Daily Water Usage

Name ____________________

Date ____________________

Activity	Amount of Water Used	Number of Times (✔)								Total Water Used
Brushing teeth (without letting water run)	1 liter (1/4 gal)									_____ liters (_____ gal)
Taking a shower	114 liters (30 gal)									_____ liters (_____ gal)
Flushing the toilet	6 liters (1 1/2 gal)									_____ liters (_____ gal)
Drinking a glass of water	0.24 liter (8 oz or 1/16 gal)									_____ liters (_____ gal)
Taking a bath	152 liters (40 gal)									_____ liters (_____ gal)
Washing hands	1 liter (1/4 gal)									_____ liters (_____ gal)
Washing dishes by hand	38 liters (10 gal)									_____ liters (_____ gal)
How much water do you use in one day?										**_____ liters (_____ gal)**

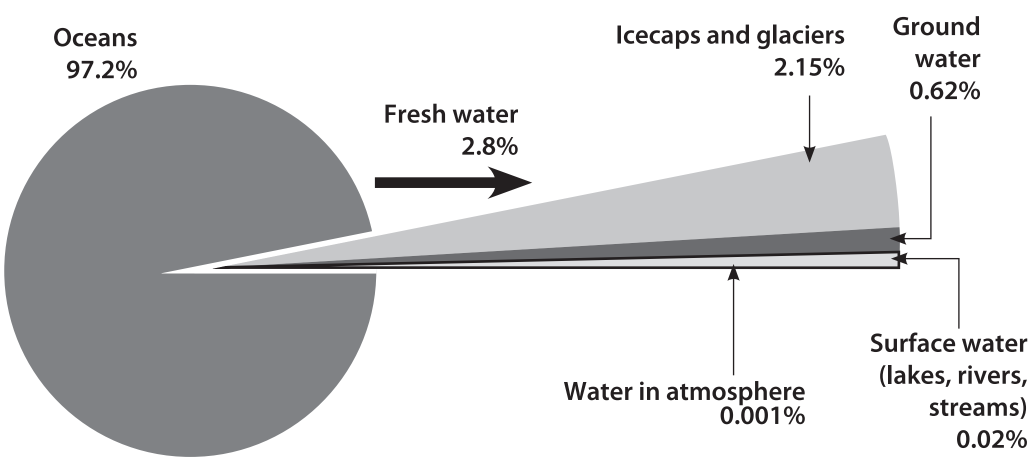
Reading Selection

Tapping into the Water Cycle

Turn on a faucet and what happens? Out comes fresh, clean water. But where does this water come from and why doesn't it ever run out?

Think about all the water on earth. You can find it in lakes, streams, and oceans. Some of it is frozen on snow-capped mountains. Other water is hidden underground. Of all the water on earth, only a small amount can be used for drinking.

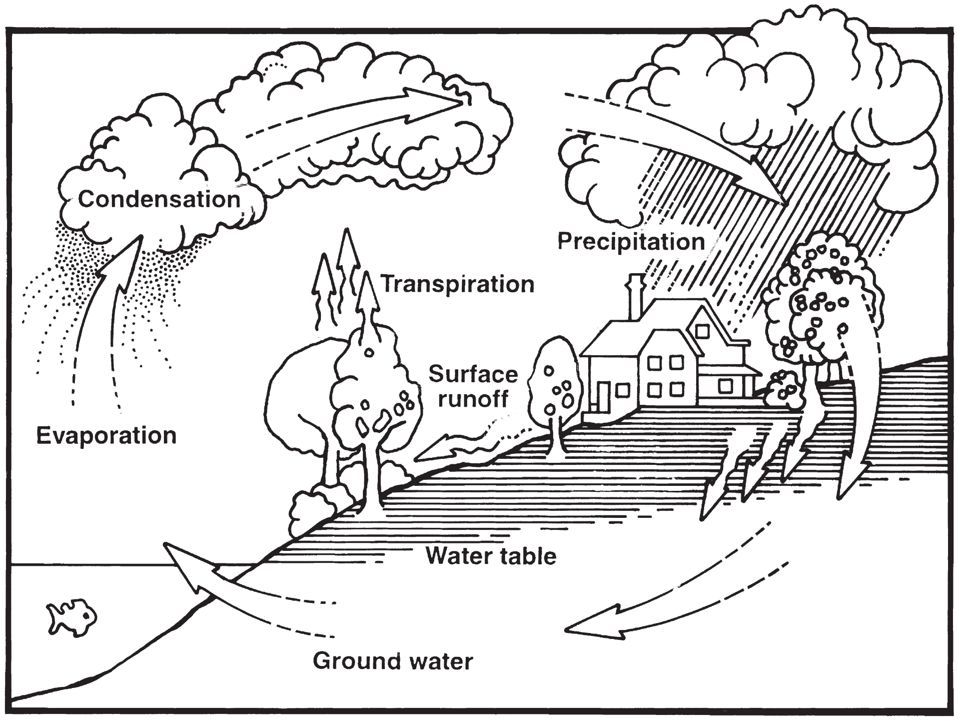
Water on earth



What Goes Around Comes Around

Water is constantly moving. This is because of the **water cycle.** As the sun heats the earth, water changes to a gas. Minerals, such as salt, and other particles are left behind. The gas, called **water vapor,** rises high into the cold air and clings to particles of dust. The cold air turns the gas back into water droplets. Many of these droplets combine to form clouds. Eventually the clouds gather more water than they can hold. Then the water falls back to earth as rain, snow, sleet, or hail. In a continuous cycle, water moves out of the oceans, into the atmosphere, and back down to earth.

The Water Cycle



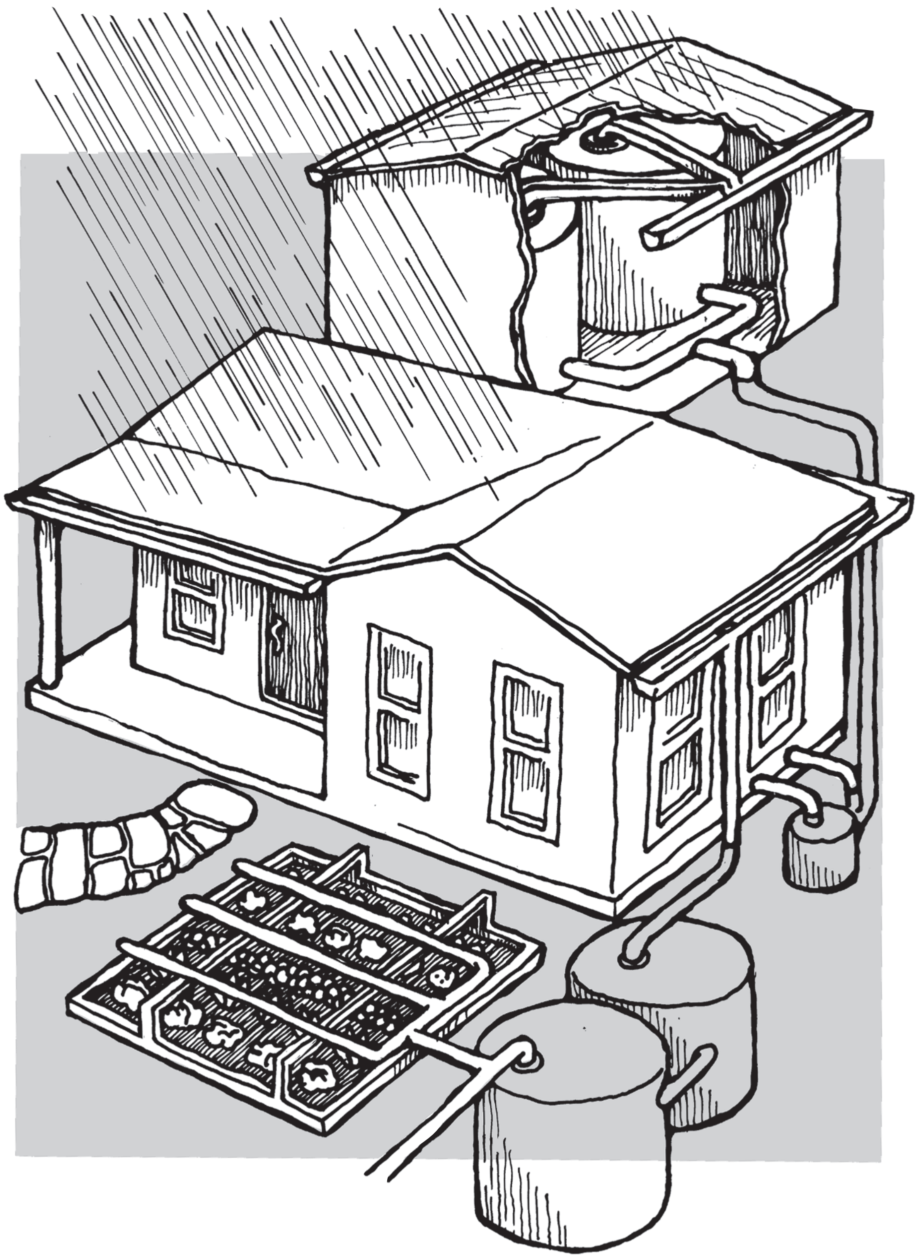
The water cycle is vital to life on earth. Without it, all of the world's water would end up in the oceans and stay there forever. Rain would not fall to the earth. Plants could not live. Streams would dry up. Ponds would empty. The land would become a lifeless desert. And your faucet would run dry.

Rainwater keeps our lakes, streams, and land filled with water. It supplies our drinking water. But rainwater does not fall evenly over the earth. In fact, some areas get almost no rain at all. People all over the world have found clever ways to collect and store water. How do they do it? Let's visit a few places and see.

Collecting Rainfall for Year-Round Use

In the southwestern United States, weeks and often months go by without rain. Droughts, or long periods without rain, are common. **Droughts** cause crops to fail. Streams flowing over the dense clay soil gradually dry up.

To deal with this problem, citizens in Austin, Texas, have created a way to collect rainfall they can use all year long—they use their roofs! Outside one family's house, two 32,000-liter (8,500-gallon) tanks sit inside a large shed with a tin roof. When it rains, rainwater



Rainwater collection system

runs down the tin roof into the tanks below. Special lights in the tanks kill bacteria in the water. Water tests make certain the water is pure and clean. Then pipes carry the collected rainwater to different parts of the house. Even the downspouts along the edge of the house are set up to collect rainwater. This water can be used for appliances and outdoor use. A rainwater collection system like this one can supply a family with 190 liters (50 gallons) of water a day for 11 months!

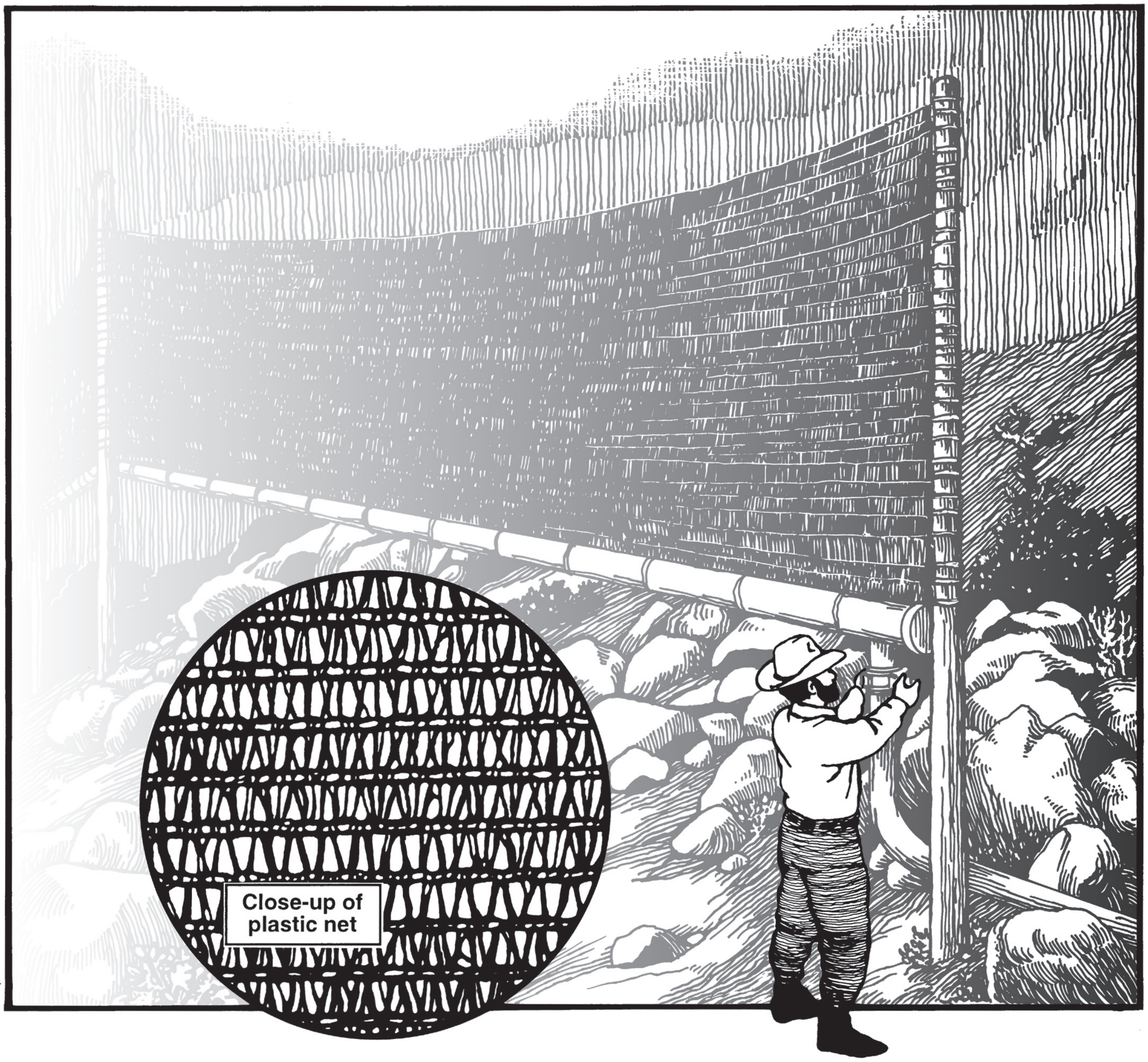
Melting Rivers of Ice

In the mountains of the northwestern United States and Canada, most of the year is very cold. Water stays frozen as snow or rivers of ice, known as **glaciers.** But people have found ways to tap into these frozen water sources. How? During the warm and dry summer months, there is little rainfall. As the sun beats down, the ice and snow begin to melt. People collect and use the meltwater for drinking, bathing, and other uses in the home. Businesses use the water to run machines. And farmers use the water to irrigate their crops. People store the extra water for the winter months.

Chile Today—Foggy All the Time!

Imagine a place where there is always fog, but it never rains! In Chungungo, a rural town in Chile, high in the Andes mountains in South America, water is scarce. Until recently, the only way for people to get water was to truck it from a village over 13 miles away on a dirt road. Most villagers could buy only 15 liters (4 gallons) of water a day. In the United States, each person uses an average of 350 liters (about 90 gallons) a day!

To solve this water shortage, scientists created a system that collects fresh water from fog. They lined up 75 enormous plastic nets on the mountain. Each net is the size of eight queen-sized beds. Particles of water from the fog collect in the triangular-shaped holes in the nets.



Net for collecting water from fog

Over 10,000 particles of fog must combine to make one single drop of water. Yet each net collects over 152 liters (40 gallons) of water a day! A solar-powered system puts chlorine in the water. This makes the water safe to drink. In one day, the entire system of nets can collect 11,400 liters (3,000 gallons) of water—all from fog! This is enough water for one day for each of the town's 330 people.

Because of the water cycle, water can be used again and again. But clean drinking water is not easy to find everywhere on earth. Sometimes we take clean water for granted. We forget that water must be shared by many people. Find out how much water you use each day. How could you cut back on the amount you use? Turn off your water and see.

Keep track of your daily water usage

Activity	Amount of Water Used	Number of Times (✓)	Total Water Used
Brushing teeth (without letting water run)	1 liter (¼ gal)		_____ liters (_____ gal)
Taking a shower	114 liters (30 gal)		_____ liters (_____ gal)
Flushing the toilet	6 liters (1½ gal)		_____ liters (_____ gal)
Drinking a glass of water	0.24 liter (8 oz or 1⁄16 gal)		_____ liters (_____ gal)
Taking a bath	152 liters (40 gal)		_____ liters (_____ gal)
Washing hands	1 liter (¼ gal)		_____ liters (_____ gal)
Washing dishes by hand	38 liters (10 gal)		_____ liters (_____ gal)
How much water do you use in one day?			**_____ liters (_____ gal)**

Record Sheet 4-A

Name ____

Date ____

Comparing Streams

Directions: Complete only the first column during Lesson 4. You will complete the other columns during Lessons 10 and 13.

	Lesson 4	Lesson 10	Lesson 13
Date			
Description or drawing of stream			
Measurements (in cm)			
Length of stream			
Width of stream			
Width of soil dropped at the end of the stream			
Other observations			

Record Sheet 4-A

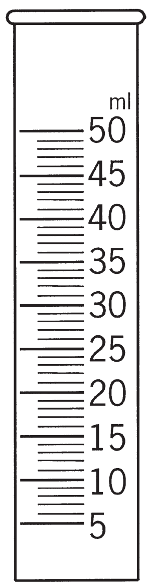
Name ____

Date ____

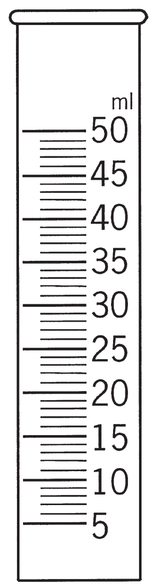
Comparing Streams, *continued*

1. What does the cylinder of runoff look like today? Color the soil and water in the cylinder.

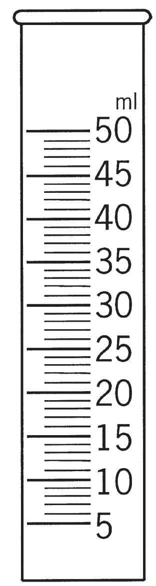
Lesson 4



Lesson 10



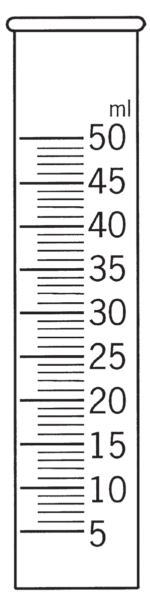
Lesson 13



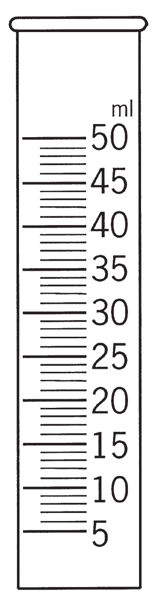
2. Talk with your group. Predict what the cylinder will look like tomorrow.

3. What does the cylinder of runoff look like after it sits for a day? Color the soil and water in the cylinder.

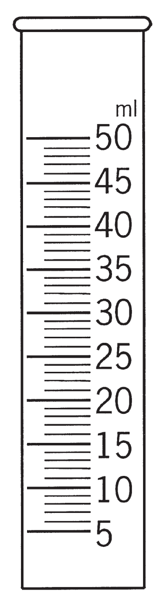
Lesson 4



Lesson 10



Lesson 13



Record Sheet 5-A

Name ______________________________

Date ______________________________

Examining Earth Materials

	Gravel	Sand	Clay	Humus
Appearance (how it looks: color, shine, clumping)				
Texture (how it feels)				
What it does when you put it in water				
What it does when you stir the water				
Other observations				

Record Sheet 5-A

Name ______________________________

Date ______________________________

Examining Earth Materials, *continued*

1. Stir the cup of soil and water again. What happens to the soil when the water begins to move?

____

____

2. What happens to the soil when the water slows down?

____

____

3. Which soil component drops to the bottom of the cup first? ______________

Why do you think this happens?

____

____

4. Which soil floats on the water? ______________________

Why do you think this happens?

____

____

In Lesson 7, you will learn more about the way soil is picked up and dropped off in your stream table.

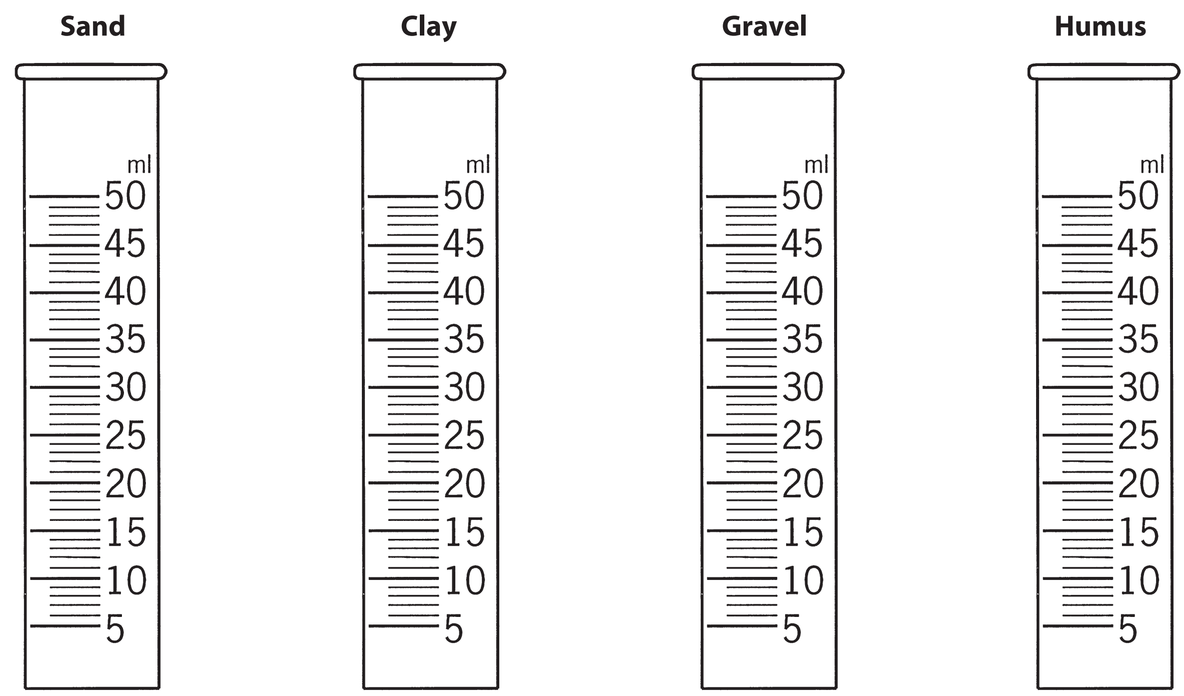
Record Sheet 6-A

Name ____

Date ____

Testing Pore Space in Earth Materials

1. Pour a different soil component into each cylinder. Pack the soil down with the chopstick until it is at the 20-ml mark. Ask for more soil if you need it. Draw the soil as it looks in each cylinder. (Use a crayon that matches the color of the soil.)



2. Pour onto a paper towel any extra soil left in your cup.

3. Make a prediction. If you added 30 ml (1 oz) of water to each cylinder, what do you think would be the total volume of soil and water in the cylinder? Use a blue crayon to draw where you think the water will be in each cylinder.

4. Fill each empty small cup with 30 ml (1 oz) of water. Pour 30 ml of water into each cylinder of soil. After 5 minutes, draw how the water and soil look in each cylinder. Use the cylinders on the next page to record the total volume.

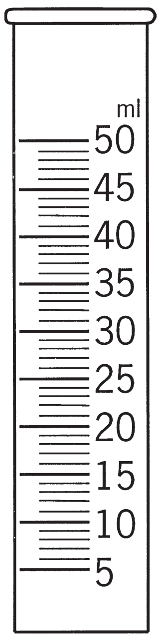
Record Sheet 6-A

Name ______________________________

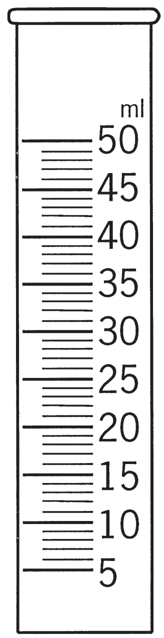
Date ______________________________

Testing Pore Space in Earth Materials, *(continued)*

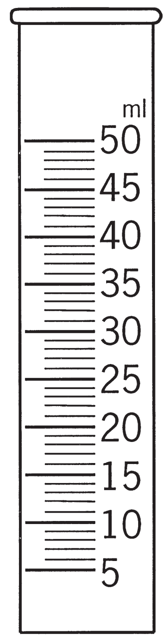
Sand and Water



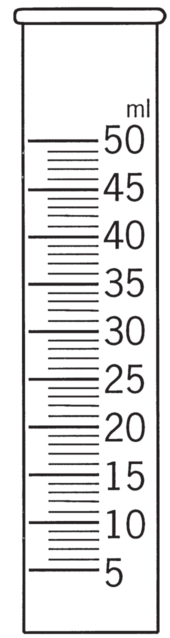
Clay and Water



Gravel and Water



Humus and Water

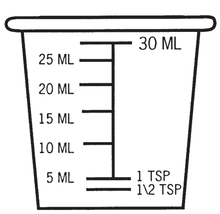


5. Where did the 30 ml of water go when you added it to each soil type? Why do you think this happened?

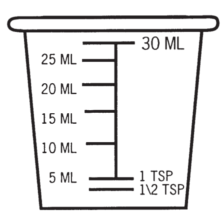
____

6. Now pour the water out of each cylinder and back into its cup. How much water is in the cup? Show the water level in the four cups pictured below.

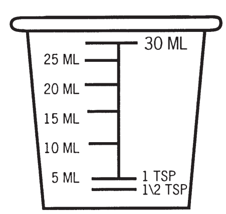
Water from Sand



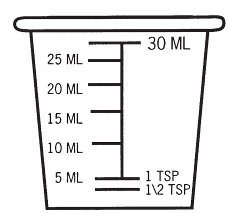
Water from Clay



Water from Gravel



Water from Humus



7. Did you get 30 ml of water back from each cylinder? Why do you think this happened?

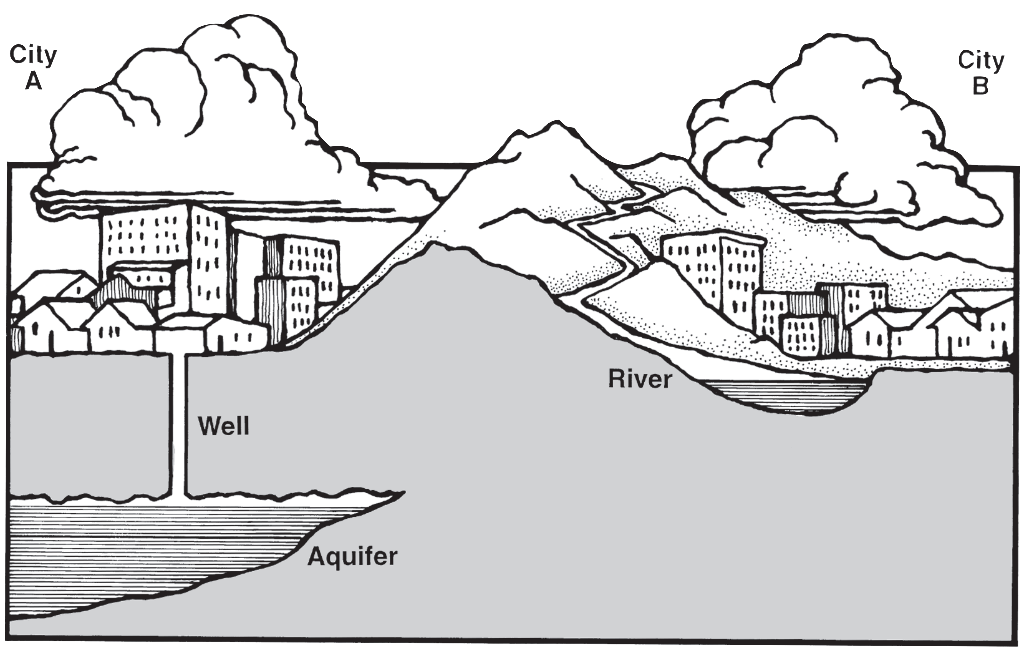
____

Where Does Our Drinking Water Come From?

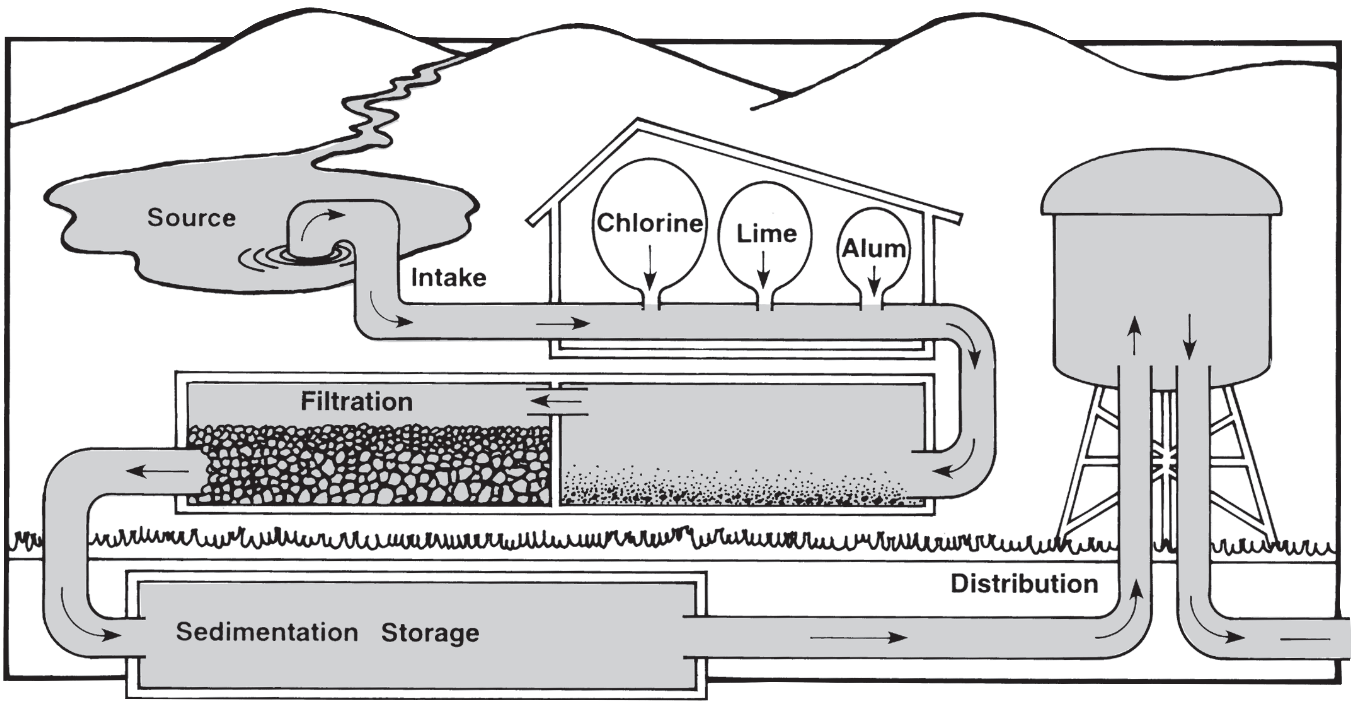
Have you been keeping track of how much water you use each day? Just think of all the ways you use water. You use it to wash your face after you get up in the morning. At school, you might stop by the water fountain for a cool drink. And there's nothing like a dip in the swimming pool on a hot summer day. You already know that each person in the United States uses an average of 350 liters of water (about 90 gallons) each day!

Most of the water on earth is found in oceans. We can't drink this water. Do you know why? Ocean water is very salty. Set out a pan of salt water in the sun. Over time, the water evaporates and salt is left behind. Scientists can remove salt from ocean water. But this process is expensive and takes a long time.

Our bodies need fresh water. Some fresh water comes from lakes and streams. These sources are called **surface waters.** Other fresh water is hidden underground. **Ground water** is water that has fallen



Water sources



Filtering water at a treatment plant

to the earth as rain, snow, or other precipitation. It seeps through layers of sand, gravel, and other earth materials known as **aquifers** (say ah-kwi-ferz). The water stops when it reaches a layer of rock or other hard material. Look at your stream table from underneath. Do you see any water beneath the soil?

How Do We Get Our Water?

If you live in a city or town, you probably get your water from a public utility company. Utility companies pump water to your home either from surface waters or aquifers.

Sometimes utility companies must send the water from lakes or rivers through pipes for hundreds of miles. The pipes that bring water to a big city may be wide enough for you to stand in. In fact, the water tunnels in New York City are so large you could drive a truck through them!

If you live far from the city, you probably get your water from a well drilled in the ground. Well drillers are workers who make holes deep into the earth until they find water. Sometimes a well can be more than 305 m (1,000 ft) deep! After the well is drilled, the driller puts a plastic or steel pipe that looks like a giant drinking straw into the hole. This keeps the soil and rock from caving in. Then the well driller attaches an electric pump to the pipe. The pump forces the water that has seeped into the pipe upward, through the pipe, and into your house.

Cleaning the Water

Have you ever poured sandy water through a strainer at the beach? The strainer is like a **filter.** It separates some of the sand from the water. You might say it helps to clean the water.

The land can be a filter, too. As water seeps through the soil, layers of sand and gravel clean the water. People can usually drink spring water, which has been underground, just the way it is.

Surface waters, however, usually are not clean. Do you remember what the water in your catch bucket looked like? It was very dirty because of sediment. When water flows over land, it wears away soil and rock and carries the particles along. This is called **erosion.** Pollutants—like fertilizer, road salt, and other chemicals—can get into both surface water and ground water. Then the water is not safe to drink.

Utility companies must clean the water before people can use it. In treatment plants, utility companies add certain chemicals to the water. For example, chlorine gets rid of bacteria that might harm you. Alum makes particles clump together and sink to the bottom. This is called **sedimentation.** After the sediment is removed, the water passes through layers of sand and gravel. These layers filter the water and remove smaller particles. This is called **filtration.** Before the water can be stored or distributed to homes and businesses, utility plant workers bubble air through the water to make it taste fresh. Many utility companies add fluoride to the water, too. This helps keep your teeth from getting cavities.

Getting the Clean Water to You

Have you ever noticed a water tower in your town or on top of a building? Utility companies use water towers to store clean water until you are ready to use it.

Why do you think water towers are so tall? Think of pouring water from a cup. The higher you hold the cup, the bigger the splash. That is because the **water pressure** is greater when the water falls from a greater height.

Water towers

When water is released from the tower, the pressure of the water pushes it down and through pipes. The pipes carry the water directly to your home, offices, and other buildings.

Conserving Our Water

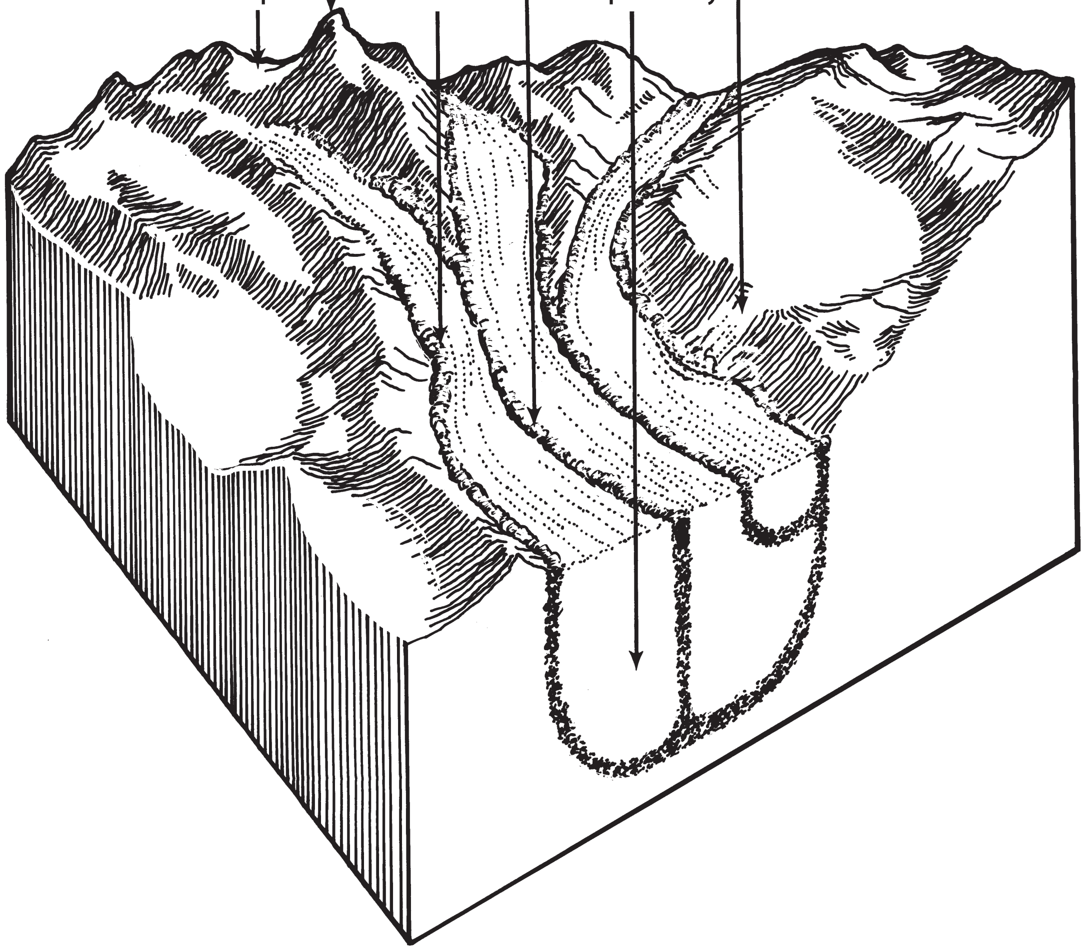
What happens to the water we use after it disappears down the drain? This **wastewater** must be cleaned before we can use it again. Cleaning our water costs money and takes time. Clean water is a limited resource. We must be careful not to waste it. Continue to keep track of how much water you use each day. Then decide if you are using it wisely.

Reading Selection

Glaciers: Rivers of Ice

Have you ever seen a glacier? **Glaciers** are huge rivers of slowly moving ice that erode the land as they creep downhill. They form in cold, mountainous areas.

To learn more about glaciers, let's take an imaginary helicopter ride. We're heading for the mountains near the coast of Alaska. Fasten your seat belts. The gusty winds may give us a bumpy ride!



We will be flying over a **valley glacier.** This kind of glacier often flows in a V-shaped valley created by a river. On our way there, let's talk about how glaciers form.

Valley glaciers begin when snow collects on the sides of mountains. It never gets warm enough to completely melt the snow. Over the years, new snow falls. It becomes deeper. Sometimes the snow can get as high as two houses stacked together. When this happens, the snow is very heavy.

The weight of the snow presses the bottom layers of snow into ice. The ice crystals lock together. The ice is like rock. It is heavy enough to carve bowl-shaped holes in the sides of a mountain. These holes are called **cirques.**

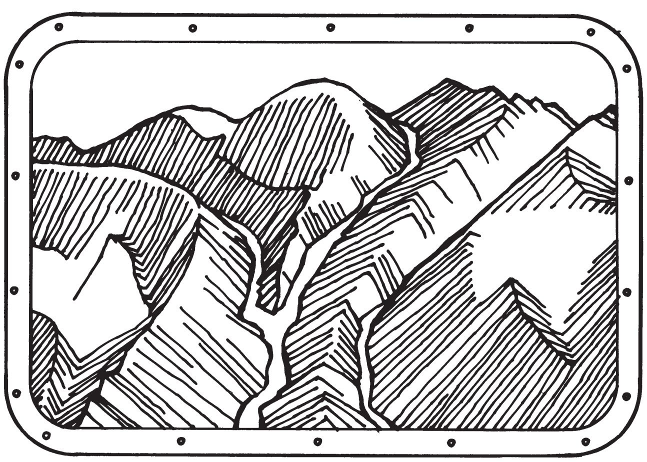
Over time, the ice spills over the edges of the cirques. The ice begins to flow downhill into the valley below. Usually it moves only a few inches a day. Now the ice can be called a glacier.

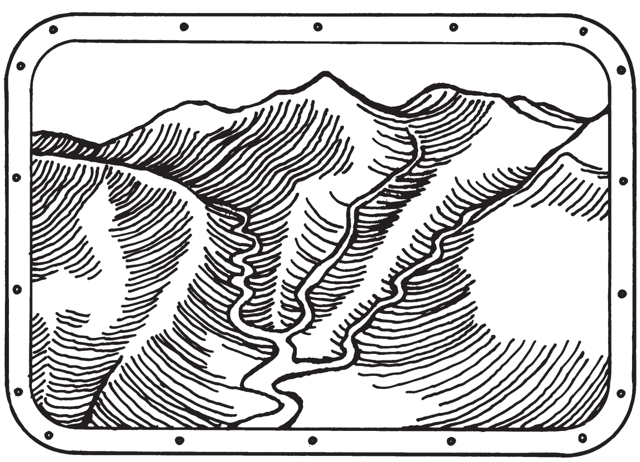
Look ahead! Our helicopter has finally arrived at the glacier.

Do you see the sharp mountain peak at the head of the valley? This peak is called a horn. A **horn** forms when there are several cirques around a mountain. The ice in the cirques keeps wearing away at the mountain. The cirques get bigger. The mountain becomes pointed.

Now look at how several valley glaciers are coming together into one gigantic glacier. As the ice moves, it can stick to huge boulders and pull them up from the sides and floor of the valleys. Boulders stuck to the bottom of the glacier can scour and erode the land. Some of these boulders may be bigger than your classroom. Beneath the ice, the valley is becoming wider and deeper. Now it has a U-shape.

Let's drop our helicopter down and look more closely at the glacier. Do you see the chunks of rock deposited along the sides and front of the glacier? These deposits are called **moraines.** When two glaciers flow beside each other, they both deposit materials. A moraine forms between them.





V-shaped and U-shaped valleys through helicopter windows

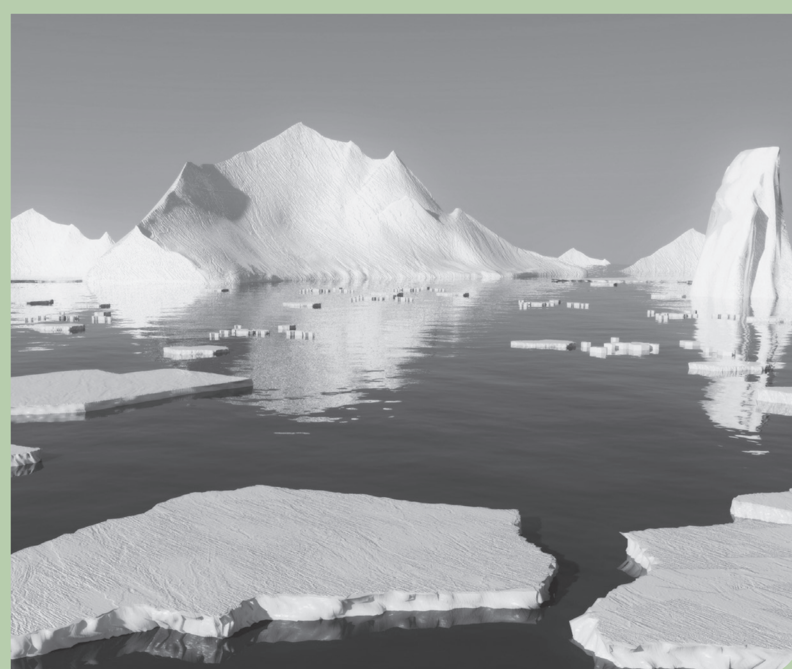
Have you ever seen ice crack? Glaciers crack, too. Deep cracks in glaciers are called **crevasses.** Sometimes glaciers move over uneven land. The ice on top of the glacier bends and breaks. This is how crevasses form.

Now let's fly east. Can you see a smaller glacier plunging over a steep cliff? It is a **hanging glacier.** It is separate from the main glacier. Huge blocks of ice the size of railroad cars can break off.

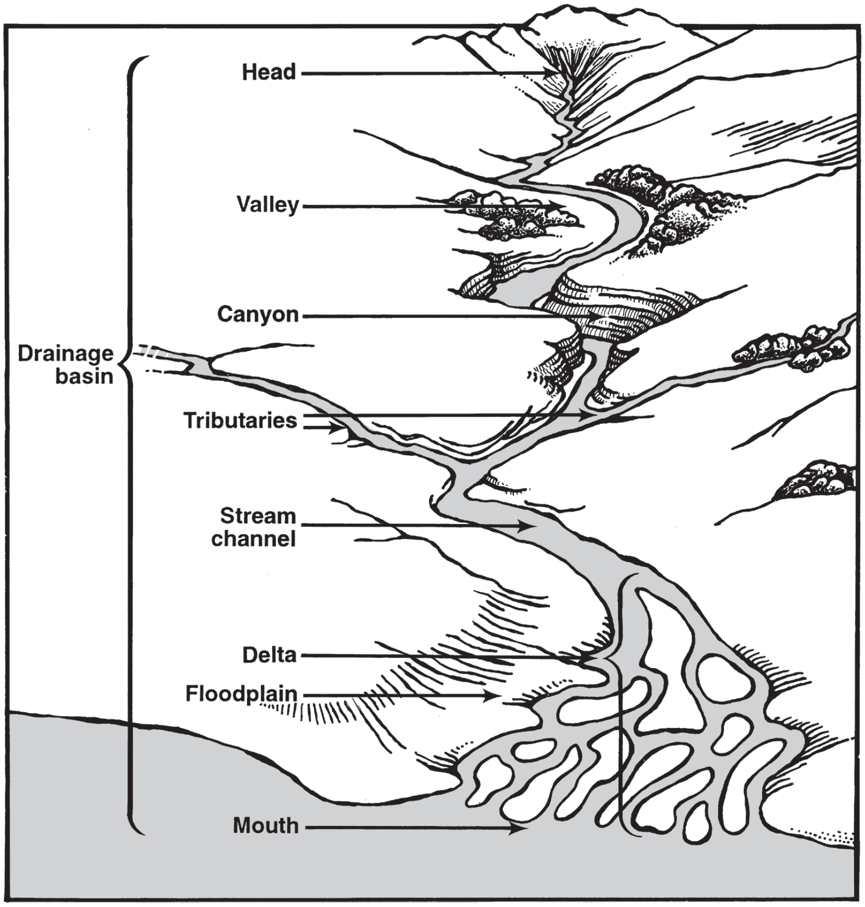
Glaciers are always gaining and losing ice. High in the mountains in winter, new snow falls on the head of the glacier. Down lower, it is warmer. The front of the glacier can melt. Sometimes the glacier flows all the way to the sea. Giant blocks of ice break off and crash into the water. That's how **icebergs** form.

It's time to turn our helicopter around. Let's fly back to the coast. As we do, look out your window. Do you see the valleys below? Which one do you think was made by a river? Which one was made by a glacier?

After you get home, take a look at the land in your own area. Can you tell whether glaciers once flowed there?



Blackline Master
Stream System



- **Head:** the beginning of a stream or river where runoff has cut a channel.
- **Valley:** a long, low area carved by a stream or glacier with higher areas on both sides. Valleys can range from narrow ones with steep cliffs on both sides to wide ones with broad, flat plains.
- **Canyon:** a deep, steep-walled gorge carved in rock by a stream or glacier.
- **Drainage basin:** all of the land drained by a river and its tributaries.
- **Tributary:** a stream that flows into a larger stream or river.
- **Stream channel:** the course along which water moves.
- **Delta:** a flat plain created by the sediment dropped at the river's mouth. A delta can be bow shaped, like the Nile Delta. It can also be bird's foot, or triangular, like the Mississippi Delta.
- **Floodplain:** a flat area next to the stream and made up of loose sediment, such as silt. The sediment is deposited when the stream overflows its banks.
- **Mouth:** the point at which water from a river or stream empties into another body of water, such as a larger stream, lake, or ocean.

Land and Water Student Self-Assessment A

Name ______________________________

Date ______________________________

1. Write down two or three things you have learned in doing the *Land and Water* unit.

____

____

____

2. How well do you think you and your partners are working together? Give some examples.

____

____

____

3. How do you feel about working with the stream table materials? Are your feelings changing as you work through the unit? Give examples.

____

____

____

4. What activities have you enjoyed? Why did you like them?

____

____

____

5. Were there any activities so far in the unit that you did not understand or that confused you? Explain your answer. (Think about which investigation was the most difficult for you.)

____

____

____

Name ______________________________

Date ______________________________

6. Look at your record sheets, aerial drawings, and science notebook. How well do you think you have recorded your observations and conclusions?

____

____

____

7. Think about the work you have done so far in this unit. What do you think you have done very well?

____

____

____

What area of your work do you think you can improve on?

____

____

____

8. How do you feel about science now? Circle the words that apply to you.

a. Interested **b.** Relaxed **c.** Nervous **d.** Excited

e. Bored **f.** Confused **g.** Successful **h.** Happy

i. Add one word of your own: ______________________________

Record Sheet 12-A

Group ______________________ **Names** ______________________

Date ______________________ ______________________

____

____

Building a Dam

1. **Examine the Problem:** During heavy rains, the Gaveo River experiences flash floods. The Gaveo Town Council has asked your design engineering team to look into this problem. How would you solve the problem? List your ideas.

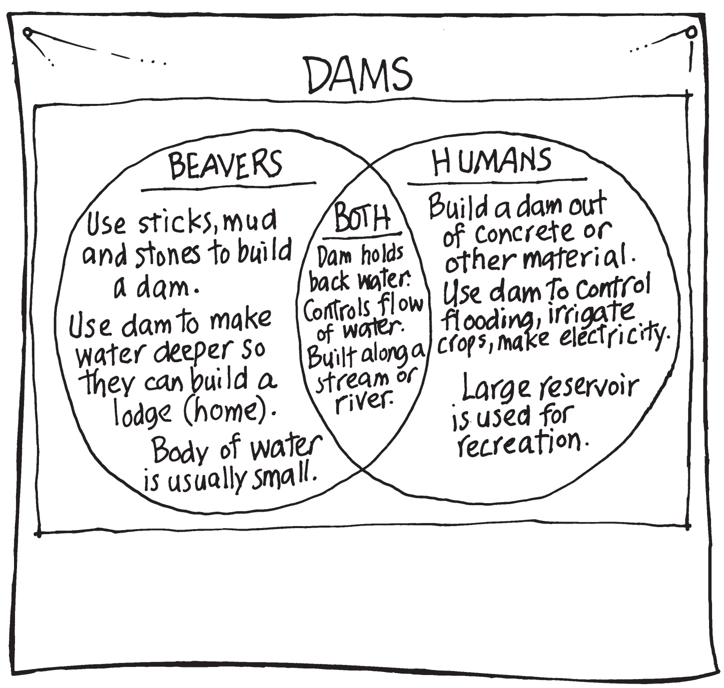
____

____

____

____

2. **Look at the Research:** A group of students has conducted research on how dams can be used to control the flow of water. Use their data, which appear on the Venn diagram below, as your starting point.



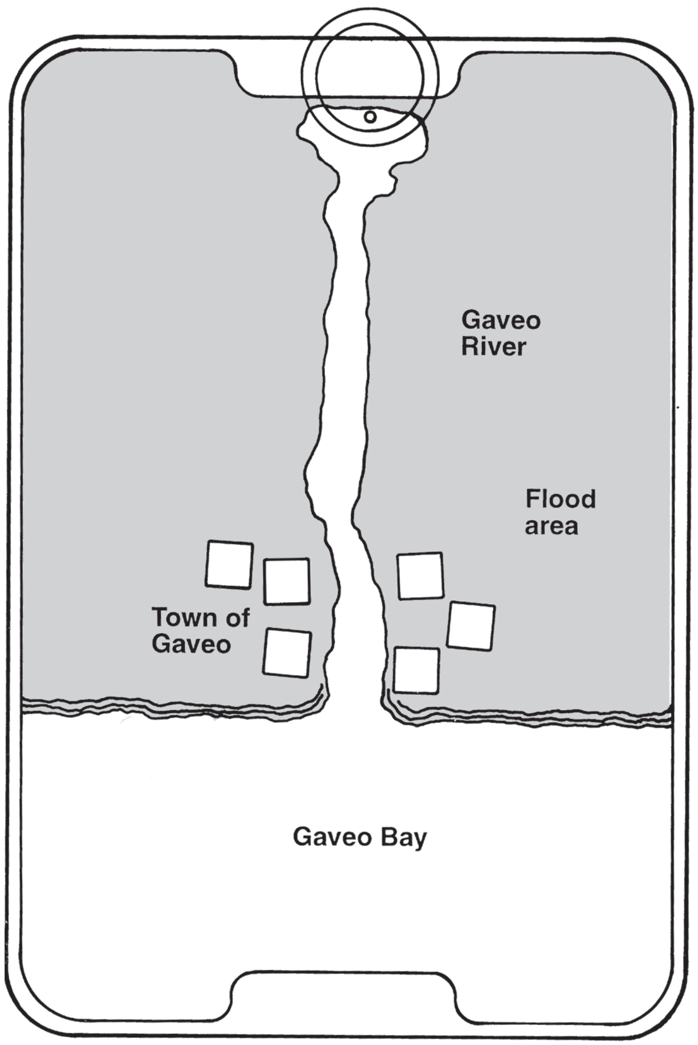
Record Sheet 12-A

Name ____________________

Date ____________________

Building a Dam, *continued*

3. **Make a Plan:** Look at the map. Consider the location of the town of Gaveo. Where would you build your dam to protect the town from flooding? Draw your dam on the map.



Why would you choose this location?

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4. **Make a Prediction:** What do you think will happen when the river floods after you build your dam? Use a blue crayon to show your prediction on the map.

Record Sheet 12-A

Name ______________________________

Date ______________________________

Building a Dam, *continued*

5. **Design, Build, and Test Your Dam:**

- Set up your stream table as you have in other lessons.
- Use a spoon to carve the Gaveo River in your stream table. Use the illustration to help you.
- Look at the map. Place the plastic cubes in your stream table to represent the town of Gaveo. Make certain they are in the same place in your stream table as they are on the map.
- Build your dam.
- Test your dam by filling the stream source cup once. Change your dam, if you wish, and stop building when you are satisfied with your results. Record your observations in the space below.

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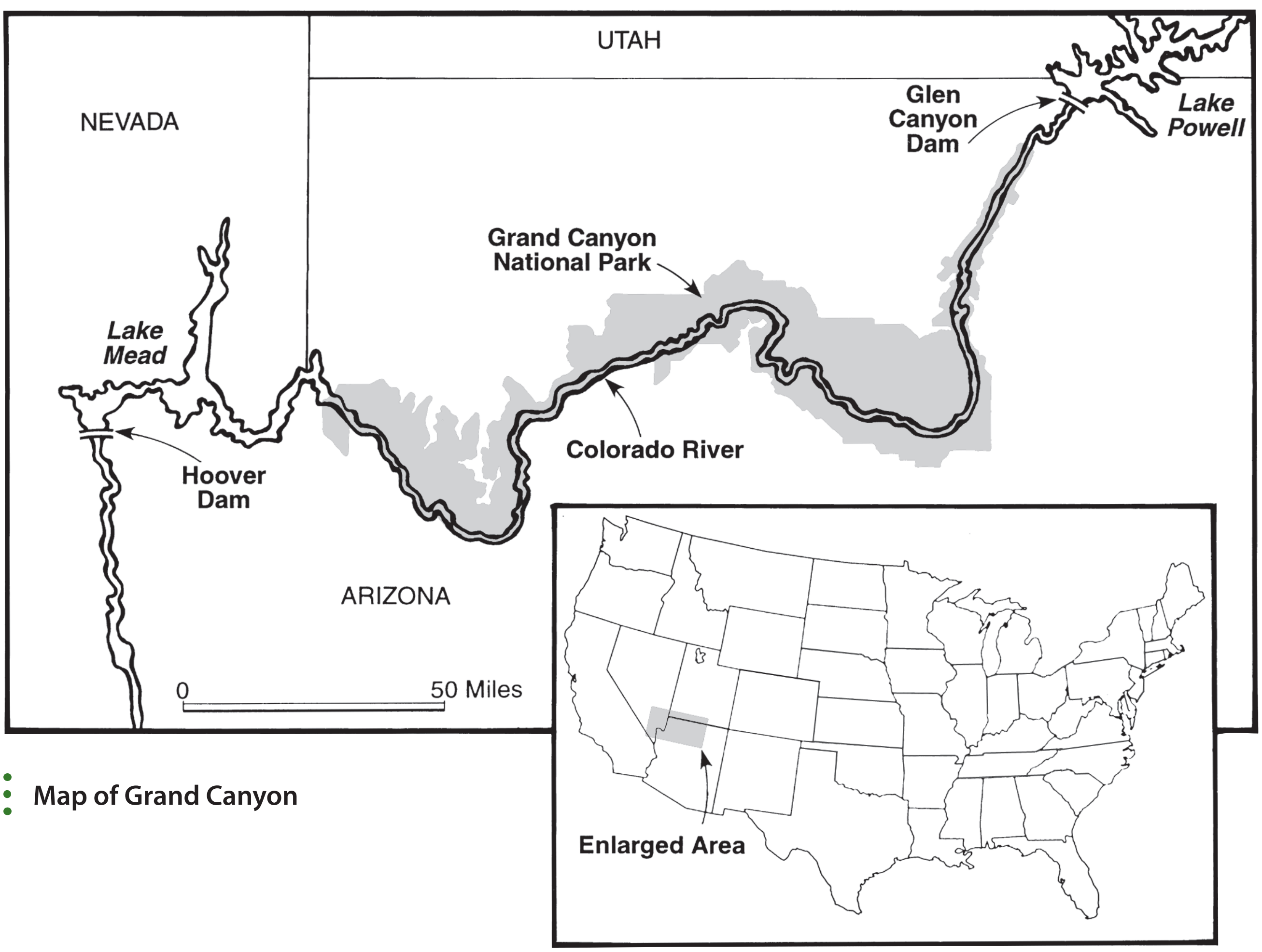
Releasing a River

It is March 26, 1996. A group of scientists stand at the base of the Glen Canyon Dam on the Colorado River. They are looking at the landscape shaped by the river. Earlier in the day, they canoed along the river observing its banks and the organisms—like ambersnails and the southwestern willow flycatcher—that live there.

Millions of years ago, the Colorado River flowed across the Colorado Plateau. The land was high and flat then. Over the centuries, the Colorado River and its floods sculpted and shaped the land until a huge, deep canyon formed—the Grand Canyon.



Map of Grand Canyon

A Lake Made by Humans

The scientists turn around to look at the massive concrete wall that holds back part of the Colorado River. Behind the dam is Lake Powell. It is the human-made lake, or **reservoir**, that formed when workers built the dam in 1963. Operators of the dam can control the flow of water that passes through the large pipes in the dam and into the canyon.

The water stored in the reservoir is used to make electricity. This **hydroelectricity** can provide power to homes and businesses. Just like a waterfall, water from the lake gushes through narrow openings inside the dam. The water hits the blades of **turbines**, or engines, and causes them to spin. These engines power the generators that make electricity.

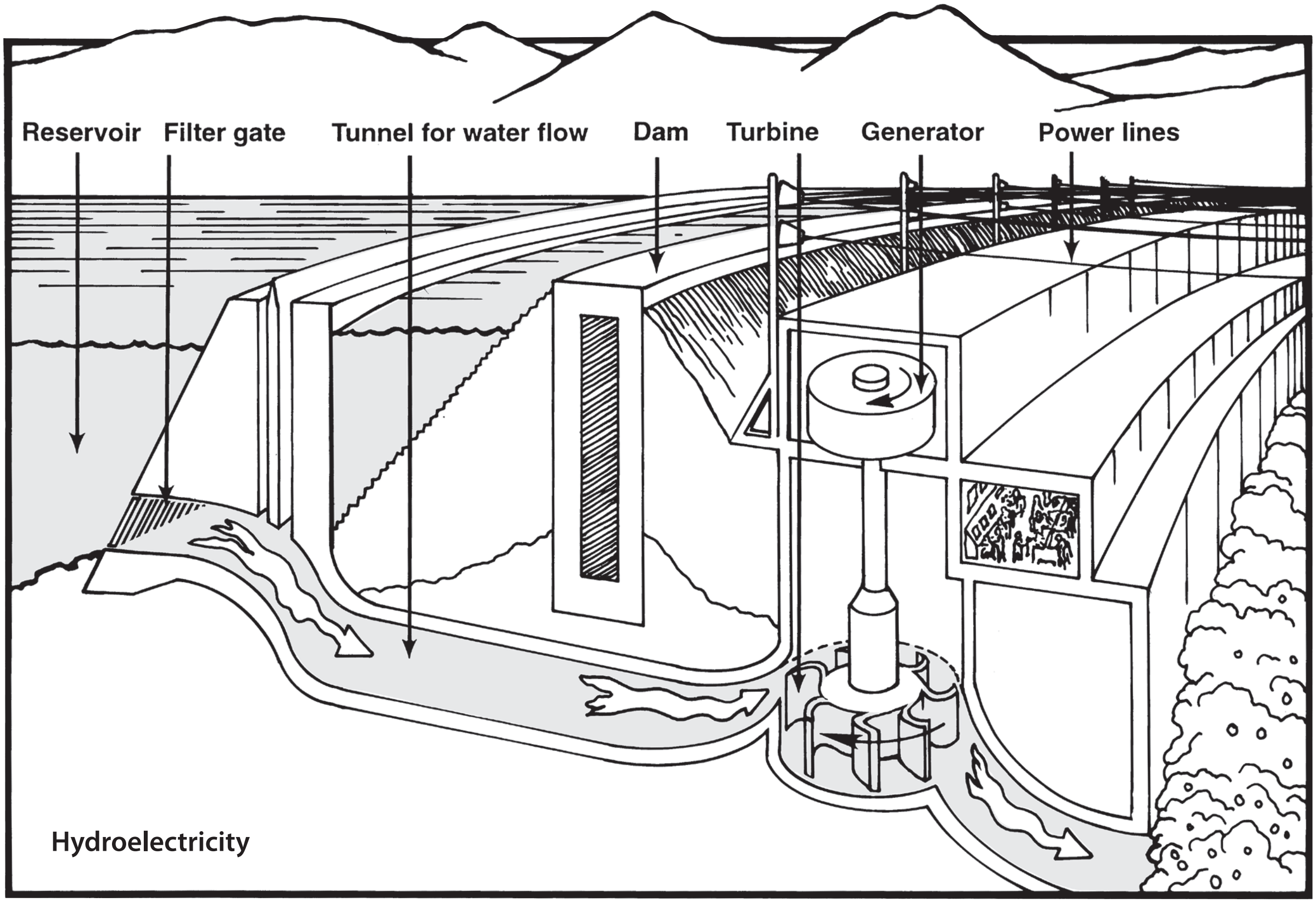
Towns as far away as 250 miles receive water piped from reservoirs along the Colorado River. Towns can receive water from the reservoirs even during a drought. **Irrigation**, which brings water to farmland through drainage channels, provides farmers with water for growing crops.

People use the reservoir for recreation, too. Swimming, boating, and fishing are only a few of the fun things people enjoy doing on Lake Powell.

Swoosh! The Water Is Released

The dam was built to create electricity. But today, the scientists are going to open the dam. They will create a human-made spring flood.

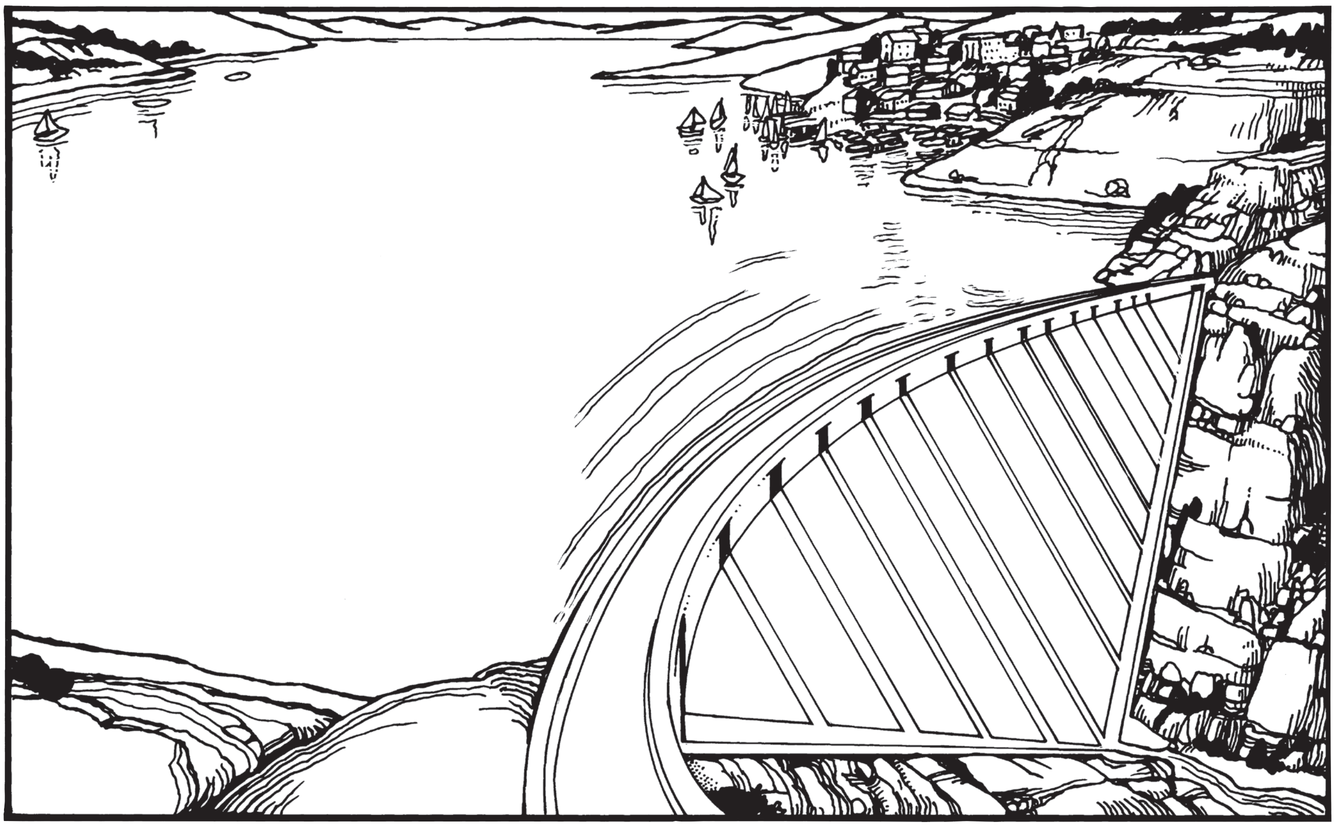
Swoosh! The dam opens. A thunderous roar echoes through the canyon. More than 117 billion gallons of water blast out of the large tubes at the bottom of the dam. The scientists plan to leave the dam open for a week.



Hydroelectricity

Why would anyone want to flood a canyon on purpose? Before 1963 when the dam was built, the river flooded every spring. The water eroded huge amounts of soil and deposited it along the river's banks. Beaches and sandbars formed when the floodwater pulled back. People on rafting or canoe trips could camp on the beaches. Fish could hide behind the sandbars in the warm, still water and lay their eggs. All along the river, the **ecosystem,** or environment in which plants, animals, and their environment interact, depended on the floodwater.

When scientists and engineers dammed the river, it no longer flooded each spring like it had for centuries. Across the country, scientists observed that dammed-up rivers were getting smaller.



Using a reservoir

Trees sprouted in the middle of dry riverbeds. Some rivers, like the Colorado, no longer reached the sea. No wonder! Except during extremely high flood years, humans collect and use almost all the water in the entire Colorado River.

What were the scientists' goals for flooding the river? They wanted to restore the beaches along the river's banks. They also hoped the human-made flood would help bring back the natural habitat that plants and animals lost when the river was dammed.

USGS Gaging Stations	Predicted Arrival of Flood	Actual Arrival of Flood (estimated)
Lees Ferry	2 hours, 45 minutes	3 hours
Above Little Colorado River	14 hours, 16 minutes	13 hours
Above Grand Canyon	18 hours, 41 minutes	15 hours
Diamond Creek	40 hours, 39 minutes	37 hours

One person's predictions for the flood

Planning the Human-Made Flood

Scientists carefully planned each step of the flood. They tied transmitters to boulders to study how floods move sediment. They tagged endangered organisms. They even moved snails to higher ground before opening the dam.

And then there was the red water. To measure the speed of the flood, scientists who study water, or **hydrologists**, at the U.S. Geological Survey dyed the water red. They set up stations along the river below the dam. Each station transmitted data to satellites in the sky. Students, teachers, scientists, and others were asked on the World Wide Web to predict how long it would take the red floodwater to reach each station. Because of computers and satellites, people across the world could follow the flood as it happened!

More than a week later, the floodwater reached the Hoover Dam 300 miles away at the lower end of the Grand Canyon. What were the results of releasing the river? It will take a long time to tell how the flood affects plants and animals in the river habitat. But after the dam was closed and the flooding stopped, beaches could be seen along the river. Scientists are calling the flood a success. They might release the river every 10 years.

Humans have learned many ways to control the flow of water. Now they are realizing the effects. What do you think are the benefits of a dam? What are the disadvantages? Should humans release other dammed-up rivers? You might want to do some research to find out more about this topic.

Record Sheet 14-A

Name ______________________________

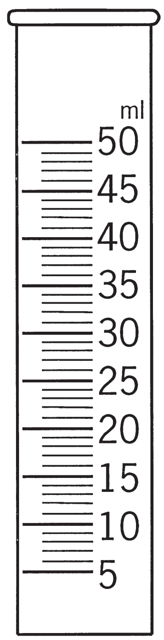
Date ______________________________

Investigating the Effects of Plants on Erosion

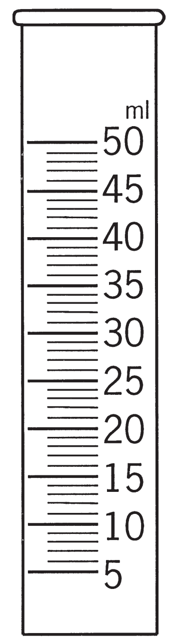
Observing the Cylinders of Runoff

1. Place your two cylinders of runoff (14A and 14B) side by side. Let them sit for a few minutes. Then draw what you see.

Cylinder 14A: With Plants



Cylinder 14B: Some Plants Removed



2. Compare the two cylinders. How are they alike? How are they different?

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3. Look at the soil in each cylinder. In which cylinder do you see more soil? __________

What happens when you remove plants from soil?

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Record Sheet 14-A

Name ______________________________

Date ______________________________

Investigating the Effects of Plants on Erosion, *continued*

Thinking about Plants on Earth

1. Why do people plant grass or other vegetation? List as many reasons as you can.

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2. Think of some situations in which people remove trees and other plants from the soil. List as many as you can.

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3. How does removing plants affect the land?

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4. Do you think people should remove plants? Explain.

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Record Sheet 15-A

Group ______________________ **Names** ______________________

Date ______________________ ______________________

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Designing and Building a Landscape

Part A: Plan Your Landscape

Circle the features you will include in your landscape.

Circle one:	**Circle one:**	**Circle as many as you plan to use:**
Sloped stream table	Fast-moving water (cup with large hole)	Rocks Hills Valleys
Level stream table	Slow-moving water (cup with small hole)	Extra clay Extra humus
	Multiple water source (cup with three holes)	Extra gravel Extra sand
		Plants Dam

Other ideas for your landscape in words or pictures:

Record Sheet 15-A

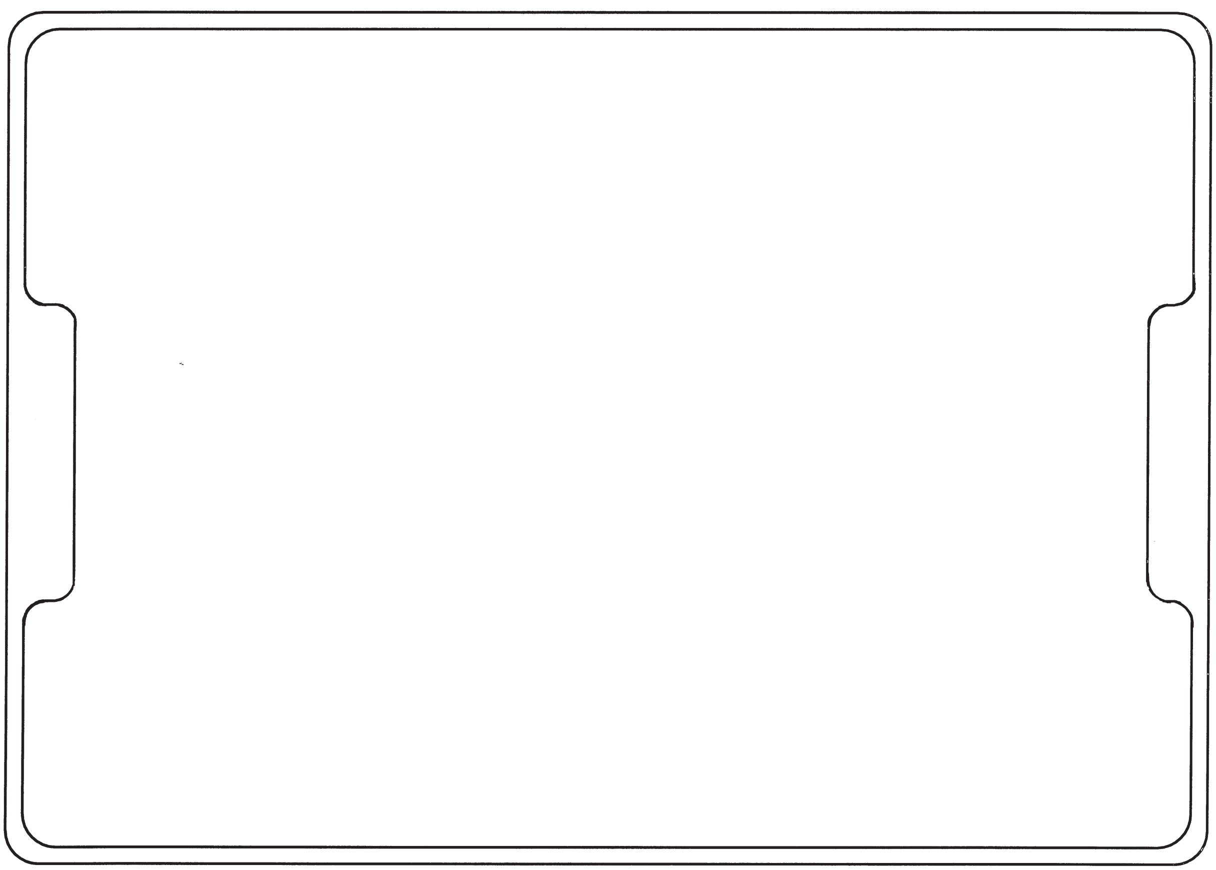
Name ______________________________

Date ______________________________

Designing and Building a Landscape, *continued*

Part B: Build Your Landscape

1. *Carefully* remove all the plants remaining from Lesson 14 in your stream table. What do you notice about the roots and soil? Set the plants on the paper towel.
2. Mix the soil in the stream table. Bulldoze and shape the soil so it matches your planned landscape.
3. Add gravel, clay, humus, or sand to the areas where you want to have a different soil composition.
4. Place rocks, hills, slopes, valleys, dams, or other features in the landscape.
5. Carefully replant the ryegrass and mustard plants in the areas of the stream table where you want vegetation to cover the soil.
6. Draw your finished landscape in the space below.



Record Sheet 15-A

Name ______________________________

Date ______________________________

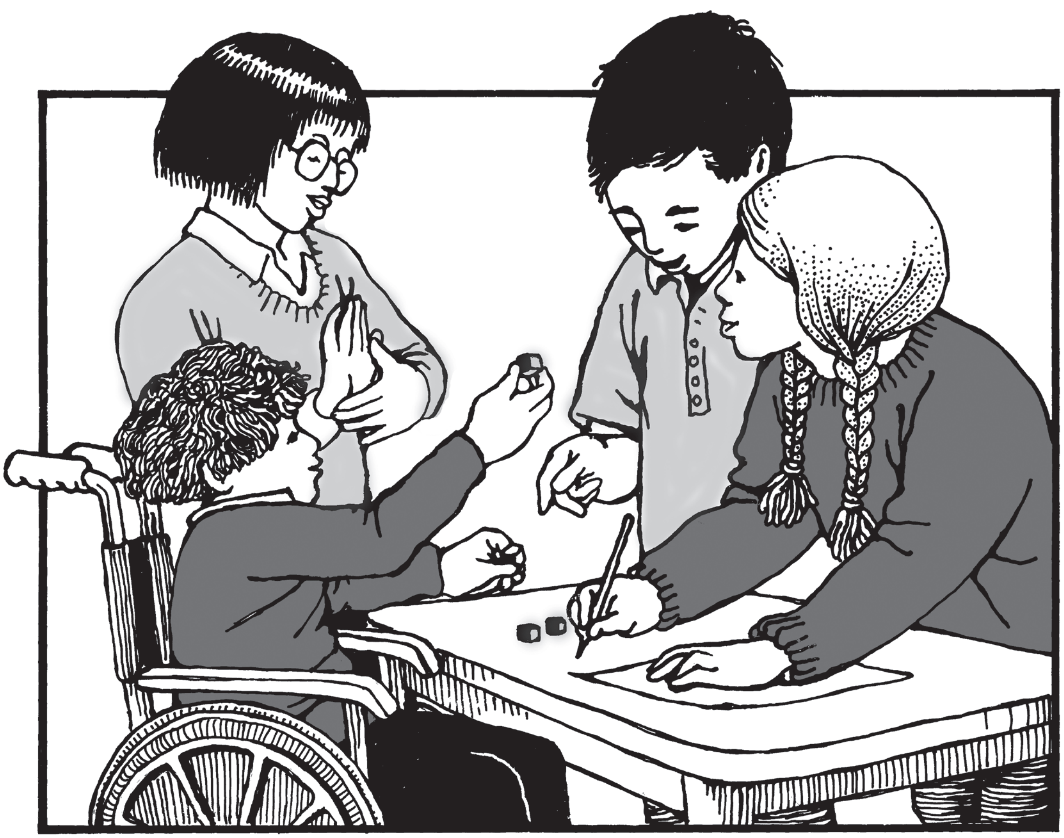
Designing and Building a Landscape, *continued*

Part C: Predict How Water Will Affect Your Landscape

Think about the type of stream source cup you have decided to use (large hole, small hole, or three holes). Where do you think water will flow on your landscape? With a blue crayon, draw the water on your picture. Use a brown crayon to show any changes to the land that you think will occur.

Part D: Select a Homesite

Look at your drawing in Part B. Then look at your landscape. Where will a home be safe from flowing water and erosion? Each member of the group should select a place on the landscape to build a home. Place your plastic cubes in the stream table at the locations you selected for each homesite. Then add them to your drawing.



Reading Selection

Fallingwater: Wright On!

During the 1920s, Edgar Kaufmann, who owned a large department store in Pittsburgh, Pennsylvania, often took his wife and children to the country for weekend vacations. The family loved to picnic on a sandstone boulder overlooking a 20-foot waterfall on Bear Run. The stream ran through the forest. Mr. Kaufmann dreamed of building a summer cottage at this beautiful site. He wanted to locate his home across from the falls. Could any site be more spectacular?

Fallingwater

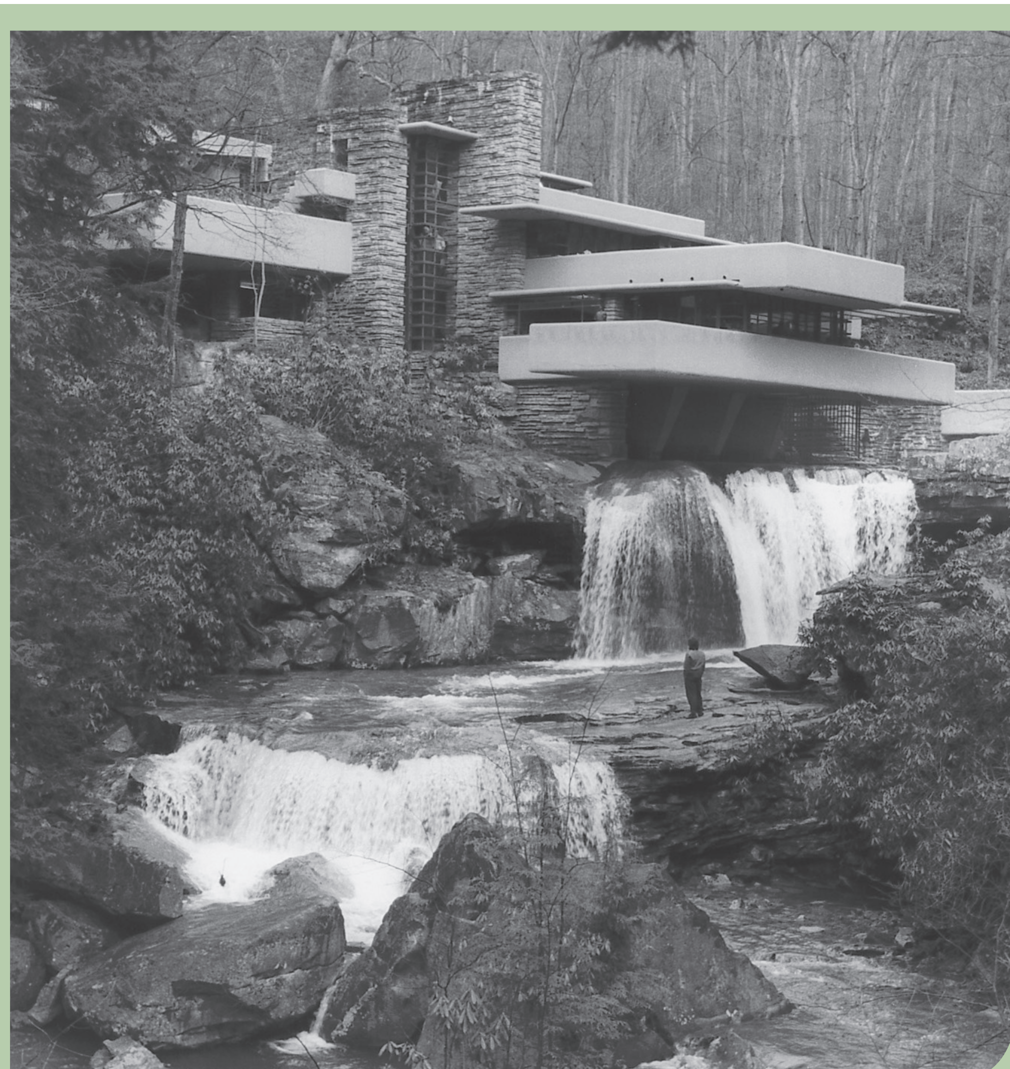
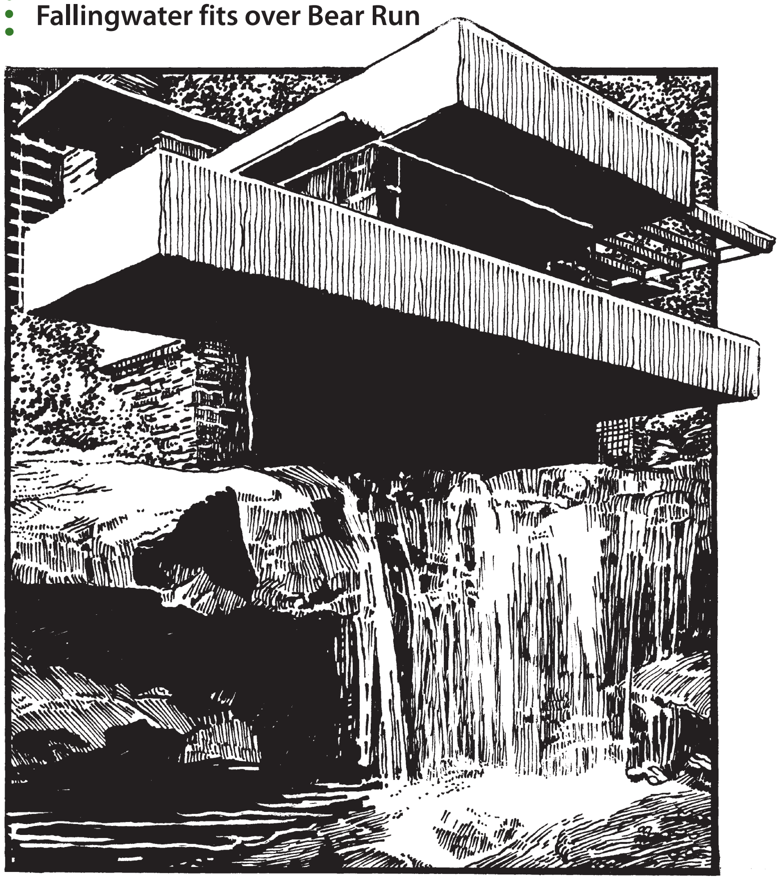


Photo: Jerry A. McCoy © 1995

Fallingwater fits over Bear Run



Yes. How about a home built over the waterfall? A house that straddled the stream? That's what Kaufmann's architect, Frank Lloyd Wright, proposed. Wright even suggested a name for the residence: Fallingwater. "I want you to live with the waterfall, not just look at it," said the architect.

The Kaufmanns were delighted with Wright's idea. And at age 68, the most famous American architect of the twentieth century began to design the Kaufmann's home. First, he did his homework. He studied special maps until he knew the position of every boulder, every tree, and every turn of the stream. Later, Wright visited Bear Run with the Kaufmann family.

Months passed. Still Mr. Wright had not put his pencil to paper. The house had not been designed. Then, as Mr. Kaufmann and several others watched, Wright sketched his plan for the entire four-story house in just a few hours. His design was nearly perfect.

Construction began on the tree-covered hillside in 1936. The Kaufmanns moved in three years later. In 1963, the Kaufmann family gave the home to the Western Pennsylvania Conservancy. Today, Fallingwater is one of the best-known homes in America. More than 70,000 people tour it every year.

Working *with* Nature

Fallingwater gave Mr. Wright the opportunity to apply an idea he had developed during more than 40 years as an architect. He believed an architect must work with nature, not against it. This approach is called **organic architecture.**

Fallingwater blends perfectly with its surroundings. It is made of sandstone that miners dug from the ground nearby. The house fits over the stream and the surrounding boulders. Some beams are anchored in the boulders. Huge slabs of concrete serve as **cantilevers** to help support the house. They reach boldly over the waterfall and seem to defy gravity. The "backbone" of the house is a large, four-story chimney. From the balcony of the main bedroom, you can look 35 feet straight down into the tumbling waterfall!

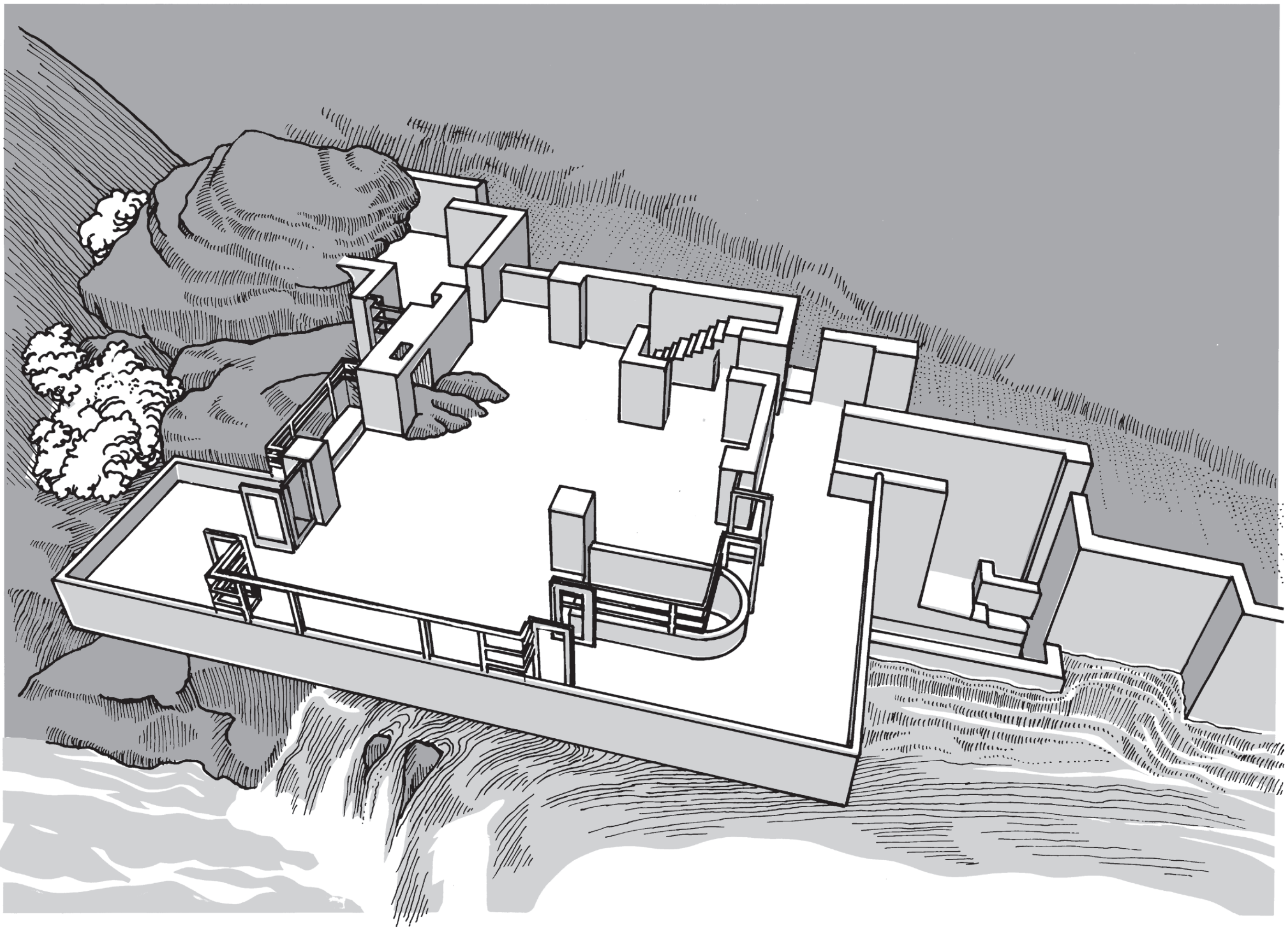
Wright did not want the building to disturb local plant life. So he designed a concrete grid that allowed space for the trees on the property to grow. And remember the boulder where the Kaufmanns used to picnic? It's still there—sticking out from the stone floor in front of Fallingwater's main fireplace.

Wright also paid attention to the design and furnishings inside Fallingwater. The ground floor is a large open space that serves as a living room, dining room, and small kitchen. Walls are replaced by windows. Like curtains, they flow from ceiling to floor. The floors are made of natural polished stone. For the doors, Wright ordered special wood from a shipbuilding company. This wood wouldn't be harmed by the moisture. Beds, desks, and dressers are built into the walls. The dresser drawers have straw bottoms so that air can circulate in the moist atmosphere. The shower heads are unusually large. Taking a shower feels like standing under the waterfall!

But Will It Tumble into the Creek?

From the beginning, some people wondered whether Wright's design would work. Was it strong enough to withstand the forces of nature? Today, more than half a century later, it has. Even a tornado that ripped through the area in the 1950s did not damage the house. An ordinary house might not withstand such force. But Wright designed Fallingwater with the landscape in mind. He knew that his special house was adapted to its unusual setting.

Floor plan of Fallingwater



The Kaufmann house brought a lot of publicity to Frank Lloyd Wright. Fallingwater has been the subject of magazine stories and has won awards. Some people believe it was Wright's personal favorite. How can they tell? They think he cleverly enclosed his own initials in its name:

FaLLingWater!