



Description: Students will color the different watersheds in the Southwest to learn which rivers drain out of each area of the state/region. Extensions include making a pie chart to show the area of each watershed in the state, researching the watersheds in teams and presenting findings about the state's watersheds to the class in a poster presentation.

Objectives: Students will:

- understand the concept of watersheds; and
- be able to identify the watersheds in New Mexico and the Southwest and where they flow.

Materials: colored pencils or highlighters
 a copy of the Define Watershed Boundaries worksheet for each student
 a copy of the New Mexico Watersheds map for each student
 physical map of North America (for finding where New Mexico's rivers flow)

Background: Precipitation that falls to the ground can have one of several things happen to it—it can evaporate, soak into the soil to become ground water, or flow downhill as surface water in rivers and lakes. In this activity, we consider surface water movement as we look at the watersheds of New Mexico. Watersheds are identified by surface water movement. Rivers, streams, creeks, and arroyos are formed where water flows when following gravity. A watershed, or drainage basin, is an area of land drained by a river, river system or other body of water. Except in closed basins, which have no outflow, all watersheds eventually drain into an ocean or sea. Thus you can follow a river from its mouth up to its headwaters, including all of the tributaries that flow into it, to get an idea of the size of the watershed.

31. Watersheds in New Mexico



Grades: 6–8

Time: two class periods

Subjects: science

Terms: watershed, tributary, Continental Divide, closed basin, headwaters



It is important for students to understand their place in the watershed. There are plants, animals and people living above them (upstream) and below them (downstream). Things that happen upstream in the upper watershed will flow down to affect them, and things that their community does in the river or drainages of their area will affect plants, animals and people downstream.

New Mexico also contains several closed basins. The water falling in these basins flows down into the basin, but does not flow out to other rivers. Thus, this water does not flow into an ocean. These basins are surrounded by mountains or highlands. The water either soaks into the ground, becoming an aquifer, or pools in surface lakes open to evaporation. In this activity, the closed basins are shaded so as not to confuse students in their search for the boundaries of the major river watersheds.

Terms:

Closed basin: a drainage surrounded by high land without a natural outlet; surface water does *not* flow out to a larger river and thus does not reach the ocean.

Continental Divide: the boundary that separates streams flowing toward the Atlantic or Pacific oceans. Along this divide, water falling within a few feet, such as at a mountain ridge, could flow to different oceans.

Headwaters: the upper reach of a watershed, where the water first collects and begins to flow as a stream.

Tributary: creeks, streams or rivers which feed into a larger stream, river or lake.

Watershed (drainage basin): an area or region drained by a river, river system or other body of water.

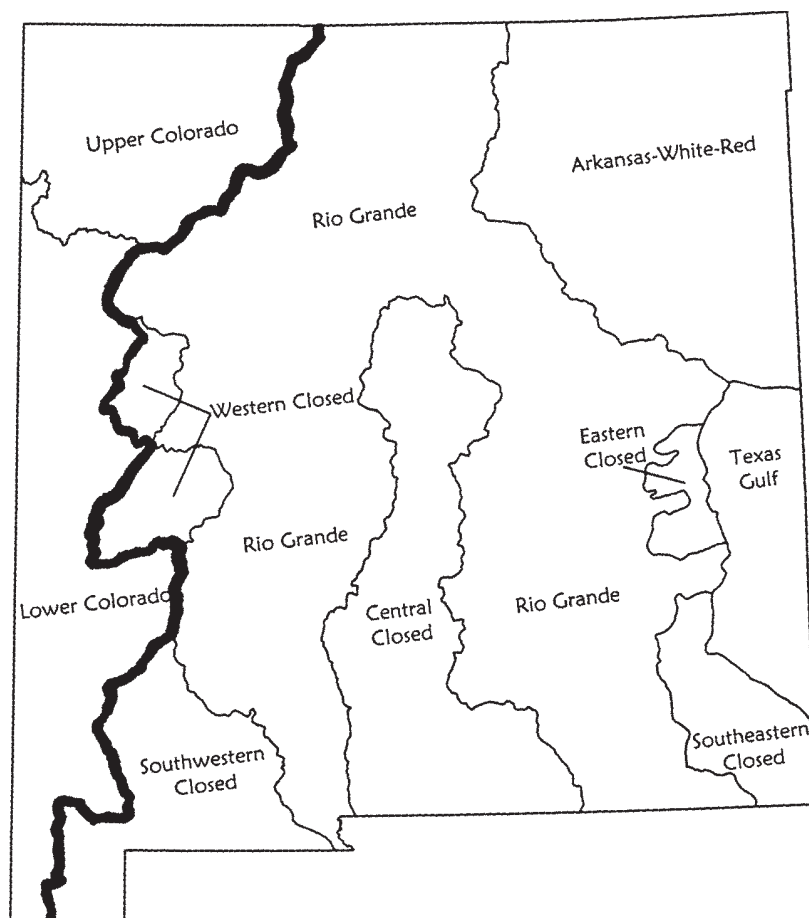
In the activity, the tributaries of the Colorado River are divided into the Upper Colorado Basin and the Lower Colorado Basin. They are all part of the Colorado River Basin, but are considered separately in dividing water for human use. The Glen Canyon Dam near the Arizona–Utah border marks the division.

Procedure:

Introductory questions:

What river do we live near?

Where does our river come from—where are the headwaters of that river? Where does it flow from here—in what direction? Does it flow into a larger river and where does that flow? We are going to look at maps to learn about all of the drainages in New Mexico, called **watersheds**. We will also identify all of the large rivers in New Mexico and where they flow.



River basins and Continental Divide in New Mexico

Do we live in the Atlantic or Pacific watershed? Do you know what the Continental Divide is? The Continental Divide passes right through New Mexico so some of the water that falls in New Mexico goes to the Pacific and some goes to the Atlantic.

Begin the activity: hand out the Define Watershed Boundaries worksheet. Ask students to choose a color of pencil or highlighter marker for each different river system in New Mexico. Begin with the Rio Grande. Start at the bottom of the map with the Rio Grande; begin outside the state boundary and trace upstream. Make sure everyone knows where to begin. Students should trace the main channel of the Rio Grande and all of the tributaries that feed into it with the same color. Color the rivers only at this point. Students must look closely for the sometimes-small space between the upper end of two streams—they almost meet in many locations and in reality only a few feet may separate one watershed from another. (Refer to the “Surface Water Demonstration” activity for a physical model of a watershed.)



After coloring the Rio Grande, color its tributaries in the same color. Then find the rivers below and color them and their tributaries in separate colors:

Pecos
 Canadian/Beaver/Cimarron/Arkansas/Frio
 San Juan
 Little Colorado/Gila/Black

The boundaries of each watershed are between the differently colored river systems. Students can draw a line to divide each color from the other colors, then lightly color the entire area within that divide with the same color as the river. They now have a watershed map.

Use classroom or library resources to link the series of rivers from New Mexico to other rivers and into their respective ocean (the Atlantic/Gulf of Mexico and the Pacific/Sea of Cortez) as shown in the answer key below.

Answer Key:

Rio Grande Basin

Rio Grande—Gulf of Mexico—Atlantic
 Pecos River—Rio Grande— Gulf of Mexico—Atlantic

Arkansas-White-Red Basin

Canadian River—Arkansas—Mississippi— Gulf of Mexico—Atlantic
 Beaver River—North Canadian—Arkansas—Mississippi— Gulf of Mexico—Atlantic
 Cimarron River—Arkansas—Mississippi— Gulf of Mexico—Atlantic

Upper Colorado Basin

San Juan River—Colorado—Sea of Cortez (Gulf of California)—Pacific

Lower Colorado Basin

Little Colorado River—Colorado—Sea of Cortez (Gulf of California)—Pacific
 Gila River—Colorado—Sea of Cortez (Gulf of California)—Pacific

Texas Gulf Basin

No major streams are in New Mexico's portion of this basin, so it is shaded already.

Once they have defined the watershed basins of the state, the students can locate the Continental Divide. Ask the students which watersheds flow to the Atlantic and which to the Pacific. The divide is the line where those watersheds meet.

It runs north-south, in the western part of the state. Have them draw the Continental Divide on their map with a different color or type of marker.



- Extensions:** A. Follow up the mapping activity with the following open-ended questions/discussion.

Major John Wesley Powell was well-known for making the first scientific exploration by boat of the Colorado River through the Grand Canyon. He was politically influential in the late 1800s as a result of his extensive research trips in the western U.S. He maintained in written reports and congressional hearings that the West should be organized by watersheds. New political lines, such as state boundaries, should follow the natural watershed boundaries and not arbitrary lines such as the 37th parallel.

In 1876 Powell wrote: “Nature in its drainage network has indicated the pattern of rational settlement.” He further wrote in a report to a special congressional committee, “I early recognized that ultimately these natural features would present conditions which would control the engineering problems of irrigation and which would ultimately control the institutional or legal problems.”

What did Major Powell mean when he said this?

How would New Mexico be different if the state boundary followed watershed boundaries?

How does the upper watershed area affect areas downstream?

This can be answered in many ways. For example, ecologically plants and animals travel up and down watersheds. Hydrologically water flows downstream and any pollutants will travel down—what is upstream in terms of pollution possibilities? The volume of water—if too much is used, there won’t be much downstream; each year the snow melt causes a flood pulse—the rise in water in the spring brings nutrients, moisture for seed germination, etc; sediment is moved—etc.



B. Here are the number of square miles and kilometers of the state that are drained by each watershed:

Basin (Watershed)	Square Kilometers	Square Miles
Rio Grande	127,718	49,299
Upper Colorado	25,241	9,743
Lower Colorado	34,573	13,345
Arkansas-White-Red	45,539	17,578
Texas Gulf	13,695	5,286
Central closed	30,836	11,903
Eastern closed	3,115	1,202
Western north closed	2,942	1,136
Western south closed	5,136	1,982
Southwest closed	17,071	6,589
Southeast closed	9,002	3,475
Totals	314,868	121,538

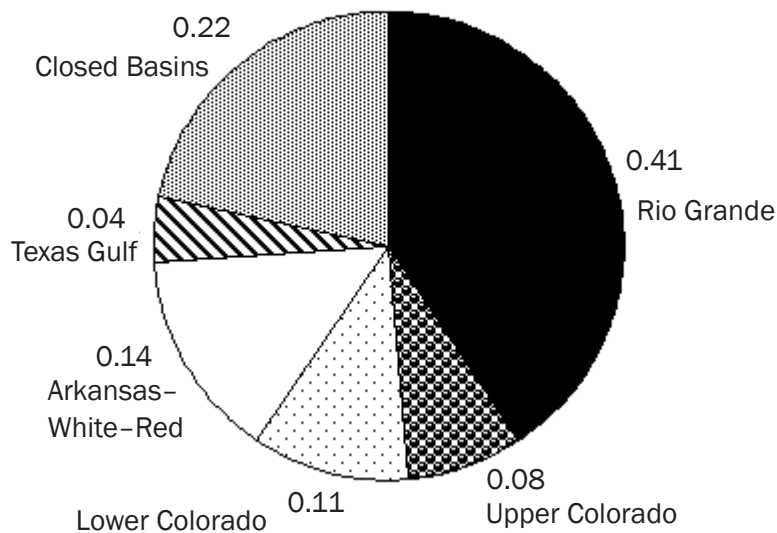
Summary of New Mexico area:

Area NOT a closed basin: 246,766 km²/95,251 mi²

Area of closed basins: 68,102 km²/26,287 mi²

Make a pie chart to show how much of the state is in each watershed. This is easiest with a computer program.

Ratios of Areas of New Mexico Watersheds and Closed Basins





The entire Rio Grande watershed is 920,389 square kilometers/355,500 square miles. What percent of the watershed is in New Mexico? *18.4%*

The entire length of the Rio Grande is (about) 3033 kilometers/1885 miles (depending on how finely one counts the changing meanders); 752 kilometers/470 miles of it is in New Mexico. What percent of the length is in New Mexico?

Almost 25%; 24.8/24.9% rounded

- C. Divide students into teams for each of the watersheds. Have them do a poster on that watershed and present to the entire class. Things to be included: hand-drawn map of the watershed showing at least three communities; descriptions of a watershed boundary, for example: where does it flow to—does it go to the ocean (and which ocean)? Research other statistics—length of each river? What dams if any are on this river? What wildlife refuges, if any, are on or near this river? What major industries are located along the river. What threats are there to the quality of water and natural areas along this river?
- D. Discuss the City of Albuquerque’s plan to use San Juan/Chama water for municipal use. This water is already brought from the Colorado watershed into the Rio Grande watershed as part of the Colorado River compact. What do students think about moving water from one watershed to another?

Assessment: The group project (C.) can be a final assessment. Have students draw a free-hand map of New Mexico showing the rivers and watersheds of the state or give them a different map to draw.

**Resources/
References**

maps (North America, New Mexico and NM Fishing Waters Map)

deBuys, William, ed. 2001. *Seeing Things Whole: The Essential John Wesley Powell*. Washington: Island Press/Shearwater Books.

Reisner, Marc. 1986. *Cadillac Desert: The American West and Its Disappearing Water*. Viking Press, New York, NY (Powell)

Stegner, Wallace. 1954. *Beyond the 100th Meridian: John Wesley Powell and the Second Opening of the West*. Houghton, Mifflin, Boston.

Williams, Jerry L. 1986. *New Mexico in Maps*. University of New Mexico Press, Albuquerque. “Surface Hydrology” p. 55–57.

“Tributary Tree,” p. 201, *Discover a Watershed: The Rio Grande/Rio Bravo*. Bozeman, MT: The Watercourse. 2001. Background information and additional activity for Grades 6–12.



Define Watershed Boundaries

Student Worksheet

1. Color these groups of rivers, choosing a different color for each group. Color the boxes next to the river groups below to correspond with how you colored the rivers on your map. Start with the main stem of one river: trace it all the way up, then color all the tributaries for that river system the same color as the river. Then use another color for the next river system, tracing the main stem and the tributaries. Look closely—some streams are very close together, but they belong to different watersheds. Often, they are separated by only a few feet on either side of a mountain ridge. Work your way upstream on each river.

- Rio Grande
- Pecos
- Canadian/Arkansas/Cimarron/Beaver/Frio
- San Juan
- Gila/Little Colorado/Black (AZ)

2. Locate the boundaries of the watersheds. Draw a line to show the edges of the watersheds.

Here are some hints to help you draw the boundaries.

A boundary separates different river systems. Look for rivers and tributaries that are almost connected, but not quite.

There are five watersheds in New Mexico.

The Texas Gulf Basin does not have any rivers or tributaries marked on your map. It is already colored for you.

3. Using the same color as the river system, lightly color in the watershed. Don't color the closed basins.



4. Using your map and a map of the United States, trace the path of the following rivers to the ocean; list all of the rivers between each river and the ocean.

Example: Rio Grande→Gulf of Mexico→Atlantic Ocean

Pecos→

Canadian→

Beaver→

Cimarron→

San Juan→

Little Colorado→

Gila→

5. The Rio Grande watershed includes another major New Mexico river. Which river is it?

6. Label the following watersheds on your map:

Arkansas-White-Red Basin

Texas Gulf Basin

Rio Grande Basin

Upper Colorado Basin

Lower Colorado Basin

7. Locate the Continental Divide and draw it on your map with a different color or type of marker. Add that to the map key.

8. Put a star where your community is on the map. List that on the key as well.