

3.1

KEY CONCEPT

Fresh water is an essential resource.

Sunshine State STANDARDS

SC.D.2.3.1: The student understands that quality of life is relevant to personal experience.

SC.G.2.3.1: The student knows that some resources are renewable and others are nonrenewable.

SC.H.3.3.4: The student knows that technological design should require taking into account constraints such as natural laws, the properties of the materials used, and economic, political, social, ethical, and aesthetic values.

VOCABULARY

irrigation p. 83

aquaculture p. 85

dam p. 86

lock p. 86

BEFORE, you learned

- Fresh water is found on Earth's surface and underground
- People use wells to bring ground water to the surface

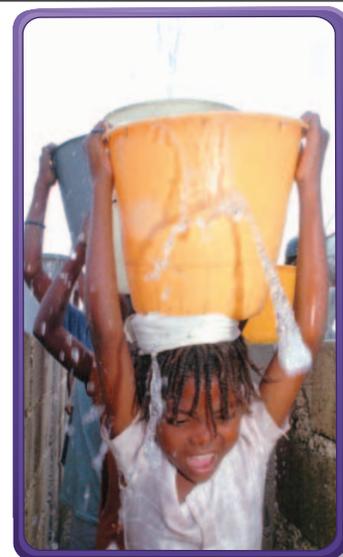
NOW, you will learn

- How water is required for life
- How water is used for many human activities

THINK ABOUT

How valuable is water?

In the United States, fresh water seems plentiful. When you want water for a drink or to wash, you can go to a drinking fountain or turn on the tap to get all the water you want. In some parts of the world, water is scarce and difficult to get. In Port-au-Prince, Haiti, this girl is getting her bucket filled with fresh water so that she can take water home. If you had to get your water this way, how might that change the way you think of water? Would you use water differently than you do now?



Fresh water supports life.

Close your eyes and imagine a beautiful place in nature that is full of life. Maybe you think of trees, flowers, and a waterfall and pools where animals come to drink. Water is important in any scene that involves life.

People have always lived near clean, fresh water. Why is water so important to humans? One reason is that our bodies are more than one-half water. Without the water in your blood, your cells would not receive the nutrients they need. Your skin and tissues hold water in your body, but some water is lost every day. As a result, you get thirsty and drink water or something that contains mostly water, such as milk or juice. Without water, a person cannot live for more than a few days. And without water, people wouldn't be able to grow food.

U.S. Population Near Water Sources

Many U.S. cities are located by rivers or lakes.



Pittsburgh, Pennsylvania, is one of many cities by rivers. Here the Allegheny and the Monongahela rivers come together to form the Ohio River.

You have read that fresh water on Earth is a limited resource. A fixed amount cycles through the atmosphere, flows in rivers, is held in lakes and glaciers, and is stored in aquifers deep under the ground. As more and more people live on the planet every year, our water sources become more precious. If too much water is taken from aquifers, the supply will eventually run out. If the water in rivers and lakes becomes polluted, we can no longer use it.

CHECK YOUR READING

What can happen to water as the world population grows?

SUPPORTING MAIN IDEAS
Record details about how water is important to human activities.

- _____
- _____
- _____
- _____

Most human activities require water.

Almost everything you do requires water. When you take a shower or brush your teeth, you use water. Your dishes and clothes are washed with water. You might exercise in water at a pool.

Some of the ways you use water might surprise you. Let's say you do your homework after school. You grab a slice of pizza from the refrigerator, switch on the light, and sit down to read a book in your favorite chair. Have you used any water so far? The answer is yes, many gallons of water.

On farms water was needed to grow the tomatoes and wheat for your pizza. The cheese topping came from a cow that drank water and ate grain grown with water. The paper in your book was produced at a paper plant that used vast amounts of water to wash and mix wood pulp. When you switch on a light, you are probably using energy that was generated by some form of moving water. And the metal in the lamp was mined from underground, using—you guessed it—water.

INVESTIGATE Water Usage

How much water do you use in a week?

PROCEDURE

- 1 Write down all the ways you use water in a day. Start with the time you get up in the morning. Include things such as brushing your teeth, flushing the toilet, using ice, and taking a shower.
- 2 Look at the Water Use sheet, and from it, identify other ways that you and others in your household use water.
- 3 Add up how many liters of water you use in a day, and multiply that by 7. This is how much water you use in a week.

WHAT DO YOU THINK?

- Which of your activities used the most water?
- What are some ways that you could reduce the amount of water you use weekly?

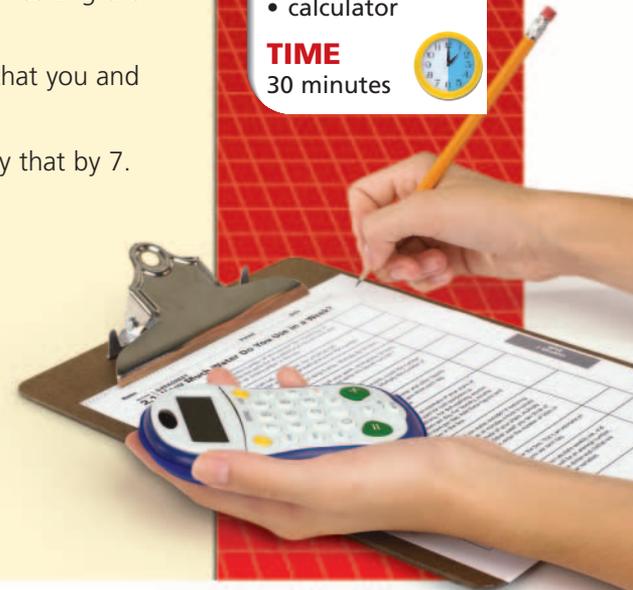
CHALLENGE Based on your weekly water usage, how much water is used by the United States annually? **Hint:** Find the population of the United States in a reference source.

SKILL FOCUS
Analyzing data

MATERIALS

- Water Use sheet
- calculator

TIME
30 minutes



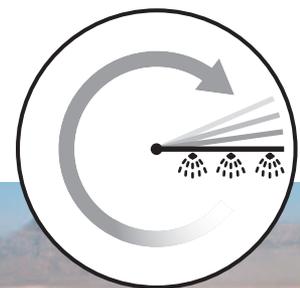
Farming

In the United States, about 40 percent of the water that is used goes to growing crops and raising livestock. Any kind of farm depends on water to grow plants for food and to raise animals. To grow oranges, a farm needs about 0.25 centimeters (0.1 in.) of rainfall a day. To produce one hamburger can require 5000 liters (1300 gal.) of water or more because animals not only drink water but also eat grass and grain that use water.

In many areas, rainfall does not provide enough water to support crops and animals. In these drier areas, farmers draw water from aquifers, rivers, or lakes to grow crops. The process of supplying water to land to grow crops is **irrigation**.

A common method of irrigation pours water through canals and waterways so that it flows through the fields. A little more than half of U.S. farms that are irrigated use this method, which is called flood irrigation. Most of the other farms that irrigate use spray irrigation, which sprays water onto the fields. You can think of lawn sprinklers as an example of spray irrigation for grass. On farms, the water often is delivered by metal structures that roll around entire fields.

These green irrigated fields are circular because the metal sprinklers move like clock hands from a center point





A paper mill uses large quantities of water to process wood pulp.

Industry

The industries that make our cars, notebooks, jeans, sneakers, skateboards, and TVs are major water users. The manufacture of just about any item you can name probably uses water. Consider these examples.

- The process of making one car can require about 50 times the car's weight in water. This process begins with the mining of minerals and ends with the final washing as the car rolls out of the factory.
- In many industries, huge amounts of water are used to cool down machines.
- In a coal mine, water is used to separate chunks of coal from other clumps of dirt and rock.
- A paper mill uses 100 to 300 metric tons of water to manufacture one ton of paper.

Water used in industry can be used again. Factories can clean the water they use and return most of it to lakes and rivers.



**CHECK YOUR
READING**

How is water used in industry?

Transportation and Recreation

Since the earliest times, rivers and lakes have helped people visit their neighbors and trade food and goods. In the United States, major rivers and the Great Lakes provide an efficient way to transport goods, especially cargo that is bulky and heavy, such as coal. For example, on the Great Lakes, large ships carry iron ore from Minnesota to cities where it is used to make steel. On the Mississippi River, barges haul grain to ports, where the grain may be processed or placed on ships to go overseas.



This freighter carries cargo on the Great Lakes.



People also use rivers and lakes for recreation. Whitewater rafting, canoeing, and kayaking are popular activities. Many people also like to camp, picnic, swim, and fish along the shores of freshwater rivers and lakes.

Not every section of a river can be navigated by boat. A river may flow too fast or be too shallow for safe travel. To make water transportation easier, people dig channels called canals that bypass rough spots and connect waterways. For example, a 376-kilometer (234-mi) canal lets boats travel between the Tennessee and Tombigbee rivers in Mississippi and Alabama. In Canada, west of Buffalo, New York, the Welland Canal connects two Great Lakes, Ontario and Erie. It is part of the waterway known as the St. Lawrence Seaway, which connects the Great Lakes to the Atlantic Ocean.

Fisheries and Aquaculture

Fresh water is full of life—from tiny one-celled organisms to small shrimp and worms, to trout and salmon. Rivers and lakes provide fish for our food, a living resource that people depend upon. They also provide food for frogs, insects, birds, and larger animals.

When people talk about livestock, do you think of fish? Probably not, but fish farming is a thriving business all over the world. **Aquaculture** is the science and business of raising and harvesting fish in a controlled situation. Freshwater fish farms provide a cheap, ready source of catfish, trout, and salmon. However, aquaculture also causes some problems. The farms can cause excess nutrients and pollution to flow into rivers and lakes.

To help maintain the population of fish in rivers and lakes, fish hatcheries are used to raise fish to release into lakes and rivers. Hatcheries give people who fish something to catch and also help threatened species survive.

READING TIP

You can use word parts to help remember vocabulary terms. *Aqua-* comes from the Latin word for water.

An aquaculture worker tends to a fish farm in Nepal.





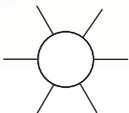
At a hydroelectric plant, water flowing through a dam spins turbines to produce electricity.

FLORIDA Content Review

You learned how humans impact ecosystems in grade 6. Building dams is another example.

VOCABULARY

Add a description wheel for *lock* in your notebook.



Energy

Not so long ago, water wheels could be seen dotting the rivers of America. The force of the river turned the water wheel, which powered machinery in factories such as grain mills. In dams, electricity is generated in a similar way. A **dam** is a structure that holds back and controls the flow of water in a river or other body of water.

At a hydroelectric dam built across a river, water rushing through the dam turns machines called turbines, generating electricity. Even electric plants that are not powered by rivers use water. For example, many plants use coal or nuclear power to heat water, creating steam that turns the turbines. Nuclear power stations also use water to cool the system.

Dams and other structures alter rivers.

When a dam is built on a river, the landscape and the shape of a river are greatly changed. Below the dam, the speed and volume of water flow may change, making a new ecosystem. Behind the dam, water may collect and form a lake covering what once had been a river valley.

In some locations, a lake behind a dam is used as a source of fresh water. A lake that is used to store water is called a reservoir (REHZ-uhr-VWAHR). Some dams are built solely for the purpose of creating a reservoir, and many communities rely on reservoirs for their water needs. Some reservoirs provide opportunities for boating and other recreational activities.

Dams have purposes in addition to providing hydroelectric power and forming reservoirs. Dams may also be built to control rivers that flow too fast or too unpredictably for boats to use them. These dams might separate a river into sections of different elevations, like steps in a staircase. To allow boats to climb or descend these steps and move to the next river section, locks are built at the dams. A **lock** is a section of waterway, closed off by gates, in which the water level is raised or lowered to move ships through.

In addition to rivers with dams, locks are used in canals and rivers that connect lakes of different elevations. Locks are also used in canals that slope upward and then downward, such as the Panama Canal. The Panama Canal is dug into a strip of land between the Atlantic and Pacific oceans, allowing ships a handy shortcut.



**CHECK YOUR
READING**

Why do ships need to use locks?

In some cases dams cause problems as well as solve them. For example, in Egypt's Nile valley the giant Aswan Dam stopped floods that happened every year. However, the dam also blocked the flow of rich soil to the valley below the dam. The soil in the Nile valley was fertile for more than 4000 years. Yet today farmers need to add chemical fertilizers to grow their crops.

Dams can also cause problems for fish. When a dam blocks a river, salmon and steelhead cannot reach their breeding grounds. People have tried to solve this problem by installing fish ladder structures along dams that allow fish to climb up the river.



Learn more about dams.

Locks and Dams

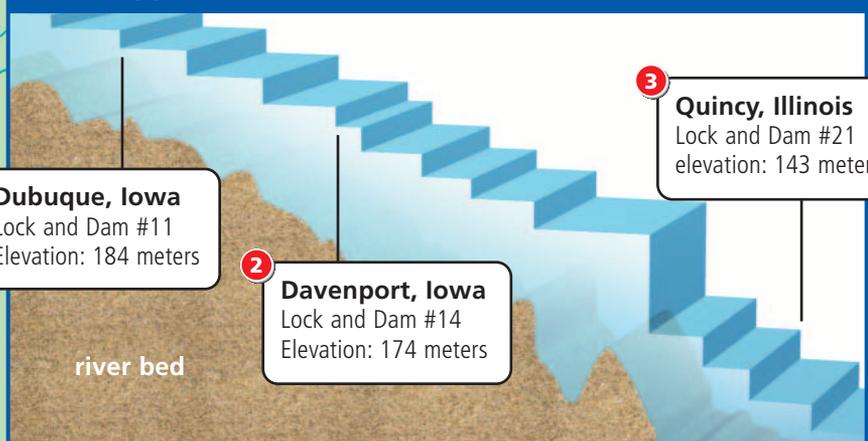
Locks and dams control the flow of rivers and allow boats to pass through.



Locks and dams on the upper Mississippi River have divided the river into a series of sections that flow downhill like a staircase. This is Lock and Dam #11 near Dubuque, Iowa.



Mississippi River Locks and Dams



READING VISUALS

Which gates are open in the lock shown in the photograph?
Which gates are closed?

This dammed-up waterway in Texas spilled around its dam during a flood. It formed a new channel that flows to the left of the dam.



Other changes to rivers can have unwanted effects. The placement of locks and the digging of a channel into a river bottom force a river to follow a constant path. In nature, however, a river changes its path depending on how much water it is carrying. It regulates itself by flooding during the wet season. As people alter rivers and build their homes closer to them, flooding becomes a problem. Some people argue that changing the natural flow makes it hard for a river to regulate itself, causing even more flooding.

People have different opinions about structures on rivers. In some places with hydroelectric dams, people want the dams removed so that salmon can swim upstream. Some people think that habitats for wildlife would be improved on the upper Mississippi and the Missouri rivers if the waters were allowed to flow more naturally. Others stress the value of hydroelectricity and the importance of navigation. In many cases the people with differing points of view try to reach compromises so that rivers can serve many purposes.

3.1 Review

KEY CONCEPTS

1. What are three ways that you directly use fresh water daily?
2. Identify a benefit and a possible disadvantage of aquaculture.
3. Explain why dams are both helpful to people and harmful to a river.

CRITICAL THINKING

4. **Predict** Do you think people will need more or less fresh water in the future? Why?
5. **Provide Examples** Explain how water is used in the manufacture of three products that you use every day.

CHALLENGE

6. **Connect** In some towns near rivers, the federal government is buying houses and paying people to move to a different location. Explain why the government might be doing this.