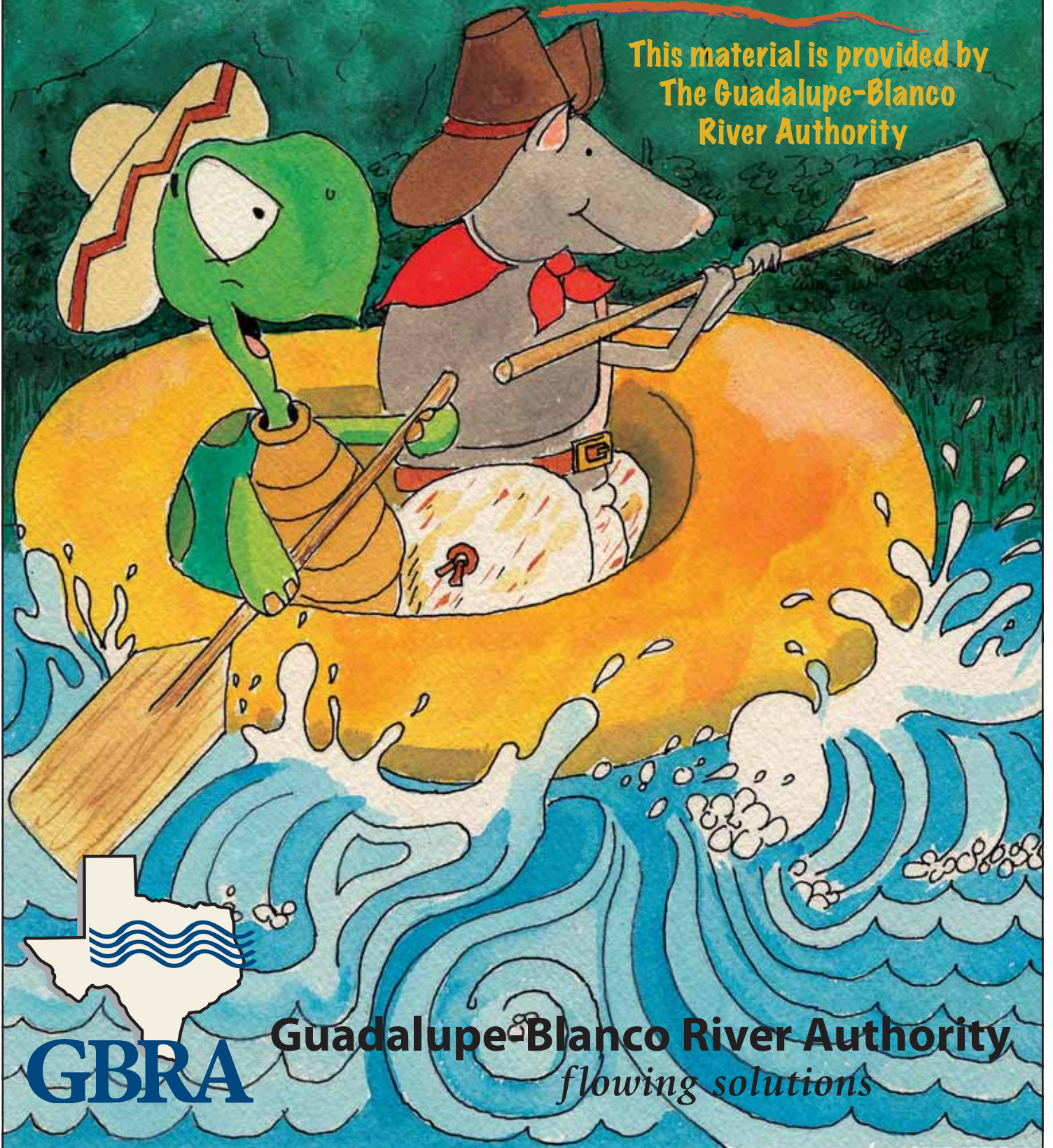


Journey Through The **GUADALUPE RIVER BASIN**

This material is provided by
The Guadalupe-Blanco
River Authority



Guadalupe-Blanco River Authority
flowing solutions

LESSON 1 — INTRODUCTION TO THE GUADALUPE RIVER BASIN

1 Hi kids! You are invited to join us for an exciting tour of the Guadalupe River Basin. We would like to introduce ourselves -- Edward A. Armadillo and Lupe the Turtle. We will be your guides for this watery adventure.



2 On this trip you will learn about the importance of the river to all of us who live in the Guadalupe River Basin. A river basin (sometimes called a watershed) is the land area where rainfall run-off drains to a river.



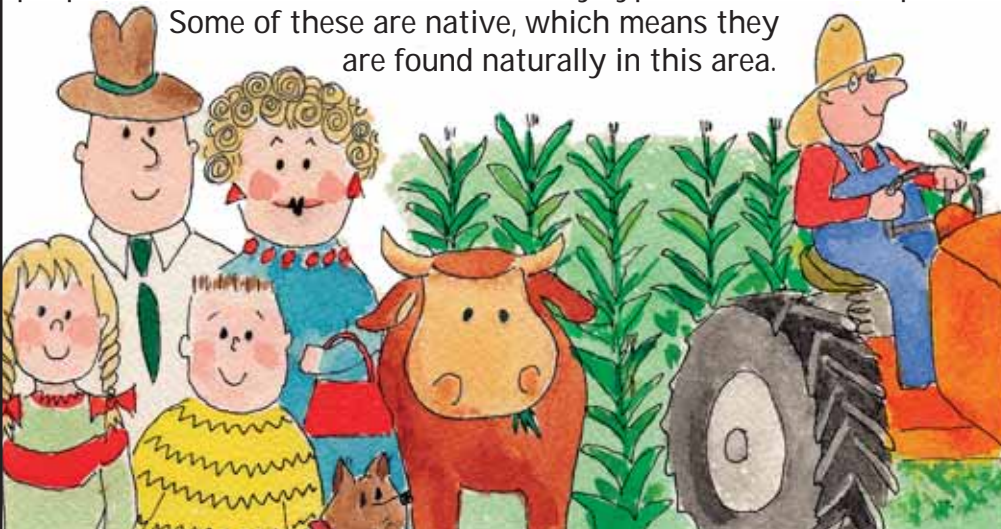
3 The Guadalupe River begins in the central Texas Hill Country. It is joined by the Comal River at New Braunfels, and the Blanco and San Marcos Rivers near the city of Gonzales. The Guadalupe continues its flow southeast to the San Antonio Bay and the Gulf of Mexico.



4 Long ago, Native Americans lived on the banks of these rivers. In 1689, Spanish explorer Alonzo DeLeon named the Guadalupe River after the saint, "Our Lady of Guadalupe." Later, pioneers settled near the rivers and started communities. The rivers provided water for people, their crops and animals.



5 Today, about 500,000 people live in the Guadalupe River Basin. The rivers provide water to meet the needs of many of these people. The rivers are also home to many types of animals and plants. Some of these are native, which means they are found naturally in this area.

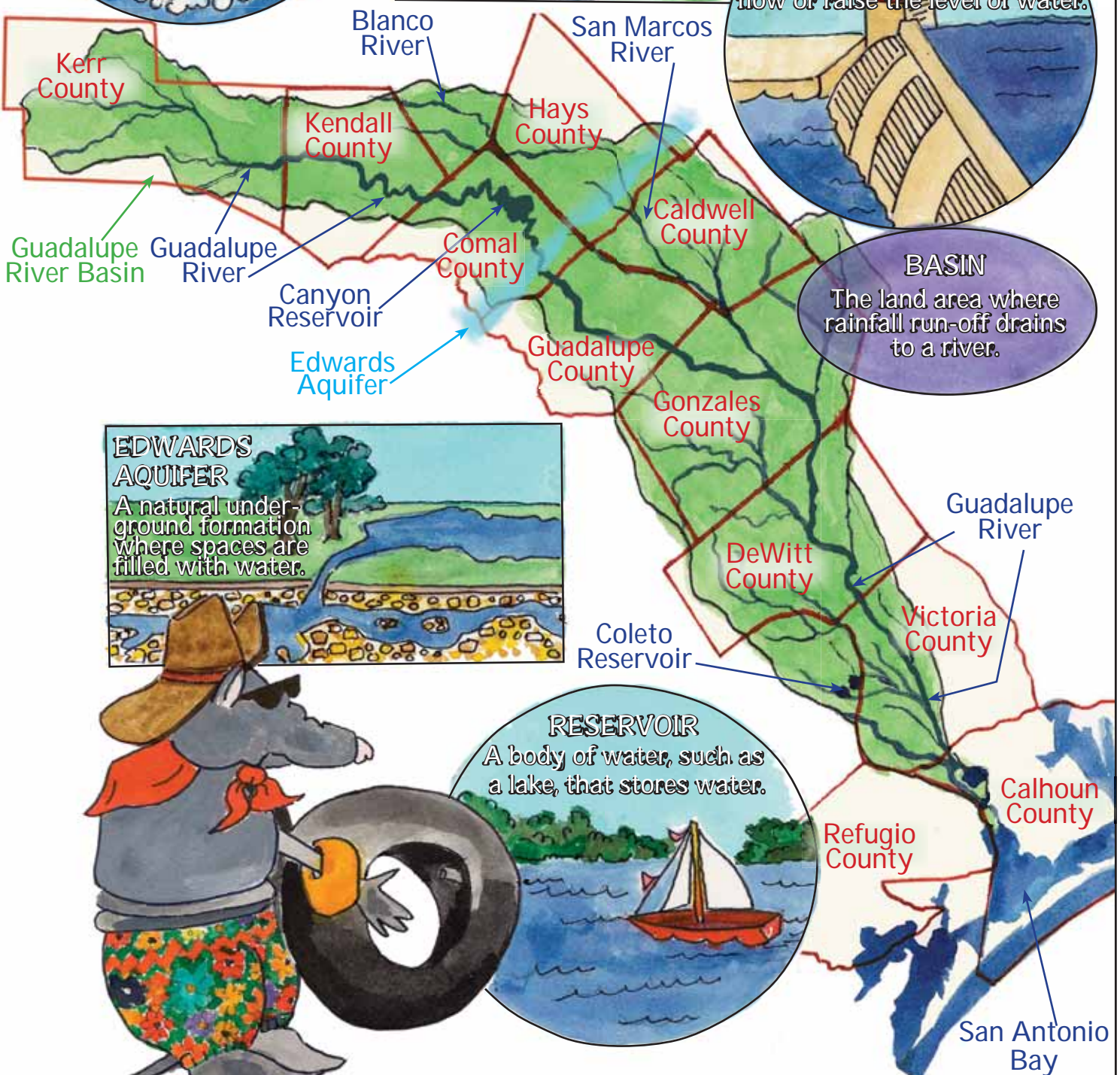
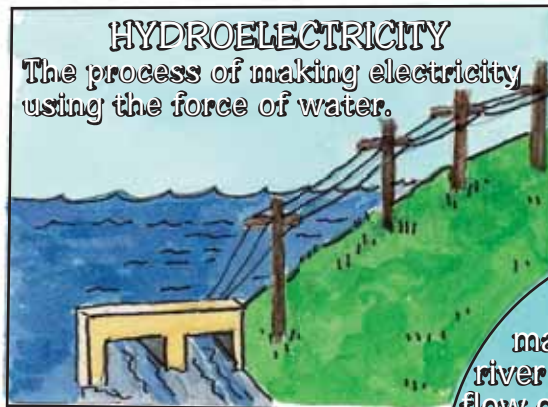


6 As you can see, the rivers are important to all living things in the basin. The Guadalupe-Blanco River Authority plans ways to make sure we all have enough clean water now and in the future.



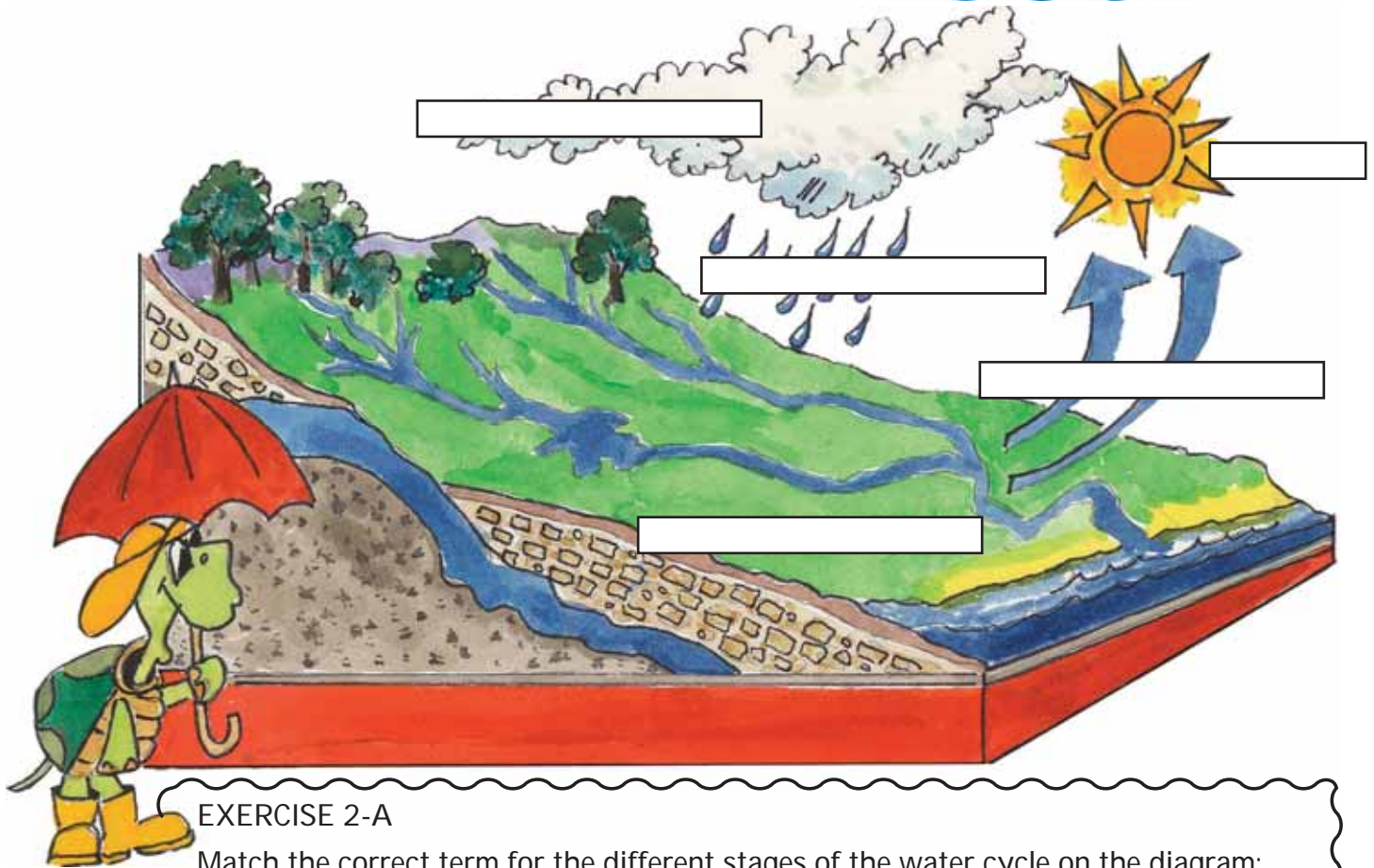
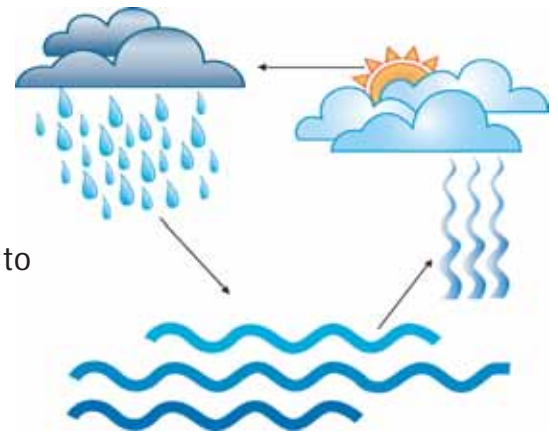
GUADALUPE RIVER BASIN

Grab your inner tubes and sunglasses and float down the rivers with us!



LESSON 2: THE WATER CYCLE AND WATERSHEDS

1 The water cycle is the continuous movement of water on our planet. Water falls to the surface as precipitation. It either accumulates in a surface water body like a lake or river, or it percolates underground. Heat from the sun then changes the water from a liquid to a gas. This is called evaporation. After it evaporates, it changes from a gas back to a liquid during condensation, forming clouds. After condensation, it comes back to earth as precipitation. Then the cycle starts over again.



EXERCISE 2-A

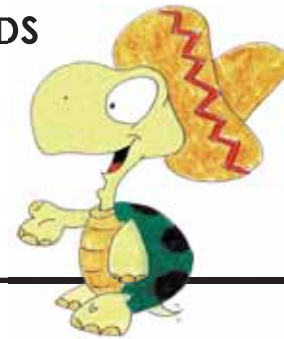
Match the correct term for the different stages of the water cycle on the diagram: Use the following vocabulary terms: evaporation, condensation, precipitation, accumulation. Also label the sun, which is the source of all energy in the cycle and on the earth's surface.



2 A watershed is an area of land that water flows across. This water drains into a creek, stream or river. Look back at the diagram above... you can see that the precipitation moves to the rivers, and the rivers are flowing downhill. This is true of all rivers in Texas - the rivers all flow towards the south and east, towards the Gulf of Mexico. There are 23 major river watersheds in the state of Texas, and the Guadalupe River watershed is one of them.

LESSON 2: THE WATER CYCLE AND WATERSHEDS

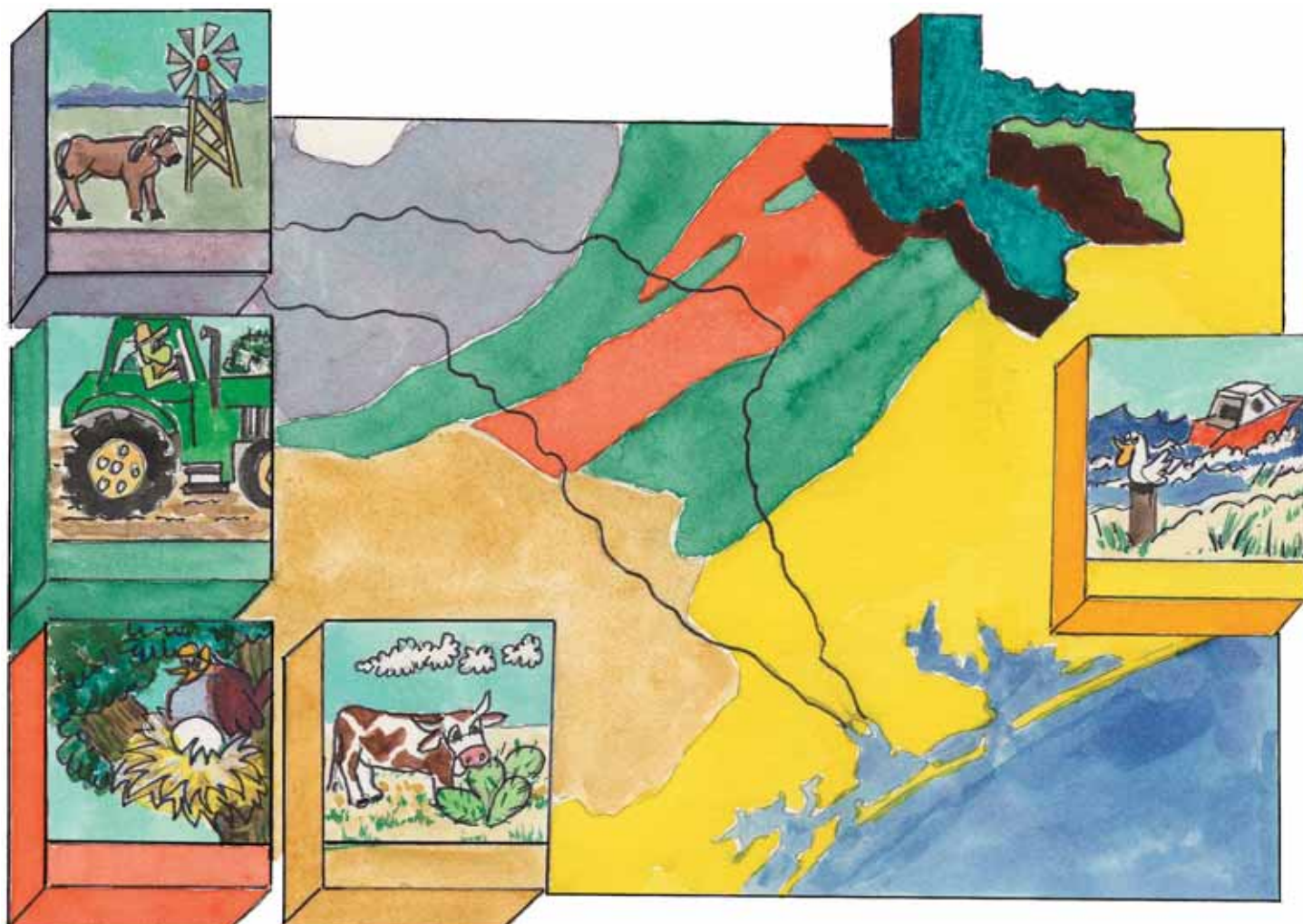
The land changes as the Guadalupe River flows through it. The river starts up in the hill country, and flows through five "Eco-Regions" before it flows into San Antonio Bay at the coast. The chart and map below will help you learn about these Eco-Regions.



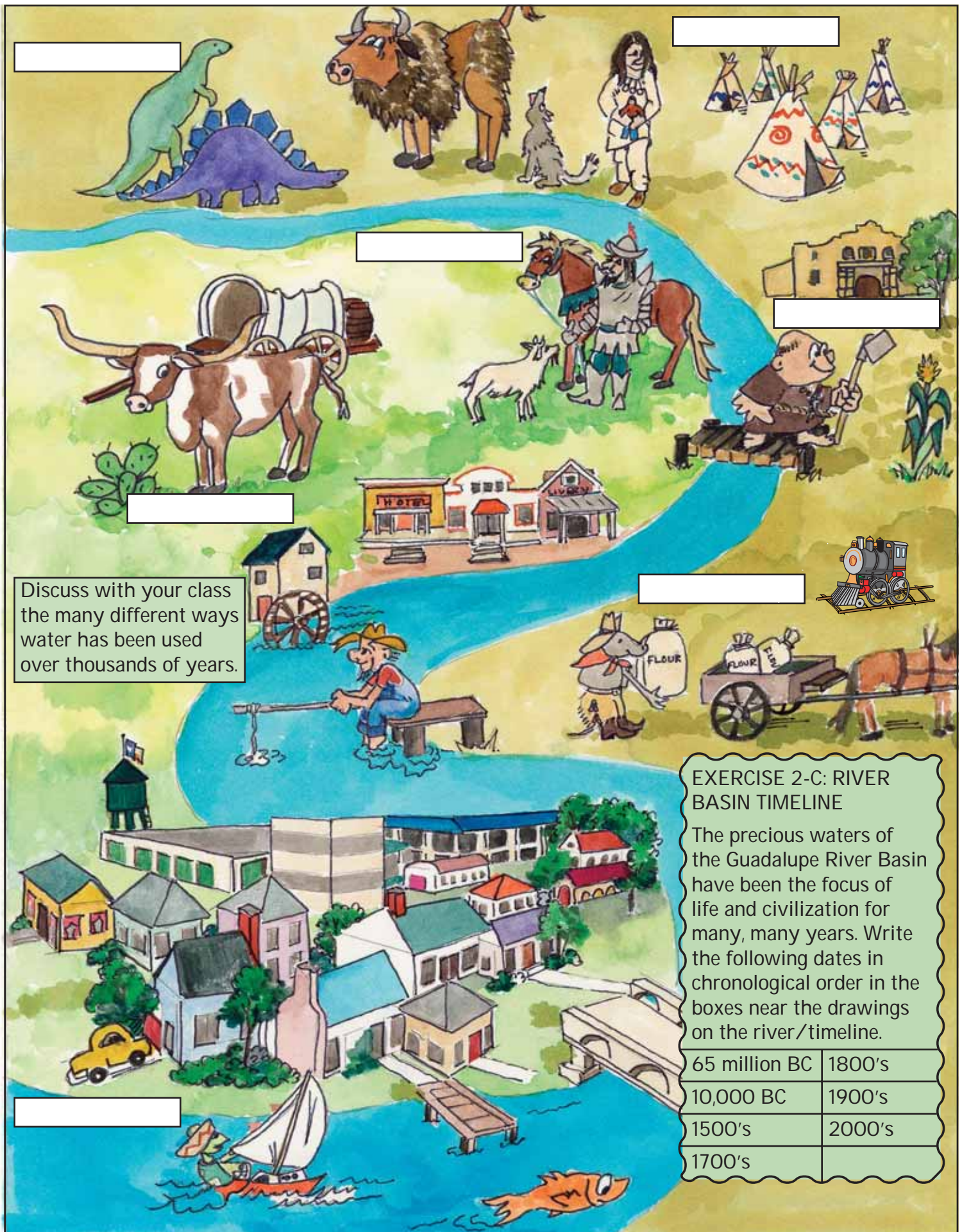
GUADALUPE RIVER BASIN ECO-REGIONS		
<i>Eco-Region</i>	<i>Physical Land Description</i>	<i>Economic Activities</i>
Edwards Plateau	Rocky land, thin soils and few trees; little water.	Cattle and goat ranching
Blackland Prairie	Dark fertile soil; plants and trees grow well.	Farming and ranching
Oak Woods and Prairies	Light sandy soils, gently rolling hills; abundance of wildlife.	Farming and hunting
South Texas Brush	Land is covered with grass and thorny plants such as mesquite trees and prickly cactus; dry.	Cattle ranching and hunting
Gulf Coast Prairies	Wetlands are mostly flat and low, with a mix of salty and fresh water caused by rivers flowing into the Gulf.	Sport fishing and bird watching

EXERCISE 2-B: ECO-REGIONS OF THE GUADALUPE RIVER BASIN

Directions: use the clues in the chart above to label the Eco-Regions of the Guadalupe River Basin. Write the name of the Eco-Regions in the colored boxes below the drawings. Note that the color of the box matches the Eco-Region on the map.



LESSON 2: THE WATER CYCLE AND WATERSHEDS



Discuss with your class the many different ways water has been used over thousands of years.

EXERCISE 2-C: RIVER BASIN TIMELINE

The precious waters of the Guadalupe River Basin have been the focus of life and civilization for many, many years. Write the following dates in chronological order in the boxes near the drawings on the river/timeline.

65 million BC	1800's
10,000 BC	1900's
1500's	2000's
1700's	

LESSON 3: FOUR USES OF WATER

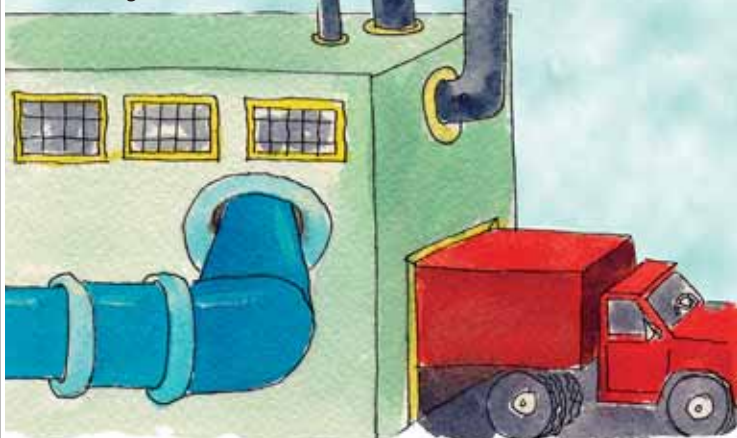
MUNICIPAL

In the Guadalupe River Basin, some cities and towns pump water directly from the rivers. Others get their water from aquifers. First, the water is "treated" to remove dirt and bacteria. Then, it is piped into homes, schools, and businesses for drinking, cooking, cleaning, laundry, flushing toilets, baths and showers, watering lawns and washing cars.



INDUSTRIAL

Some factories and industries need large amounts of water to make a product. Special pipes bring water directly to them. This water is used to create electricity or to make plastics, textiles, metal products and many other items.



AGRICULTURAL

When there isn't enough rain, farmers use water from rivers and aquifers. Irrigation systems, like huge sprinklers on wheels, or long plastic pipes help to water crops. Ranchers also use the water to raise animals. Remember, we depend on farmers and ranchers for the food we eat.



RECREATIONAL

Swimming, boating, fishing, rafting, and tubing are all recreational uses of water. This is when we use the water just for fun.



Each county uses water differently. Your county's water needs depend upon its population, location, and how the people make a living. Some communities have large factories that use water for industry. Other communities have many farms and ranches that need it for agricultural uses. Recreation is an important business in some communities. But every county uses municipal water.

LESSON 3: FOUR USES OF WATER



EXERCISE 3-A

Directions: Circle the letter of the word that best completes each sentence. Then write the word in the blank.

EXAMPLE: Turtles can hide in their shells.

a) have parties b) fly c) hide

1. _____ water is used to grow crops and raise animals.
a) Recreational b) Agricultural c) Municipal
2. _____ water is used to create or make a product.
a) Agricultural b) Municipal c) Industrial
3. _____ water is treated water used by cities or for household use.
a) Municipal b) Agricultural c) Industrial
4. _____ water is used just for fun.
a) Industrial b) Recreational c) Municipal

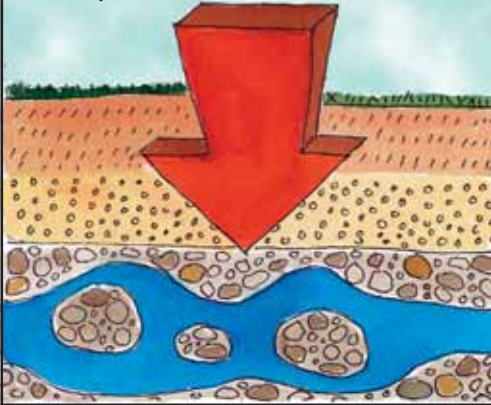
EXERCISE 3-B

Directions: Identify which type of water use each activity is by checking under the Municipal, Industrial, Agricultural or Recreational box. Then describe how humans had to modify the environment to get the water to the location for use.

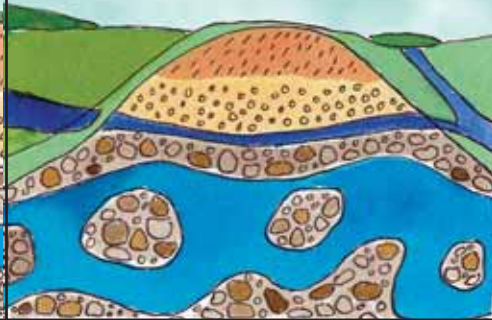
Water Use activity	Municipal	Industrial	Agricultural	Recreational	How did we modify the environment to get the water for this activity?
Water used in a home for bathing					
Water used in an office bathroom					
Water used in restaurant's kitchen					
Water used to cool heavy machines					
Water used to irrigate crops					
Water played in at a swimming pool					
Water in a tank for cattle to drink					

LESSON 4: THE IMPORTANCE OF SPRINGFLOW

1 An aquifer is an underground area of sand, gravel or rock where spaces are filled with water. Surface runoff percolates (seeps) through the ground to fill the aquifer with water.



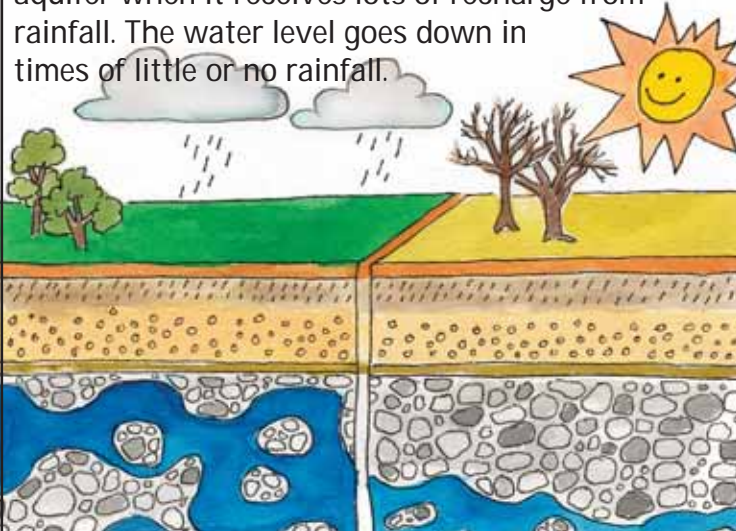
2 The Edwards Aquifer is the largest and most important aquifer in central Texas. When it rains in the Hill Country, hundreds of creeks, streams and even large rivers help to recharge (refill) the Edwards Aquifer.



3 Some of the water that percolates into the Edwards Aquifer comes out at the surface through natural openings called springs. This 'springflow' supplies much of the water in the Comal, San Marcos and Guadalupe Rivers.



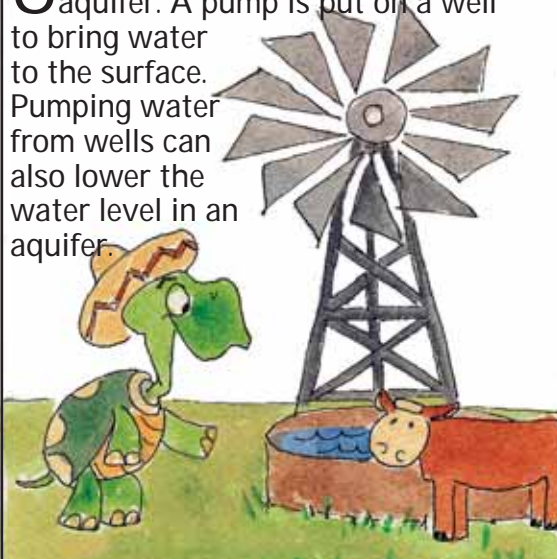
4 The amount of springflow depends on how full the aquifer is. There is more water in the aquifer when it receives lots of recharge from rainfall. The water level goes down in times of little or no rainfall.



5 In the Guadalupe River Basin, some municipal, industrial and agricultural users get their water supply from aquifers such as the Trinity, Edwards, Carrizo-Wilcox, and Gulf Coast. Others rely on runoff from rainfall into streams. In the Guadalupe River Basin, you may rely on both.

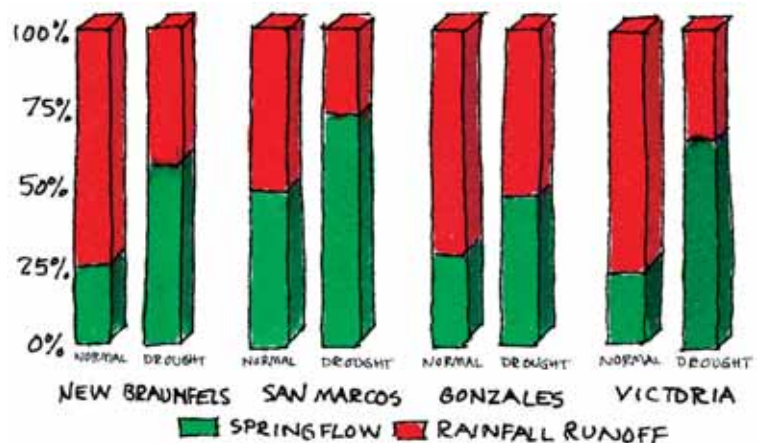


6 A well is a hole drilled into an aquifer. A pump is put on a well to bring water to the surface. Pumping water from wells can also lower the water level in an aquifer.



7 The Guadalupe and San Marcos Rivers are special because they depend mainly on springflow when there is little rainfall in the watershed.

TOTAL RIVER FLOW



LESSON 4: THE IMPORTANCE OF SPRINGFLOW

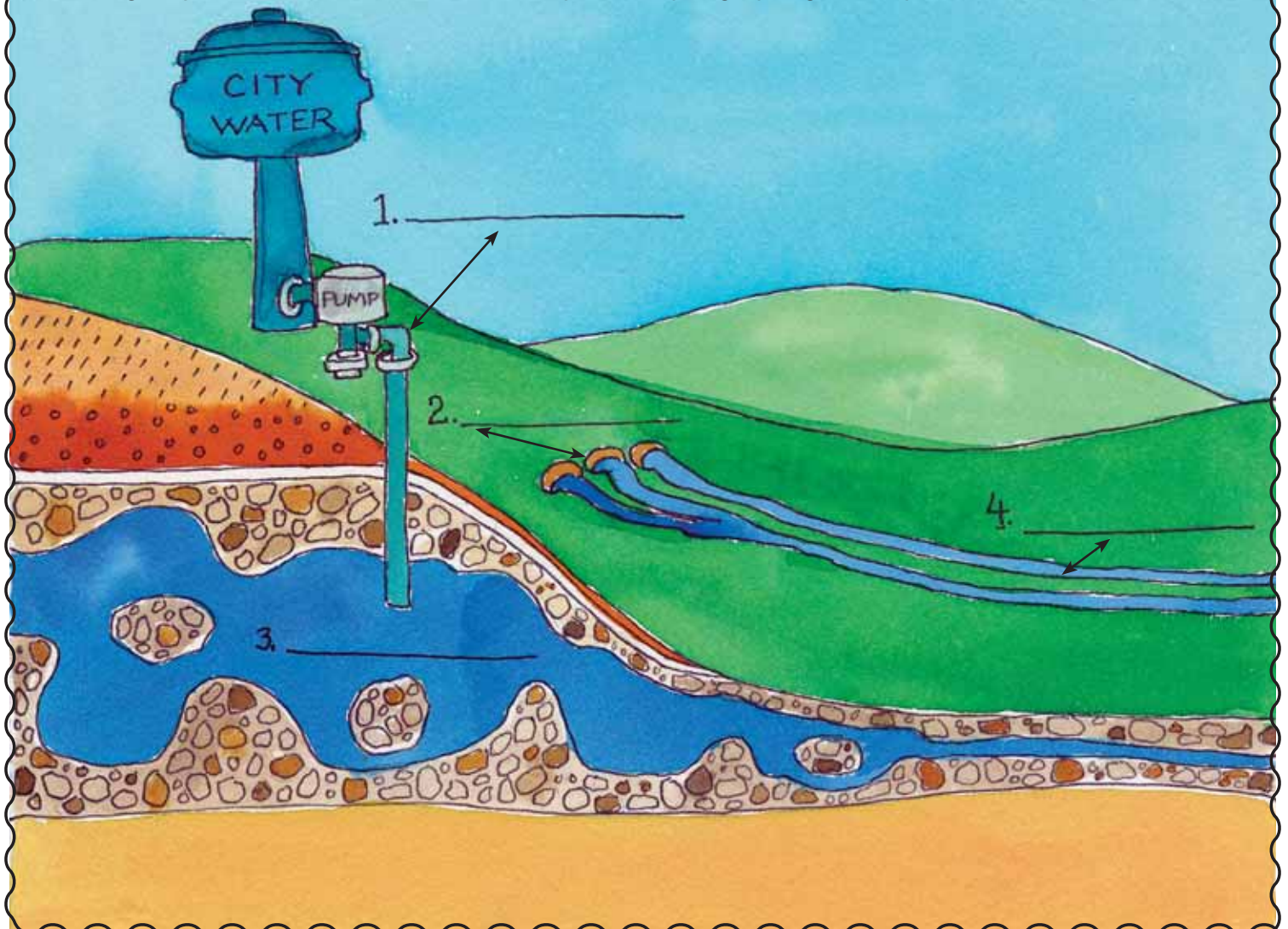
EXERCISE 4-A: SPRINGFLOW VOCABULARY

Directions: Circle the letter of the word that best completes each sentence. Then fill in the blank.

1. A _____ is a natural opening that brings water from underground to the surface.
a. spring b. springflow c. well
2. A(n) _____ is an underground area of sand, gravel or rock where spaces are filled with water.
a. well b. aquifer c. spring
3. A(n) _____ is a hole drilled into an aquifer to bring water to the surface.
a. spring b. aquifer c. well
4. _____ is water flowing through springs from an underground source.
a. well b. springflow c. aquifer.

EXERCISE 4-B

Labeling Map - Use these words to label the picture: spring, springflow, aquifer, and well.

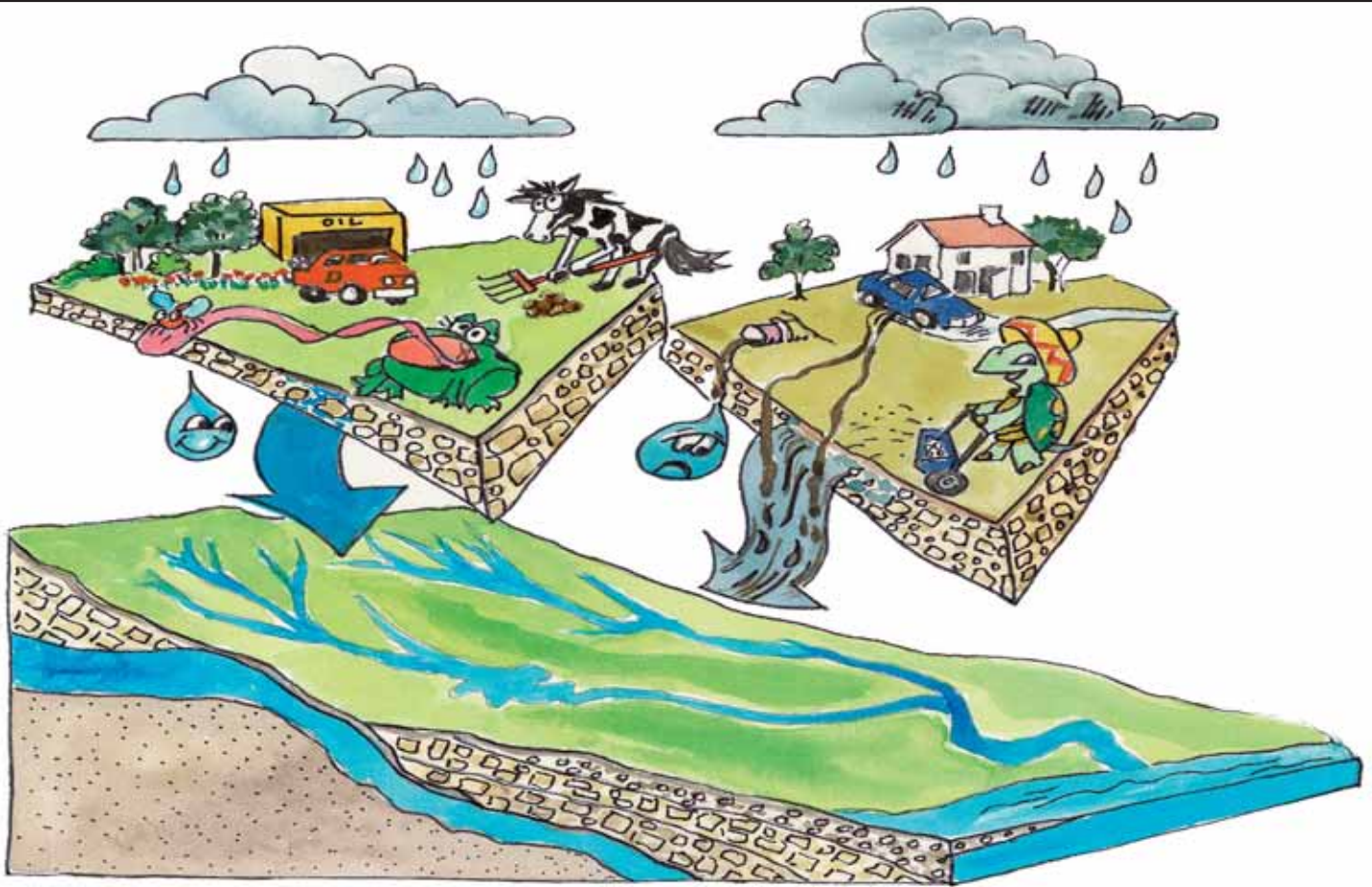


LESSON 5: WATER QUALITY

1 As we learned in Lesson 4, we use water for many different reasons. Sometimes when we USE water, we MISUSE it and can damage our environment. A few decades ago water pollution was a severe problem because of something called Point Source Pollution, which was mostly due to industrial users. Now that the industrial users have "cleaned up their act," we are more concerned about something called Nonpoint Source Pollution.....which is mostly due to you and me!

2 Point Source Pollution -- pollution that can be traced to a single point source, such as a pipe or culvert (for example: industrial and wastewater treatment plant discharges).

Nonpoint Source Pollution -- pollution that cannot be traced to a single point, because it comes from many places or a widespread area (for example: urban runoff or agricultural runoff).



3 On the diagram above, you can see that there are two different scenarios taking place. Remember that nonpoint source pollution means that there is no single person or source to blame for the pollution.... it is all of us! Nonpoint source pollution is simply the result of things that we do outside everyday, such as using chemicals in our yards or littering. Simple activities such as changing the oil in our cars can be bad for the environment if we make the wrong choices about disposal of the wastes.

EXERCISE 5-A

Directions: Use the diagram above to identify the choices made for the activities as good or bad for the environment. Circle Good or Bad after the sentences.

1. Clearing of animal wastes Good Bad
2. Taking a vehicle to a business for an oil change that properly disposes of the oil... .. Good Bad
3. Changing the oil in your vehicle and dumping the used oil on the ground... .. Good Bad
4. Using chemicals on the lawn.. .. Good Bad
5. Using organic or natural pest control... .. Good Bad
6. Not taking care of a leaking septic tank. Good Bad

LESSON 5: WATER QUALITY

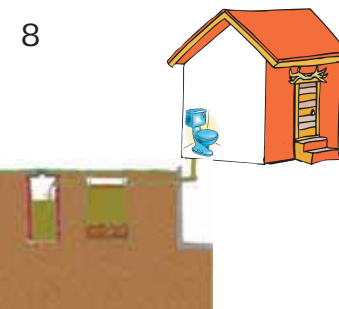
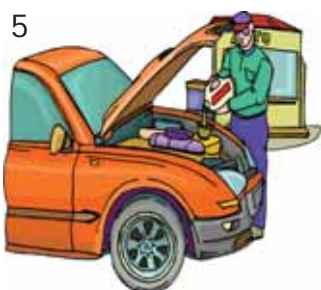
4 Bacterial Pollution comes from human and animal wastes. Sometimes, lakes are closed to swimmers because of high counts of fecal coliform bacteria from raw sewage (human waste) and feedlot runoff that makes its way into rivers and streams that empty into lakes. Coliform bacteria itself is not harmful, but it usually indicates that pathogens (disease-causing organisms) are present.

5 Toxic Pollution is the presence of poisonous chemicals in water. Toxic pollution can come from point sources, such as industrial discharges or accidents in transportation (such as oil spills, train derailments or truck wrecks on highways). It can also come from nonpoint sources such as runoff from urban areas, as well as fallout from the atmosphere (acid rain).

6 Nutrient Pollution comes from fertilizers. Although plants need nutrients for growth, if there is too much nitrogen and phosphorous in water then algae and other aquatic plants grow. This uncontrolled growth in water means that more plants die and decay, using up the oxygen dissolved in the water. When this happens fish and other aquatic life can die.

EXERCISE 5-B

First, match the picture to the pollution description by putting the number in the box. Second, classify pollutants as nonpoint or point. Then classify pollutants as bacterial, toxic or nutrient.



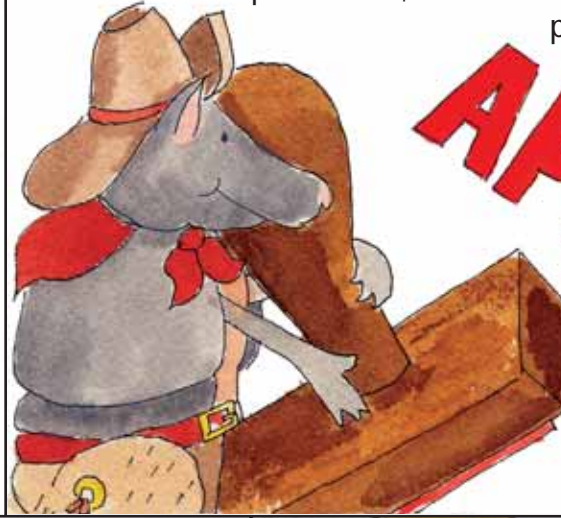
Picture number?	Pollution Description	Point Source	Nonpoint Source	Bacterial	Toxic	Nutrient
	Animal Waste (Ranches)					
	Human Waste (Leaking Septic Tanks)					
	Human Waste (Poorly Operated Wastewater Treatment Plant)					
	Fertilizers (Lawns and Farms)					
	Pesticides (Lawns and Farms)					
	Petroleum Byproducts (Automobiles Leaking or Improper Disposal)					
	Improper Disposal of Trash by People					
	Chemical Waste (Factories)					

LESSON 6: WATER REGULATION

1 All people in the Guadalupe River Basin need water. To make sure everyone has water, the State of Texas has made regulations, or rules, to decide who can use the water.



2 Surface water -- or water in rivers, lakes and streams -- is regulated. This means that you must have a permit, or written permission, to take this water. In most instances, people who live on the river do not need a permit to take the river water to use for their personal needs.

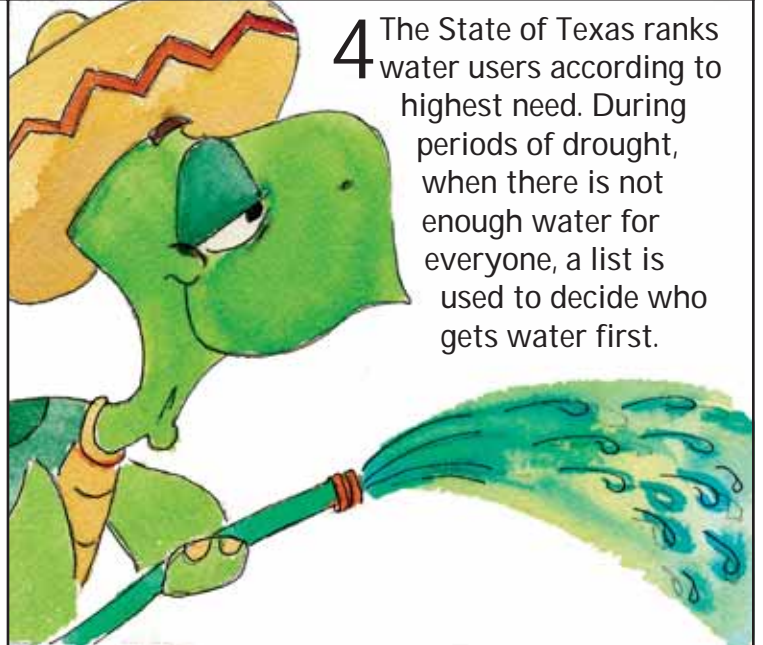


3 In some parts of Texas, groundwater is not regulated. Anyone can drill a well and pump water. No permit is needed.



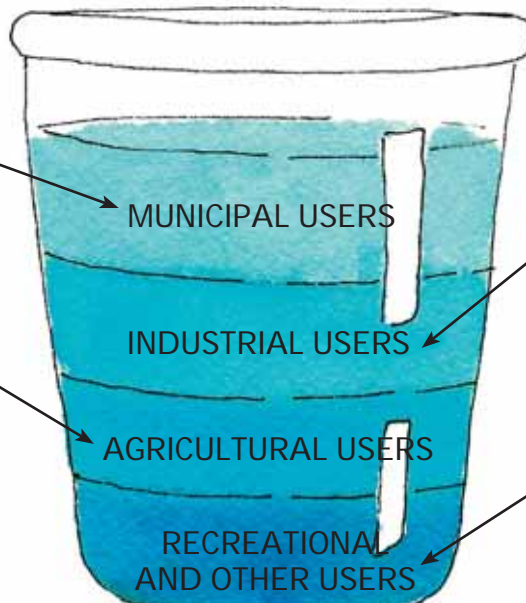
The Edwards Aquifer IS regulated because Comal and San Marcos Springs supply water to people downstream and are also the home to a number of Endangered Species. A permit is required to pump water from the Edwards Aquifer.

4 The State of Texas ranks water users according to highest need. During periods of drought, when there is not enough water for everyone, a list is used to decide who gets water first.



5 First in this order is you! Individuals, cities and towns have the right to use the water first. Water is a basic human need.

Agricultural users are third in line because water is needed to grow crops and raise animals.



Industrial users are second, because they provide products and jobs to our communities.

Recreational and other users who want water for fun are last. Can you guess why?

LESSON 7: WATER USE AND CONSERVATION

1 Each of us uses quite a bit of water each day...often without even realizing it! Our personal water use at home is about 100 gallons a day! Just picture 100 milk jugs filled with water... believe it or not, that is how much YOU use each and every day at your home! Incredible!

2 How is this possible? It is pretty easy if you stop and think of all the ways you use water each day. You use the most water in the bathroom- washing your hands, showering or bathing and flushing the toilet. You also use water in the kitchen -cleaning and cooking. And it may not be YOU that washes laundry, but it is likely that someone washes clothes! In addition, we water our plants and animals, and WE drink water too! It all adds up!



EXERCISE 7-A

Directions: The swimming pool represents 100 gallons of water. Each section of the pool represents the percentage of water used in different parts of our home. Use the table below to label the pie graph above. Put the percentage on the top line and write the water use on the second line.

Toilet Flushing	45 gallons
Outdoor and miscellaneous	10 gallons
Cooking and Dishwashing	15 gallons
Bathing or Showering	30 gallons



LESSON 7: WATER USE AND CONSERVATION

3 Water is brought to your home through a simple system of pipes called a 'distribution system.' Once it gets to your home, the pipes within your home form a smaller distribution system, taking the water to your kitchens (sinks), bathrooms (tubs, sinks and toilets), washing machines, and outdoor faucets.

In some parts of the United States, people have found very innovative ways to capture the water they have used, and use it again. This is called "reclaiming" or "recycled" water. Can you think of any ways to re-use water?

4 As time goes on and our population continues to grow, we will need to find ways to use our water more efficiently. We call this water conservation. By taking simple steps in our everyday water uses, we can save quite a bit of water. And saving water means saving money... remember, that water is not free!



EXERCISE 7-B: WATER CONSERVATION SAVINGS CHART

Water Uses	Typical Action/Gallons Used	Conservation Action/Gallons Used	H2O Savings
Showers/Baths	15 minute shower, or bathtub full. Uses about 20 gallons.	5 minute shower or bathtub halfway full. Uses about 10 gallons.	
Washing Hands	Water left running while washing/brushing. Uses about 2 gallons.	Turn off water while soaping or brushing. Uses about ½ gallon.	
Toilets	Older toilets use 6 gallons a flush.	Install low-flow toilets using about 2 gallons.	
Washing Cars	Water running uses over 300 gallons.	Use a nozzle to shut off water while soaping. Uses about 30 gallons.	
Cleaning Dishes	By hand, with water running for rinse. Uses 50 gallons. Older dishwasher uses about 20 gallons.	If you shut the water off while washing by hand, you use about 10 gallons. A full load in a water efficient dishwasher uses 5 gallons.	
Outdoors Watering Lawn	Watering without a timer. Uses over 2,500 gallons.	Water with a timer. Uses about 1,200 gallons.	



Journey Through the Guadalupe River Watershed Word Search

Directions: Find the words in the grid.

Words can go horizontally, vertically, and diagonally. Words may be spelled forward or backward.

Agricultural
Aquifer
Basin
Blanco
Comal
Condensation
Conservation
Dam
Drought
Edwards
Evaporation
GBRA
Groundwater
Guadalupe
Hydroelectric
Industrial
Municipal
Native
Nonpointsource
Permit
Pointsource
Pollution
Precipitation
Recharge
Recreational
Regulations
Reservoir
Runoff
San Antonio
San Marcos
Springflow
Springs
Surface Water
Texas
Water Cycle
Well

K	L	T	J	B	K	B	L	W	C	O	N	D	E	N	S	A	T	I	O	N	T	Z	C	S
D	G	N	A	T	I	V	E	S	A	G	R	I	C	U	L	T	U	R	A	L	Y	B	O	P
B	J	L	Y	X	K	K	A	N	Q	C	Y	F	S	T	R	L	T	J	B	P	N	H	N	R
F	P	V	T	L	D	X	L	Y	Z	T	Q	D	Y	R	A	G	R	G	M	Y	Y	H	S	I
T	Y	M	F	T	E	R	L	J	K	M	R	R	B	P	T	U	B	L	L	D	G	F	E	N
B	T	D	D	T	J	R	M	L	V	A	D	F	I	L	N	A	D	L	R	J	K	X	R	G
N	W	H	R	Y	W	T	V	C	W	I	N	C	B	O	S	D	R	O	G	C	D	S	V	S
T	X	A	P	O	Q	X	O	D	N	G	I	M	F	I	K	A	E	W	W	G	O	V	A	M
G	R	L	T	W	U	M	E	D	C	N	K	F	N	N	Q	L	C	R	E	C	Z	C	T	D
R	H	E	R	E	A	G	U	G	U	K	T	M	O	T	E	U	R	K	R	L	P	L	I	N
O	V	P	G	L	R	S	H	M	X	V	B	I	M	C	Z	P	Y	A	R	R	L	G	O	O
U	N	G	G	U	T	C	C	T	S	W	T	W	T	K	R	E	M	J	E	M	K	V	N	N
N	Q	T	J	R	L	L	Y	A	M	A	K	R	W	E	M	N	X	C	N	X	R	C	Y	P
D	P	P	I	R	G	A	N	C	R	H	I	C	F	W	A	K	I	P	X	M	C	G	F	O
W	P	A	F	M	E	A	T	O	L	C	R	I	B	S	J	P	B	P	N	T	D	R	K	I
A	L	M	M	R	N	C	P	I	K	E	U	E	O	X	I	P	O	L	L	U	T	I	O	N
T	L	Q	K	T	F	A	R	Y	O	Q	H	C	S	T	P	L	C	G	B	R	N	L	H	T
E	B	M	O	N	V	K	L	E	A	N	N	X	A	E	E	R	C	D	G	W	T	R	T	S
R	R	N	G	E	W	L	W	P	A	A	S	T	H	T	R	J	E	C	P	L	B	X	V	O
T	I	L	B	N	M	G	M	T	L	T	I	K	Y	C	M	V	X	C	D	D	M	T	V	U
O	F	G	R	K	Y	A	T	B	L	O	I	D	L	W	I	H	O	L	H	Z	Q	Z	L	R
D	Q	N	A	B	D	N	N	W	N	Q	R	O	C	P	T	N	G	I	C	A	Q	X	X	C
Z	S	U	R	F	A	C	E	W	A	T	E	R	N	K	V	J	H	M	R	X	R	W	B	E
V	C	B	S	P	R	I	N	G	F	L	O	W	B	A	G	N	Y	N	D	Q	X	G	K	N
P	O	I	N	T	S	O	U	R	C	E	K	C	G	B	L	L	Z	M	N	G	P	K	E	X

Hey Kids!

Learn more about water and WIN A COOL PRIZE by completing
the Guadalupe-Blanco River Authority's Water Trivia Quiz!

Go to: www.gbra.org/watertriviaquiz

GOOD LUCK

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