

# POST-VISIT LESSONS

Aquarium of the Bay Self-Guided Tour KINDERGARTEN - FIRST GRADE

Download all four parts from Bay Academy to enhance your students' educational experience:

- Pre-Visit Lessons
- **○** Chaperone Guide
- On-Site Activites
- **Y** Post-Visit Lessons

#### **OVERVIEW**

GRADE LEVEL: K-1

PREPARATION TIME:

15 minutes

ACTIVITY TIME: 40 minutes

LOCATION: School

#### **MATERIALS**

- Water
- Spray bottle with water in it
- Paper
- Water-based markers
- Pans or containers to put underneath wet paper
- Game Cards(Appendix B)
- Start Line and Finish Line (Appendix A)



# PROTECTING OUR ESTUARIES

Intro to Estuaries: Post-Visit Lesson Plan

#### ENDURING UNDERSTANDING

Students will understand that freshwater flows are important to the SF Bay estuary and to all the animals that live in the watershed.

#### LESSON OVERVIEW

Activity	Students will	Students will learn
San Francisco Bay Watershed Health & Freshwater Flows	Make simple models of watersheds to understand the role of freshwater flows in the San Francisco Bay.	The San Francisco Bay Estuary depends on freshwater flows from its watershed.
Journeying Through the Watershed	Participate in a game that shows how humans impact freshwater flows.	Human impacts on freshwater flows directly impacts the watershed.
Protecting the San Francisco Bay	Discuss ways to conserve water so that more freshwater makes it to the Bay .	They can protect life in the San Francisco Bay by conserving water.

#### SET UP

#### Activity One

- 1. Fill the spray bottle with water.
- 2. Clear off desks completely as the watershed model activity will get them a bit wet.
- 3. Lay out paper and washable markers for students.
- 3. Set out pans or containers to put underneath wet paper.

#### **Activity Two**

- 1. Print and cut out the Watershed Action cards(Appendix B) and organize the three different categories (Nature Event, Human Impact, and Human Solution) into three separate piles.
- 2. Prepare a start and finish area for the activity area needs to be large enough for students to take 7-10 large steps forward, as well as space for them to spread out into a line.
- 3. You can also print out the Start and Finish line signs in Appendix A.

# PROCEDURE SF BAY WATERSHED HEALTH & FRESHWATER FLOWS

- 1. Review where freshwater comes from.
- 2. Explain how freshwater flows are needed to make the brackish water of the San Francisco Bay estuary.

- 3. Introduce what a watershed is (can use bathtub analogy) and how the Bay is a unique part of a much larger San Francisco Bay watershed.
- 4. Tell students that in order to more clearly understand watersheds, they will be making simple models of watersheds.
- 5. Explain what a model is in case students do not know.6. Ask students to crumple the paper to make mountains, valleys, etc.
- 7. .Have students use a brown washable marker to mark the ridges and high points of the landscape.
- 8. In different colors, have students draw houses, farms, etc.
- 9. Ask students to place the paper in the pan, making sure all of the paper is contained in the pan.
- 10. Tell students that you'll be spraying the paper and that they should pay close attention to where the water ends up.
- 11. Using the spray bottle with water, go to each watershed model and spray the paper.
- 12. Describe how pollution can get into our waterways through runoff.
- 13. Discuss ways to keep water clean.

# PROCEDURE JOURNEYING THROUGH THE WATERSHED

Students will learn how humans impact the watershed and learn how they can protect freshwater flows coming into the San Francisco Bay.

- 1. Review with students how we are connected to the watershed and explain that our actions can affect the water in our watershed.
- 2. Explain that the students will be playing a game where they will be a drop of water in the watershed. It's going to be their job to travel from your school/local river(Start Line) to the San Francisco Bay(Finish Line).
- 3. Explain that the game will happen in two rounds. In the first round, they will have to make a decision during each turn
  - a. Stand Up to travel down the watershed.
  - b. Sit Down and become groundwatersafe from the action of the turn
- 4. Emphasize that during each turn all of the standing students will either be stepping forward- if the action brings more freshwater, or they will be stepping back- if the action takes away freshwater. All of the sitting students will stay in place..
- 5. Tell students that if they make it down the river, and then end up at the starting line, they are out of the round.
- 6. The round will end when all students are either back at the Start Line or at the Finish line.

#### GAME PROCEDURE

- 1. Spread the students out along the starting line- once everyone is ready they should all take one step forward.
- 2. Remind students that they stay standing to travel down the watershed, or they sit

- down to become groundwater and are safe- staying in their current spot.
- 3. While students are deciding, shuffle the red and green decks together, leaving the blue deck for the second round.
- 4. Once everyone has made a choice, choose the card on the top of the stack and read it out loud.
- 5. Remind students to follow the action on the card..
- 6. Continue to have students choose to stand or sit, and then read a Watershed Action card.
- 7. If students return to the Start Line, they are out and should cheer on their classmates until the next round.
- 8. The round ends when all students are either out, or have crossed the finish line.
- 9. Tally on the board how many students made it through the watershed to the Bay(crossed the finish line) and those who didn't(returned to the start line).
- 10. Follow the same rules for the second round, but include the blue cards in the deck.
- 11. After the second round has concluded, re-tally the students.
- 12. Discuss with the students the difference in the tallies from Round 1 to Round 2 and discuss how the addition of the Blue Watershed Action Cards changed the game.
- 13. Use example cards from the deck to show that both natural events and human impacts can affect the watershed in a positive or negative way.

#### DISCUSSION

#### PROTECTING THE SF BAY

- 1. Conclude the lesson by reviewing the connection of freshwater flows to the San Francisco Bay estuary and watershed.
- 2. Explain how the San Francisco Bay has lost over 50% of its freshwater flows due to the impact of dams, groundwater removal, and water exports for agriculture and urban development.
- 3. Explain to the students that we are all part of our watershed and that the actions that we take in our everyday lives can affect the animals who depend on our estuaries.
- 4. Ask students to brainstorm how they can reduce the amount of freshwater they use.

# TEACHER BACKGROUND INFORMATION

#### **ESTUARY**

One of the reasons the San Francisco Bay can support its diverse wildlife is that it is an estuary. An estuary is a partially enclosed, coastal body of water where freshwater from rivers and streams mixes with salt water from the ocean.

The brackish water—a mixture of freshwater and salt water—is a major reason that estuaries are such productive, diverse, and dynamic ecosystems. Many animals rely on estuaries for food, places to breed, and migration stopovers. Humans also rely on estuaries for food, recreation, and jobs.

The San Francisco Bay Delta ecosystem is the largest estuary on the West Coast of the Americas, fed by the water flowing over about 40% of California's land mass.

#### FRESHWATER FLOWS

Freshwater flows are rainfall and snowmelt that run into surface streams and groundwater, downstream to major rivers, and eventually to the sea. For the San Francisco Bay, the Sacramento and San Joaquin rivers and their tributaries provide the freshwater flows into the Bay. Freshwater helps create a healthy estuary through the transport of nutrients, sediment, and small organisms to and through the Bay. Freshwater flows are also essential corridors for migratory fish like salmon and other fish like sturgeon and striped bass. These animals must travel between the ocean and freshwater habitats to complete their lifecycle.

The amount of freshwater that comes into the San Francisco Bay has been dramatically affected by the alteration of flows. A combination of dams,

groundwater withdrawal from the Central Valley, water exports from the Delta for agribusiness, and for the needs of Southern California's growing population has led to a 50% reduction in freshwater flows into the Bay, with increasing frequency in the last several decades. The reduction of freshwater flows into the Bay has made it a less dynamic and less productive environment

#### SAN FRANCISCO BAY WATERSHED

A watershed is the area of land that drains to a body of water. The Bay's watershed is like a large bathtub, with mountains as the sides of the tub. and its drain is the San Francisco Bay. All the water in the watershed has to make it to the Ocean through this drain. The San Francisco Bay Delta watershed covers more than 75,000 square miles and includes the largest estuary on the west coasts of North and South America. It also contains the only inland delta in the world. The watershed extends nearly 500 miles from the Cascade Range in the north to the Tehachapi Mountains in the south, and is bounded by the Sierra Mountain Range to the east and the Coast Range to the west. Nearly half of the surface water in California starts as rain or snow that falls within the watershed and flows downstream to the Pacific Ocean through the Golden Gate strait.

#### CONSERVING WATER

There are countless ways that we can reduce the amount of freshwater that we use in our daily lives, as well as habits that we can cultivate to conserve water in all areas of our life.

#### IN THE KITCHEN

- + Only run full dishwashers.
- + Choose one glass to be your go-to water glass at home.
- + Collect the water you use while rinsing fruit and vegetables to water house plants.

#### IN THE BATHROOM

- + Keeping showers to under 5 minutes can save up to 1,000 gallons of water per year.
- + Drop tissues into the trash or compost instead of in the toilet.
- + Become a leak detective check faucets, hoses, and connectors for leaks.

#### IN YOUR COMMUNITY

- +Reuse your towels and sheets when staying out of town.
- + Suggest ways that your school could save water and money!
- + Let your water go brown during the winter the rain will give it all the water it needs.
- + Wash cars at carwashes that recycle their water.
- + Research local plants and landscaping techniques that save water.
- + Teach others about how they are connected to their water.

#### **GLOSSARY**

Brackish: Slightly salty. With a salinity between freshwater (O ppt) and normal ocean water (35 ppt).

Estuary: A partially enclosed body of water where freshwater from land and saltwater from the ocean mix.

Watershed: An area of land where all the water - above ground, below ground, and from precipitation - flows to the same place. A drainage basin.

#### **STANDARDS**

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

### APPENDIX A

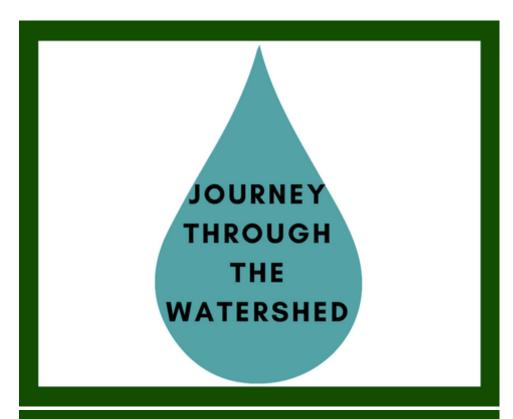
JOURNEY THROUGH THE WATERSHED SIGNS

# START HERE

You are at the source of the watershed.

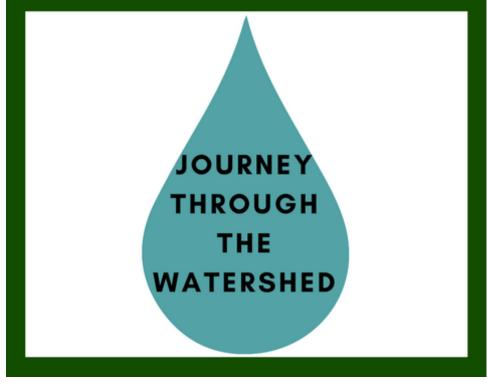
## FINISH

Congratulations, you made it through the watershed and are now in the San Francisco Bay.



It's been a warm winter without a lot of rain or snow.

Move one step back.



#### NATURAL EVENT

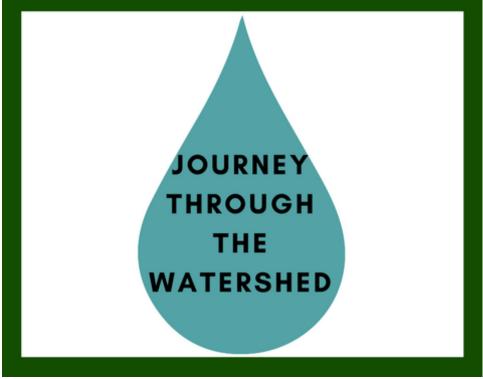
The winter snowpack is melting. The rivers are filled with water.

Move two steps forward.



A beaver built a HUGE dam. The beavers are happy, but the water can't move downstream.

Move one step back.



#### NATURAL EVENT

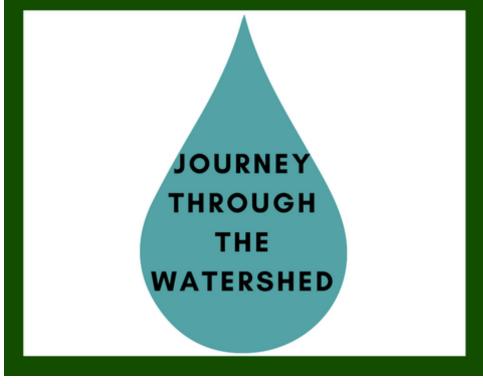
All the winter snow means that there will be lots of water in the spring!

Move one step forward.



A giant tree fell in a storm, blocking the water from flowing downstream.

Move one step back.



#### NATURAL EVENT

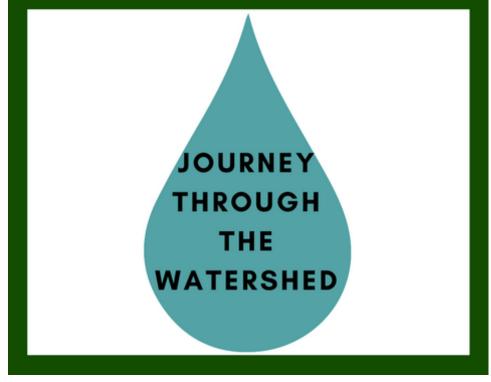
A mudslide covered the river, stopping the water from flowing.

Move one step back.



There's a drought! The rivers are running low.

Move two steps back.



#### NATURAL EVENT

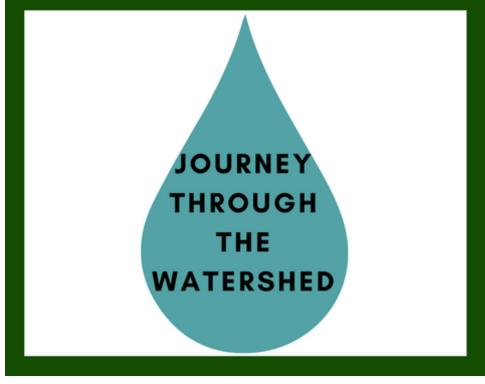
A dry stream started flowing again, bringing more water into the system.

Move one step forward.



An dry stream has running water again.

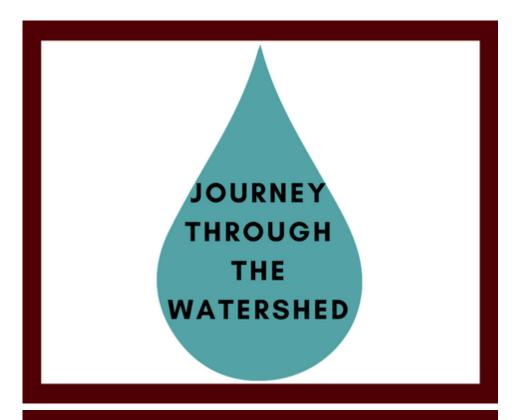
Move one step forward.



#### NATURAL EVENT

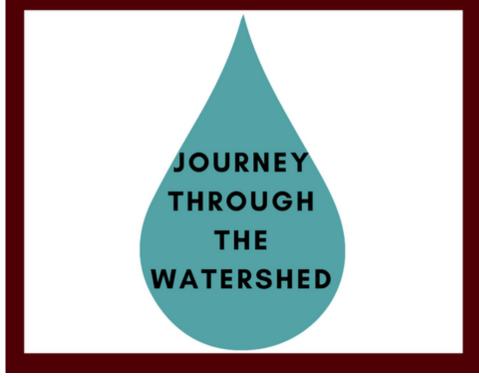
It's been a wet fall and winter.

Move two steps forward.



People have built a large dam in a major river.

Move back two steps.



#### **HUMAN ACTIVITY**

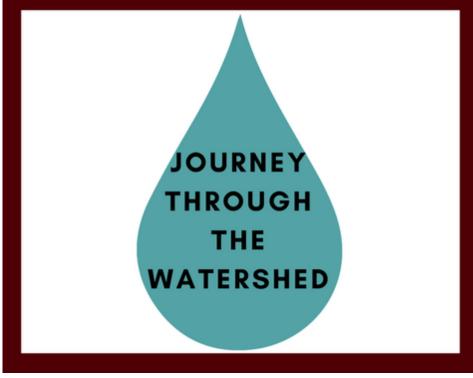
A boat spilled oil into the river, making it unsafe for people and animals.

Move back two steps.



People in the desert are growing strawberries, bringing water from other areas.

Move back one step.



#### **HUMAN ACTIVITY**

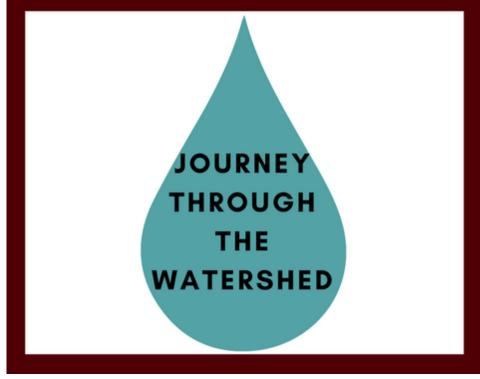
Everyone in your town waters their lawn morning and night.

Move back one step.



A factory that sells bottled water is taking water from your river to fill their bottles.

Move back two steps.



#### **HUMAN ACTIVITY**

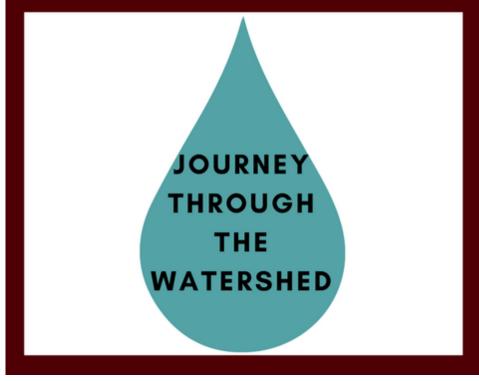
There's a water leak in your school that no one has fixed.

Move back one step.



A big company is dumping all of its water in the river so it doesn't have to clean up its mess.

Move back two steps.



#### **HUMAN ACTIVITY**

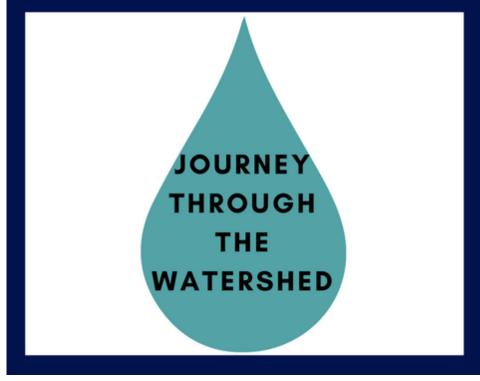
A new town in the desert needs to share our water because they don't have enough.

Move back one step.



Your town has started collecting rainwater to water local gardens.

Move one step forward.



#### **OUR SOLUTIONS**

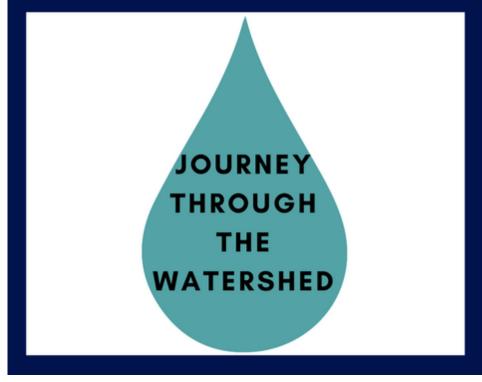
Your family decides to only buy local food, which usually uses less water.

Move one step forward.



Everyone in your town agrees to take shorter showers.

Move one step forward.



#### **OUR SOLUTIONS**

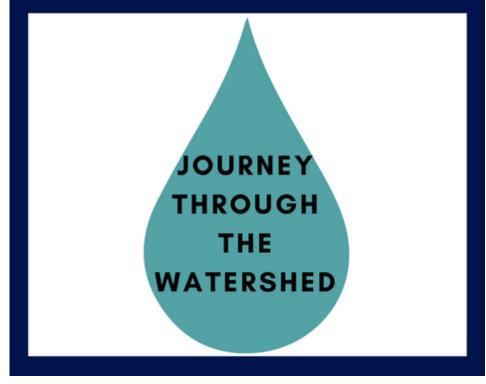
A local dam is removed so that fish can swim upstream.

Move two steps forward.



Factories have started paying more money for water that they waste.

Move two steps forward.



#### **OUR SOLUTIONS**

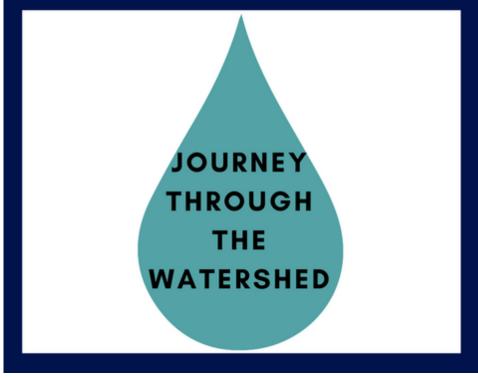
Companies are no longer allowed to use large amounts of water without paying.

Move one step forward.



You started using water that would go down the drain to water your plants.

Move one step forward.



#### **OUR SOLUTIONS**

You and your friends decide to make signs to tell your neighbors about using local plants in their yard.

Move one step forward.