MAJOR RIVERS
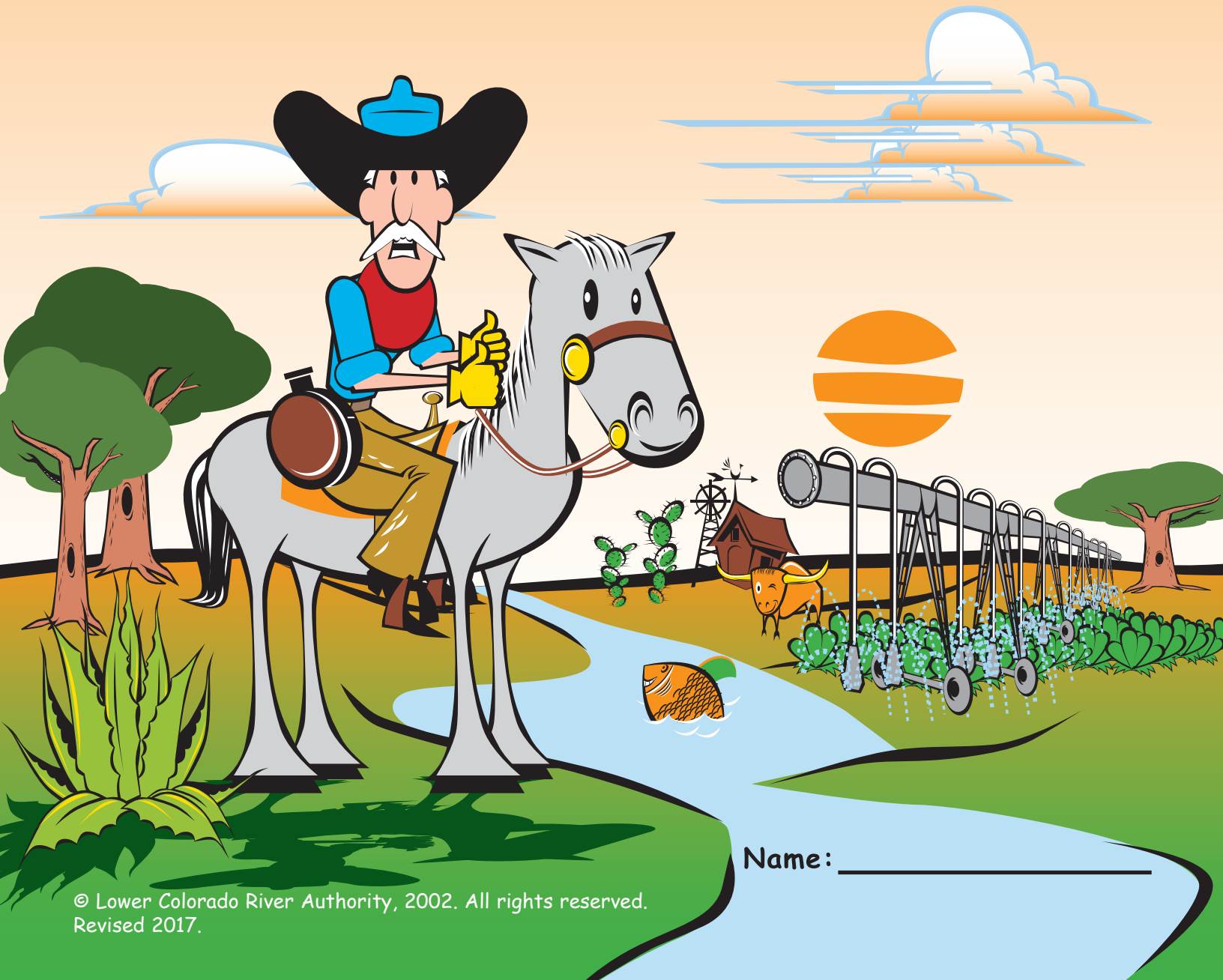
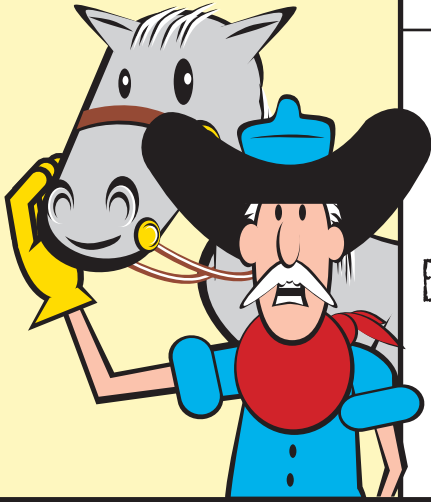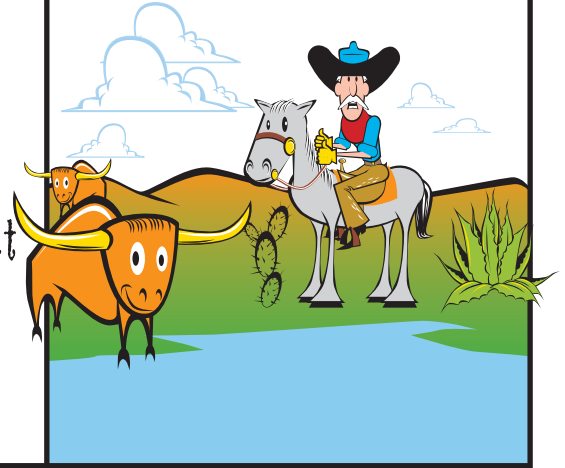## A Water Education Program for Texas

Name: _____

1. Howdy! I am Major Rivers, and this is my trusty horse, Aquifer.

2. We've done lots of traveling through Texas. We've roamed from Amarillo to Brownsville and from El Paso to Beaumont.

3. We've learned a lot about Texas. One of the most important things we learned about is water!

4. Every living thing needs water. Ranchers need water for their cattle to drink. Farmers need it to grow our food. You and your families need water for cooking, for cleaning, and even for playing.

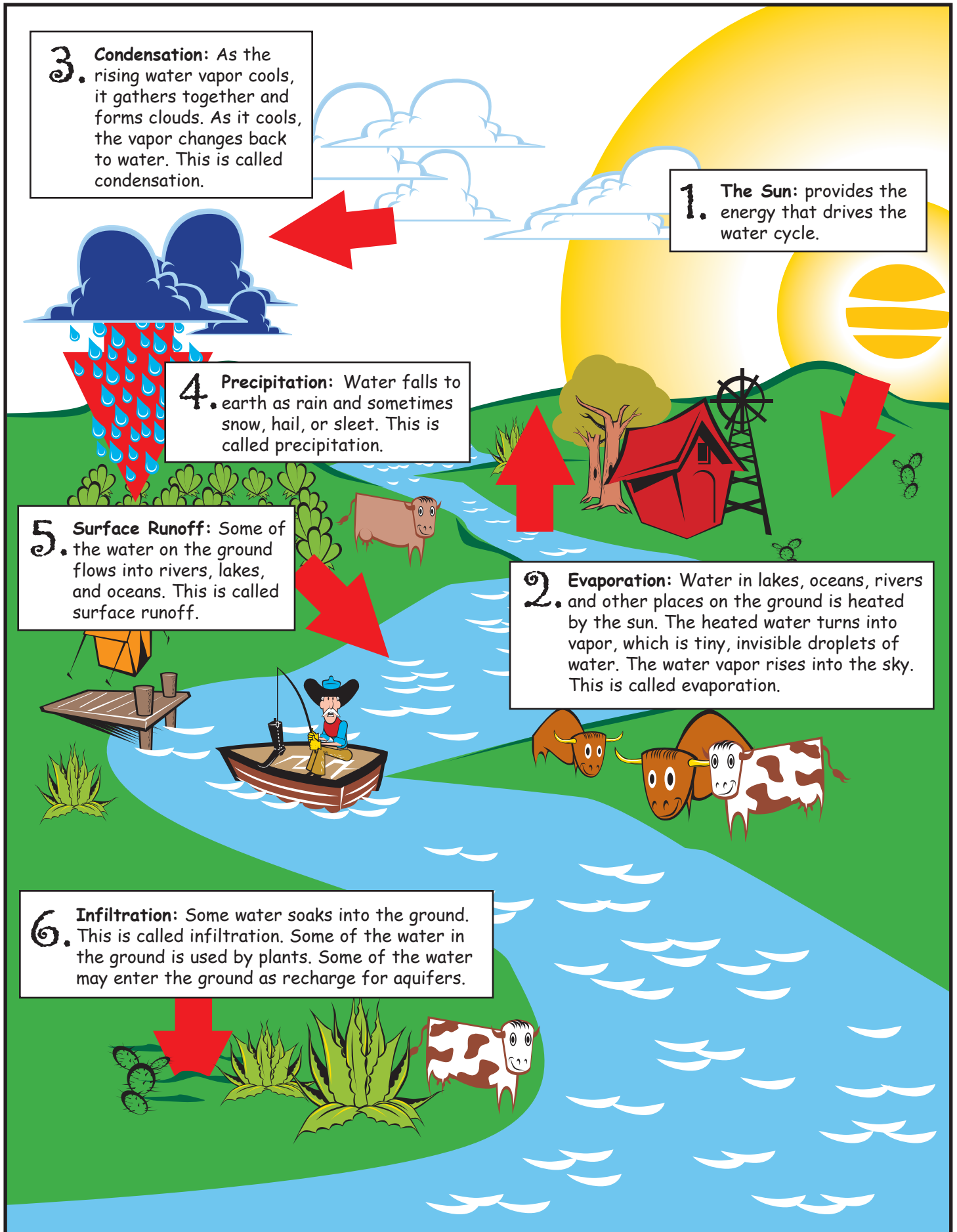5. In Texas, many folks work hard to see that you have clean water when you turn on the faucet.

6. There is only so much water, and there are more people using it every day. In dry years, when very little rain falls, we have even less water.

7. It is important that we use water wisely. We should never waste water.

3. **Condensation:** As the rising water vapor cools, it gathers together and forms clouds. As it cools, the vapor changes back to water. This is called condensation.

1. **The Sun:** provides the energy that drives the water cycle.

4. **Precipitation:** Water falls to earth as rain and sometimes snow, hail, or sleet. This is called precipitation.

5. **Surface Runoff:** Some of the water on the ground flows into rivers, lakes, and oceans. This is called surface runoff.

2. **Evaporation:** Water in lakes, oceans, rivers and other places on the ground is heated by the sun. The heated water turns into vapor, which is tiny, invisible droplets of water. The water vapor rises into the sky. This is called evaporation.

6. **Infiltration:** Some water soaks into the ground. This is called infiltration. Some of the water in the ground is used by plants. Some of the water may enter the ground as recharge for aquifers.

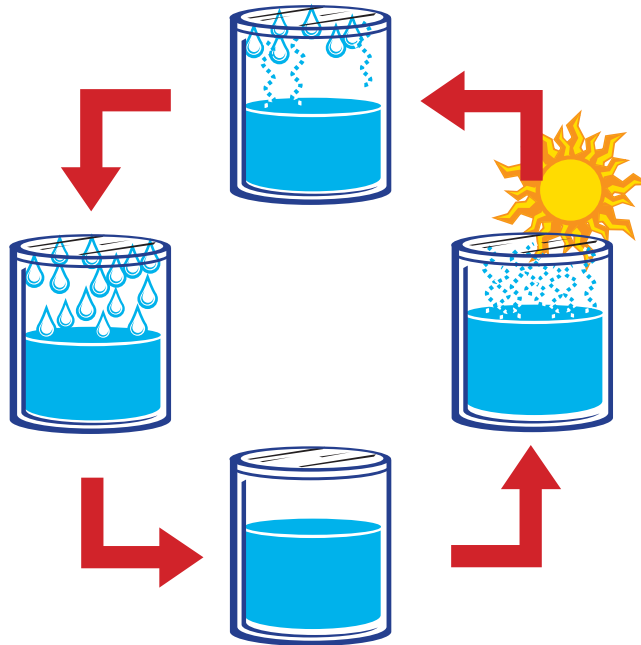## EXERCISE 2: THE WATER CYCLE

Part A

Directions: The picture below is a way of showing the water cycle. Fill in each blank space with the part of the water cycle being described.

The vapor rises, hits the lid of the cup and cools.
Liquid water drops form on the lid. This is an example of _____.

The liquid water drops fall from the lid into the cup.

This is an example of
_____.

The liquid water is heated by the sun and turns into vapor.

**This is an example of**
_____.

Water Source

Part B

Directions: Circle the letter of the word that best completes each sentence. Next, write the word on the blank line.

1. Water falls to earth as either rain or snow. This is called _____.
    a.) surface runoff   b.) infiltration   c.) precipitation

2. Some water on the ground flows into rivers, lakes, and oceans.
This is called _____.
    a.) condensation   b.) evaporation   c.) surface runoff

3. Some water soaks into the ground. This is called _____.
    a.) infiltration   b.) precipitation   c.) condensation

4. Water on the ground gets heated and changes into vapor. The vapor rises into the sky. This is called _____.
    a.) evaporation   b.) precipitation   c.) infiltration

5. Vapor cools, forms clouds, and changes back into water.
This is called _____.
   a.) infiltration   b.) condensation   c.) precipitation

1. The water cycle shows how water moves in a circular path from the earth to the sky and back to the earth again.
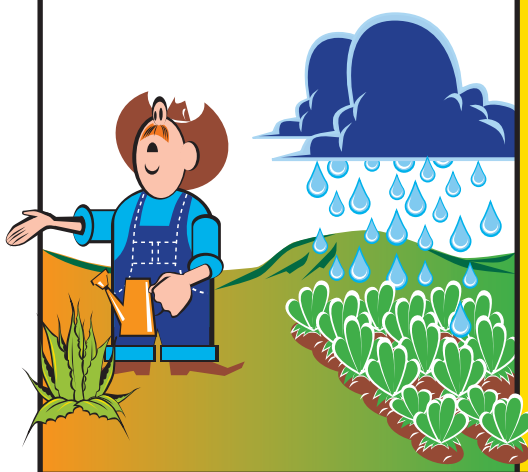
2. One side of Texas — the west side — gets very little rain. Only 8 to 30 inches of rain fall every year in West Texas.

3. The other side of Texas — the east side — gets quite a lot of rain. Nearly every year between 30 and 56 inches of rain fall in East Texas.

8 inches of Rain

N W E S

56 inches of Rain
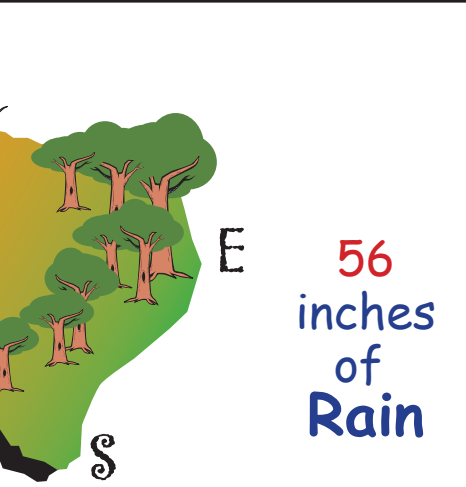
4. Surface runoff from rain in Texas forms what I am proud to call "major rivers." Most of these rivers run downhill toward the south and east.
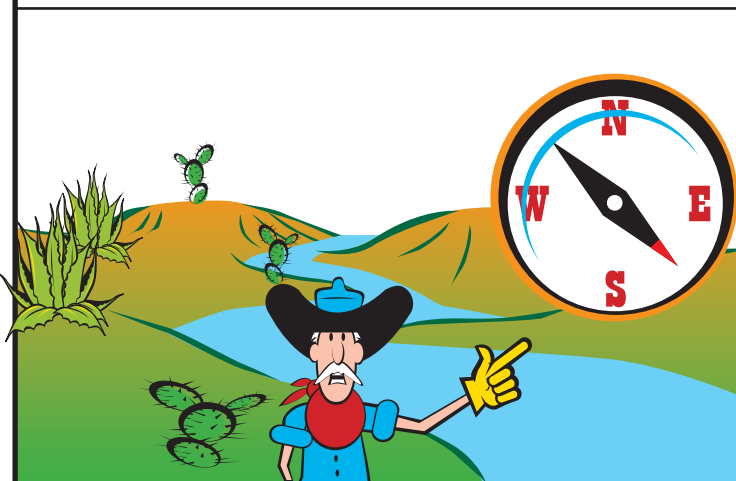
5. The rivers spill into the Gulf of Mexico, which is a large body of salt water. Before they reach the Gulf, these rivers supply ALMOST half of the water for Texas.

Gulf of Mexico

6. A lot of surface runoff infiltrates through the ground and is stored underground in aquifers. Besides being the name of my horse, an aquifer is an underground layer of gravel, sand, or rocks that is filled with water. MORE than half of the water used in Texas is pumped up from aquifers.
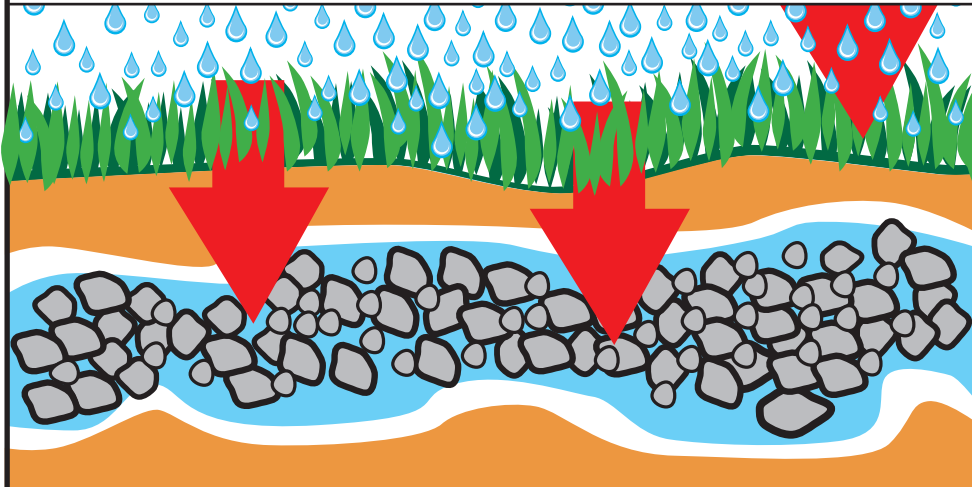
7. Look on the next page and you'll see where all the rivers and aquifers that supply water in Texas are located.
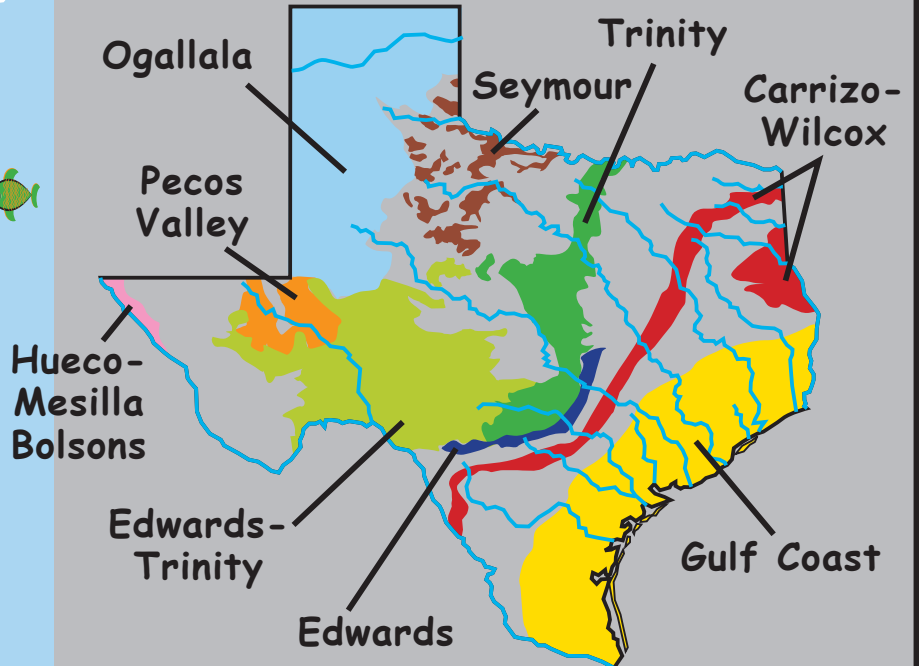
Major Rivers of Texas

New Mexico

Oklahoma

Canadian River

▲ Amarillo

Wichita Falls
▲

Lubbock
■

Fort Worth
◆

Abilene
▲

Colorado River

Midland
▲

Odessa
▲

Waco
▲

Austin
★

Pecos River

Guadalupe River

San Antonio
✳

Victoria
◉

Rio Grande

Del Rio
◉

El Paso
◆

Nueces River

Laredo
■

Corpus Christi
■

Mexico

Brownsville
▲

Legend

Cities with Populations of:

◉ <100,000

▲ 100,000 - 200,000

■ 200,000 - 500,000

◆ 500,000 - 1,000,000

✳ >1,000,000

★ Capital of Texas

Arkansas

Louisiana

Red River
Sulphur River
Texarkana
Cypress River
Sabine River
Dallas
Longview
Trinity River
Neches River
Brazos River
Beaumont
San Jacinto River
Houston
Lavaca River
San Antonio River

Gulf
of
Mexico

The population of Texas is expected to increase more than 70 percent to 51 million by 2070. Water planning will help Texans have enough water in future years to meet their many different water needs.

If we don't plan ahead, there may not be enough water for my young'un.

Major Aquifers

Ogallala
Seymour
Trinity
Carrizo-Wilcox
Pecos Valley
Hueco-Mesilla Bolsons
Edwards-Trinity
Edwards
Gulf Coast

Part A

Directions: Circle the letter of the word that best completes each sentence. Next, write the word on the blank line.

1. An underground layer of gravel, sand, or rocks that is filled with water is called _____.

   a.) a reservoir   b.) an aquifer   c.) a lake

2. The area of Texas that receives the most rain is the _____.

   a.) east   b.) north   c.) west

3. Almost _____ of the water we use in Texas comes from rivers.

   a.) one-half   b.) none   c.) all

4. The river that supplies Austin, our capital city, is the _____.

   a.) Rio Grande   b.) Colorado   c.) Trinity

5. The rivers in Texas all flow to the southeast and empty into the _____.

   a.) Matagorda Bay   b.) Gulf of Mexico   c.) Yucatan Peninsula

6. _____ is the process that community leaders use to prepare for future water needs.

   a.) Building dams   b.) Bottling water   c.) Water planning

Part B

Directions: Next to the name of each river, write its letter shown on the map. Try not to look back at pages 6 and 7. The first one has been done for you.
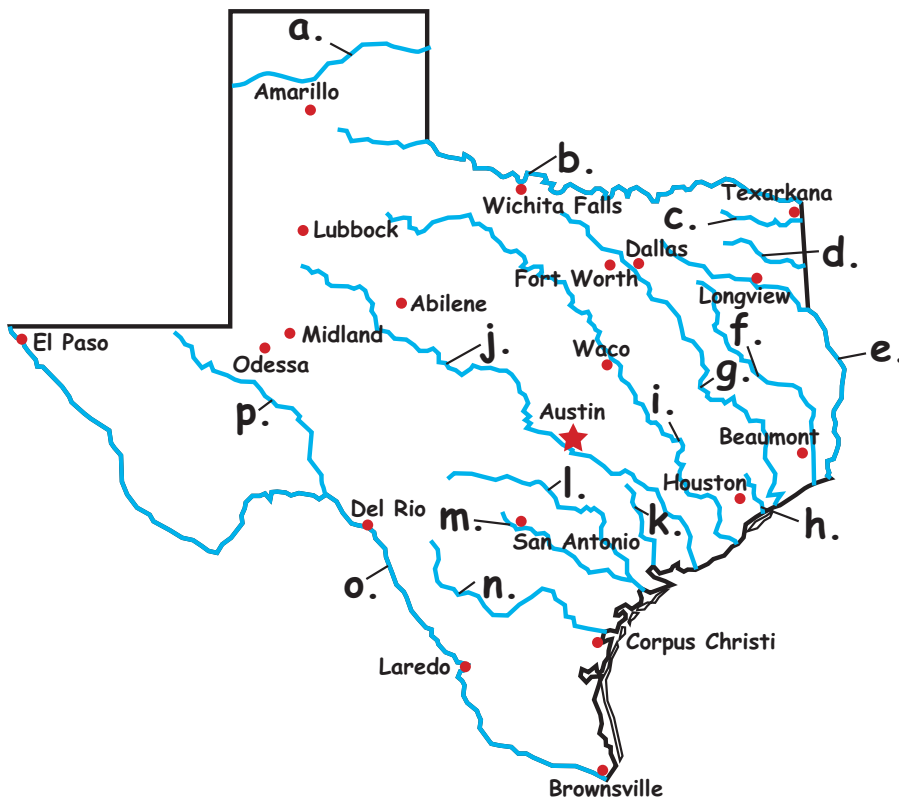
___i__ 1. Brazos River

_____ 2. Canadian River

_____ 3. Colorado River

_____ 4. Cypress River

_____ 5. Guadalupe River

_____ 6. Lavaca River

_____ 7. Neches River

_____ 8. Nueces River

_____ 9. Pecos River

_____ 10. Red River

_____ 11. Rio Grande

_____ 12. Sabine River

_____ 13. San Antonio River

_____ 14. San Jacinto River

_____ 15. Sulphur River

_____ 16. Trinity River

1. A watershed is an area of land that water flows across and drains to a creek, stream, or river.
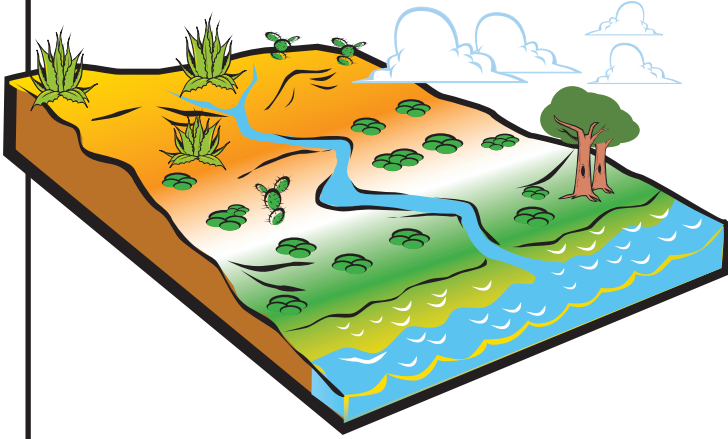
2. Small watersheds combine to become river basins. Texas has 23 major river basins. Most of the rivers in Texas flow from west to east into the Gulf of Mexico.

Gulf of Mexico

3. Long ago, Native Americans lived along the rivers and other areas where they could find water. Later on, pioneers settled and built communities in the same locations.

4. As the communities grew into cities, people realized they could not depend on the river to flow. Sometimes it was very dry.
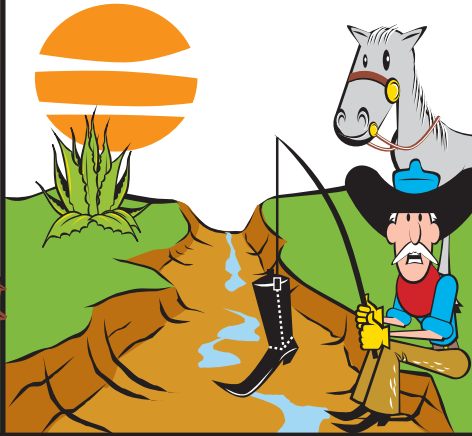
5. Sometimes when it rained too much, there were floods. River authorities, groundwater conservation districts, and irrigation districts were formed to manage surface water and groundwater throughout Texas.

HELP!

6. Many dams were built along the rivers of Texas to provide a constant supply of water for the people of Texas. Some also were built to help control flooding. These dams form all but one of the lakes or reservoirs in Texas.

YOUR MALL

YOUR MALL
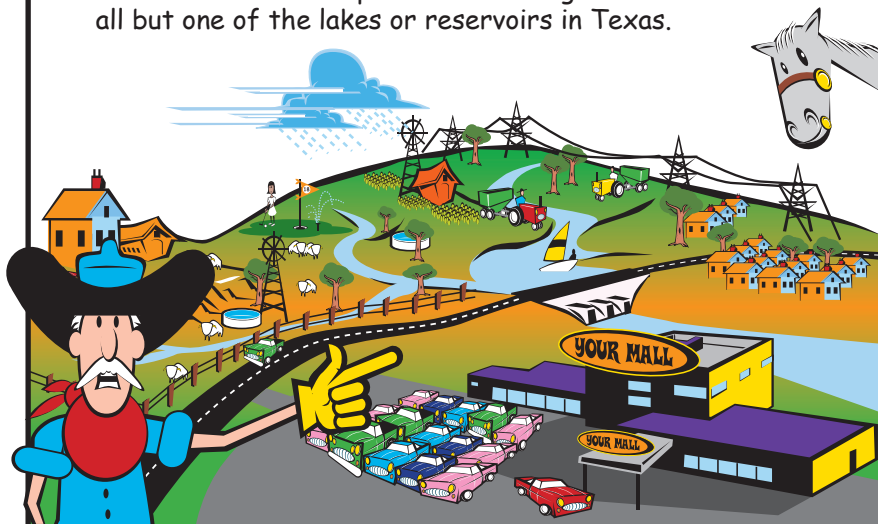
7. Today more than 25 million people live in the watersheds of Texas, and they use the water in many different ways. Watersheds are also the homes of many different plants and animals.

GULF OF MEXICO

Directions:

1. Put the following words in the correct blank to label the watershed: tributary, floodplain, meander, headwaters, wetland, delta, and main channel.

2. Color the tributaries that flow into the main river blue.

3. Place an arrow showing the direction of the river's flow.

1. **Municipal:** Municipal water uses include drinking, cleaning, flushing toilets, bathing and showering, and watering lawns.

2. **Industrial:** Some factories (sometimes called industries) use large amounts of water while making a product. Large pipes bring water to the factory.
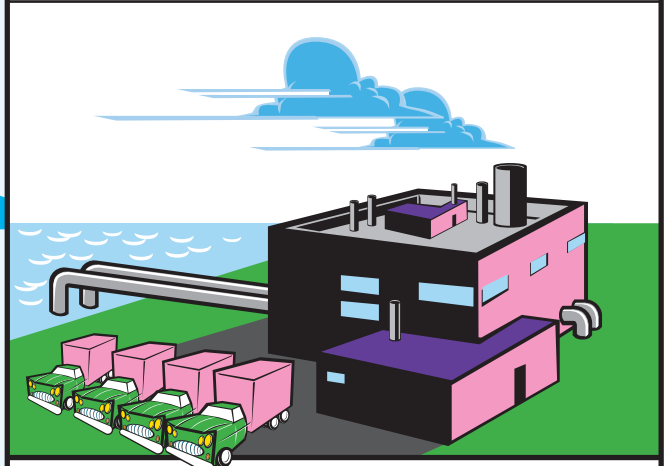
3. **Agricultural:** When it does not rain enough, farmers and ranchers use water from the river and aquifers. Farmers can irrigate their crops with huge sprinkler systems.
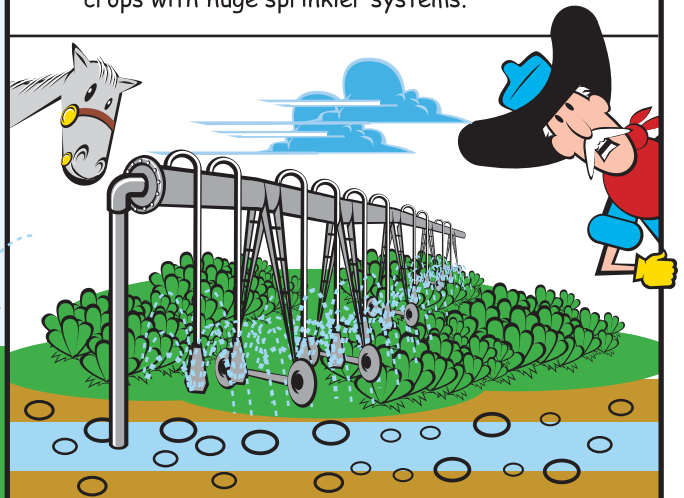
4. **Electricity:** Water turns the turbines that generate our electricity, either by the force of flowing water (at hydroelectric plants at dams) or by heating the water into steam (at other power plants).
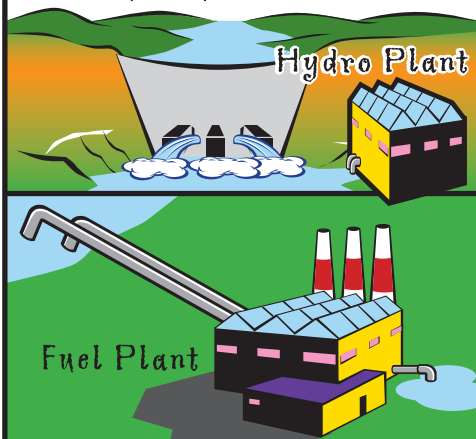
5. **Recreational:** Swimming, fishing and boating are all examples of recreational use of water — using the water for fun!

6. As we use water, we can sometimes misuse it and damage our environment. Decades ago, point-source pollution was our biggest water quality problem. This type of pollution comes from specific sources such as industrial plants.

the Chef

Hydro Plant

Fuel Plant
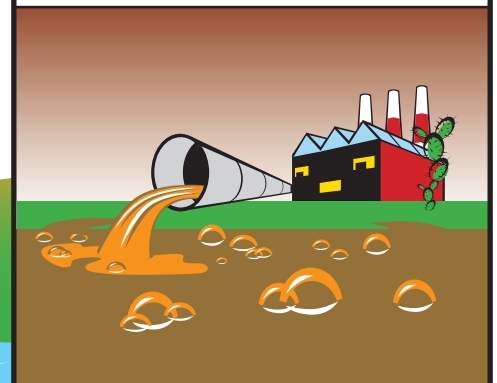
7. In recent years, nonpoint-source pollution has become a larger problem. Nonpoint-source pollution means that there is no single source or person to blame for the pollution. It is all of us! Nonpoint-source pollution is the result of our everyday activities such as using chemicals on your yard or littering. We need to be careful with what we add to the ground because we all live in a watershed, and our watersheds feed into our rivers!

EXERCISE 5: WHAT IS POLLUTION?

Directions: Complete the form based on your observations.

Date: _____

Site Description (name): _____

Weather Conditions: Air Temperature (ºC): _____ Water Temperature (ºC): _____

Date of last rainfall: _____

1. **Water clarity (circle one):**   clear   cloudy   turbid

2. **Water surface (circle one):**   clean   scum   foam   debris   sheen (oil)

3. **Water odor (circle one):**   none   oil/gas   sewage   rotten egg   fishy   musky

4. **Type of pollution (circle one):**   nonpoint-source   point-source   none

5. **Nonpoint-source evidence:** _____

_____

6. **Point-source evidence (i.e., wastewater treatment plant pipe):** _____

_____

7. **Observations of area land use:** _____

_____

1. In the early days of Texas, there were not as many people living here. Most folks just dipped right into the rivers or dug wells into the ground to reach aquifers. However, the population of Texas grew. To have plenty of water, we had to find a way to store water.

Okay. The rivers and aquifers supply our water. How does the water get to you in your home?

2. The government formed river authorities to build dams across rivers to make lakes. These lakes, called reservoirs, hold water until it is needed downstream.
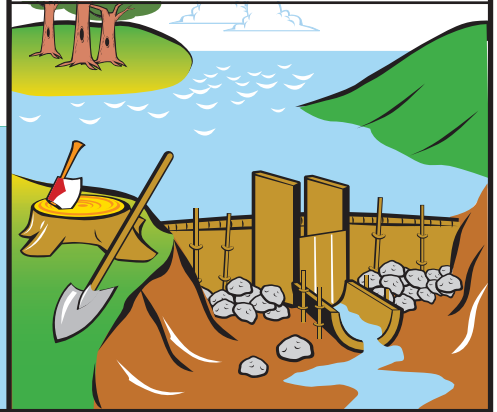
3. Dams also help to minimize flooding when it rains too much. Yessiree. Before we tamed these Texas rivers, they could be wilder than a bucking bronco!

FEED

4. We've tamed the rivers and stored the water. However, more people now live in our watersheds, and the water is exposed to additional nonpoint-source pollution.

5. To make sure all our water is safe for us to drink, water companies and cities have built treatment plants. This is where water is cleaned.
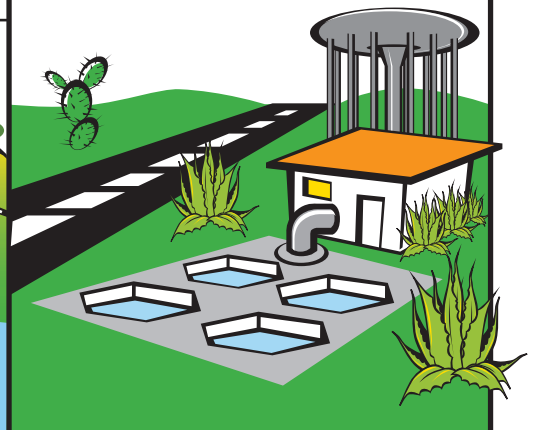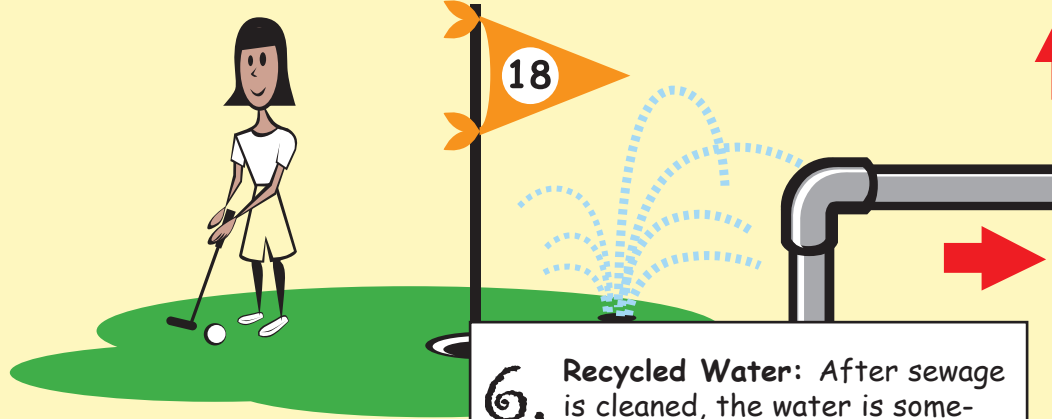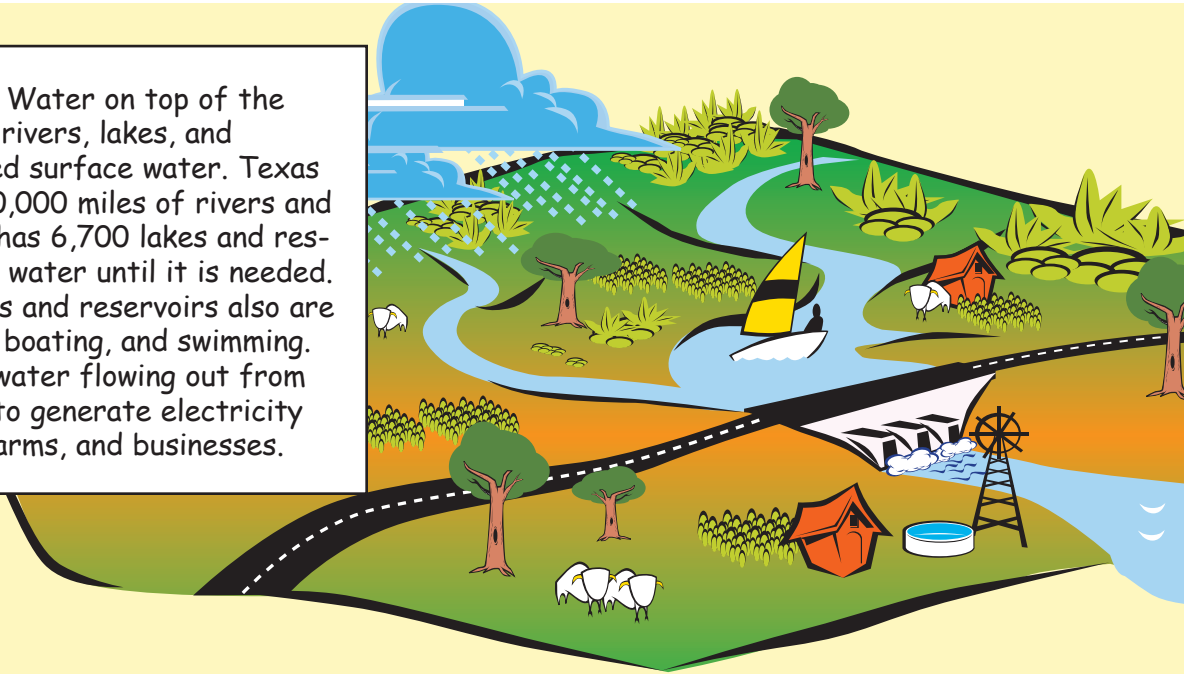
6. After treatment, water goes through pipelines, sometimes miles and miles, to get to our homes. Other pipes, called sewer lines, take our wastewater away.
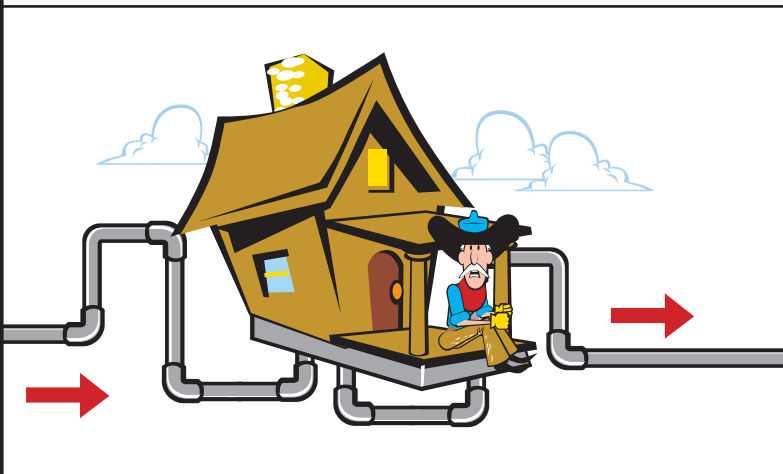
7. It costs a lot of money to bring this water to you. Most homes have a water meter to show how much is used. Your family pays for the water it uses just like it pays for electricity.
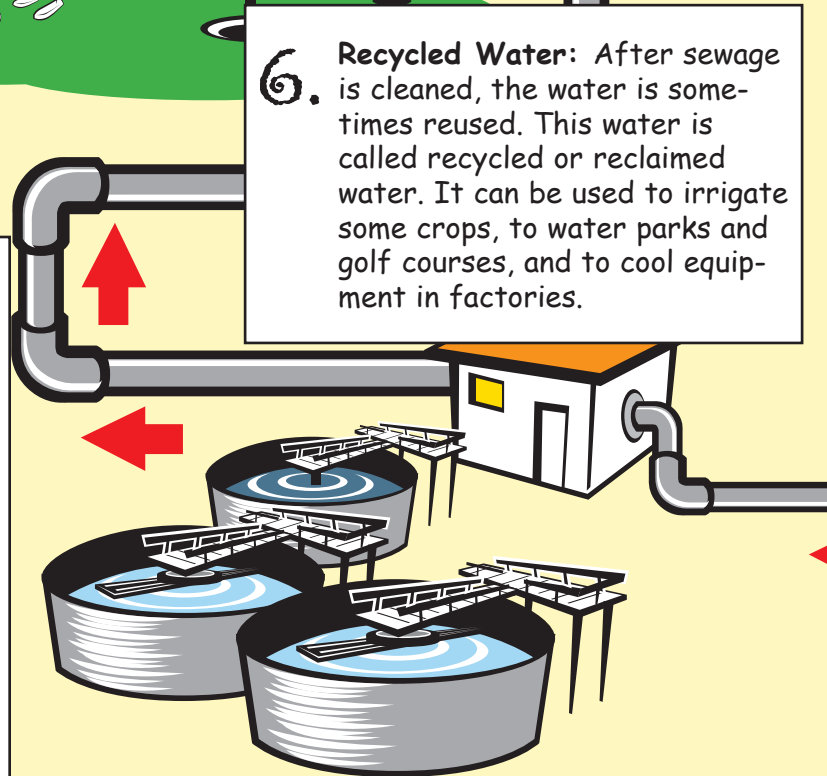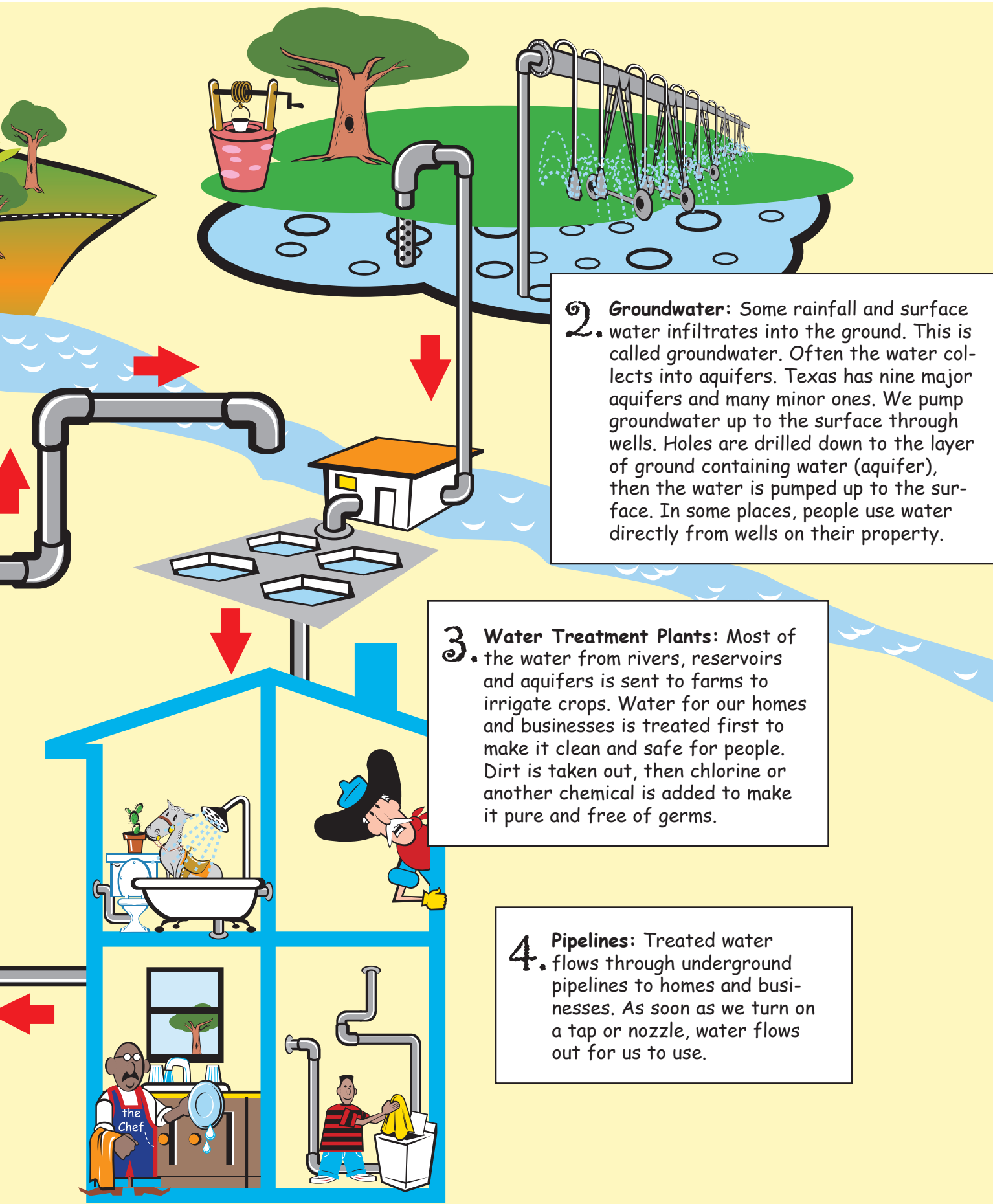
The next page shows how water gets into your home, then back out again.

0 1 1 7 5 2 0

1. **Surface Water:** Water on top of the ground – such as rivers, lakes, and streams – is called surface water. Texas has more than 80,000 miles of rivers and streams. It also has 6,700 lakes and reservoirs that hold water until it is needed. Many of the lakes and reservoirs also are used for fishing, boating, and swimming. On some rivers, water flowing out from the dam is used to generate electricity for our homes, farms, and businesses.

18

6. **Recycled Water:** After sewage is cleaned, the water is sometimes reused. This water is called recycled or reclaimed water. It can be used to irrigate some crops, to water parks and golf courses, and to cool equipment in factories.

5. **Wastewater Treatment Plants:** We use water every day for washing, cooking, and cleaning. We add many pollutants to the water. This used water is called wastewater, or sewage. It goes through pipes to a wastewater treatment plant where it is cleaned. It is then returned to the water cycle by either being discharged back into the river or by being used to water golf courses and some crops. Many rural areas of Texas do not have wastewater treatment systems, so they use septic systems. Septic systems slowly release the water back into the ground or into the air.

2. **Groundwater:** Some rainfall and surface water infiltrates into the ground. This is called groundwater. Often the water collects into aquifers. Texas has nine major aquifers and many minor ones. We pump groundwater up to the surface through wells. Holes are drilled down to the layer of ground containing water (aquifer), then the water is pumped up to the surface. In some places, people use water directly from wells on their property.

3. **Water Treatment Plants:** Most of the water from rivers, reservoirs and aquifers is sent to farms to irrigate crops. Water for our homes and businesses is treated first to make it clean and safe for people. Dirt is taken out, then chlorine or another chemical is added to make it pure and free of germs.

4. **Pipelines:** Treated water flows through underground pipelines to homes and businesses. As soon as we turn on a tap or nozzle, water flows out for us to use.

the Chef

Part A

Directions: Read each item. Fill in the blank spaces with the words listed below.

• surface water

• water treatment plants

• pipelines

• reservoirs

• wastewater treatment plants

• groundwater

• recycled water

1. Dirt and germs are removed from water at _____ _____ .

2. Water is delivered to homes through _____ .

3. Large amounts of surface water are stored in _____ .

4. Sewage is cleaned at _____ .

5. Cleaned wastewater that is used to water grass and some crops is called _____ .

6. Water we pump out of aquifers is called _____ .

7. Water from rivers, reservoirs, and lakes is called _____ _____ .

Part B

Directions: Trace Major Rivers and Aquifer through the maze. Stop at each water distribution point and unscramble the words to show where Major Rivers is.

ecafrus wraet

1._____ _____

rrreesiov

2._____

tawre ttrnaetme tnalp

3._____
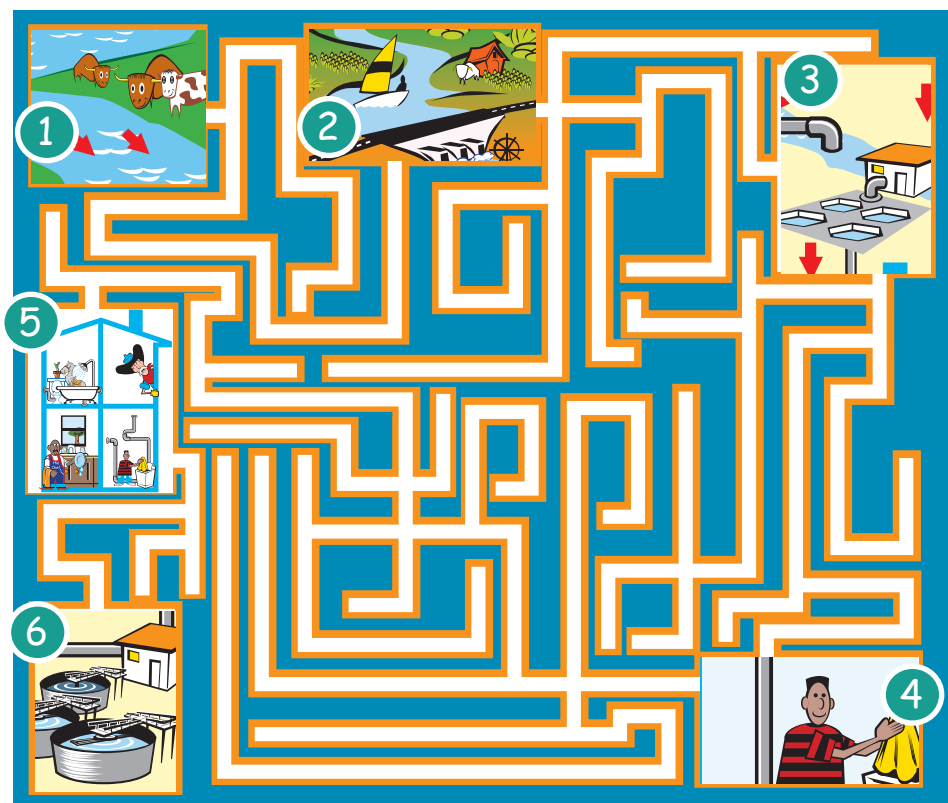
mohe
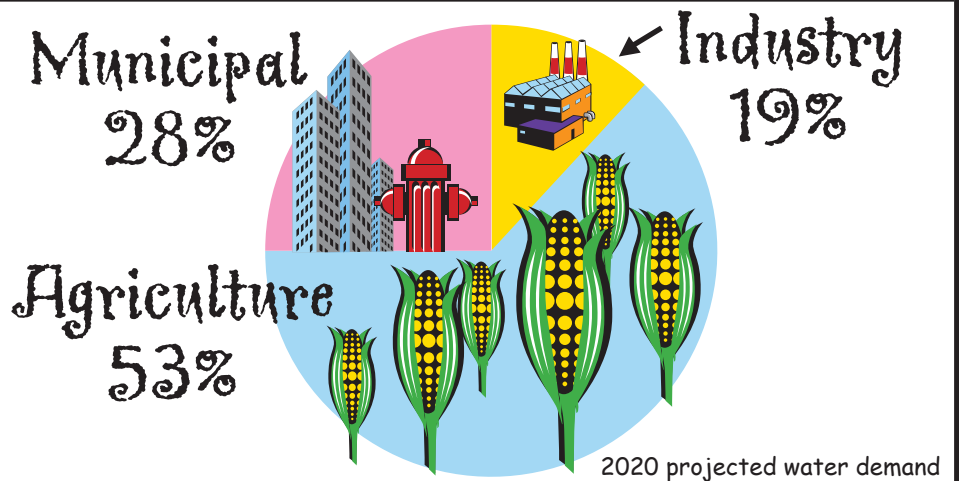
5._____

etsawretaw rtntaetme pntla

6._____

epipsenil

4._____

**1.** More than 25 million people live in Texas, and all of these people use water.

2. Water is needed on farms and ranches to grow crops and raise animals. Water is needed in cities to make products and fight fires and in homes for cooking, bathing, and drinking.

Municipal 28%

Industry 19%

Agriculture 53%

2020 projected water demand

3. More people each year need and want more water, but there is only a limited amount to go around.

4. First, not many places are left where we can build more dams and reservoirs to store water. Even if there were places, building dams costs a lot of money and could harm the environment.
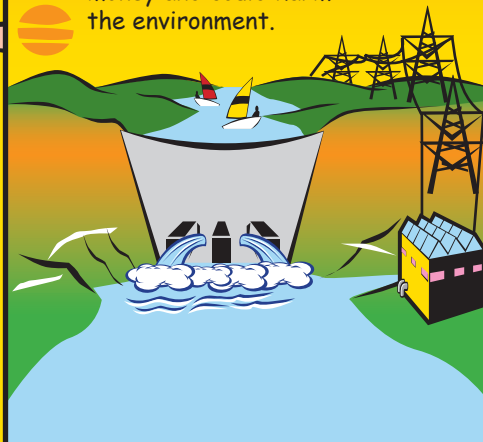
5. Second, many of our aquifers have had more water pumped out of them than can recharge back into them.

6. Finally, distributing more water means building new treatment plants, pipelines, and wastewater plants. New plants and pipes cost a lot of money, too.
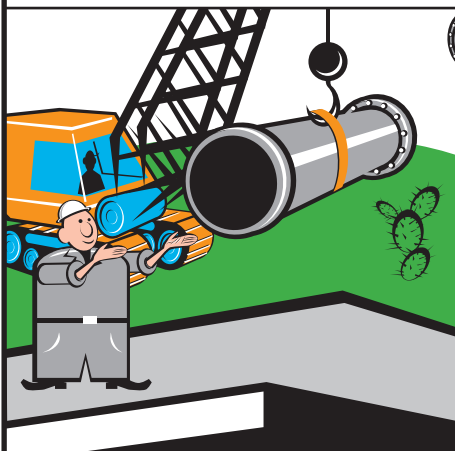
7. We need to use the water we have wisely and not waste it. This is especially important in the hot summertime. Everyone wants more water then.
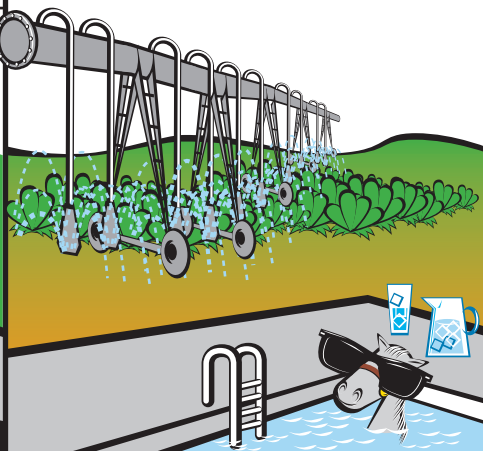
8. You can help, too. Be a partner to Major Rivers by using only as much water as you really need.
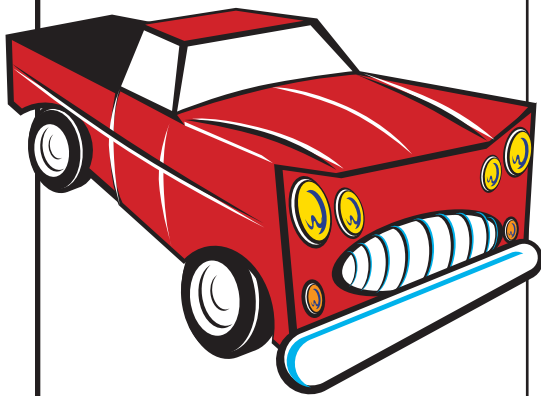
Every family uses a lot of water. The chart below shows what takes the least and the most amounts of water in a year.

LOW

Drinking: If you drink eight glasses of water a day, you drink 1/2 gallon. If everyone in a family of four drinks eight glasses a day, that's more than 700 gallons a year.

Car Washing: It can take as much as 100 gallons to wash a car. If a family washes one car once a month, that's about 1,200 gallons a year.

MEDIUM

Faucets: You use 1/2 to 4 gallons of water each time you turn on the faucet to wash hands, brush teeth, or get water for cooking and cleaning. Each family uses about 45 gallons of water a day or 16,000 gallons a year to do those things.
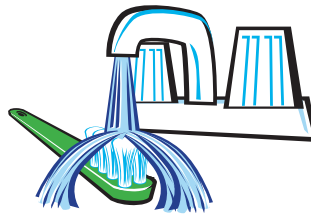
Clothes Washers: About 25 to 45 gallons are used for each load of wash. Most families probably use about 10,000 to 16,500 gallons a year.
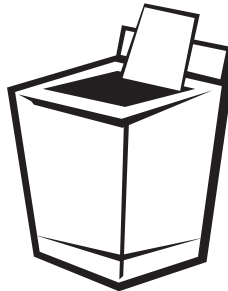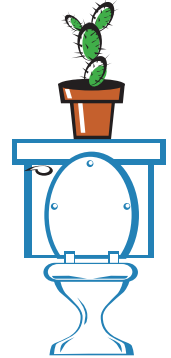
Dishwashers: Running a dishwasher takes between 5 and 15 gallons. Washing one load of dishes a day would use between 1,800 and 5,500 gallons a year.
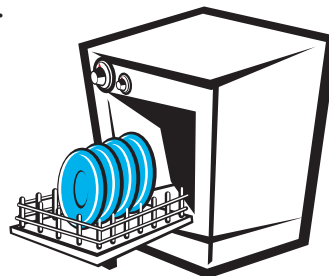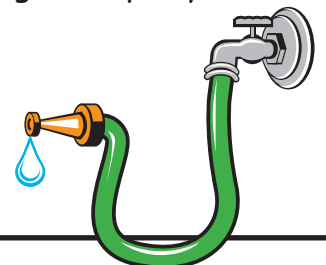
HIGH

Toilets: Each flush of the toilet uses 1.2 to 4 gallons. For a family of four, that's about 25 to 80 gallons a day, or 9,125 to 29,200 gallons a year.

Showers: You might use 13 to 38 gallons for each shower. If everyone in a family of four takes one shower a day, that's about 19,000 to more than 55,000 gallons a year.

Watering Lawns and Yards: It takes about 2,500 gallons to put 1 inch of water on 4,000 square feet of a lawn or yard. If you water once a week during the warmer months, that's about 75,000 gallons per year!

Part A

Directions: Look at each group of activities that use water. Place a check on the line of the one that uses the most water in each group.

1.   taking a shower
drinking
running dishwasher

2.   washing the car
watering lawn
washing clothes

3.   drinking
flushing a toilet
washing the car

4.   running dishwasher
drinking
using the faucet

5.   washing clothes
watering lawn
flushing a toilet

6.   using the faucet
drinking
washing the car

Part B

Directions: For each use of water listed, think of a way you could use less water. Write your answers in complete sentences.

1.   **Washing dishes** _____
_____

2.   **Taking a bath** _____
_____

3.   **Using the faucet** _____
_____

4.   **Washing clothes** _____
_____

5.   **Taking a shower** _____
_____

6.   **Washing the car** _____
_____

7.   **Watering the lawn or yard** _____
_____

USING WATER EFFICIENTLY

Here are some ways you can help use water wisely. By conserving water, you can help make sure that we will always have plenty of water in Texas.

	Wastes Water	Saves Water
TAKING A BATH	**bathtub full**	**bathtub 1/2 full**
	20 gallons	**10 gallons**
TAKING A SHOWER	**15 minutes**	**5 minutes**
	38 gallons	**13 gallons**
BRUSHING TEETH	**water running**	**wet brush, rinse**
	4 gallons	**1/2 gallon**
WASHING CLOTHES	**older model (per load)**	**water-efficient model (per load)**
	45 gallons	**20 gallons**
WASHING DISHES IN DISHWASHER	**older model (per load)**	**water-efficient model (per load)**
	12 gallons	**5 gallons**
WATERING LAWN	**Applying 2 inches of water**	**Applying 1 inch of water**
	5,000 gallons	**2,500 gallons**

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WATER IQ
Know your water.

Post Consumer Friendly