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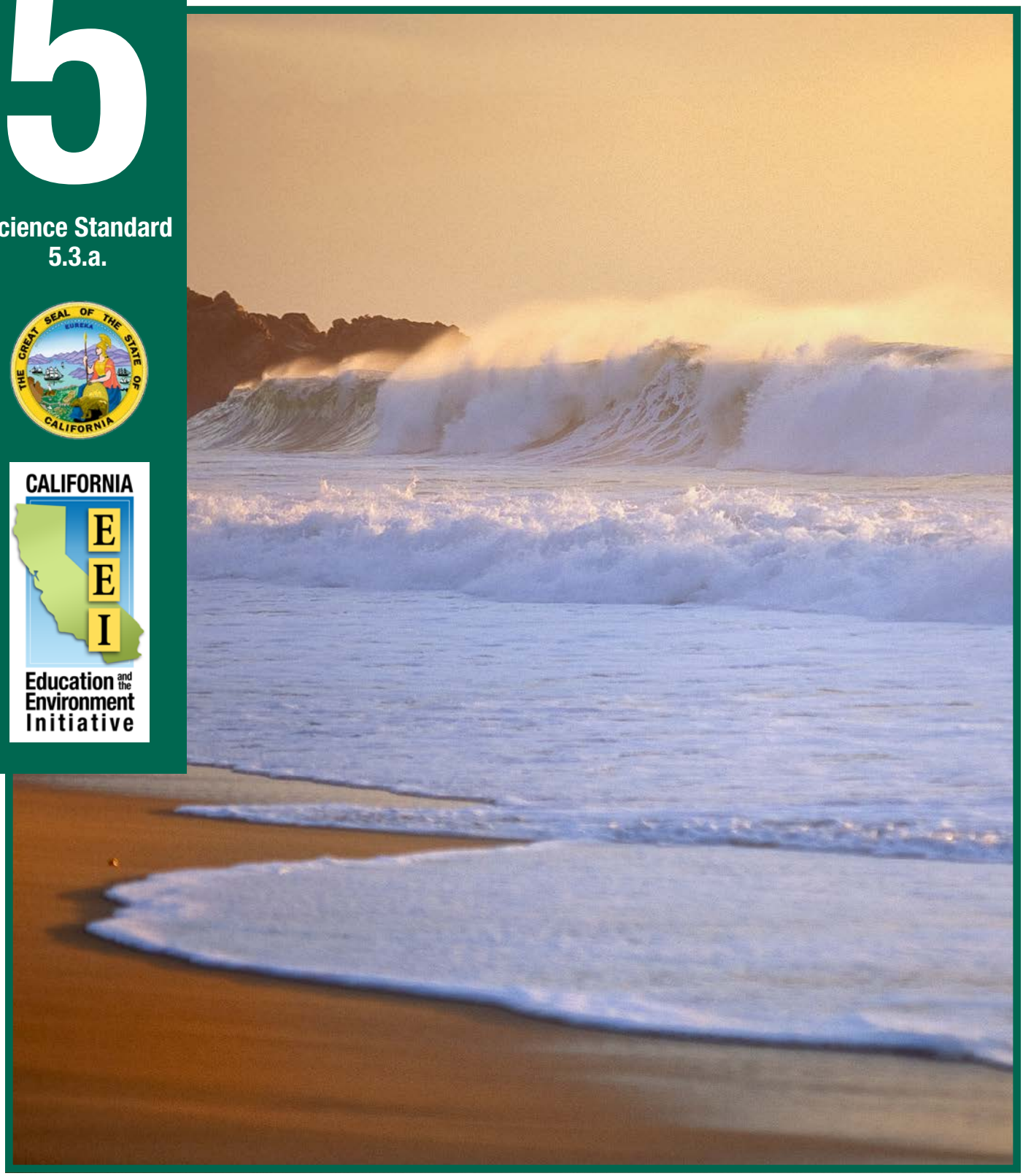
Science Standard
5.3.a.

Student Edition

California Education and the Environment Initiative



Earth's Water

California Education and the Environment Initiative

Approved by the California State Board of Education, 2010

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California Environmental Protection Agency

California Natural Resources Agency

California State Board of Education

California Department of Education

Department of Resources Recycling and Recovery (CalRecycle)

Key Partners:

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None required for this lesson.

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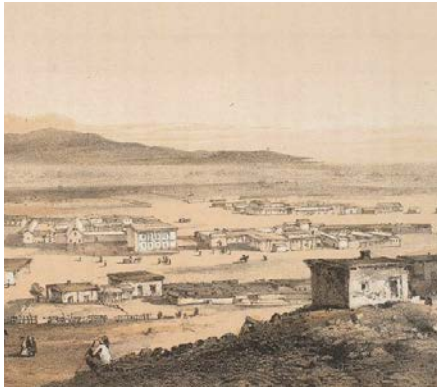
None required for this lesson.

Water to Grow a City

It Started with a *Pueblo*

Over two hundred years ago, eleven families came to North America from Spain. They built a small town called a *pueblo*. It was nestled between the San Gabriel Mountains and the Pacific Ocean. The climate was dry and mild. The people built their pueblo on a hilly plain. The land was near a small river that flowed from the mountains to the sea. The people dammed the river with rocks and wood and dug simple ditches to guide the water from the little river to their fields of grain. The people named their town after "the queen of the angels."



Los Angeles, 1854

Rio Bravo Ranch, Kern County, California

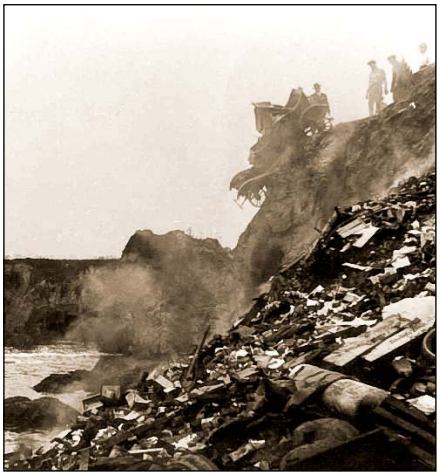
A Little River Runs Free

At first, the little pueblo grew slowly. It took a long time for people and supplies to arrive from across the ocean. People from Spain and Russia sailed to the coast west of the town and docked their ships in the calm bay. The little river that brought water to the town and its fields continued to run free. At times it was hard to control, because the river often changed its path. It flooded the fields and parts of the town in rainy seasons and slowed to a lazy creek during the long, dry summers. The families living in the town realized that if they wanted their town to grow, they would soon need more water.

Coming Up with a Plan

In 1848, gold was discovered in the mountains north and east of town. Ships soon arrived in the bay, bringing more people to California. Miners needed supplies and food, and the pueblo families found new work providing these things. Some of them started new businesses. Restaurants, saloons, and banks sprang up everywhere. With all this new growth came the need for more water. The leaders of the pueblo came up with a plan. They would continue to use water from the little river. In addition, they would try to find more water. A new water company was formed. Its job would be to pump water from deep underground.

Gold miners with tools



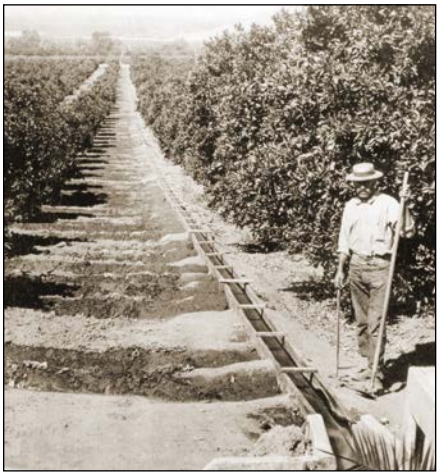
Trash dump at Glass Beach, Fort Bragg, California

New Uses for the River

As time passed, the town grew into a small city. The little river continued to flow from the city to the bay. People started new businesses, and built houses and buildings. They soon found a new use for the little river. They dumped all their garbage into it, and the water carried it out of town. Some of the dirty river water became cleaner as it soaked into the ground through rocks and sand. As the river neared the sea, some of this water collected in ponds. Special plants growing near these ponds took the dirty water into their stems and roots and cleaned it. Wherever there were standing ponds, cleaner water flowed into the bay.

Farming Requires More Water

Soon, most of the gold in the mountains had been mined. By the time California became a state, many miners had begun to look for new ways of making money. Farming was one of them. Farmers had grown orange, lemon, and avocado trees since the pueblo was first settled. These crops grew well in the mild, sunny climate. As the city grew, many new people came to try their hands at farming. They planted large orchards, and the more they planted, the more water they needed. Though some rain fell in the winter, it was not enough. The little river's water had already been taken by the growing city.



Irrigated orange grove in Redlands, California, 1919

Dry Canyon Reservoir

Strategies to Move and Clean Water

In 1900, city leaders tried to solve the water problem. In the winter, they stored extra water in human-made lakes, called reservoirs. They would use this water during the dry summer months when more water was needed. The city also built a channel to straighten the river and control its flow. They built storm drains to carry waste from farms, homes, businesses, and ranches. The waste was stored in a large sewage plant near the bay.

The special plants that had cleaned the river water were cut down. The standing ponds where these plants grew were filled with dirt and concrete to make room for the city to grow. Without a natural system to clean the water, pollution flowed straight into the bay. This dirty water killed many fish and other marine animals. After a few years, only worms and one type of clam could live there.

Moving Water from the Sierra Nevada

The city continued to grow. Soon, there were thousands of people living in the area. They needed more water to sustain the rapid growth. The city's water company came up with a plan. Each spring, snow melted in the Sierra Nevada Mountains northeast of the city. The water ran into a big lake in the Owens Valley. The city built a huge open channel or ditch, called an aqueduct. It was more than 233 miles long. The aqueduct carried the water all the way to the growing city. Farmers used this "new" water to plant more orange, lemon, avocado, and grapefruit trees.

In the 1930s, the movie business brought more people to the city. Many more houses were built, and the city's need for water grew again.

Opening of Los Angeles Aqueduct, 1913

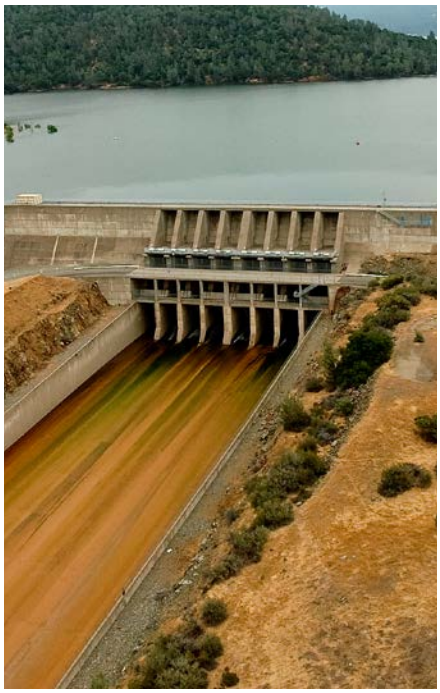
Hoover Dam on the Colorado River

Water Demand Increases After World War II

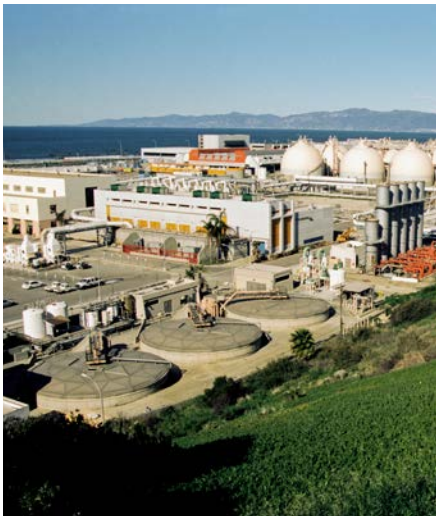
The city grew even more during World War II. Soldiers came to train for the war, and their families came with them. Many new businesses opened their doors. Every time someone moved in, more water was needed. The city again searched for water in surrounding areas. Finally, it brought water from the Mono Basin in California and worked with other cities to bring water from the Colorado River in Arizona. From 1945 to 1979, many more dams and aqueducts were built. Other cities and states joined as partners in the work. They, in turn, shared the water with their own growing populations.

California State Water Project

In 1962, President John F. Kennedy attended a ceremony to begin construction of parts of the California State Water Project and the California Aqueduct. The aqueduct was built to move water from the Mount Shasta area in northern California to cities and farms in central and Southern California. The California Aqueduct is still used today. At one point, this aqueduct rises almost 2,000 feet. Water travels up and over the Tehachapi Mountains to reach the thirsty farms and cities hundreds of miles from its source.



Oroville Dam, California



Hyperion Wasterwater Treatment Plant, California

Sewage Treatment: A Solution

The people of the city started to believe that they had solved their water supply problems forever. But there was another problem to solve. Pollution from the city was still streaming into the bay. The water was so dirty it could barely support life. Some of the city's beaches were closed to swimming and fishing, to protect people from the polluted waters. To solve the problem, the city built its first sewage treatment plant in 1950. It was the most modern sewage treatment plant of its kind in the world. In 1998, waste treatment was again improved, and the plant was expanded.

Today, the bay near the city is cleaner than it was in the past, and some fish and other marine animals have finally returned to live there.

The "Never Ending" Story

Do you know which city this story is about? Can you guess?

Nearly 10 million people now live in Los Angeles County. Almost 9.5 million people live in the counties that surround it: Ventura, San Bernardino, Riverside, Orange, and San Diego. The cities in these counties grow larger every year, and all that growing means more water is needed.

In the last few years, there has been less water in California's rivers, streams, and lakes. The snow in the mountains is not as deep as in the past, and it melts very quickly. State and city leaders are worried. If this continues, how will there be enough water to grow our food and to run our cities? Will there be enough water to drink?

This story is not over yet. All of us living in Los Angeles and the rest of California know that we need to pay more attention to how much water we use. Otherwise, we will have to go looking for other sources of water. And where do you think those might be?

Drop of water

Underground Fresh Water

Which do you think contains more water: the ground, or all the world's rivers, lakes, and wetlands combined? It may surprise you to learn that scientists think there is 100 times more fresh water beneath Earth's surface than on its surface.

Groundwater can be fresh or salty. You can find salty groundwater under seas or salty inland lakes. You can also find it under oceans, close to coastlines. You can find fresh groundwater under land almost everywhere. It lies under hills, mountains, forests, grasslands, deserts, and some swamps and marshes. Nearly half of the world's groundwater is fresh.

Groundwater is found within a few miles of Earth's surface. At deeper levels, the weight of the rock pressing down squeezes out any open spaces, or pores. Without pores, water cannot seep into deep layers of Earth's crust.

Aquifers form when water seeping down from the surface collects in rock, sand, or open spaces underground. In an aquifer, all the available spaces are full of water. The land is saturated. Closer to the surface, unsaturated soil has room to hold more water. The "water table" is the line between saturated and unsaturated land. It is at the top of the aquifer, separating groundwater from soil moisture.

The location of the water table varies greatly. It affects how easily people can use groundwater to meet their freshwater needs. Below marshes, lakes, and rivers, the water table is often very close to the surface. In these areas, groundwater can be relatively easy for people to reach. However, aquifers may lay many hundreds of feet below the surface. This is the case in some dry areas in the western United States. Groundwater in these areas can be hard to access.

Wet rock

Many communities rely on fresh groundwater for their water supply. Groundwater supplies the drinking water for most people in rural areas. Some large cities rely on groundwater to meet some of their needs. About one-third of the water used for farming comes from groundwater. Some things humans do (for example, industry and farming) can create byproducts that can seep into aquifers. This can contaminate groundwater supplies and affect the quality of drinking water.

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