

# Water Quality

📖 Grade Level: 6-8

📖 Subject Area:  
Science

📖 Duration:  
Pre-visit: 1 1/2 hours  
Visit: 3 hours  
Post-visit: 2 hours

📖 Setting:  
Classroom and outside at  
Espada Dam, Espada Aqueduct  
& Mission Espada

📖 Skills:  
6,7,8.1 Conducts field and laboratory investigations and field using safe, environmentally appropriate and ethical practices.  
6,7,8.2 Uses scientific methods during field and laboratory investigations.  
6,7,8.3 Uses critical thinking and scientific problem solving to make informal decisions.  
6,7,8.4 The student knows how to use a variety of tools and methods to conduct science inquiry.

📖 Essential Terms:  
*acequia*, concentrations of chemicals, water flow rate, pH, water clarity

## STRUCTURE

**Big Idea**  
**What is the present water quality of the Mission Espada *Acequia* System?**

### Objectives

Students will:

- ◆ describe characteristics of the missions' *acequia* systems
- ◆ take standardized measurements of water characteristics
- ◆ develop their appreciation of the importance of water quality
- ◆ interpret a map
- ◆ acquire historical facts about the area's Missions

This lab will explore the many factors that can affect the quality of the water in the Espada Aqueduct. The areas to be addressed will include:

1. A visual survey of the aqueduct
2. A water quality survey
3. Mapping and profiling

### Making Connections

*Acequia*, a Spanish term of Arabic derivation, refers to a gravity-fed irrigation

ditch. An *acequia* may consist of earthen banks, sometimes reinforced at strategic points of high stress by stones, or may be entirely stone lined. An *acequia* system consisted of a dam constructed of earth, or stones and branches, which diverted water from a river into a main ditch or *acequia madre*.

The San Juan *acequia madre* carried water to *labores*, or farmlands, to be irrigated. It flowed into the *acequia en media*, the first ditch to carry water from the *acequia madre* to the *labores*. At this point, the *acequia madre* became the *acequia afuera*, or outer ditch. It continued on to feed subsidiary ditches watering other *labores*. At these junctures and also at those where the many lateral ditches radiated out from the *acequia en media* to water individual plots, water gates were located to control the flow of water. Water returned to the river by means of an *acequia* termed a *desague*.

The *acequia* system at Mission San Juan is important especially from a historical perspective. This system, like those for Concepción and Espada,

was hand dug shortly after the three missions were relocated to the San Antonio River in 1731. All of the missions, from San Antonio de Valero (the Alamo) to the four now incorporated into San Antonio Missions National Historical Park, had its dam and *acequia* system.

Today, only two of these systems remain - those of Missions San Juan and Espada. The only aqueduct still in use from the Spanish Colonial period in the United States is that of the Espada *Acequia* system. Taken together, the *acequia* is important as a continued tradition dating from the Spanish colonial period that today remains a viable method of irrigation.

This particular *acequia* system is important in light of the National Park Service mission to "preserve, restore and protect in perpetuity" both the natural and cultural resources contained in San Antonio Missions National Historical Park established by Congress in 1978. It is also important to the local community due to its inclusion in two flood control projects in the early 1990's.

Students will explore the water quality of the

Mission Espada *Acequia* system both past and present. Students will learn how to take proper water quality measurements, and compile and interpret meaningful data. Observational skills will be used for water quality and wildlife observations.

## Materials

Engagement (Pre-visit):

- ◆ video "*Gente de Razón*" available from San Antonio Missions National Historical Park
- ◆ San Antonio Missions Official Map & Guide

Explanation (Pre-visit):

- ◆ Student Questionnaire
- ◆ Student Activity Sheet

Exploration (Visit):

- ◆ paper
- ◆ journal
- ◆ pencil
- ◆ student map
- ◆ colored map pencils
- ◆ pH paper or meters
- ◆ thermometer
- ◆ tape measure or meter stick
- ◆ basic water test kit (if available)
- ◆ Student Questionnaire
- ◆ Student Activity Sheet

## Engagement (Pre-visit):

1. Brainstorming session: List or write down what students know about how water got from rivers to the San Antonio missions.

2. Read the San Antonio Missions Official Map & Guide. Compare the students' responses to what they read.

3. View the video "*Gente de Razón*" if not done so in a previous unit.

4. Discuss what the students saw in the film dealing with water and its relation to the missions.

## Explanation (Pre-visit):

1. Problem Situation: Have students list what they think affects water quality in general. Then what they think would have affected water quality at the missions in the 1700s.

2. Review the Student Questionnaire and the Student Activity Sheet with the students carefully so that they will be ready for the visit.

3. Review National Park Service rules and proper etiquette (Environmental Interactions Big Idea from the Mission Settlement Unit covers these).

## Exploration (Visit):

- ◆ Collect equipment needed for the walk
- ◆ Make sure students are dressed properly with long pants and good walking shoes
- ◆ Cover safety rules. Warn students about poison ivy, fire ants, snakes, and the possibility of falling in the water.

Discuss the different features and landforms students should recognize during their field trip. If you have a large class you may want to form teams.

1. Take a visual survey of all three sites: Espada Dam, Espada Aqueduct and Mission Espada.

The students should survey approximately 50 feet of the *acequia* at each site.

2. Record observations during the visual survey.
- a. Bordering lands: urban, agricultural, industrial, residential, wooded, swamp, etc.
  - b. Wildlife
  - c. Plant life seen in and around the water.
  - d. Evidence of human usage of the water

3. Take a visual survey of the water quality.

- a. Clarity: clear, semi-clear, muddy

- b. Evidence of human trash such as cans, bottle caps, plastics, or paper
- c. Evidence of mother nature's trash such as dead animals, nests, etc.
- d. Monitor flow rate, by placing a twig and watching it's direction and speed (Speed = distance/time).

5. Test for:

- a. whether the water is acidic or basic. (Water should register close to 7 as neutral on pH paper.)
- b. water temperature at three different depths in the aqueduct, at the Espada Dam, and near Mission Espada's church. If you have a hard time locating the area near the Mission Espada, ask the National Park Ranger on duty.

6. If the water test kit is available test for:

- ◆ Dissolved oxygen content
- ◆ Chloride
- ◆ Calcium
- ◆ Iron concentration

## Elaboration (Visit/Post-visit):

1. Have the students compile the data recorded at the San Antonio Missions National Historical Park.

2. Ask the students to explain their observations

and findings in their own words.

3. Ask the students to justify of their findings by using the record they made on their field trip.

## Evaluation (Post-visit):

1. Students create a visual display on the *acequia* system and its water quality focusing on the Mission Espada Dam, Espada *Acequia* and Mission Espada.

2. Students present this information with other classes at school or community clubs.

## Student Questionnaire Water Quality

Name \_\_\_\_\_ Date \_\_\_\_\_

Answer these questions in your journal and/or on your *acequia* map. Be sure to record your observations of different land uses or pollution problems and where they are located on the *acequia*.

Describe the *acequia*:

1. Does the *acequia* flow in a straight line or does it curve? Illustrate.
2. Is the *acequia* natural or did it get changed by people?
3. Describe the bottom of the *acequia*. (Soil, rocks, sand, bedrock, etc.)
4. Is the *acequia* paved like a street with concrete on the bottom?
5. What kind of sides do you see on the *acequia*? (Concrete, soil, rock, etc.)
6. Are the *acequia* sides natural or do they have structures built to hold them in place?
7. Do you see sediment?
8. What sizes of sediment do you see?
9. Watermelon size and larger = boulder
  - a. Orange size = cobbles
  - b. Grape size = gravel
  - c. Smaller than grapes and gritty = sand
  - d. Smaller than sand and silky = silt
10. What color is the water? Is the *acequia* water the same color along the entire 50 feet or does the color change? Can you see any pollution problem that might change the color of the water?
11. Do you see trash in the *acequia*? Describe the kinds of trash you see.
12. Describe any unusual smells.
13. Explain why the *acequia* has lasted many years.
14. Is there vegetation growing on the sides?
15. If there is vegetation, describe the vegetation: trees, shrubs, bushes, grass?

## Describe the *acequia* (continued)

### Describe the land uses

- 1. Describe the land uses alongside the *acequia*. Do you see pipes, houses, apartments, schools, churches, park land, farms, golf courses, animal pastures, trash dumps, landfills, discharge pipes, storm water drains, sewer manhole, roads, etc. Describe all the land uses you see and indicate their locations on your *acequia* map.**
- 2. Is the land along the *acequia* paved for parking lots or roads? Is the land made up of grass for lawns or parks? Is the land made up of trees and shrubs?**
- 3. Do you see any pipes along the *acequia* that might discharge water into the stream?**

### Describe the wildlife

**Stop and listen. Be patient and quiet so you do not disturb wildlife.**

- 1. Do you see animal tracks? Draw pictures of animals or animal tracks that you see in your journal.**
- 2. Do you see animal houses such as beaver dams or bird nests?**
- 3. Describe the animals, birds and other wildlife you see on your 50 feet walk.**
- 4. Can you see fish in the *acequia*?**
- 5. Do you see or hear insects? What kinds of insects do you see?**

**Student Activity Sheet**  
**Water Quality**

**Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Place of Readings:

Date: \_\_\_\_\_ Time of Day: \_\_\_\_\_ Air Temperature: \_\_\_\_\_

Water Temperature:

Just below the surface: \_\_\_\_\_ (degrees)

Half way to the bottom: \_\_\_\_\_ (degrees)

At the bottom: \_\_\_\_\_ (degrees)

Clarity of Water:

Can see the bottom: \_\_\_\_\_

Can see, but not to the bottom: \_\_\_\_\_

Muddy: \_\_\_\_\_

Cannot see at all: \_\_\_\_\_

Water flow water is flowing: fast moderate slow not flowing

Water is flowing: North South East West

Water pH: \_\_\_\_\_ Water Tests: Acidic Neutral Basic

Additional Notes:

If kit is available, record:

dissolved oxygen \_\_\_\_\_ and

concentrations of calcium \_\_\_\_\_, iron \_\_\_\_\_, chlorides \_\_\_\_\_