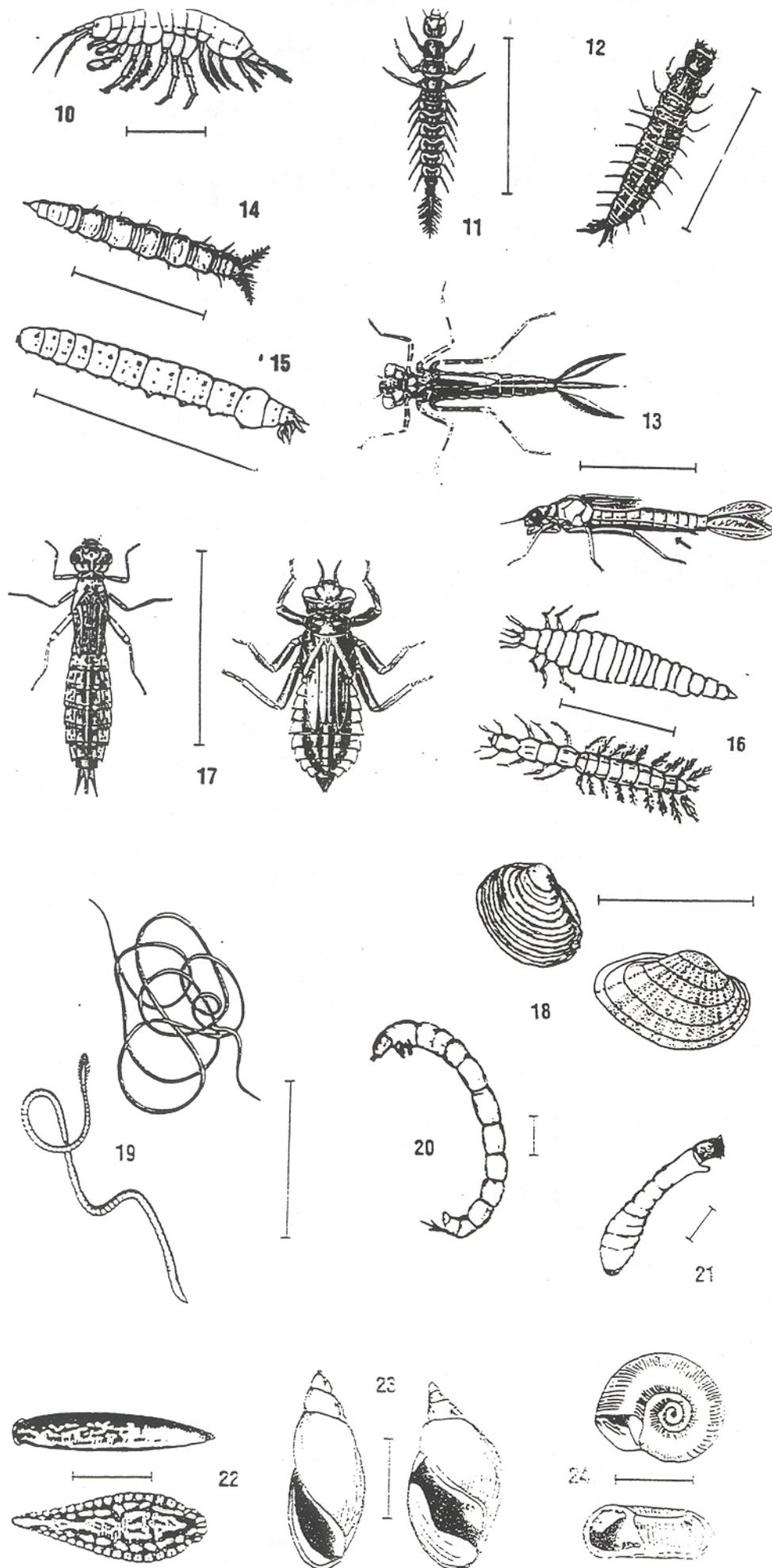
20 *Midge Fly Larva: Suborder Nematocera*. Up to 1/4" dark head, worm-like segmented body, 2 tiny legs on each side.

21 *Blackfly Larva: Family Simuliidae*. Up to 1/4", one end of body wider. Black head, suction pad on end.

22 *Leech: Order Hirudinea*. 1/4" - 2", brown, slimy body, ends with suction pads.

23 *Pouch Snail and Pond Snails: Class Gastropoda*. No operculum. Breathe air. Shell usually opens on left.

24 *Other snails: Class Gastropoda*. No operculum. Breathe air. Snail shell coils in one plane.



Bar lines indicate relative size.



Stream Insects & Crustaceans

GROUP ONE TAXA

Pollution sensitive organisms found in good quality water.

- 1 Stonefly: Order Plecoptera.** 1/2" - 1 1/2", 6 legs with hooked tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (See arrow.)
- 2 Caddisfly: Order Trichoptera.** Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on lower half.
- 3 Water Penny: Order Coleoptera.** 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs on the other side. Immature beetle.
- 4 Riffle Beetle: Order Coleoptera.** 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.
- 5 Mayfly: Order Ephemeroptera.** 1/4" - 1", brown, moving, plate-like or feathery gills on sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.
- 6 Gilled Snail: Class Gastropoda.** Shell opening covered by thin plate called operculum. Shell usually opens on right.
- 7 Dobsonfly (Hellgrammite): Family Corydalidae.** 3/4" - 4", dark-colored, 6 legs, large pinching jaws, eight pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails and 2 pairs of hooks at back end.

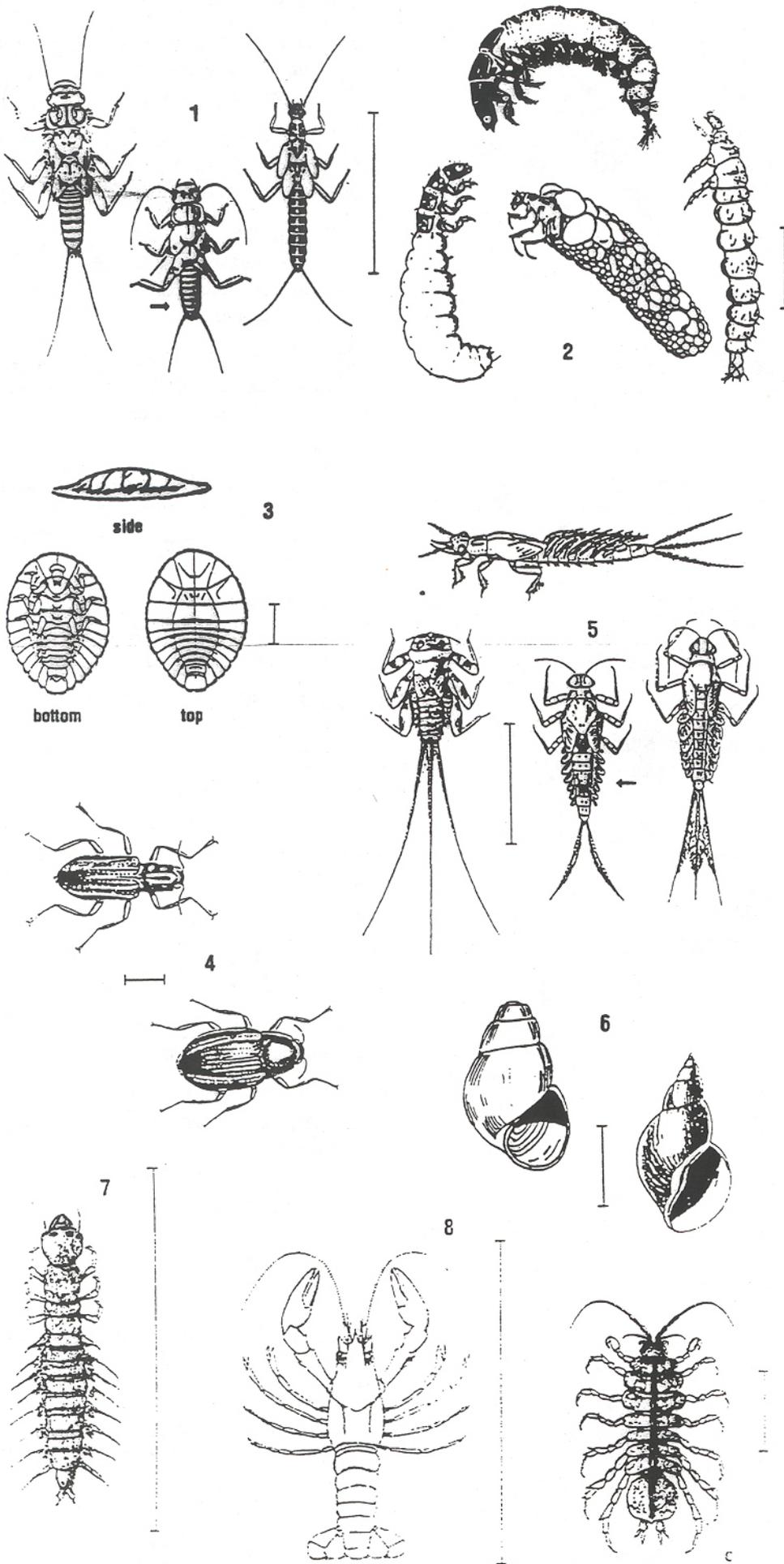
GROUP TWO TAXA

Somewhat pollution tolerant organisms can be in good or fair quality water.

- 8 Crayfish: Order Decapoda.** Up to 6", 2 large claws, 8 legs, resembles small lobster.
- 9 Sowbug: Order Isopoda.** 1/4" - 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

Save Our Streams

Izaak Walton League of America
1401 Wilson Blvd. Level E
Arlington, VA 22209



Bar lines indicate relative size.

WATER WIZZARD TRIVIA QUESTIONS/ANSWERS

HISTORY/GENERAL

Background:

In 1803, President Thomas Jefferson purchased the land West of the Mississippi River from Napoleon Bonaparte of France. The Louisiana Purchase cost the United States \$15 million. Napoleon had no idea what he had sold, and Jefferson had no idea what he had bought. It wasn't until 1804 that the U.S. Congress provided money to fund an expedition to the Western territory. Meriwether Lewis and William Clark, along with 50 men, set out to map and explore this unknown territory. They were successful in reaching the Pacific Ocean and returned to share their discoveries. Their expedition opened the doors so many explorers to follow. In 1806, Gen. Zebulon Pike crossed the plains through what became Kansas and Colorado. He wrote of the area "these vast plains of the Western Hemisphere may become in time as celebrated as the sandy deserts of Africa." A decade after Pike's expedition, Major Stephen Long had a similar impression. Long labeled the whole territory between the Mississippi and the Rocky Mountains as the "Great American Desert" – a phrase and an image that held for almost half a century. (Excerpts form Cadillac Desert, by Marc Reisner)

Name the explorer who compared the western plains to the sandy deserts of Africa.
Zebulon Pike

One of the first Anglo explorers to the American West has a peak named after him. His expedition in 1820 resulted in labeling of maps with "The Great American Desert."
Stephen Long

In what wilderness area does Boulder Creek have its headwaters?
Indian Peaks Wilderness Area

What is it called when water is diverted from one river basin into another?
Transbasin diversion

When water is left in a river for aquatic life this is called?
Minimum streamflows

What is the Boulder-owned watershed?
Silver Lake Watershed

What watershed is your school located in?
Boulder Creek Watershed

What are two main tributaries to Boulder Creek?
South Boulder and Coal Creek

What is a watershed?

the area drained by a river or stream and its tributaries

Name three species native to Boulder Creek.

tiger salamander, white sucker, northern leopard frog, painted turtle, green sunfish, northern water snake

FLOOD

What does a 100-year flood mean?

a very large flood that has a 1% chance of occurring in any year

What should you remember to do in a flood?

climb to safety

Name three of the six basic supplies that you should tock in your home in case of a flood or other disaster.

water, food, first aid, clothing, bedding, tools and supplies, and special items (diapers, bottles, prescription medicine, eyeglasses, etc.)

The worst natural disaster in Colorado history occurred in 1976. What is this known as?

The Big Thompson Flood

Can a flood occur on a very small creek?

yes, if enough precipitation falls fast and hard enough in a short period of time.

GEOGRAPHY/SCIENCE

Name the three major groundwater aquifers in Colorado.

High Plains, San Luis Valley, Denver Basin

Name the four rivers that originate in Colorado.

Colorado River, South Platte, Arkansas, and the Rio Grande

Most of Colorado's precipitation falls in which portion of the state?

mountains

What famous river in Colorado used to be called the Grand River?

Colorado River

Name the 3 physical forms of water.

Liquid, solid and vapor

How much of the earth's surface is covered by water?

80%

How much of the water on earth is usable fresh water?

0.5%

What is an acre-foot, and how many gallons are there in an acre-foot of water?

1 acre, 1 foot deep; 325,900 gallons

An acre-foot of water is enough to meet the inside-home, lawn watering and industrial needs of how many urban people for one year?

4-5

What percentage of your body weight is water?

65%

How long can a person live without water?

about a week, depending upon conditions

What is the significance of the Continental Divide to water supplies?

this is where water flows east to the Atlantic or west to the Pacific

What major river in Colorado does Boulder Creek eventually feed into?

South Platte (Saint Vrain > South Platte > Missouri River > Mississippi > Gulf of Mexico)

WATER CYCLE

Name the process of the water cycle when water changes from a liquid to a vapor.

Evaporation

Name the process of the water cycle where water vapor is transmitted through the pores of leaves into the atmosphere.

Transpiration

What is the name for the portion of the water cycle where solid or liquid water falls to the earth's surface?

precipitation

Name the process in the water cycle when water changes from a vapor to a liquid or solid state, such as within a cloud.

condensation

What is the energy source that drives the water cycle?

the sun

WATER SUPPLY

What percent of Colorado's water supply comes from snowpack?

80%

What is Boulder's average annual precipitation?

18.2 inches/year

What is the largest reservoir in Colorado?

Blue Mesa

What is the second largest reservoir in Colorado?

Lake Granby

WATER RIGHTS/ADMINISTRATION

Name the system of water allocation in Colorado, and explain how it works.

prior appropriation, "first in time, first in right"

What agency is responsible for administering water rights in Colorado?

State Engineers Office

How are disagreements over water rights handled?

in water court

Name the two primary areas of responsibility of the State for establishing water policy.

administering water rights and making sure that the water available to Colorado is used to the fullest extent possible

What federal agency is responsible for constructing and operating many of the water projects in the Western US?

Bureau of Reclamation

WATER CONSERVATION

(Visit the web sites www.boulderdrought.net or www.h2ouse.org to find out how much water is used and how you can save water in and around your school/home.)

Name three ways to save water outside:

- a. Use shut-off nozzles on hoses
- b. Plant low-water using plants
- c. Use mulch in planting beds
- d. Use drip-irrigation systems
- e. Direct sprinklers only onto plants, not streets or driveways

Where is most of the treated water used in western cities?

in the landscape

What is xeriscape?

an attractive and water conserving landscape

How much water does a single leaking faucet waste?

up to 100 gallons/day

Name three native plants that can be used for landscaping:

Buffalo grass golden current, rabbitbush, Rocky Mountain maple, American plum, and penstemons.

What are three ways to use less water for bathing or showering?

install a low-flow showerhead, take a shorter shower, and fill the bathtub only half full

What are three ways to use less water from a toilet?

Check for leaks, install an ultra-low-flow toilet, which uses 1.5 gallons per flush, or flush less often

When is the demand for water highest in Boulder?

in the summer months of June, July and August

WATER USE

In Colorado, what percentage of water use is by cities and what percentage by agriculture?

10% city, 90% agricultural

Name two instream uses of water.

habitat protection, recreation

What percent of the water treated by public water systems is used for drinking and cooking?

less than 1%

How much water does the average person in Boulder use in a day inside the home?

80 gallons

How is water used worldwide?

5% for human use/consumption, 75% for agriculture, 20% for industry

What room of a house typically has the highest water use?

bathroom

How much water is used in an average toilet flush?

3.5 gallons

How much water must a person consume each day to be healthy?

2 ½ quarts

How much water does it take to produce one hamburger? (Take into consideration all the uses of water, such as irrigating the grain to feed the steer.)

600 gallons

Name six categories of water use.

agricultural irrigation, landscape irrigation, drinking, wildlife habitat, cleaning, cooking, cooling, industrial/commercial, transportation, recreation, transporting wastes, heating, fighting fires, power production

How much water does Boulder use in the average year?

7.3 billion gallons

How much water does Louisville use in the average year?

1.2 billion gallons

How much water does Lafayette use in the average year?

1 billion gallons

How much water does Broomfield use in the average year?

2 billion gallons

WATER TREATMENT

Where does the water from lakes and rivers go to be cleaned so that it is safe to drink?

water treatment plant

At the water treatment plant, which two processes treat water?

physical and chemical

Why are water treatment plants located at a point higher than the city?

to take advantage of gravity and minimize the amount of pumping necessary to build up the water pressure

What chemical is added to water to kill disease germs that could make people sick?

chlorine

Why isn't it safe for hikers and backpackers to drink water directly from the streams in Colorado?

stream water may contain impurities such as dirt and disease germs that can make you sick

Name the water treatment process that includes passing water through 3 feet of coal, sand, and gravel

filtration

Name the drinking water sources for Boulder.

Silver Lake/Lakewood Watershed on North Boulder Creek, Barker Reservoir on Middle Boulder Creek and Boulder Reservoir Sources.

Name the drinking water sources for Louisville.

South Boulder Creek and water from the Northern Colorado Water Conservancy District

Name the drinking water sources for Lafayette.

South Boulder Creek

Name the drinking water sources for Nederland.

Middle Boulder Creek

Name the drinking water sources for Broomfield.

Carter Lake

Name the drinking water sources for Superior.

Lake Granby, Carter Lake and Terminal Reservoirs

Name the drinking water sources for Gold Hill.

Individual Private Wells

Name the drinking water sources for Jamestown.

James Creek

WASTEWATER TREATMENT

Where does all the water and wastes from sinks, bathtubs, and toilets go to be cleaned before the water is put back into the river?

to the sanitary sewer system and then the wastewater treatment plant

Why are wastewater treatment plants located at points lower than the city?

Since sewage from the city's homes and businesses flows by gravity, and is not pumped, the wastewater treatment plants must be located at a lower point.

In rural areas, wastewater flows to what system for treatment?

Septic Systems

In Boulder, cleaned and treated wastewater from the wastewater treatment plant goes where?

Boulder Creek

In Louisville, cleaned and treated wastewater from the wastewater treatment plant goes where?

Coal Creek

In Broomfield, cleaned and treated wastewater from the wastewater treatment plant goes where?

Big Dry Creek

In Lafayette, cleaned and treated wastewater from the wastewater treatment plant goes where?

Coal Creek

In Nederland, cleaned and treated wastewater from the wastewater treatment plant goes where?

Barker Reservoir

In Superior, cleaned and treated wastewater from the wastewater treatment plant goes where?

Rock Creek

In Gold Hill, wastewater goes where?

Individual Sewage Disposal Systems (ISDS)

In Jamestown, wastewater goes where?

Individual Sewage Disposal Systems (ISDS)

STORMWATER

Name the two different types of sewer systems in Boulder.

storm sewer and sanitary sewer

Where does runoff from rain and snow go?

the storm sewer system and into Boulder's creeks

Does runoff increase or decrease in urban areas?

increase

Why should motor oil, paints or other materials never be dumped in storm drains?

Because storm drains connect to creeks; these materials may be harmful to fish and other wildlife.

What are the benefits of groundwater recharge?

water is cleaned and aquifers are replenished

Why is groundwater recharge less in urban areas than in natural areas?

Urban areas have more impervious surfaces (such as parking lots) which water can not seep through.

Name the term used to define water which soaks into the ground and adds water to an aquifer.

surface storage

NORTHERN COLORADO WATER CONSERVANCY DISTRICT

The system of water law used in Colorado is sometimes referred to as the "Colorado Doctrine."

What is the technical name?

Doctrine of Prior Appropriation

As Colorado-Big Thompson water drops a half-mile to the Front Range it generates power as it falls. What is this called?

hydroelectricity

What is the purpose of the Northern Colorado Water conservancy District?

water distribution

How many cities receive water from the Colorado-Big Thompson system?

30

Name the system which diverts water from the Western slope to the Northern Front Range.

The Colorado-Big Thompson Windy Gap Project

Where does water in the Colorado-Big Thompson system originate?

headwaters of the Colorado River in Rocky Mountain National Park

What is the length of the Adams Tunnel that carries Colorado-Big Thompson water through the mountains?

13 miles

When was Boulder included within the Northern Colorado Water Conservancy District?

1953

Name three Front Range storage reservoirs for the Colorado-Big Thompson water?

Horsetooth Reservoir, Carter Lake, and Boulder Reservoir

What is the largest city within the Northern Colorado Water Conservancy District?

Boulder