

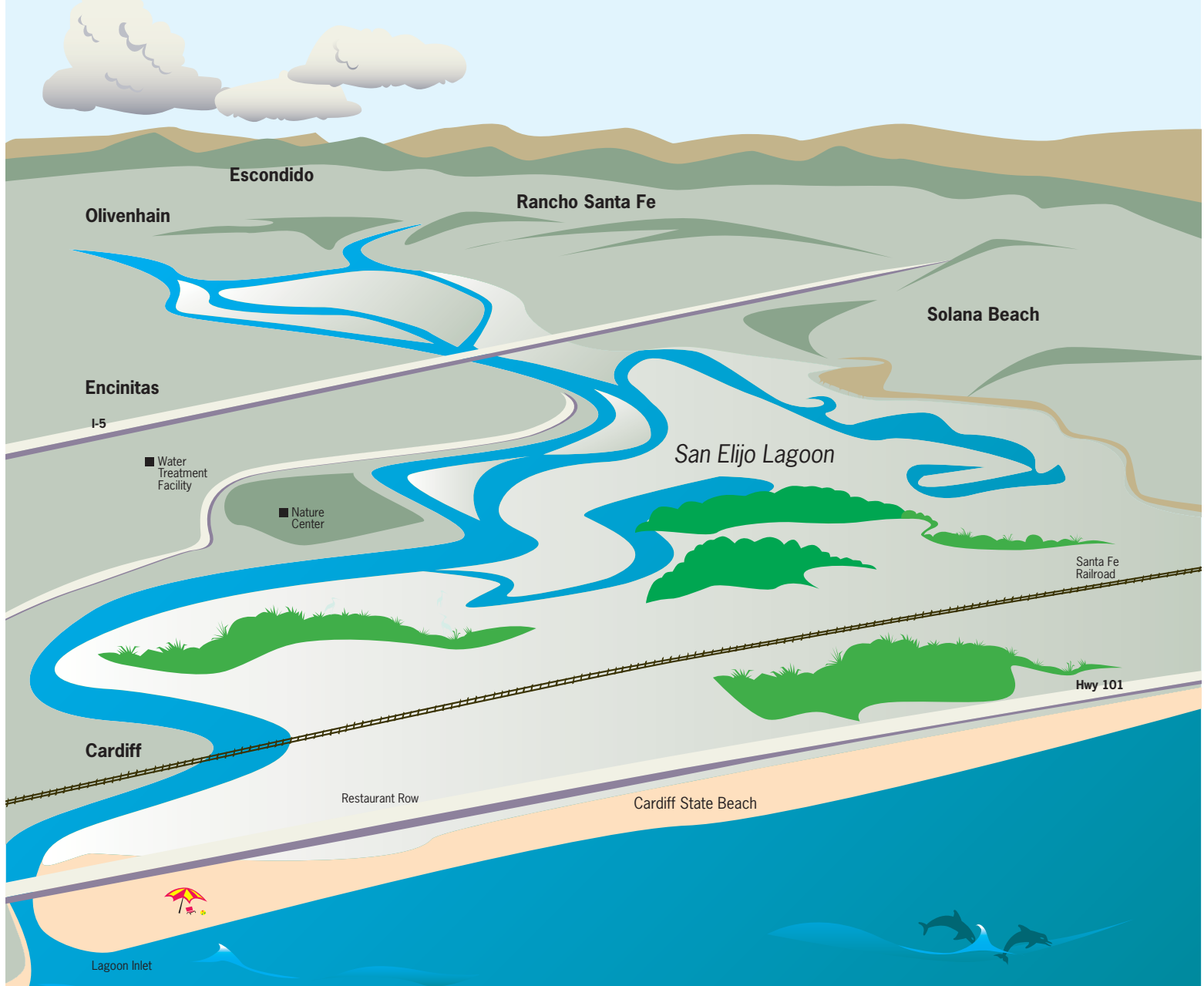


San Elijo Lagoon CONSERVANCY

Preserving, Protecting, and Enhancing San Elijo Lagoon Ecological Reserve and its Watershed

Water and Wetlands: Our Precious Resources

Teacher's Guide • Grade 5 • Supplemental Curriculum & Field Experience



Objectives

From the information and activities in this packet, students will gain:

- An awareness of the distribution of Earth's fresh water and salt water, and how precious fresh water is.
- An understanding of where the fresh water that they need comes from and where it goes.
- An awareness that the lagoon helps clean the water that flows through it, and provides many other functions, including habitats for wildlife.
- An understanding of their role in keeping the water that flows to San Elijo Lagoon and ocean clean.

California State Standards

This packet will assist you in meeting these Science Content Standards for California Public Schools, in particular the Grade 5 Earth Sciences standards that focus on Earth's water distribution, local water sources for people and nature, and water conservation.

- 5.3a.** Students know most of Earth's water is present as salt water in the oceans, which covers most of Earth's surface.
- 5.3d.** Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
- 5.3e.** Students know the origin of the water used by their local communities.

Vocabulary

aqueduct	a large channel or pipe that carries water over a long distance
decompose	the process of breaking down the remains of dead organisms into simpler forms of matter; to decay or rot
delta	a landform usually near the mouth of a river where soil or sediment is deposited making a broad, shallow, fan-shaped area
environment	all the living and nonliving things that surround and affect an organism
erosion	the process by which wind, water, or other means wears away land
estuary	a place where fresh water from rivers meets salt water from the ocean
fertilizer	organic or inorganic material added to soil to supply nutrients for plant growth

freshwater marsh	a type of wetland in or near fresh water where mostly grassy or grasslike plants grow
habitat	a specific type of environment inhabited by particular animal and/or plant species; a place where an animal or plant lives
invertebrate	an animal without a backbone or vertebral column
lagoon	a body of water cut off from another larger body of water by sand, coral, or reef
mudflat	an area of mud and other fine sediment that's part of a coastal wetland, which is often exposed during low tides and covered during high tides
nutrient	a substance that living things need to live and grow
organism	a living thing, such as an animal, plant, alga, bacterium, or fungus
pesticide	a substance used to kill harmful or undesirable plants or animals
pollutant	something, such as chemicals or garbage, that pollutes
pollution	a substance, usually produced by humans, that causes harm to a natural environment. Pollution comes from a variety of sources, which can be easy or difficult to pinpoint. If the source is known, such as a power plant, it is called point source pollution. If the source is unknown, such as runoff from streets or fields, it is called non-point source pollution.
reservoir	a place where something is collected and stored, in this case, water in an artificial lake
riparian	a type of wetland habitat near or along the banks of a river, stream, or lake
salt marsh	a type of wetland with low-lying salt-tolerant pickleweed dominating
sediment	sand, particles of rock, bits of soil, and remains of once-living organisms that move with a fluid and are eventually deposited
species	a group of the same type of living organisms that can mate and produce (reproduce) other living organisms of the same kind
watershed	an area of land that drains rain falling onto it or water running through it into a common body of water, such as a creek or stream, which flows into a larger body of water, such as a river, lake, or estuary, and eventually flows to the ocean (<i>for details see page 6</i>)
wetland	an area that is covered by water during all or some part of the year

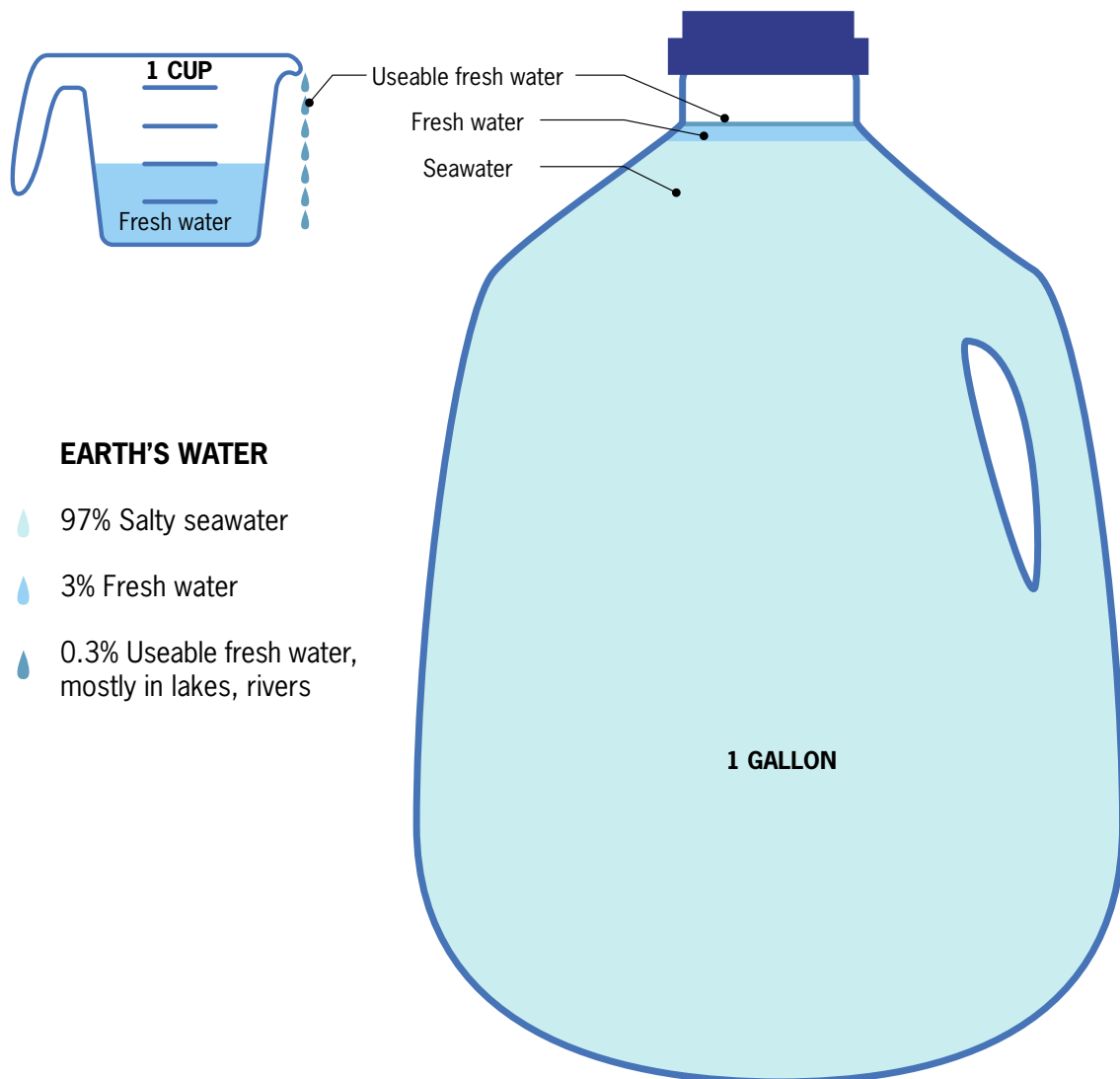
Introduction

Fresh water is precious

Can you imagine a day without water? We need fresh water every day to drink, keep things clean, and grow our food. It's nearly impossible to think of living without water. Earth is a water planet — about 70% of its surface is water — and when viewed from space, it's blue.

Most of Earth's water, about 97%, is salty seawater, which we can't use directly for drinking or many other daily needs. However, the ocean is the source of our fresh water through the water cycle. That makes us intimately connected with the ocean on a daily basis.

Even though the vast ocean supplies us with fresh water, our planet's freshwater supply is very limited. Only about 3% of Earth's water is fresh and much of that is not usable. Most fresh water is inaccessible to us because it's trapped in ice caps and glaciers, underground, or in soil. The remainder, mostly in lakes and rivers, is only about 0.3% of all fresh water. If a gallon of water represented all of Earth's water, about a 1/2 cup would equal all of Earth's fresh water. And, of that fresh water, only 7 drops would be accessible to people and other life on this planet. Clean fresh water is a very limited, precious resource.



You live in a watershed

With so little fresh water to go around, it's important to understand the flow of water on Earth, and **watersheds** play a key role in freshwater flow.

Did you know that you live in a watershed? We all do. A watershed is an area of land that drains the rain falling onto it or water running through it into a common body of water, such as a creek or stream, which flows into a larger body of water, such as a river, lake, or **estuary**, and eventually flows to the ocean. In a watershed, water flows from the highest points (mountains and hills) to the lowest point, which is the ocean. A watershed is named after its largest river or stream.

San Diego County contains 11 major watersheds, from the San Juan Creek watershed along the county's north border to the Tijuana River watershed along the California-Mexico border.

(Note: To find the watershed you're in, see references on page 10.)

San Elijo **Lagoon** (which you'll be visiting soon) is part of the Escondido Creek watershed. This watershed starts in Bear Valley above Lake Wohlford in the City of Escondido and stretches 26 miles to the coast, through San Elijo Lagoon, and ends in the Pacific Ocean. You may live in this watershed if you live along San Diego County's north coast from Encinitas to Solana Beach, and inland to Escondido. The fresh water flowing in the Escondido Creek watershed supports a variety of **habitats** and multitudes of California native plants and animals.

San Elijo Lagoon is one of the most important natural places in the Escondido Creek watershed. It is a type of **wetland** called an estuary, which is a partially enclosed body of water that receives fresh water from rainfall and runoff and salty seawater from tidal flow. In addition to the wetland, other habitats include **riparian** (river-bank) forests, **freshwater marshes**, **salt marshes**, and **mudflats**. The lagoon is **nutrient**-rich and very productive, providing food and shelter for many different **species** of **organisms**, including endangered species. It's also a nursery for young birds, fishes, and **invertebrates**. When you and your students visit the lagoon, you'll see an amazing diversity of life adapted to the mixing of fresh water and salt water.

The flow of water

What do you know about the water you rely on every day? Does it flow from your watershed or from somewhere else?

If you live along San Diego County's north coast, your water most likely comes from one of several **reservoirs**: Lake Wohlford, San Dieguito Reservoir, Dixon Lake, or Lake Hodges. (A fifth, Olivenhain Reservoir, is an emergency water source.) These reservoirs are not natural lakes. They're freshwater holding areas built by constructing dams across rivers and creeks. Some reservoirs are also places for fishing, boating, or other types of recreation.

The San Diego area doesn't get enough rain to fill its reservoirs and so most of that water, about 82%, is imported from hundreds of miles away. The majority (about 54%) of the water comes from the Colorado River, starting at Lake Havasu (a reservoir) on the California-Arizona border and pumped west through the Colorado River **Aqueduct** (about 242 miles long). About 28% of the water comes from the San Joaquin-Sacramento River **Delta** in Northern California and is pumped south through the California Aqueduct (nearly 445 miles long). These aqueducts

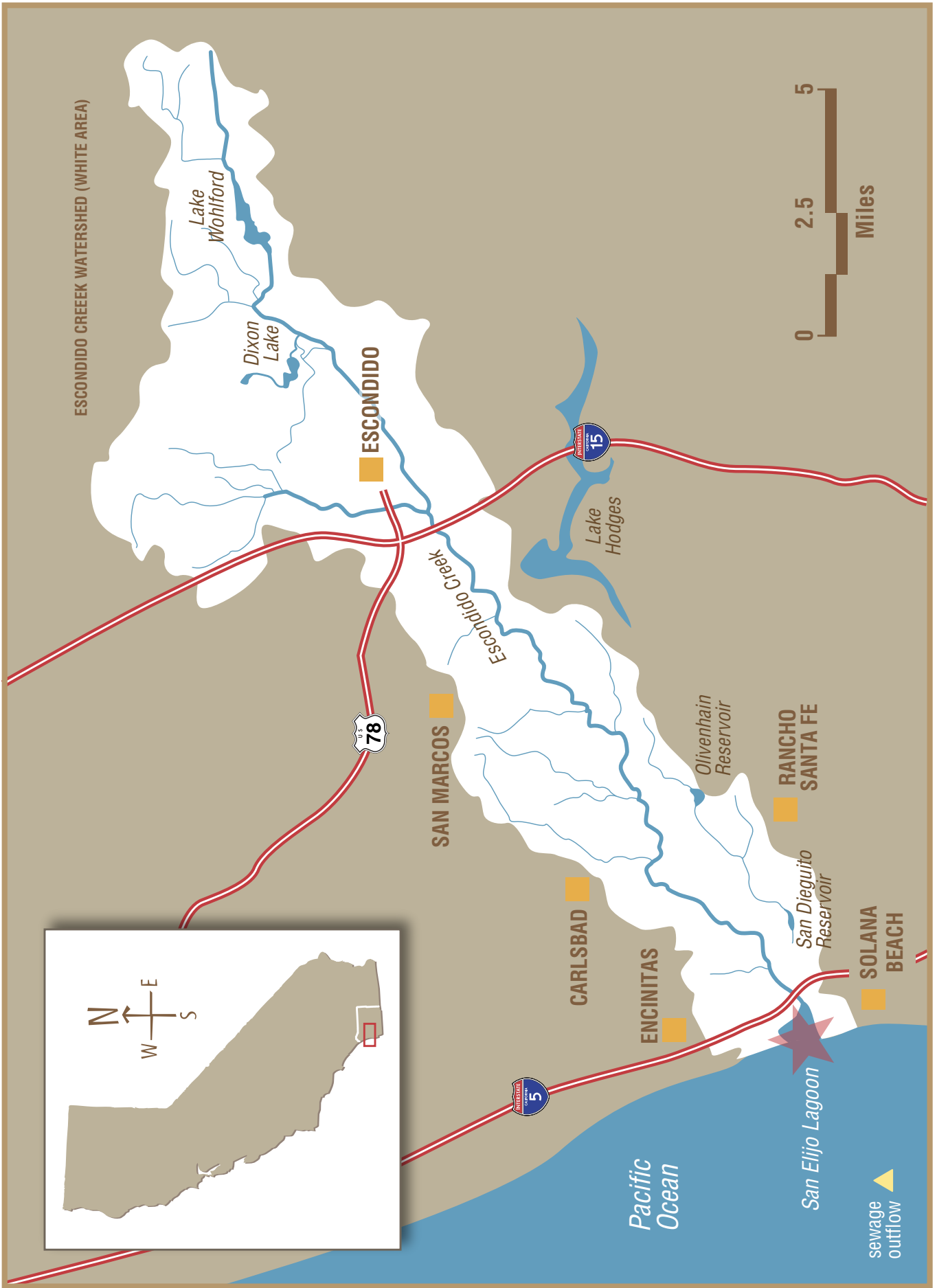
deposit water into Riverside County reservoirs where it is picked up by the San Diego Aqueduct and delivered to San Diego County reservoirs. The San Diego Aqueduct consists of several pipes, some as long as 70 to 100 miles.

About 18% of San Diego County's water comes from rain, some of which falls in the Escondido Creek watershed. Lake Wohlford, San Dieguito Reservoir, Dixon Lake, and Olivenhain Reservoir are all part of this watershed and collect rainwater. Water from reservoirs needs to be treated before it is piped to your home or school for use.

So what happens to the water you use? Water that flows down the drains at home or school (our wastewater) goes into sewers and then to a treatment facility. After a complex treatment process, the water is discharged through a pipe that extends about 1.5 miles out into the ocean.

What about the water that flows from homes when we water gardens, wash our cars, or play in sprinklers on a hot day? That water, along with rainwater, flows down streets and sidewalks to storm drains. Storm drain water is not filtered or cleaned at a treatment facility. Everything that's in it flows directly to the coast and through San Elijo Lagoon to the ocean.





Keeping fresh water clean

San Elijo Lagoon, as a coastal wetland, serves many important functions within the watershed. In addition to providing habitat for a wonderful diversity of plants and animals, the wetland also helps clean water before it empties into the ocean. Water slows as it moves through a wetland and this allows **sediment** to settle, clearing the water. Wetland organisms take up **pollutants** in the water or sediment and **decompose** many toxic substances. By slowing water, wetlands also help control flooding and limit land **erosion**.

Unfortunately, over the past 200 years, 90% of California's coastal wetlands have been destroyed by human development. Most of the water today that flows through watersheds to the coast no longer gets the cleaning services provided by wetlands.

With fewer coastal wetlands, the job for those that remain is bigger and more challenging. As water flows through our neighborhoods it picks up **pollution** from yards (**fertilizers, pesticides**), streets (oil, grease), and walkways (trash, dog poop), and carries the pollutants through the watershed to the lagoon and ocean. Because San Elijo Lagoon gathers whatever is in the water, it collects what flows from neighborhoods. Too much pollution and trash can overwhelm the cleansing mechanisms and destroy the usefulness of the wetland. This disrupts the lives of the plants and animals there, and ultimately affects the health of the ocean.

Since everyone lives in a watershed, everyone affects the quality of the water in their watershed. Whether our water comes from far away or close to home, we all have a responsibility to protect our limited freshwater resources. And when we care for and conserve freshwater resources, we're helping care for the ocean as well.

Here are some simple ways that you and your students can reduce your use of fresh water and keep clean the water that flows to San Elijo Lagoon and ocean.

- Turn off water when you don't need it, such as while you brush your teeth
- Take short showers instead of baths
- Report sprinklers or hoses left running or overflowing onto sidewalks or streets
- Pick up after pets and throw away the waste
- Never throw trash onto the ground or into a storm drain (it flows to the lagoon and ocean)
- Don't release helium balloons into the sky (when they pop they could land in the lagoon or ocean)
- Don't rinse paint brushes or other household items containing harmful chemicals into a street gutter (the chemicals will flow into a storm drain and to the lagoon and ocean)
- Don't wash the car on the street or driveway (soapy water with oil and grease flows to a storm drain and to the lagoon and ocean)
- Join a watershed, creek, or beach clean-up
- Tell others to use less water, recycle when they can, and dispose of trash properly.

References and Suggested Readings

For more information, look for these references at a local library or online.

General References

Baders, W. & Carnine, D. 2007. *Houghton Mifflin California Science*. Orlando, FL: Houghton Mifflin.

California Coastal Commission. 2003. *Waves, Wetlands and Watersheds Science Activity Guide*. Available at <http://www.coastal.ca.gov/publiced/waves/waves1.html>

San Diego Water Authority. *The Past, The Present, The Future: A tale of San Diego County's water*. Brochure available at <http://www.sdcwa.org/students>

San Elijo Lagoon Conservancy website: www.SanElijo.org

Water Education Foundation (California water resources) website: <http://www.watereducation.org>

California Maps: Aqueducts

California Aqueduct: http://en.wikipedia.org/wiki/California_Aqueduct

Central Basin Municipal Water District. Map of California's Aqueducts: <http://www.centralbasin.org/waterSupplySystem.html>

City of San Diego Water Quality website (a simple aqueduct map): <http://www.sandiego.gov/water/quality/purchasingwater.shtml>

Colorado River Aqueduct: http://en.wikipedia.org/wiki/Colorado_River_Aqueduct

San Diego Aqueduct: http://en.wikipedia.org/wiki/San_Diego_Aqueduct

San Diego County Maps: Lakes and Watersheds

San Elijo Lagoon Conservancy website: SanElijo.org/stewardship

(Note: Click on *Carlsbad Hydrologic Unit*, then click on *View larger map to see watersheds*)

Project Clean Water. San Diego County Watersheds map: <http://www.projectcleanwater.org/html/watersheds.html>

Mapping San Diego (an interactive mapping tool to see county rivers, lakes, and watersheds): <http://mappingsandiego.com/>

(Note: Click on *View Map*, then pull down the *Planning* menu and choose *Hydrology*, then select *Map Layers: Lakes, Rivers and/or Watersheds*)

We developed the activities in this packet to support your field trip.

Pre-Visit

Activities 1 and 2 are designed as pre-visit activities. We recommend you use these to familiarize your students with local freshwater resources, their use of water, and the impact of that use on San Elijo Lagoon and ocean. This will help them understand what they will see at San Elijo Lagoon and learn about from your onsite leader (docent).

Post-Visit

Activity 3 is designed as a post-visit activity that will help your students review what they learned about water, San Elijo Lagoon, and their role in keeping water clean and healthy.



Teacher's Aid

Activity Introduction

During this activity, your students will map the sources of the fresh water they use living in San Diego County and then map the flow of water through a local watershed to the ocean.

This is a map labeling activity. Your students will start by labeling their local community, then track their water to the source rivers: the Colorado River and the San Joaquin-Sacramento Delta. For the second part, they will outline the Escondido Creek watershed and trace the flow of water through the watershed to San Elijo Lagoon and ocean.

Note: Escondido Creek is the watershed mapped for this activity because San Elijo Lagoon is in this watershed. If you want your students to map one of San Diego County's other watersheds because of your location, use the References on page 10 to find that watershed's boundaries and features. If you map another watershed make sure you map it to the ocean and determine if the water flows through an estuary or lagoon to reach the ocean. This will help prepare your students for discussions during their San Elijo Lagoon field trip. You may also want to have your students map their local watershed and the Escondido Creek watershed to see their relative locations on land and where each enters the ocean.

Time & Materials

- This activity should take about 30 to 60 minutes to complete both parts.
- Students can work individually or in teams.
- Each student or team will need copies of the map templates and colored pens/markers.

Instructions to Teacher

Make copies of the Student Map templates on pages 16 and 17 and provide copies to each student or student team. The templates include squares for cities, outlines for reservoirs and rivers, and dotted lines for aqueducts. (*Note: See the fully labeled maps in the Introduction section.*) To help your students, we recommend that you draw or project (using a chalkboard, whiteboard, or overhead projector) a map template and have them follow what you do on their maps.

Part 1 (Student Map 1)

You'll ask your students where they think their water comes from and talk about all the possibilities. (*Note: If you have time, you might use this opportunity to review the water cycle.*) Then you'll label the California map (with students following) starting in San Diego. From there identify the San Diego Aqueduct, then the California Aqueduct and the Colorado River Aqueduct. Finally, label the Colorado River and the San Joaquin-Sacramento Delta.

You'll end by talking about why local drinking water comes from so far away — San Diego is arid and there's not enough local water to support the population.

Part 2 (*Student Map 2*)

On the second map template, you'll have students start with their home or school community and follow the flow of water from that home base down the Escondido Creek past reservoirs through San Elijo Lagoon to the ocean. Then they will highlight the outline of the Escondido Creek watershed and discuss what a watershed is and where the water flows (*see Introduction section*).

Instructions to Students (*to be given verbally*)**Part 1** (*Student Map 1*)*Introduction*

Where do you think the fresh water you use each day comes from? What's the source of the water that flows out of the faucet?

[Discuss all the possibilities – try to get them to be as specific as possible.]

We're going to be doing a map labeling activity. On this map we're going to follow the water backwards from our homes/school to the source. I want you to follow along. As I label the map on the board, you label your maps.

We'll start by labeling the community we're in, which on this map is the San Diego area.

But we're not going to stop here. Most of our water comes from some other place. So we're going to label the pipes and channels that bring the water to San Diego. These are called aqueducts.

The San Diego Aqueduct is several large pipes and brings water to San Diego County from Riverside County to our north. But that's not the source of our water. We have to go further.

[Label the San Diego Aqueduct and cities nearby.]

The water that is pumped to Riverside County comes from two places. Can anyone guess those places?

[Take answers.]

If you guessed the Colorado River, you're right. We get most of our water from the Colorado River (on the California-Arizona border) through an aqueduct called the Colorado River Aqueduct. That aqueduct is about 242 miles long. Our water also comes from another aqueduct called the California Aqueduct and it is about 445 miles long and stretches from Riverside County all the way up to the San Joaquin-Sacramento River Delta.

[Label aqueducts, rivers, and cities nearby.]

Let's check to make sure everyone got all of this.

[Review with students from the Delta to Riverside County, from Colorado River to Riverside County, then down the San Diego Aqueduct to the San Diego area.]

Wrap Up

Did you know that your water came from so far away? Why do you think we get our water from Arizona and Northern California?

[Take answers. Discuss: San Diego is arid and there's not enough local water to support the population.]

Part 2 *(Student Map 2)**Introduction*

Now that we've mapped where our water comes from, let's map where it goes when we're done with it. This is also a map labeling activity. On this map we're going to follow water as it flows from our homes/school to the ocean. I want you to follow along. As I label the map on the board, you label your maps.

We'll start by labeling the community we're in *[or the cities closest to homes or school.]* Where does most of the water we use each day go?

[Take answers. Proceed with script below based on how they answered the question.]

Yes, water goes down sink drains, shower drains, and toilets. That wastewater goes into sewers and then to a treatment facility. After being treated to clean it up some, the water is discharged through a pipe that extends about 1.5 miles into the Pacific Ocean. So we're going to label the triangle in the Pacific Ocean as sewage outflow.

What about the water that flows from our homes when we water gardens, wash our cars, or play in sprinklers on a hot day? That water flows down streets and sidewalks and into storm drains. Has anyone seen a storm drain near where they live? Storm drain water does not go to a treatment facility to get cleaned up. It flows underground or into creeks and rivers toward the coast and through San Elijo Lagoon to the ocean.

Rainwater flows to the coast sometimes through storm drains and sometimes in creeks and rivers to reservoirs (which are human-made lakes). So let's draw a line from the start of Escondido Creek down through San Elijo Lagoon to the ocean.

[Label local cities and lakes/reservoirs, Escondido Creek, and San Elijo Lagoon.]

All this land area where rainwater flows is called a watershed.

[Outline and label the Escondido Creek watershed, which is the white area on the map.]

A watershed is an area of land that drains the rain falling onto it and water flowing through it into a creek or stream, which then flows into a larger body of water, such as a lake or estuary, and eventually flows to the ocean. A watershed is named after its largest river or stream. San Elijo Lagoon is in the Escondido Creek watershed. This watershed starts in Bear Valley above Lake Wohlford in the City of Escondido and stretches 26 miles to the coast through San Elijo Lagoon and ends in the Pacific Ocean.

Let's check to make sure everyone got all of this. Where does our water flow when we're done with it?

[Review with students what they've labeled starting with home/school community and ending with San Elijo Lagoon and finally the ocean.]

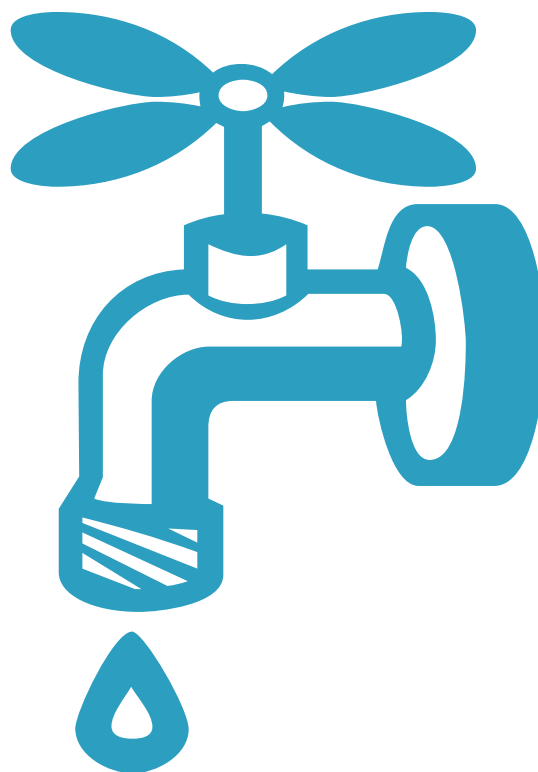
Wrap Up

So what happens if there's trash in the street or dog poop (feces) on the sidewalk in your neighborhood when it rains? Where does that go?

[Discuss: Water that flows from neighborhoods (and all that's in that water) flows down storm drains or creeks to San Elijo Lagoon and ocean.]

Do you think what you do in your neighborhood has anything to do with the health of the lagoon and ocean?

[Discuss.]



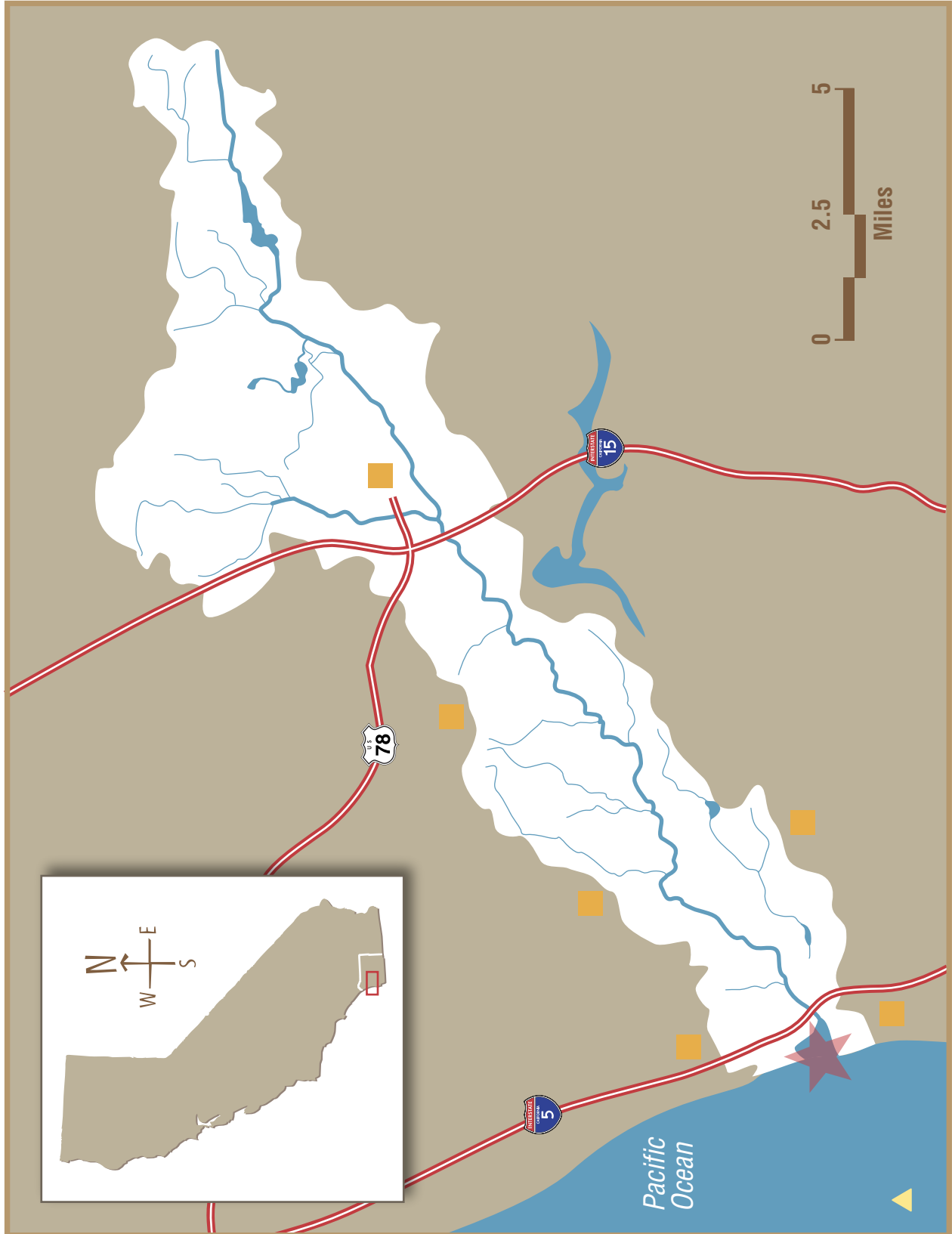
Student Map 1

Instructions: Follow your teacher's instructions and label the sources of your daily water.



Student Map 2

Instructions: Follow your teacher's instructions and label the flow of water from your neighborhood to the ocean.



Teacher's Aid

Activity Introduction

During this activity, your students will conduct an audit of the trash or other pollution near their school or home to determine what would flow to San Elijo Lagoon and ocean when it rains or gets washed into a storm drain.

Time & Materials

- This activity should take about 45 to 60 minutes to complete.
- Students can work individually or in small groups on their worksheets.
- You will need one copy of the Student Worksheet for each student or small groups of students.

Instructions to Teacher

Make copies of the Student Worksheet on page 20. Give each student or group of students a copy. You can have students do this as a homework assignment and conduct the audit around their home or neighborhood, or you can conduct this audit around the school campus.

You might start by asking students to think about all of the trash or other pollution they might find around school or home. Then write on the board a list based on students' thinking. Examples might include: trash, paper, plastic, cans or bottles, dog poop (feces), oil, lost shoes, etc.

To expand the list, have them add any things that they have seen people do that might end up in a storm drain: soapy water from washing a car on the street, plant food sprayed on flowers, trash thrown out a car window.

Next, you'll have students, either individually or in small groups, conduct the pollution audit. Have them record on their worksheets the list of things they see and tally items that they see multiple times. When they bring their worksheets back to class, create a master list on the board and tally the most common items they found. Then discuss what their audit means to the health of San Elijo Lagoon and ocean and all of the animals, plants, and other organisms that live there.

Instructions to Students *(to be given verbally)**Introduction*

Where does water go after we're done with it or when it rains?

[Take answers related to Activity 1.]

Today we're going to do a pollution audit. An audit is an official inspection of a place or organization. You'll be looking for pollution in your neighborhood/around the school. Using a worksheet you will record what you find and tally how many times you find each item.

To start this activity, I want all of you to think about all of the trash or other pollution you might find around school/home.

[When you think they've had sufficient time to think...]

I'm going to write your thoughts on the board. Tell me what you think.

[Include all ideas until they run out. If needed, expand the list by asking...]

What things have you seen people do that might end up in a storm drain?

[Include all ideas until they run out.]

Now take your worksheets home and conduct an audit, OR

Let's take the worksheets outside and conduct the audit.

[Provide additional instructions for how to conduct themselves in their neighborhood or school, and when to return their completed worksheets.]

[When they have completed their worksheets...]

Now that you've completed the worksheets, let's work on a master list on the board.

First, let's list all the things you found.

[Make a list on the board.]

Now let's tally each of these items to see what the top pollution items are.

[Take tallies of each item and total them.]

Wrap Up

What are the top pollution items? *[Identify the top 10.]*

What would happen if it were to rain tonight? Where would all this pollution go?

[Discuss with them what might flow to San Elijo Lagoon and ocean when it rains or gets washed into a storm drain, and what that might do to the health of those environments or the plants and animals that live there. Highlight the link between school/neighborhoods and the lagoon and ocean via the watershed.]

Extension

Have students graph their audit items and tallies. They could also indicate on their watershed maps, or a more detailed local map, where they found the greatest amount of pollution.

Teacher's Aid

Activity Introduction

It is important that your students reflect on and process what they learned during their field trip. This activity will help them synthesize what they learned about their important role in saving water and helping to keep San Elijo Lagoon and ocean clean and healthy for the organisms that live there.

Time & Materials

- Students can work individually or in small groups on this activity.
- This activity could be assigned as homework or be a class project taking multiple class periods to complete depending on how involved your students get.

Instructions to Teacher

Have your students talk for a few minutes about their experiences at San Elijo Lagoon. What did they learn about the watershed and the impact of the water they use on the health of San Elijo Lagoon and ocean?

Have students develop a project (such as a poster, presentation, or skit) that shares with others (schoolmates or parents or the community) what they learned. They could choose one of the topics covered in this packet (*see below*) or a related topic that interests them.

Topics

- How much fresh water and salt water there is on Earth and where it is
- Why they should use less fresh water and how they can do that
- Why wetlands are important
- What a watershed is, what watershed they live in, and how the water flows through the watershed
- Where the water they use comes from and where it goes when they're finished using it
- What they can do at home or in their neighborhood to keep pollution from flowing to San Elijo Lagoon and ocean
- How the school can work together to clean up the schoolyard, or local creek, or beach to help keep the ocean healthy.

Extension

Have students brainstorm easy things that they could do to help the lagoon and the organisms that live there. Then have each student pledge to do one of those things each day.

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Bring your class on a field trip to the lagoon.
To learn about the different programs offered
or to schedule a walk...

- visit SanElijo.org/education
- email education@sanelijo.org
- call (760) 436-3944 x 701

