# ABCWUA Water Resource Education Activity

| **Activity Title:** | **Calculate a Watershed** |
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| **Description** | Students work in small groups to build a watershed and utilize their math skills to determine how to manage the water in a local reservoir. |
| **Objectives** | Students will:<br>• learn about watersheds.<br>• a variety of units of measurement for water and their applications.<br>• how some natural resource decisions are made based upon imperfect data (best estimate). |
| **Grade Level** | $6^{th}$-$12^{th}$ |
| **Materials Needed** | • one large 32 quart plastic bin per four students<br>• for each of the watersheds - about 20 large rocks 2-4 inches, for building the watershed<br>• sand or gravel for the "land" base of the watersheds.<br>• large sheets of paper to cover the watersheds and draw the perimeter<br>• paper and pencils for calculations<br>• at least one calculator per group |
| **Background Info** | A watershed is the area of land that catches rain and snow and drains to a river, lake, or low point in the area. In this activity, some of the rainfall within the watershed runs off to a reservoir, increasing the pressure and volume so that a dam release is required.<br><br>Most students do not know what a watershed is or its connections to surface water and groundwater. Up to now, 100% of Albuquerque's drinking water has come from an aquifer that is deep underground, and the water is brought to the surface through a system of over 90 groundwater wells. The problem is that we have been pumping it out faster than it's being replenished naturally. In our area, it takes a long time for rain and river water to seep down and replenish the aquifer. To make matters more difficult, we live in a high desert ecosystem where droughts are common, everyone wants and needs water, and the population keeps growing.<br><br>By Fall 2008, the Albuquerque area will begin to use surface water (the Rio Grande) to reduce our aquifer pumping so the aquifer can begin to recover on its own. The aquifer will remain an important reserve to draw on during drought. |

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| | Rainfall is measured in inches.<br>Three dimensional volume is measured in cubic inches.<br>Reservoir volume is measured in acre feet.<br>Water is released by cubic feet per second.<br><br>**Conversions**<br>1 mile = 5,280 feet = 63,360 inches<br>1 acre feet = 75,271,680 cubic inches<br>1 cubic yard = 46,656 cubic inches<br>1 cubic foot = 1,728 cubic inches<br>1 square mile = 640 acres<br>Heron Dam at the Bureau of Reclamation website:<br>http://www.usbr.gov/dataweb/dams/nm00122.htm<br><br>Watershed education:<br>http://www.epa.gov/owow/watershed/ |
| **Procedure** | 1. Students are divided into four work groups.<br>2. Students arrange large rocks and some gravel in a large plastic bin to create a watershed basin. The model will include a small reservoir that empties into a river.<br>3. Discuss the concept of watershed, the Albuquerque Basin, and that our drinking water has always come from the groundwater within this basin.<br>4. Define vocabulary: groundwater, surface water, aquifer, and recharge. Explain that we have been pumping water much faster than the naturally occurring recharge, and the problem of a depleted aquifer and subsidence.<br>5. Explain that the solution (for now) to the water shortage is to use San Juan/Chama diversion water. Explain diversion project and the Drinking Water Project. Refer to reservoir and river on watershed model to illustrate.<br>6. Students use a large sheet of paper to calculate an estimate of surface area of watershed area, holding it horizontally over the model and marking the perimeter. Presenter explains that the perimeter would be the highest point in each direction away from the center of the basin. If needed, students will make arbitrary boundaries in order to make calculations. Students will have to reflect the scale (1"= 2 miles) in their calculations of surface area.<br>7. Students may use any combination of shapes to determine surface area estimate, but are encouraged to make the decisions and calculations without trying to |

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| | be exact.<br>8. Presenter points out the difference between the land area of the watershed (flattening out the watershed-shaped paper) and the flat paper used to calculate the watershed area (actual, linear distances).<br>9. Discuss the concept of "making assumptions" and stating clearly what those are, and basing them on all the information that is available.<br>10. Students calculate volume of rain that lands on the watershed after a rain shower of .75 inches.<br>11. Assume 25% of the rainfall will soak into the ground and the remainder will run-off, with 35% ending up in the reservoir.<br>12. Students will convert the runoff to reservoir portion of the rainfall to acre feet.<br>13. Discuss different units of measurement for water and their applications. Acre feet are used for lakes and 3 dimensional volume, such as flood irrigation. Cubic feet per second are used for stream flows and dam releases.<br>14. Given the information that the reservoir is near capacity at 399,000 acre feet and can only hold 401,000 acre feet of water, will that rainfall force the dam operators to release water from the reservoir? If so, how long will the dam open if the outlet works has a capacity of 4,000 cubic feet per second?<br>15. Recap the exercise, with emphasis on making decisions based on incomplete information and reasonable assumptions. Point out that many of our resource management policy decisions are based on this type of scenario. Invite discussion from students. |
| **Evaluation/Extension** | Cover rocks with aluminum foil and press to rocks. Ask students to draw the path that they would expect rainfall runoff to take. Spray watershed with water and watch the water run off. Were the expectations correct, or did the water run off differently than expected? Where did it pool? |