

**Loretta Singletary**

# Calming the Waters

Learning to Manage Water Conflict in the West

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# Introduction

*Calming the Waters* is designed to teach youth about water conflict in the western United States. Examples feature real-life conflicts involving the Truckee, Carson and Walker rivers in northwestern Nevada. Descriptions include the lives of the early American Indians in northwestern Nevada and their relationship with these rivers. The effects of the early mining boom and federal policies encouraging western settlement are also presented. Current water usage and conflicts surrounding water shortages and water quality are considered. Cooperative ways to learn about water issues and collaboratively manage water conflict are explored.

This material is designed for youth, ages 12 through 18. However, certain concepts and skills may be adapted for use with younger children.

*Calming the Waters* integrates many subject areas including geography, history, social studies, language arts, science, speech, art, economics and mathematics. It is designed to improve critical thinking, data organization, mapping and graphing, cooperative problem solving and communication skills.

The goals of *Calming the Waters* are to teach youth:

- Prehistory and geography of the American Great Basin;
- Role of the Great Basin rivers in the lives of early American Indians, focusing on the Northern Paiute Indians of the Truckee, Carson and Walker rivers in Nevada;
- Importance of water to western development focusing on the Truckee, Carson and Walker rivers and federal policy that shaped early development of these water resources;
- Current conflicts and issues surrounding water shortages and water quality involving the Truckee, Carson and Walker rivers;
- Methods to conserve and protect water resources including conservation, awareness of non-point source pollution and sustainable development;
- Strategies to learn about water issues cooperatively and manage water conflict collaboratively.

*Calming the Waters* provides youth with concepts, knowledge and skills to become future leaders in addressing critical water issues and collaboratively managing water conflicts. It encourages youth to consider water management issues from a socio-cultural perspective.

Through learning about the history, culture and motivations of early water users in the Great Basin, youth will better understand current water conflict and collaboratively seek creative and lasting solutions.

*Calming the Waters* is designed to supplement academic curricula dealing with similar concepts, subject areas and skills, such as Nevada geography, history, conflict resolution and computation. Youth should read each lesson before completing review and enrichment activities. Alternatively, educators may choose to read lessons aloud. Enrichment activities are designed to emphasize cooperative learning skills. Educators may serve as facilitators helping youth to navigate the lessons alone or in cooperative learning groups.

Educators may choose to utilize the entire publication beginning with Lesson 1 or may select individual lessons to supplement concepts presented through other formats and in conjunction with other publications. The amount of time each lesson requires varies depending on reading and writing skills, age and learning environment. Educators may adapt the publication to fit the special needs or size of a particular group and teaching plan.

*Calming the Waters* may also be used to supplement existing water education materials. Educators are encouraged to acquire and utilize additional materials. Several examples of education materials for youth that focus on water include (listed alphabetically):

- *Agua Pura* (University of Wisconsin Cooperative Extension, 2000)
- *The Watercourse* (Conserve Water, Montana State University, 2000)
- *Educating Young People about Water: A Guide to Goals and Resources* (E. Andrews and Cooperative Extension National Review Team, 1992)
- *Every Drop Counts* (Modesto Irrigation District, 1991)
- *Give Water a Hand* (University of Wisconsin Cooperative Extension, 1994)
- *International Project WET* (Montana State University, 2000)
- *On Common Ground: Water Quality* (National 4-H Council, 1995)
- *Water Cycle and Water Conservation* (Truckee Meadows Water Authority, 2001)
- *Wise Water Ways* (University of Nevada Cooperative Extension, 1991)

Additional resources including Internet resources are listed in the Reference section. Educators and youth alike are encouraged to seek and utilize these additional resources as needed.

## LESSON 1

# American Great Basin

### LEARNING OBJECTIVES

- Demonstrate an understanding of the geography of the American Great Basin, including location, geological history, boundaries and climate.
- Describe how Lake Lahontan, Walker Lake and Pyramid Lake were formed.
- Illustrate the location of the Truckee, Carson and Walker rivers in northwestern Nevada.

The *American Great Basin* describes a physical geographic region that covers about 200,000 square miles. Captain John C. Fremont was sent by the United States government to explore and map the region in 1843. Fremont called it the Great Basin because it looked like a giant sink into which several rivers drained from surrounding mountain chains.

The boundaries of the Great Basin are the Wasatch Mountains in central and western Utah, the Snake River and its streams in southern Idaho and Oregon and the Sierra Nevada range in eastern California.

The state of Nevada occupies 110,567 square miles or about half the Great Basin (*Map 1a*). Nevada is known for its evenly spaced valleys

and mountain ranges all of which run north and south.

About 11,000 years ago during the **Pleistocene** or Ice Age, the Great Basin was covered by water from melting **glaciers**. As these thick sheets of ice melted, they formed a great prehistoric inland sea called **Lake Lahontan**, named for Baron La Hontan, an early explorer.

Over time, Nevada's climate changed, becoming drier. This change caused Lake Lahontan to evaporate, leaving behind the basin and range landscape pattern that characterizes Nevada today.

Only two lakes remain from the Pleistocene age and its great Lake Lahontan. These are *Walker Lake* and *Pyramid Lake*. Both lakes contain briny or **brackish** water due to the layer of concentrated minerals and salts within the earth beneath.

Even though the Great Basin is considered a desert, it is not hot throughout the basin nor is it hot all the time. Nevada is located to the east of the rugged **Sierra Nevada**, which is the Spanish translation for "snow-capped mountain range." Nevada lies

### DID YOU KNOW?

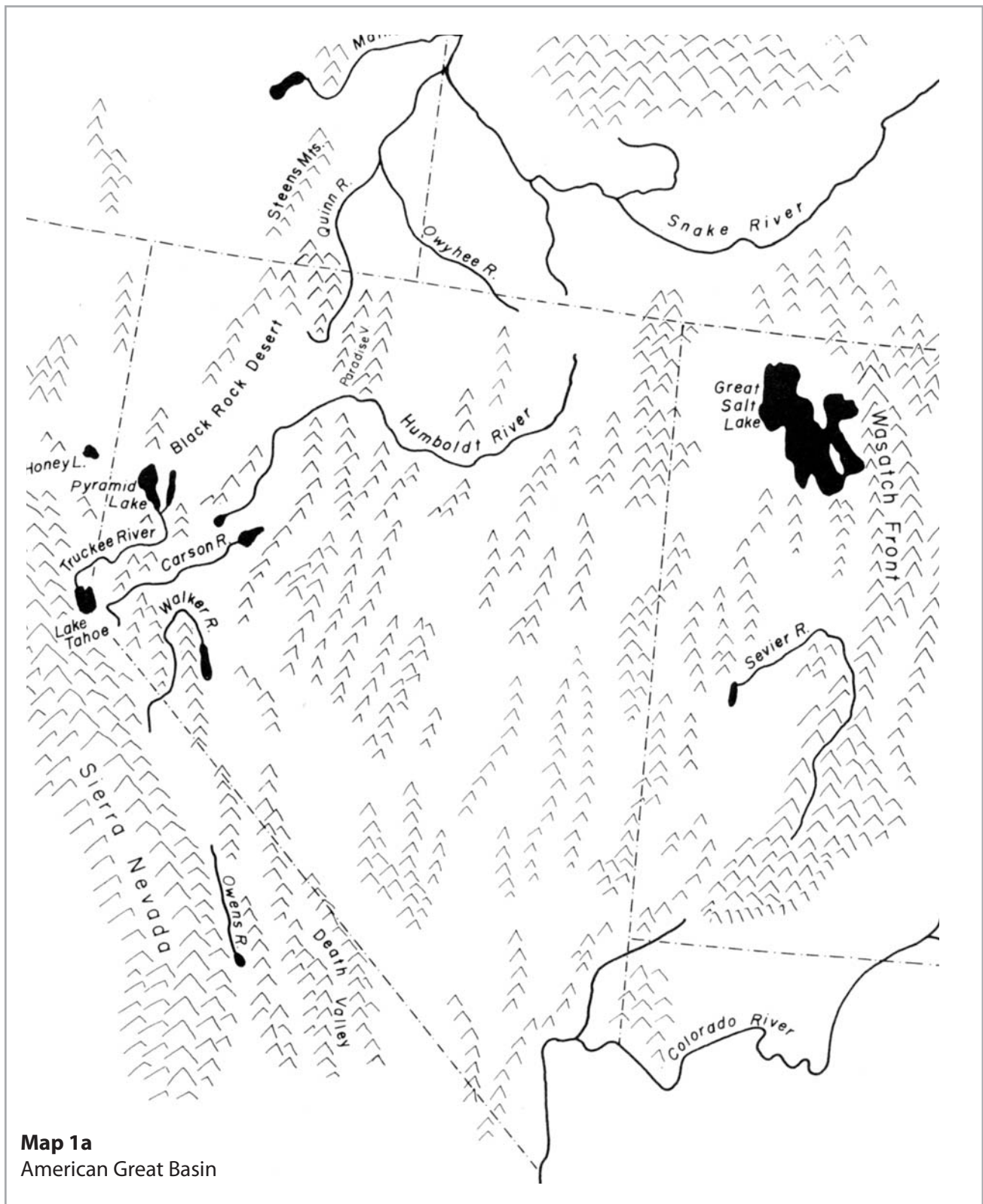
- ❖ In 1837, *Washington Irving* wrote and published *Adventures of Captain Bonneville in the Rocky Mountains and Far West*. This book generated curiosity about the Great Basin region. It led the United States to hire John C. Fremont to explore and map the territory.



*Pyramid Lake*

- ❖ Captain *John C. Fremont* explored the areas around Pyramid and Walker lakes. Fremont named Pyramid Lake for the pyramid-shaped rock that reaches 300 feet high from the lake's surface. The rock is older and larger than the Egyptian pyramids. Fremont named Walker Lake for Lieutenant *Joseph Reddeford Walker*, a fur trapper who worked for Hudson's Bay Company and in 1833 led a group of explorers and fur trappers through the Walker River area.





in the **rain shadow** of these great mountains. Most of the rain and snow fall either to the west of the Sierra Nevada, or in the mountains, rarely reaching the lands east of these high mountains. As such, Nevada receives only small amounts of snow and rain each year (between 4 and 9 inches). Temperatures can change dramatically between morning and night and throughout each of the four seasons.



In the cities of Reno-Sparks, the Truckee River provides water for homes, businesses, industry and recreational activities, such as kayaking, rafting and fishing.

Winters tend to be cold and blustery while summers are hot and dry.

The snow that falls each winter in the bordering mountain ranges melts each spring, feeding the **perennial streams** of the Great Basin. These streams flow into low-lying areas or sinks, marshes, wetlands and lakes. The Humboldt River begins in the Ruby Mountain range of eastern Nevada and flows westerly to end at the Humboldt Sink. The Owyhee River and Quinn River are **tributaries** of the Snake River, beginning as small streams in the mountains of Idaho and Oregon and flowing south across the Great Basin ending in Nevada.

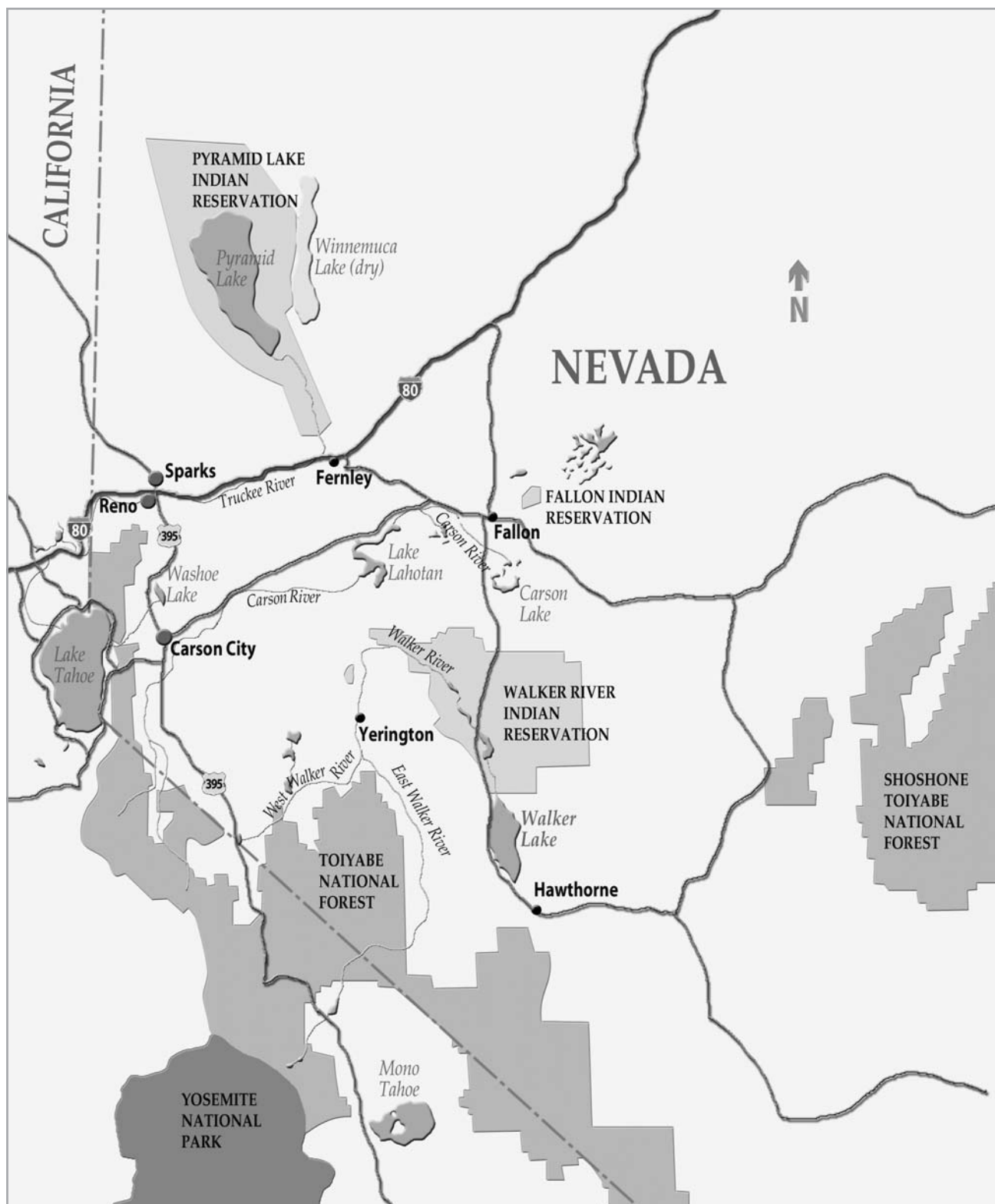


In addition to recreation, the Carson River provides water for urbanizing areas, agriculture and wildlife habitat.

Three of Nevada's perennial streams begin high in the Sierra Nevada as snow-pack and flow eastward (*Map 1b*).

- **TRUCKEE RIVER:** The Truckee River begins in the Sierra Nevada and flows into and out of Lake Tahoe through the cities of Reno and Sparks and across the Nevada desert ending in Pyramid Lake. Winnemucca Lake, which is now dry, was created when the Truckee River occasionally overflowed.
- **CARSON RIVER:** The Carson River begins in the Sierra Nevada south of Lake Tahoe and flows northeasterly across the Nevada desert around the cities of Silver Springs and Fallon. Its early flows fed wetlands and marshes in western Nevada including Stillwater,





**Map 1b**  
Truckee, Carson and Walker Rivers

Carson Lake and Carson Sink. Both Carson Lake and Carson Sink are now dry.

- **WALKER RIVER:** The Walker River begins in the Sierra Nevada south of Lake Tahoe and flows northeasterly across the Nevada desert through Wellington, Yerington, Wabuska and Schurz ending in Walker Lake.

These three rivers share certain similarities. Each river begins high in the Sierra Nevada in California and flows across the Nevada desert. Each river is perennial in that it flows year round. The amount of river flow is determined by the amount of snow that falls in the mountains each winter and then melts each spring. Early American Indian history and non-Indian settlement of the American West has been greatly affected by these rivers. Each river has determined the economic development of its surrounding communities by providing water support to mining, timber mills, agriculture, industry fishing and recreational activities. Over time, these rivers have played a critical role in the lives of many different people and now lie at the center of complex and heated conflict.



*Walker River flows approximately 160 miles from its headwaters to its terminus at Walker Lake, supporting rural communities and agriculture along the way.*



## LESSON 1: REVIEW AND ENRICHMENT

1. Define the American Great Basin and explain its name.

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2. Explain how Lake Lahontan was formed.

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3. Explain how Walker Lake and Pyramid Lake were formed.

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### VOCABULARY:

**rain shadow:** \_\_\_\_\_

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**Pleistocene:** \_\_\_\_\_

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**glacier:** \_\_\_\_\_

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**perennial streams:** \_\_\_\_\_

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**tributaries:** \_\_\_\_\_

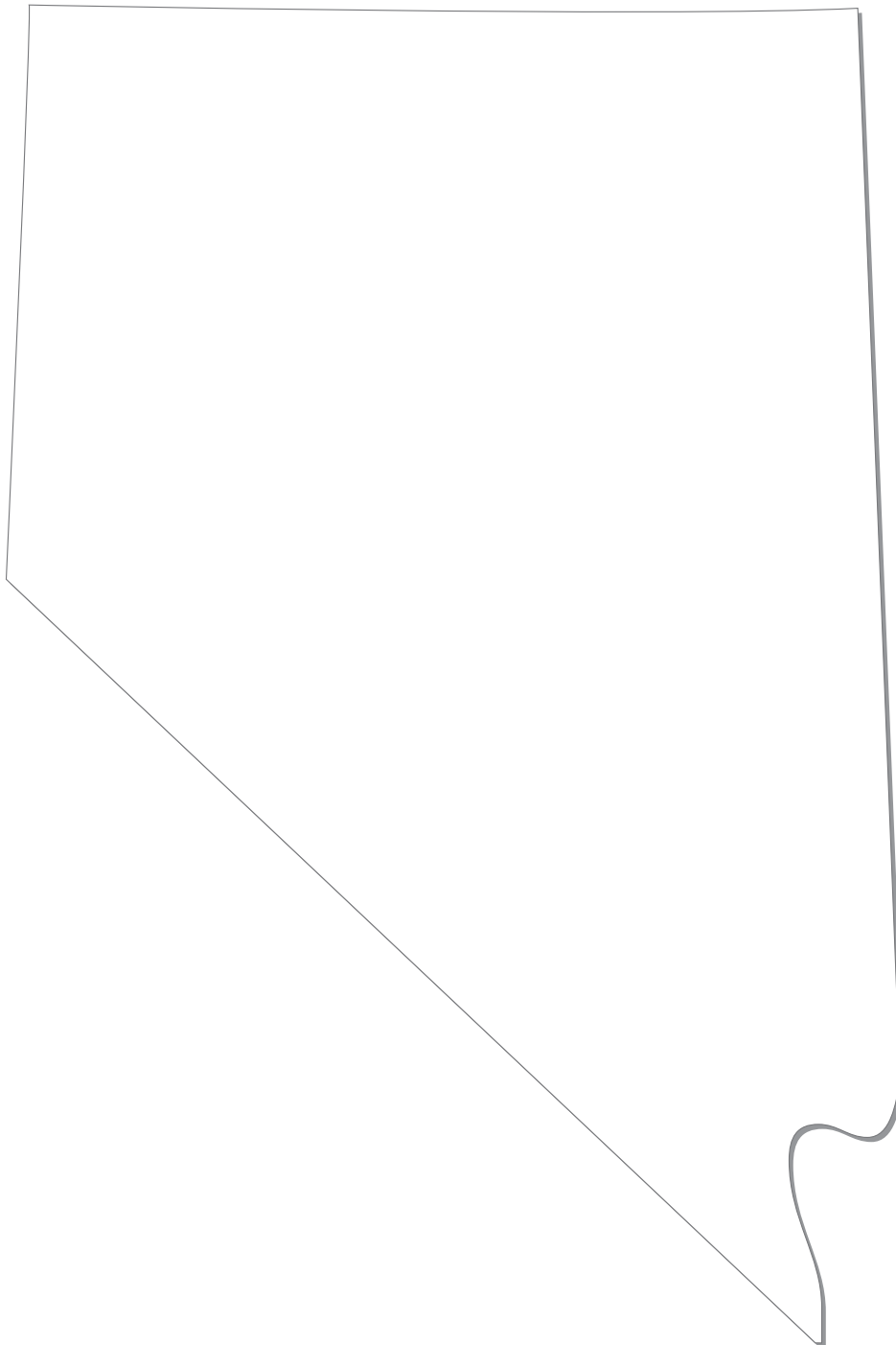
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## MAP ACTIVITY:

Using the map of the Great Basin provided, illustrate the location of states, mountains and rivers that form its boundaries.



### ENRICHMENT ACTIVITY:

Describe how the Great Basin might have looked to non-Indian explorers in the early 1800s. Include detailed descriptions of Pyramid and Walker lakes. You may include illustrations.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## LESSON 2

# Lives of Early Northern Paiute Indians

The American Indians who live in the western portion of the Great Basin are the Northern Paiute. The Northern Paiute share the Great Basin with the Western Shoshone to the east, the Southern Paiute to the southeast and the Washo[e] to the west (*Map 2a*).

The Northern Paiute of the Great Basin have lived in this land for thousands of years. They survived using what nature provided — water, plants and animals. Water was the key ingredient, which made survival possible. Plants and animals depended upon water to grow. The Northern Paiute lived in harmony with nature by eating the plants and animals that nature provided.

The early Northern Paiute called themselves **Numa (or Numu)**, which is Paiute for “human being” or “the people.” The language of the Northern Paiute comes from the **Uto-Aztecan** language family. This language family includes languages still spoken by millions of descendants of the ancient **Aztec** civilization who live in central Mexico and in parts of Guatemala, Central America.

The early Northern Paiute lived in small groups called outfits or **kin-cliques**. A kin-clique was made up of family members who were related to one another by marriage. Because distances between food sources were often great, kin-cliques traveled together on foot following the food supply throughout the year. Since no horses were available at this time, walking long distances to gather berries, nuts, seeds, or to catch fish

### LESSON OBJECTIVES

- Using a provided map, illustrate where early American Indians lived in Nevada.
- Describe the culture of the early Northern Paiute living in the Truckee, Carson and Walker river basins.
- Develop an understanding and appreciation of the survival culture of the early Northern Paiute Indians.

### DID YOU KNOW?



❖ The Northern Paiute believe they have lived in this area for at least 11,000 years. When the land was covered by prehistoric Lake Lahontan, the Northern Paiute arrived by boat. As Lake Lahontan receded, they moved from the mountains to the river valleys and lakeshores of Pyramid and Walker lakes and around the Carson Sink area following available food sources. The Northern Paiute took the names of the animals and plants that they ate.



during spawning season was normal. Since they were a smaller group of people they could gather and hunt just enough food to survive. They were sure to leave enough behind in order to provide for plant and animal populations and ensure future food supplies.

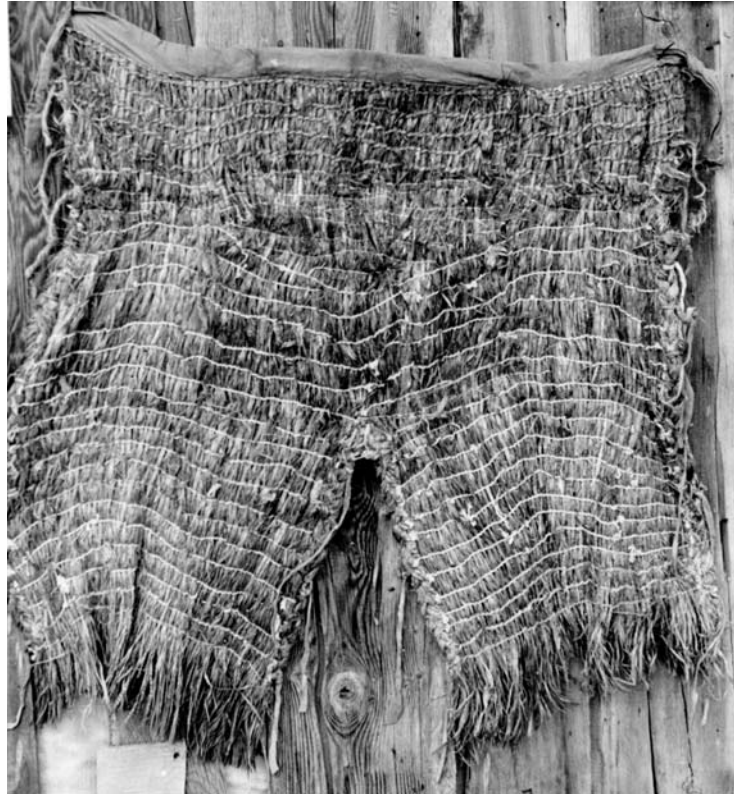
The Northern Paiute has been called a **survival culture**. This is because they were able to locate food sources year round in the high desert, a place many non-Indians considered a harsh rugged environment. Later, after non-Indians began to arrive and settle in this part of Nevada, kin-cliques began to live in larger groups called bands. This was done in order for kin-cliques to better defend themselves against intruders and possible attacks.

The Northern Paiute bands were **nomadic**. They traveled to different areas of the Great Basin according to the season and the available





*Piñon trees, which favor Nevada's high desert climate, provided plentiful amounts of pine nuts, a staple food for early Northern Paiute.*



*Early Northern Paiute made some clothing from softened sagebrush and other plants in the area.*

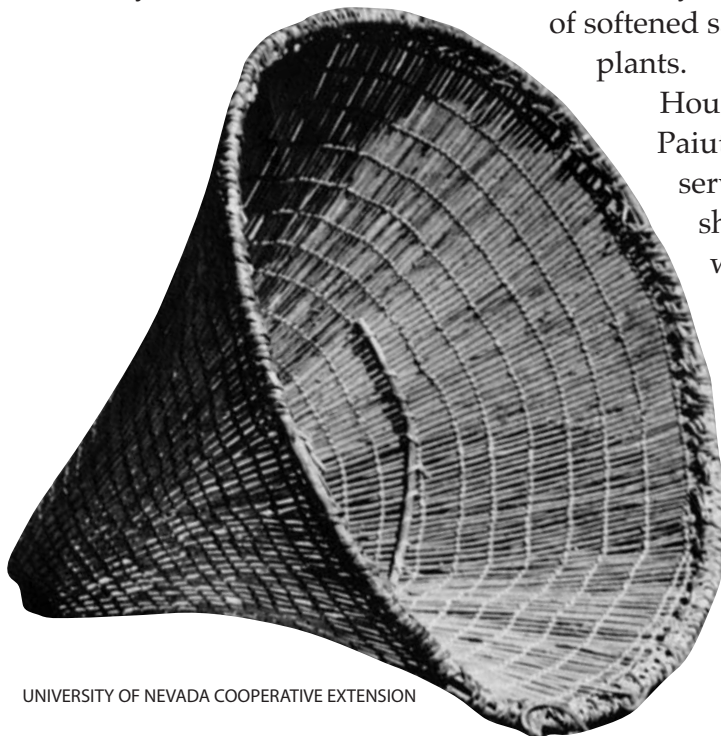
supply of food. Since Northern Paiute kin-cliques understood the difficulty in finding enough food at different times of the year or in very harsh winters, they often shared hunting and gathering grounds and participated in ceremonies together.

Roots, berries and fish provided most food supplies. In the fall, pine nuts from the piñon pine trees were gathered and used as a staple part of the diet during the long cold winter months. Each year the Northern Paiute celebrated the pine nut harvest with sacred dance and ceremony.

Ducks, geese, antelope, mule deer, jackrabbit, squirrels, sage hens, quail and dove also provided food. Since the early Northern Paiute did not use horses, it was necessary to hunt deer and antelope on foot. Buckskin blankets and clothing made from animal hides were considered very valuable. As a result, much of the early clothing was made

of softened sagebrush and other plants.

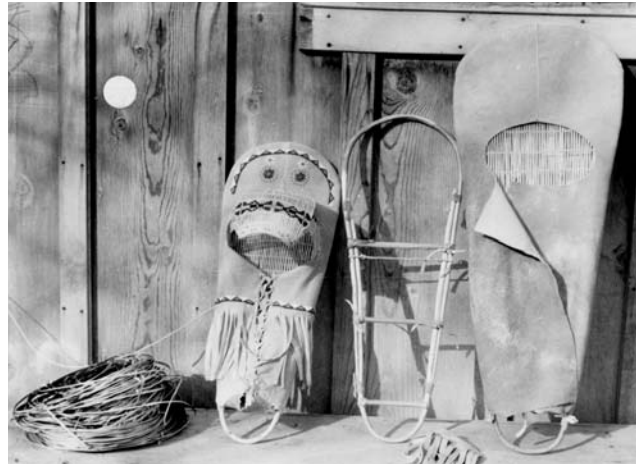
Houses were built by Paiute women and served as temporary shelters from the weather. In locations away from water, they were made of sagebrush while houses near rivers and water were made of marsh grasses. The houses were



*At left: Cone-shaped baskets were designed to easily carry family belongings from one hunting site to another as the seasons changed. Keeping family units relatively small, allowed the Northern Paiute to travel seasonally.*



*Northern Paiute women used baskets to clean and prepare seeds and nuts for eating.*



*The early Northern Paiute made cradleboards to carry babies comfortably when they traveled.*

left behind as the seasons changed and the Northern Paiute moved to another area in search of new food supplies. The houses would be repaired and reoccupied upon their return to search for food the following year.

The early Northern Paiute were also called a **basket maker culture**. Baskets made by the Northern Paiute have been discovered in northwestern Nevada that date back more than 11,000 years.

Baskets were an essential tool to the early Northern Paiute. The Northern Paiute believed in carrying with them only what was

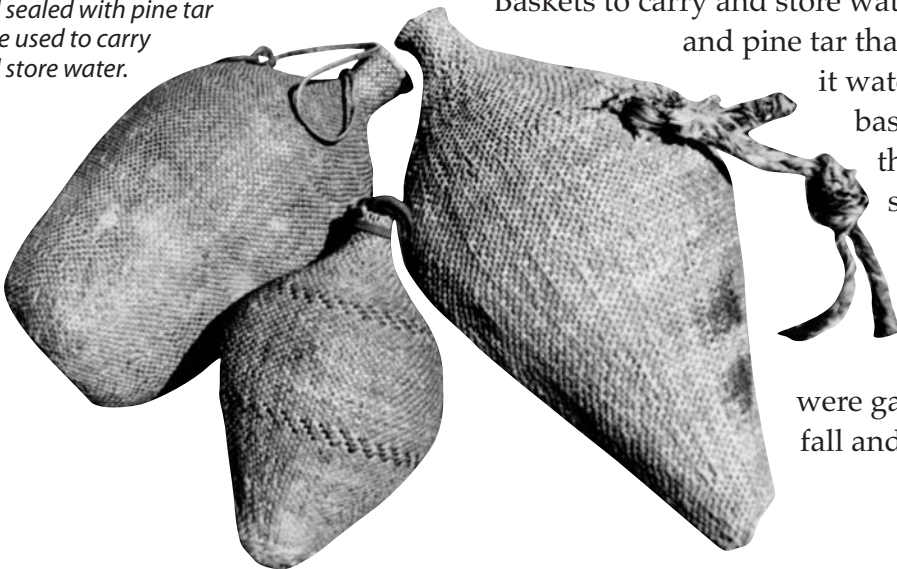
needed to gather, hunt and cook food and care for their sick. The Northern Paiute made cradle boards to carry babies when they traveled. Large cone baskets were designed to hold all a family needed to move from one location to another. Smaller cone baskets were made for children to help carry the family's belongings.

Baskets to carry and store water were made of willow and pine tar that sealed the basket making

it waterproof. Seed beater

baskets were made to beat the grasses, causing the seeds to fall into a tray underneath. The baskets were woven using willows that grew along the riverbanks. Willows were gathered beginning in the fall and ending in spring.

*Baskets made of willow and sealed with pine tar were used to carry and store water.*



## LESSON 2: REVIEW AND ENRICHMENT

1. The American Indians who live in the western portion of the Great Basin are the \_\_\_\_\_. They share the Great Basin with the \_\_\_\_\_ to the east, the \_\_\_\_\_ to the southeast and the \_\_\_\_\_ to the west.

2. Why were the early Northern Paiute called a "survival culture?"

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3. Describe the foods eaten by the early Northern Paiute.

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4. Describe the homes of the early Northern Paiute.

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5. Explain why the early Northern Paiute were called a "basket maker culture."

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### VOCABULARY:

**Numu (Numa):** \_\_\_\_\_

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**Uto-Aztecan:** \_\_\_\_\_

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**Aztec:** \_\_\_\_\_

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**kin-clique:** \_\_\_\_\_

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**nomadic:** \_\_\_\_\_

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**MAP ACTIVITY**

Use the map provided to illustrate where the American Indians of the Great Basin live in Nevada.





## ENRICHMENT ACTIVITY

Work in small cooperative learning groups. Examine pictures of Northern Paiute baskets (or real baskets, if possible). Share ideas about how each basket was used thousands of years ago. Discuss how the baskets were made and whether anyone has seen one of these baskets made recently. Have someone in the group record the discussion. Share results with the larger group.

[illegible]

## LESSON 3

# Role of Water in Lives of Early Northern Paiute

### LESSON OBJECTIVES

- Describe and summarize the role of water in the lives of the early Northern Paiute.
- Explain the names and describe the lifestyles of the early Northern Paiute.
- Demonstrate an appreciation for the early Northern Paiute culture, including survival skills and basketry.
- Demonstrate an appreciation for oral traditions unique to the early Northern Paiute.

22

*The early Northern Paiute were a matrilineal society, meaning that women played important leadership and decision-making roles. The women gathered cattails, tules and rushes to make into clothing, housing and fishing boats.*



**W**ater played a critical role in the lives of the early Northern Paiute. Map 3a shows the names and locations of the early Northern Paiute who lived along the Truckee, Carson and Walker rivers.

**Kooyoee Tukaddu** or Cui-ui eaters is the name for the Northern Paiute who lived around Pyramid Lake or Kooyoee Pah. Kooyoee (pronounced “ku you ee”) is the Paiute word for the **Cui-ui** suckerfish that was believed to exist only in Pyramid Lake and no other place in the world.

Each spring the Cui-ui came to **spawn** at the mouth of the Truckee River at Pyramid Lake. This time of year was a time of great celebration for the Kooyoee Tukaddu because the fish were abundant and they were able to preserve fish for the long winter season. Hundreds of fish would surface at the lakeshores and mouth of the Truckee River and would be collected and dried for future food supplies. The Pyramid Lake Cutthroat Trout were also caught in large numbers.

Nearby Winnemucca or “Muddy Lake,” which was formed from runoff from Pyramid Lake, was very shallow and muddy. Here the Northern Paiute could hunt mallard duck, mud hens and other types of wild birds.

The **Toidikadu**, or cattail eaters, were the Northern Paiute who lived around the Carson River Sink about 50 miles east of Pyramid. This is a large area of flat marshy land that lies at the end of Carson River. Plants, such as cattails, tules and rushes, thrive in this area. The

Toidikadu primarily ate the roots and seeds of the marsh plants as well as ducks, geese, small fish and pine nuts.

The **Agai Dicutta** or trout-eaters, and Pugwi Dicutta or fish eaters, lived in the region around Agai Pah. Agai Pah in Paiute means “trout lake.” The Agai-Dicutta and Pugwi-



*Northern Paiute living along the shores of Pyramid and Walker Lakes practiced traditional fishing methods by capturing the lakes' indigenous trout during spawning season at the river deltas.*

Dicutta traveled great distances to follow their food supply. Like most Northern Paiutes, they gathered pine nuts, berries and roots to help them through the cold winter months. They occasionally hunted larger game such as deer. This was more difficult during the time before horses were available. The men had to run down the deer on foot and trap them in a corral.

Similar to the **Kooyoee Tukaddu**, both the Agai Dicutta and Pugwi Dicutta hunted Lahontan Cutthroat trout that each year made their spawning trip upstream from the mouth of the Walker River at Walker Lake.

**Taboosi Ticutta** in Paiute means "grass-nut eaters" and was the Paiute name for Northern Paiute who lived along the Walker River. Grass-nut is a native plant that flourished along the Walker River. The fruit of the plant looked like small coconuts with white liquid inside a hairy shell. The Northern Paiute dug them out of the ground using sticks. The Northern Paiute sun-dried and ground the grass nuts into a paste like peanut butter.

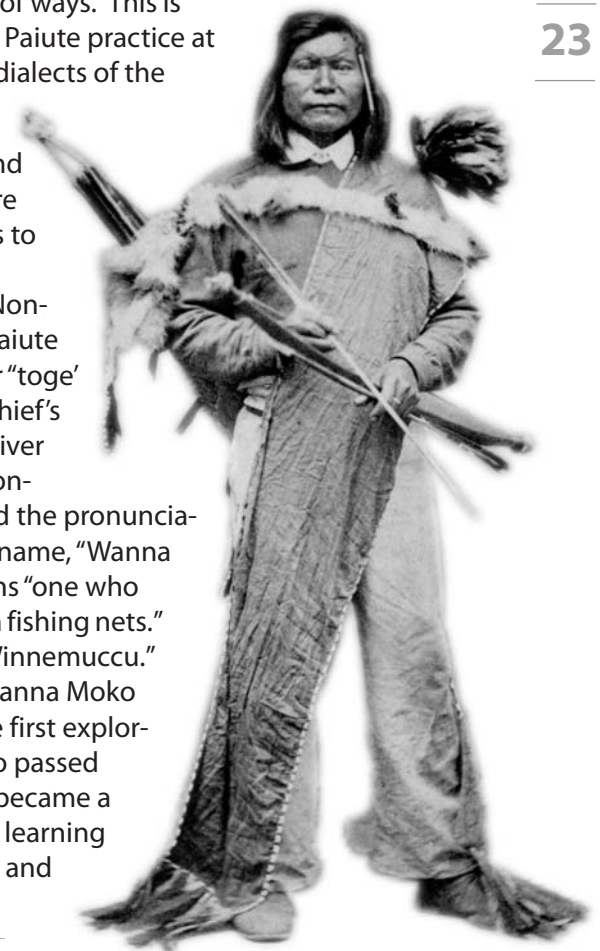
Like other Northern Paiute, the Taboosi Ticutti gathered and hunted not only grass nuts but also many different plants and animals found in this area at that time. Mud hens were plentiful in the Wabuska area, a marshy wetland.

In the late spring the Taboosi Ticutta would travel to Walker Lake and stay through the summer to share fishing grounds and participate in fishing ceremonies with the Agai Dicutta and Pugwi Dicutta.

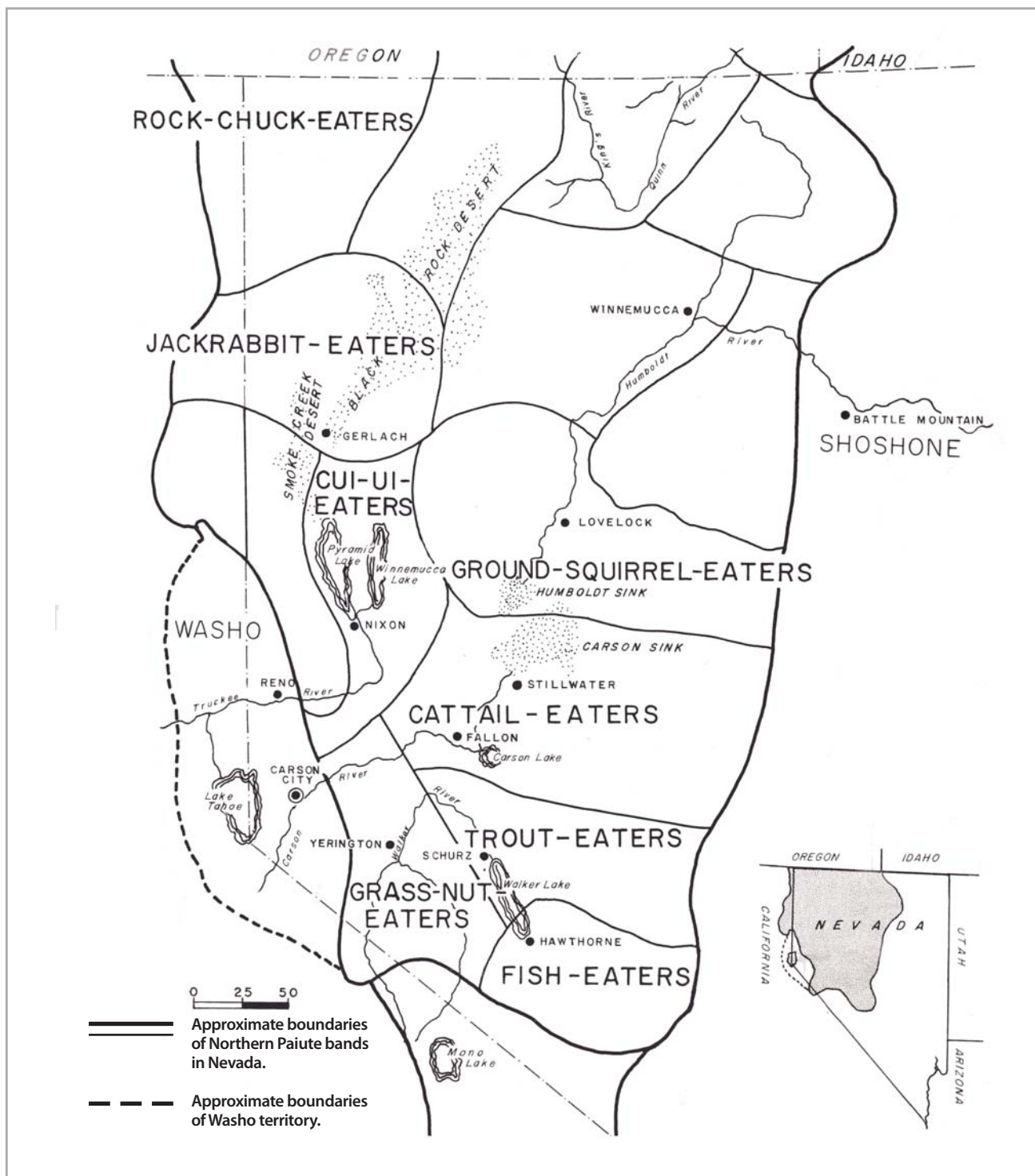
## DID YOU KNOW?

- ❖ Paiute words and names are spelled and pronounced a variety of ways. This is because the Northern Paiute practice at least eleven different dialects of the Paiute language.

- ❖ The Truckee River and Winnemucca Lake were named by non-Indians to honor the chief of the Pyramid Lake Paiute. Non-Indians believed the Paiute word for "okay, fine" or "toge' yoo" was instead the chief's name and called the river "Truckee." Similarly, non-Indians misunderstood the pronunciation of the chief's real name, "Wanna Moko Du", which means "one who makes moccasins from fishing nets." They called the lake "Winnemuccu." Born around 1780, "Wanna Moko Du" was friendly to the first explorers and emigrants who passed through the area. He became a guide for non-Indians, learning to speak both Spanish and English.



*Young Chief Winnemucca*



**Map 3a**

Locations and names of early Northern Paiute bands in Nevada



# Oral Traditions

**A**merican Indians, as many ancient peoples world over, practice **oral traditions**. Oral traditions are unwritten accounts of events and are used as a way of recording tribal history for the purpose of teaching future generations. Sometimes oral traditions are created and retold to teach important lessons about behavior and differences between right and wrong. Creation stories are oral traditions that explain the beginning of time for a particular group or tribe. The following stories are examples of oral traditions unique to the Northern Paiute culture.

## *The Legend of the Stone Mother<sup>1</sup>*

*Long ago in the Great Basin lived one large family. This was known as the Neh-muh family or the Northern Paiutes, as they are known today.*

*These people were gentle and kind, but one brother was quarrelsome. He swayed some of his sisters and brothers to his bad manners. The children then divided into two sides. There was continuous bickering from day to day that led to blows, counterblows, and much physical harm.*

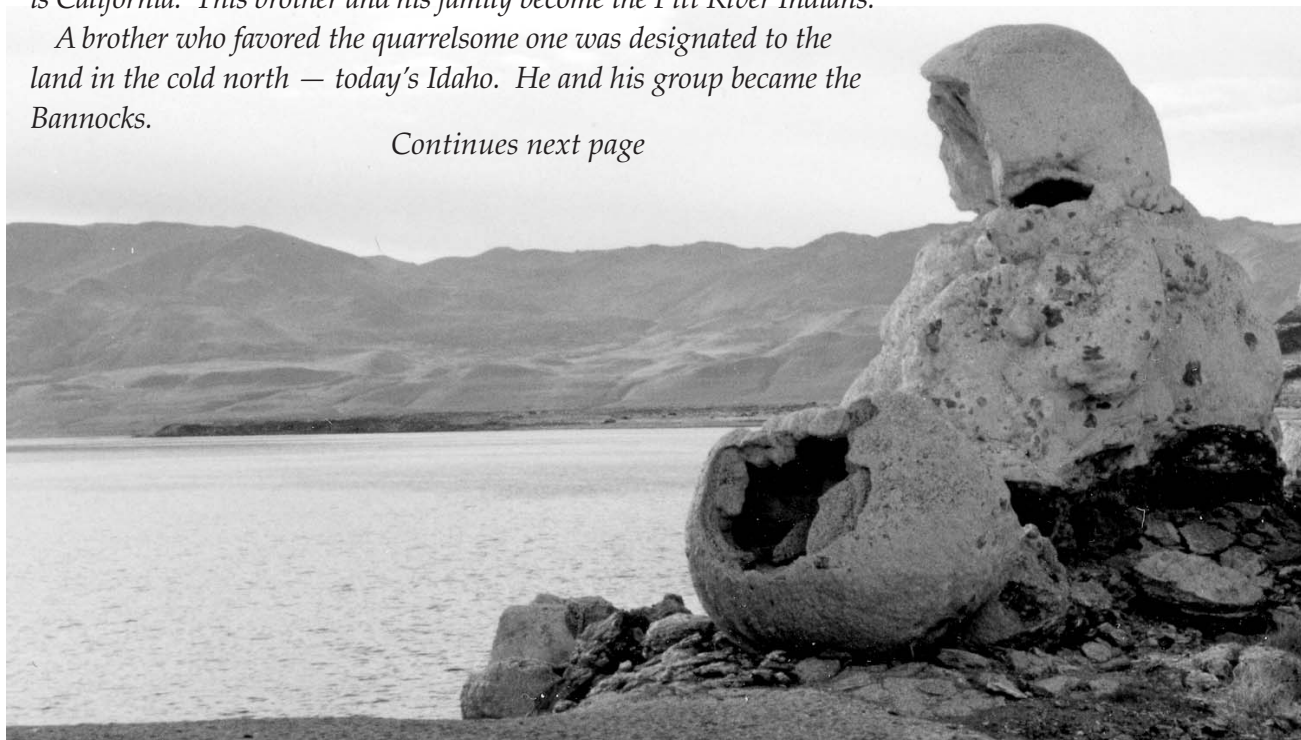
*When the parents saw that their counseling was of no avail, they decided to separate the children. This was a bitter decision, but had to be taken before murder was committed.*

*The father told the children that they had to move away. He sent the quarrelsome leader to the land over the tall Sierra Mountains into what today is California. This brother and his family become the Pitt River Indians.*

*A brother who favored the quarrelsome one was designated to the land in the cold north — today's Idaho. He and his group became the Bannocks.*

*Continues next page*

*A great rock formation at the Pyramid Lake shoreline symbolizes a Paiute woman sitting beside her burden basket waiting and watching for her children to return home.*



<sup>1</sup> Fulkerson, M.L. 1995. Weavers of Tradition & Beauty: Basketmakers of the Great Basin. Reno, Nevada: University of Nevada Press, p. 114-115.

*Another brother was asked to go to the southland beyond the Sierra Nevada to Owens Valley in modern California. These became known as the Southern Paiutes or the Pe tah neh quad.*

*Others of this family were dispersed into bands to lands near rivers and lakes.*

*The parents remained, but were very sad. They were truly heartbroken when the Pitt River band returned to fight the remaining groups.*

*The father passed on to the Great Milky Way. Then there seemed no consolation for the wife and mother. Even at her chores of seed gathering she wailed and mourned. No one checked her whereabouts when she did not return to her canee [domed willow and grass house] at night.*

*Notice was made only when a large body of salt water appeared. Near this pah nun a du [salt water] was the form of the mother. She still had her burden basket on her back. She had been turned to stone. The lake was formed by the tears she had shed.*

*The Stone Mother is one of the Coo-yu-e Lake's tufa formations. It can be seen close to the Woh noh [Pyramid] today.*

*The area around the Stone Mother is a sacred place to the Neh-muh (Numa) for their meditation and prayer.*

## ***Sagehen's Black Chest<sup>2</sup>***

*A long time ago, a sagehen lived on the earth. He was not a dumb bird. He was a very smart bird. He liked to live in high places. He liked to be able to see. He liked to watch the other animals. He liked to watch from high up on the mountain.*

*One day Sagehen was up on the mountain. He was on the very top of the mountain. He was on top of Mt. Grant. It was cold up there. It was very cold on top of Mt. Grant.*

*The male sage grouse has dramatic tail plumage he displays when he struts before the female sage grouse.*



<sup>2</sup> Reprinted with permission from the Yerington Paiute Tribe. Source: Let Me Tell You a Story, Adapted Paiute Tribes p23-24.

*Sagehen was holding a stick. It was a stick of fire. Sagehen was cold. He needed the fire stick. He needed it to keep warm.*

*Weasel was down below. He was down below in the valley. He was on the shore of Walker Lake. Sagehen watched Weasel. He watched Weasel on the shore of Walker Lake.*

*Weasel was not alone. His little brother was there. Weasel and his little brother were on the shore of Walker Lake.*

*A water baby was near the shore. It came out of the water. Weasel and his little brother teased the water baby. They teased it on the shore of Walker Lake.*

*Sagehen watched Weasel. He watched Weasel's little brother. They teased the water baby. Then they killed the water baby. They took its hair.*

*Weasel walked away. His little brother walked away. They carried the hair. They carried the water baby's hair.*

*The water began to rise. The water in Walker Lake got higher. Weasel's little brother was afraid. He said, "Brother, let's throw the hair into the water. Throw water baby's hair into the water. Hurry! Get rid of water baby's hair!"*

*Sagehen was watching. He saw Weasel and his little brother tease the water baby. He saw them kill water baby. He saw them take water baby's hair. And he saw Walker Lake rise.*

*Sagehen didn't watch the fire stick. He watched Weasel and his little brother. He clutched the stick. He didn't want the fire to go out. But he watched Weasel and his little brother. The fire singed Sagehen's chest. That is why Sagehen has a black chest.*

*Weasel and his little brother looked back. The water was getting higher. It was getting closer to them. They threw water baby's hair into the water. Weasel and his little brother ran away. And after that, the lake went down.*

## ***The Pine Nut Story<sup>3</sup>***

*Long ago there were lots of pine nuts. They were all over in the mountains. It was easy to find them. Everyone had plenty of pine nuts.*

*One day the pine nuts were all gone. Not even one was left! Every single pine nut was gone!*

*All the animals wanted to find the pine nut. They all went to look for it. Gray Wolf, Coyote and Magpie went to look. Fox, Hawk and Eagle went to look. Crow, Woodpecker and Mud Swallow went to look. Squirrel and Mouse went to look. All the animals went to look.*

*The animals went to Pyramid Lake. It was a long way off. Gray Wolf was the chief. Coyote was his younger brother. They led all the animals to Pyramid Lake.*

*It was evening. The animals were at Pyramid Lake. Gray Wolf said, "Mouse, you stand guard. The rest of us will gamble."*

*Continues next page*

<sup>3</sup> Reprinted with permission from the Yerington Paiute Tribe. Source: Let Me Tell You a Story, Adapted Paiute Tribes p73-74.



*Northern Paiute children climbed the great piñon pine trees to shake the pine cones to the ground where seeds from the cones were collected for eating.*



*Mouse went to stand guard. The other animals gambled. Mouse stood guard all night. The other animals gambled all night. When dawn came, Mouse found the pine nut. He went to Gray Wolf. He said, "I found it. I found the pine nut. I found it hidden over yonder."*

*Gray Wolf talked to Woodpecker. He said, "The sun is rising. Go get the pine nut. Bring it here."*

*Woodpecker went to get the pine nut. The other animals followed him. They killed Woodpecker. They tried to throw him away. They threw Woodpecker into the air.*

### **DID YOU KNOW?**

❖ The Pine Nut dance ceremony and pine nut harvest is still held each September at the Walker Lake Paiute Reservation.

*Gray Wolf caught Woodpecker. He caught Woodpecker in his mouth. Then Magpie grabbed the pine nut in his mouth. He flew away with it.*

*The other animals caught Magpie. They killed Magpie. He smelled bad. They said, "He stinks. Nothing could be hidden here." And they threw Magpie into the trees.*

*Gray Wolf watched. The animals left. Gray Wolf got the pine nut. He got it from Magpie's mouth. He brought it back to this area. He held the pine nut in his hand. He said, "I will create pine nuts."*

*Coyote agreed. He agreed to plant the seed. He said, "We will plant the pine nut. It will grow. There will be plenty of pine nuts."*

*Then they ate the pine nuts they created. Coyote was greedy. He ate his pine nuts very fast. He belched. He belched in the mountains. He belched in the valleys. He created juniper trees.*

*Gray Wolf ate his nuts. He spit. He made pine nut trees. He made them on the side of the Pine Nut Mountains.*

LESSON 3: REVIEW AND ENRICHMENT

1. Explain the meaning of names given to the early Northern Paiute who lived along the Truckee, Carson and Walker rivers.

2. Describe and summarize the role of rivers and lakes in the lives of the early Northern Paiute.

VOCABULARY:

Cui-ui:

spawn:

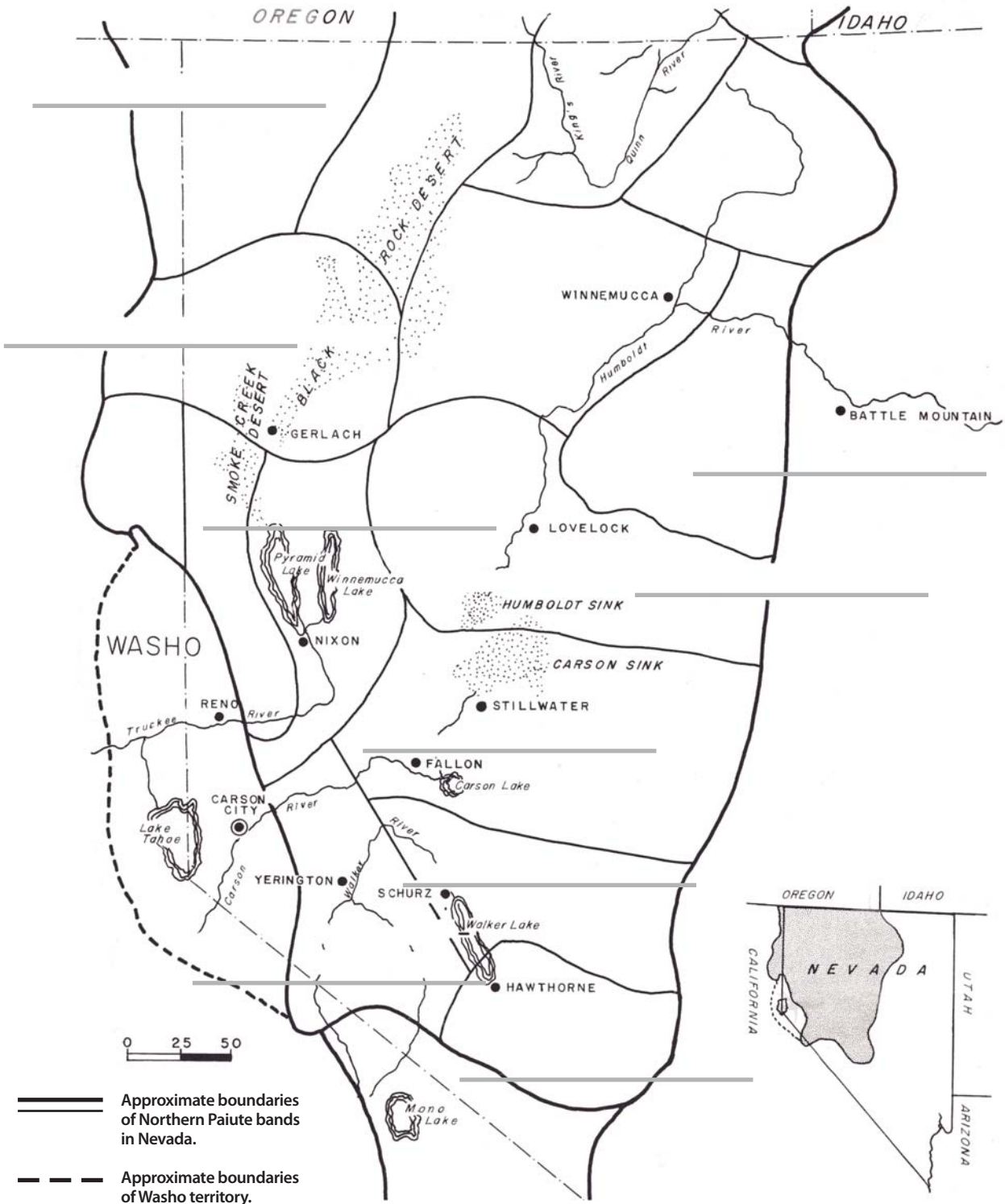
Lahontan Cutthroat Trout:

oral tradition:



## MAP ACTIVITY

Use the map provided to illustrate early Northern Paiute names and the locations where early Northern Paiute lived along the Truckee, Carson and Walker rivers.



## ENRICHMENT ACTIVITY

Work in five cooperative learning groups. Each group is assigned the role of playing one of the five Paiute bands discussed in this lesson. Each group spends 15 minutes creating a plan for acquiring food supplies for the year. Note the problems that might arise. Each group must record its discussion. Share the results of the small group discussion with the larger group.

[illegible]

## 32

- 1) Summarize each story in your own words.
- 2) What does each story mean to you?
- 3) Work in cooperative learning groups to share and discuss your answers.
- 4) Explain how stories passed by "oral tradition" might change over time.

[illegible]

## LESSON 4:

# California Gold Rush and the Emigrant Trail

In the 19th century exploration and settlement of the United States, many people, primarily from Europe, came to America in search of a new life. Many came to escape poverty by staking ownership in farmland or to start their own business. Some came to escape the potato famine in Ireland. Some came in search of adventure or to be with families. Others wanted freedom to practice their particular religion. Africans migrated westward after slavery was abolished in the southeastern United States. Many emigrants from Asia helped to build the first railroads across America while others worked in the larger mines.

By 1840, American emigrants had settled as far west as Iowa and Missouri. They began inching their way westward in the early 1840s as stories spread about fertile farmlands in Oregon and California.

In 1844, Elisha Stephens, a blacksmith and fur-trapper, was asked to serve as wagon master for the Stephens-Townsend-Murphy party. This group of 23 men, 8 women, 15 children and 11 wagons was the first wagon train party to cross from Nevada over the Sierra Nevada into California successfully. They made the trip from Iowa to the Humboldt Sink following the Humboldt River through Nevada. This path became known as the **Emigrant Trail** (*Map 4a*).

When they arrived at the Humboldt Sink, they faced the infamous **Forty-Mile Desert**. The chief of the Pyramid Lake Paiute showed Stephens how to reach the Truckee River, which lay on the other side of the desert. Stephens was then able to lead the wagon train through the Sierra Nevada before the winter snowstorms made travel through the mountains impossible.

In 1846, the Donner Party, departing from Missouri, attempted this same route. This was a more loosely organized group of farmers without an experienced trail guide. They followed a new and unexplored shortcut through the Wasatch Mountains and around the Ruby Mountains, which added weeks to their travel time. By the time the Donner Party reached the Sierra Nevada, it was late October and they were trapped in the Truckee River basin with only a few provisions left. The winter of 1846 was particularly severe, and by

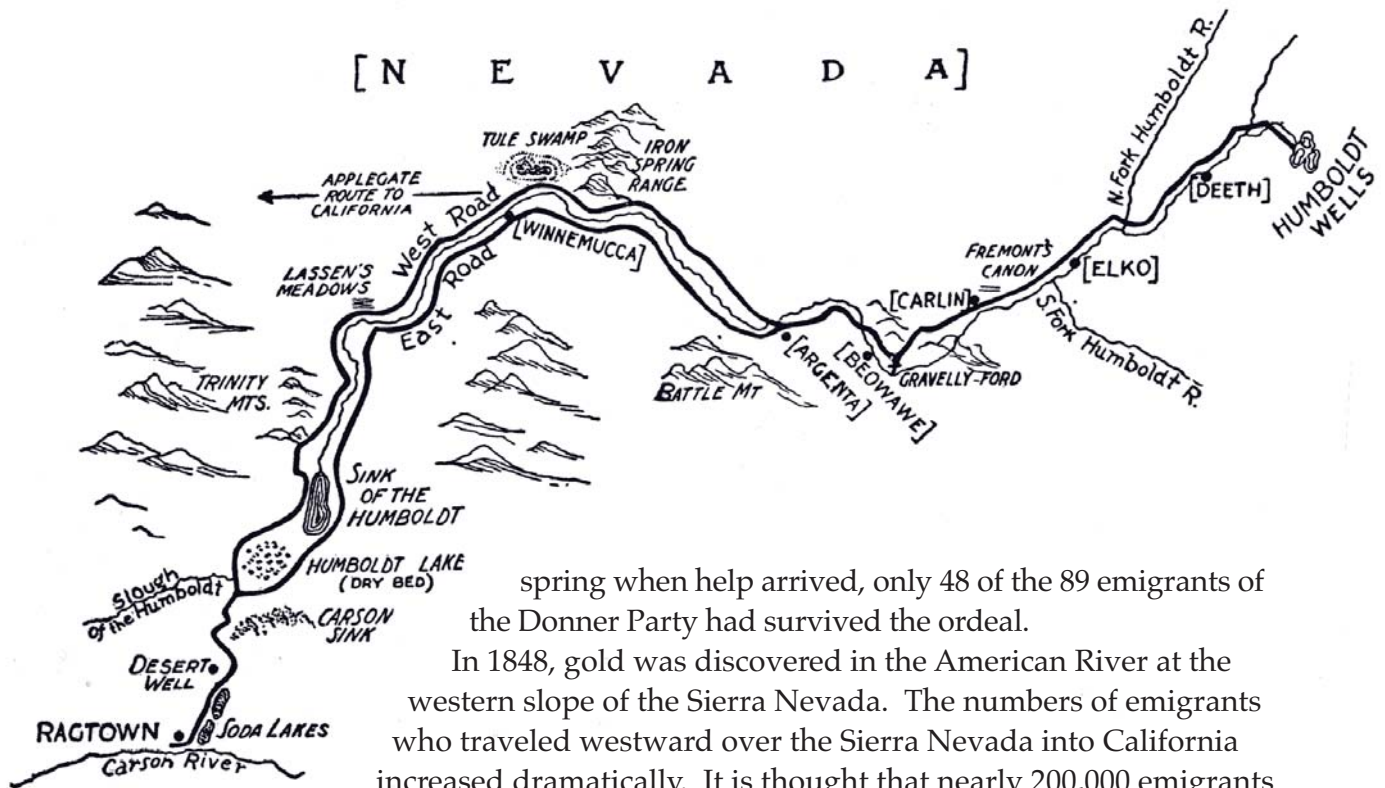
### LESSON OBJECTIVES

- State the chronological events that occurred during the early exploration of northwestern Nevada.
- Explain the importance of the Emigrant Trail.
- Analyze the effects on northwestern Nevada due to the discovery of gold and silver.
- Contrast the experiences of early emigrants who traveled westward through Nevada in the 1800s with emigrants who may travel west today.
- Demonstrate an understanding of the historical geography of Nevada.

### DID YOU KNOW?

- ❖ The Humboldt River valley later became the major route for emigrants traveling westward in search of gold and land.
- ❖ The three common causes of death to travelers on the Emigrant Trail were disease, drowning and accidental gunshot. The threat of Indian attack was not great as Indians along this route were primarily friendly toward travelers.

# [ N E V A D A ]



**Map 4a**

Emigrant Trail through the Humboldt River Valley, Nevada

Source: Hulbert, 1931. Forty-Niners, page 212.

spring when help arrived, only 48 of the 89 emigrants of the Donner Party had survived the ordeal.

In 1848, gold was discovered in the American River at the western slope of the Sierra Nevada. The numbers of emigrants who traveled westward over the Sierra Nevada into California increased dramatically. It is thought that nearly 200,000 emigrants passed through Nevada following the Emigrant Trail on their way to mine gold or to farm in California.

In 1859, silver was discovered in Nevada near what is now called Virginia City. The mineral deposit was known as the famous **Comstock Lode**. The discovery caused a large number of emigrants to settle in northwestern Nevada to mine silver in the surrounding hills and streams.

The California gold rush had a great impact on northwestern Nevada. Emigrants passing through sometimes remained on the eastern side of the Sierra Nevada. However, the discovery of the Comstock Lode had perhaps an even greater impact.

Trees were cut from the great forests of the Sierra Nevada to build houses, trading posts and mine shafts and to produce other goods in northwestern Nevada. Miners began to divert water from the Carson River as part of the mining process.

The gold and silver mining boom caused the number of emigrants to increase dramatically between 1859 and 1870 when the boom peaked. Gold deposits had also been discovered in 1859 by Waterman Body near the Walker River in an area now called the Bodie Hills. As the Comstock Lode declined, many miners abandoned it to relocate to Bodie Hills causing the population in the Walker River Basin to increase and towns to develop along the way.

As more and more emigrants moved to the Walker River Basin, the demand for a nearby food source became great. By the 1860s, settlers were irrigating lands along the Truckee, Carson and Walker rivers. In addition to mining and farming, settlements were encouraged further by a booming timber industry.





*Early gold miners used pack mules to carry their simple belongings and mining tools.*



*Virginia City, Nevada began as a mining town shortly after the discovery of the Comstock Lode and grew rapidly until the silver mining boom peaked.*



*Many emigrants came to northwestern Nevada to settle near the rivers and farm the desert lands.*



*Emigrants carried food, water, clothing and other household supplies in their covered wagons. Often oxen, instead of horses, pulled the wagons.*

## 19th century Christian hymn

*No title - Author: unknown*

I have roamed over mountain, I've crossed over flood,  
And I've traversed the wave rolling sand;  
Tho' the fields were as green and the moon shone as bright,  
Yet it was not my own native land.

No, no, no,  
None so lovely as my own native land.

I have climbed o'er the Andes, and gazed from the Alps,  
And beheld many pictures called "grand;"  
But in rich forest shade, or on wide spreading plain,  
I have sighed for my own native land.

Yes, no, no,  
None so lovely as my own native land.  
Then hail, hear Columbia, the land that we love,  
Where flourishes Liberty's tree;  
Tis the birthplace of freedom, our own native home,  
Tis the land, tis the land of the free.

Yes, yes yes, yes, yes, yes, yes, yes,  
None so lovely as my own native land.

Source: Fillmore, 1867. [Fillmore's Harp of Zion](#).



## From an emigrant's diary

Excerpts from an emigrant's diary describing passage along the Emigrant Trail in Nevada through the Forty-Mile Desert:

- *In fifteen miles someone counted 350 dead horses, 280 oxen, and 120 mules. Someone stated that one thousand wagons have been abandoned in the forty-two miles between here and the Slough of the Humboldt.*
- *Fifteen dollars was paid, by one report, for a glass of water from Cold Spring and one hundred dollars for a single pint.*
- *The suddenness with which cattle will succumb in the Desert is curious. They can appear to be going good and then fall as if shot and die instantly.*
- *[List of things seen discarded along the road]: log chains, wagon-irons, dishes, life preservers, cross-cut saws, iron-bound water caskets, tin bakers, cooking implements, boots, shoes, clothing, trunks, books, guns, pistols, gun barrels, chisels, feather beds, tents and wagon covers.*

Source: Hulbert, 1931. Forty-Niners: The Chronicle of the California Trail, pp.250-252.

LESSON 4: REVIEW AND ENRICHMENT

1. Using the information from Lesson 4, list a key event for each date and explain how each event affected northwestern Nevada.

1844

1846

1848

1859

1860

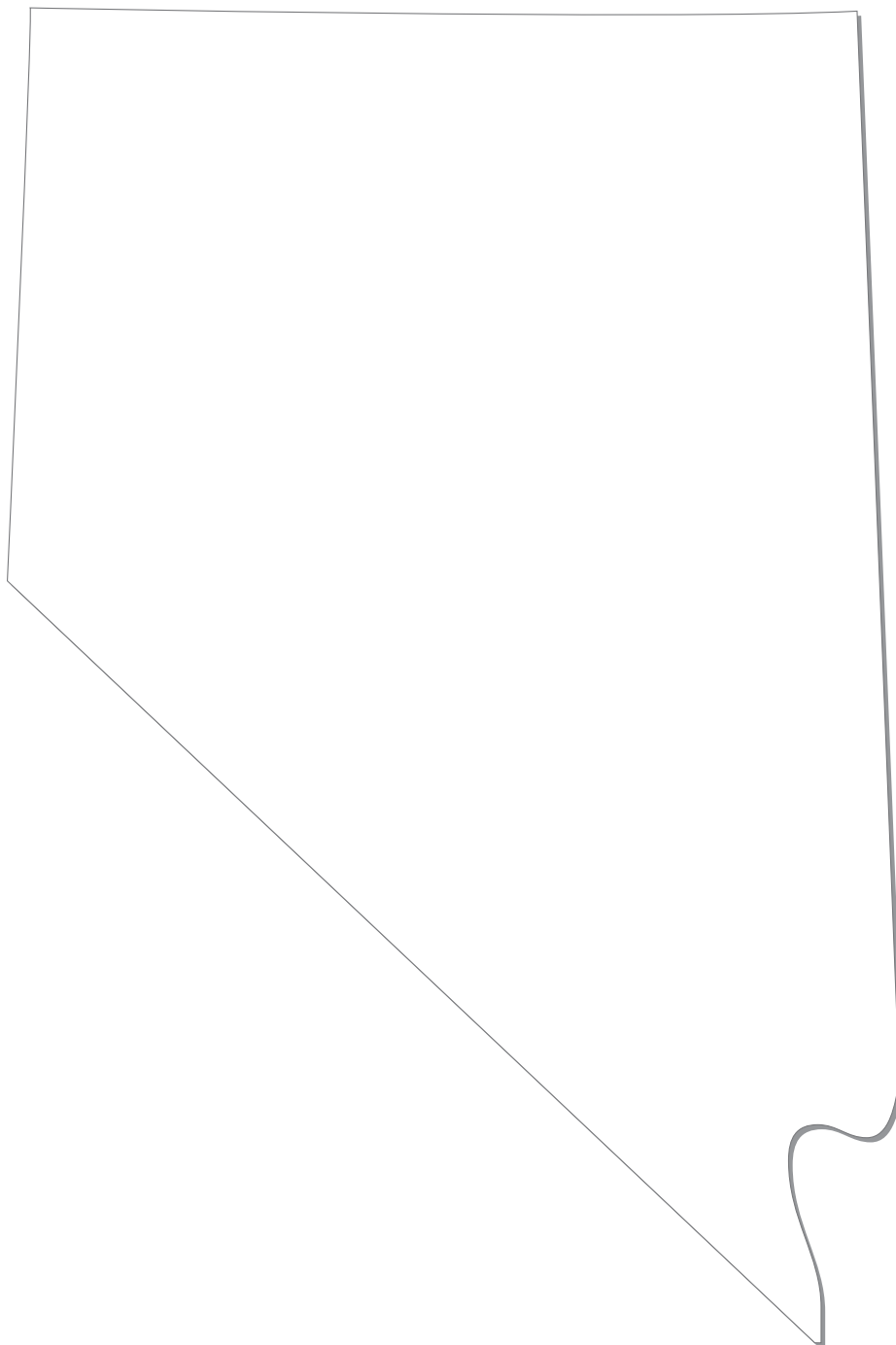
1870

2. Analyze how the discovery of gold and silver may have affected northwestern Nevada.

## MAP ACTIVITY

Use the map provided to demonstrate your mastery of Nevada's historical geography.

- 1) Draw and label the Truckee, Carson, Walker and Humboldt rivers.
- 2) Illustrate where the early Northern Paiute lived along the Truckee, Carson and Walker rivers.
- 3) Add the Emigrant Trail to the map.
- 4) Indicate the location of the Forty-Mile Desert, Comstock Lode and Virginia City.





## ENRICHMENT ACTIVITY

Summarize the hymn presented in this lesson. Do you think most emigrants on the trail felt this way? Why?

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## ENRICHMENT ACTIVITY

Describe how the Forty-Mile Desert might have looked to emigrants in the 1880s. Explain the diary excerpts included in this lesson.

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## ENRICHMENT ACTIVITY

It is 1844 and you are Elisha Stephens. You have successfully led your wagon train party from Iowa to the Humboldt Sink in Nevada. You must decide whether to continue westward across the Forty-Mile Desert or take a different route to the Sierra Nevada. You encounter the Chief of the Pyramid Lake Paiute, who is very friendly and indicates he wants to help. Using your imagination, recreate this first conversation between the chief of the Pyramid Lake Paiute and Elisha Stephens.

[illegible]

## LESSON 5

# Federal Policies to Settle the American West

### LEARNING OBJECTIVES

- List and define key federal policies designed to help settle the western United States.
- Analyze the role of these federal policies in shaping attitudes toward water use in the 1800s and early 1900s.
- Develop an appreciation for the challenges that early settlers faced in northwestern Nevada.

**B**y the 1860s, the United States government had explored, mapped and staked ownership of land, water and minerals in the western states. The federal government wanted to develop the west by building homes, businesses, towns and cities. One way to accomplish this was to build a railroad that would easily carry more people across a vast country. Another way was to give land to emigrants who would then develop it by producing crops or other goods and services. Between 1862 and 1902, the United States enacted several important **federal policies** to attract people to settle the west. These policies also played a powerful role in shaping attitudes toward water use in the west that would continue for the next 100 years.

- **Homestead Act:** In 1862, President Abraham Lincoln signed into law the Homestead Act. At that time, farming was the most common way for settlers to make a living. This law granted emigrants and existing U.S. citizens 160 acres of land if they could farm it for at least 14 months.

- **Pacific Railroad Act:** To encourage the development of a railway and telegraph system from Missouri to the Pacific Ocean, Congress

enacted the Pacific Railroad Act in 1862.

This policy granted railroad investors every other square mile of land per 20 miles on each side of a railroad. This prompted a number of settlements to develop along railroads.

- **Morrill Land Grant Act:** Enacted in 1862, this policy donated land to states and territories in order to establish colleges to teach agriculture and the mechanical arts.

- **Desert Land Entry Act:** In 1877, the United States government passed the Desert Land Entry Act, which gave 640

acres of desert land to any man who could irrigate a portion of it and produce crops. This was later reduced to 340 acres.

As the mining boom ended in 1881, many settlers left the area as quickly as they had come. Those who had come to farm encountered difficult soils, a harsh dry climate and a short growing season. The population in Nevada dropped dramatically. Despite the previous land grant policies enacted at the turn of the century, the United States

### DID YOU KNOW?

❖ The Pony Express was established in 1860 to move mail over 1,860 miles from St. Joseph, Missouri to Sacramento, California directly across Nevada. The mail system consisted of 500 horses and 190 rest and delivery stations. Eighty qualified riders rode for the Pony Express averaging 75 miles per day and earning \$25 per week. Delivery charges ranged from \$1 to \$5 per ounce of mail. Mail was carried in a leather vest or “mochila.” The mochila was designed to enable quick changes from one rider to another.

government determined that more assistance was needed to attract settlers and boost development.

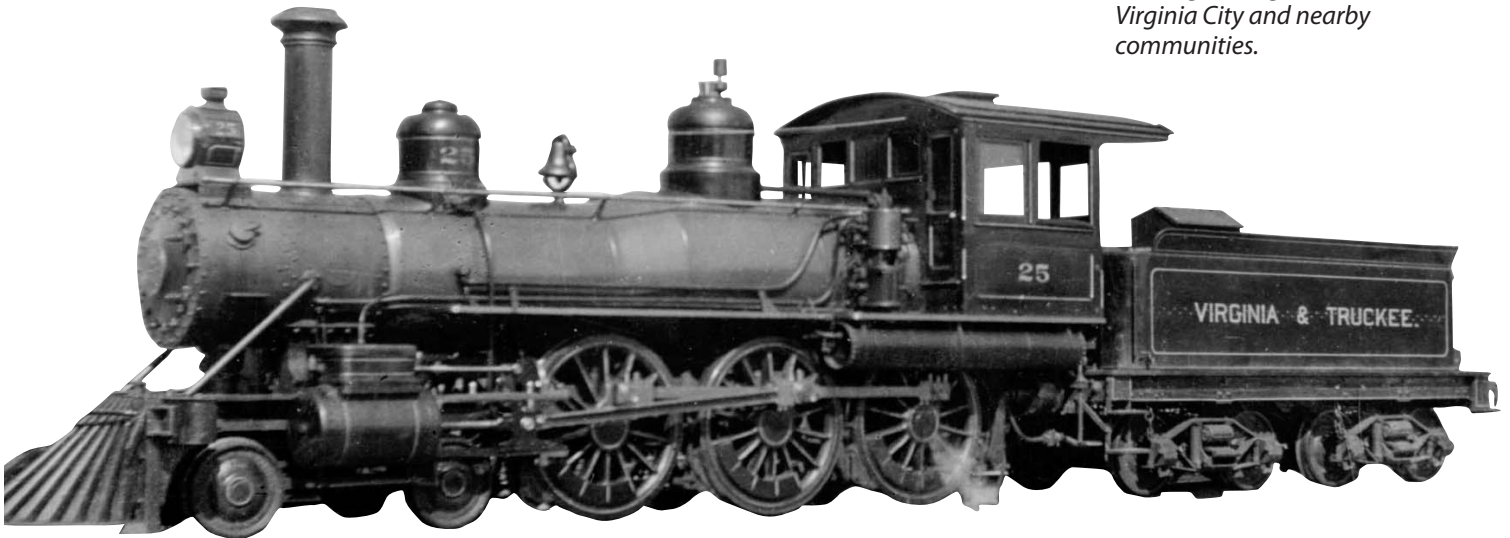
In 1902, the United States government passed the National Reclamation Act and created the U.S. **Bureau of Reclamation**. Federal lawmakers hoped that this policy would develop the west further by assisting western farmers in irrigating arid lands. The very first project undertaken by the Bureau of Reclamation in 1905 was the construction of Derby Dam on the Truckee River 20 miles east of Reno, Nevada. First called the Truckee-Carson Irrigation Project, **Derby Dam** diverted Truckee River water away from Pyramid Lake through the man-made Truckee Canal to meet the Carson River at Lahontan Reservoir. A few years later, this project came to be known as the **Newlands Project** in honor of Nevada Democratic Senator Francis Newlands who spearheaded reclamation policy.

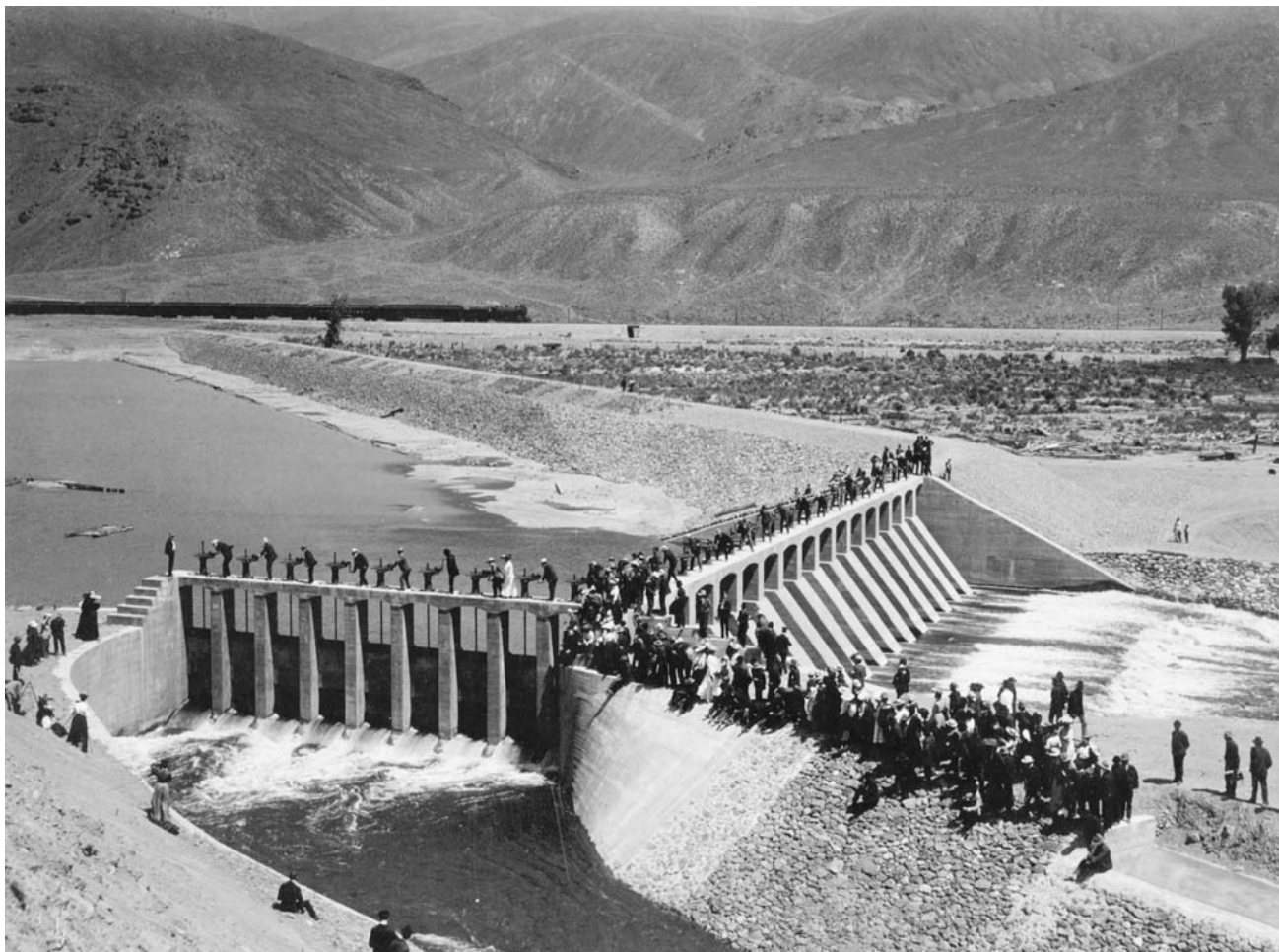
The Newlands Project became one of the most famous examples of irrigated agriculture in the western United States. The project made irrigated farming the top priority for water use on the Truckee and Carson rivers.

## DID YOU KNOW?

- ❖ Railroad fever, thought to be as contagious as gold fever, significantly affected Nevada's growth and development. Some historians believe that the development effects from railroads in Nevada far outlasted the effects from mining booms.
- ❖ Private investors, with the support of the federal Pacific Railroad Act, financed and built two primary railroads through Nevada that served to link this wild and untamed land to the rest of the United States. Smaller branch lines (no longer operating) connected more remote areas of Nevada with major cities throughout the country.
- ❖ The Central Pacific, which was a primary railroad constructed through north and central Nevada, was made possible through federal grants of land totaling over 5 million acres. The city of Reno originated through the sale of a land grant by private railroad investors. Most of the labor needed to build the railroads in early America was supplied by Chinese emigrants who worked 12-hour days for a monthly wage of \$35.

*The Virginia and Truckee railroad carried passengers and goods between the bustling mining town of Virginia City and nearby communities.*





Derby Dam diverted Truckee River water away from Pyramid Lake in order to provide water to irrigate farmland.

The result of the National Reclamation Act and reclamation projects constructed in Nevada was increased numbers of emigrants moving to the area to file claims for land and water rights in order to farm. More

### DID YOU KNOW?

❖ *"The U.S. Bureau of Reclamation built Derby Dam as part of the Newland Irrigation Project, sending Truckee River water down the newly constructed canal that met northern Nevada's other major river [Carson] at the Lahontan Reservoir. When this dam was completed, it was a highly ceremonial event with ladies dressed in their finery, long white dresses, big brimmed hats and gentlemen in two and three-piece suits, and bowler or derby hats."*

— Russ Armstrong, quote from Healing the Water Video (Water Education Foundation, 2000).

and more settlers began diverting water from the Truckee and Carson rivers to irrigate cropland and provide water for livestock. Although no reclamation projects were constructed on the Walker River, irrigated farming became the primary livelihood of settlers along that river as well.



## LESSON 5: REVIEW AND ENRICHMENT

1. Explain why the United States government created policies to encourage settlement of the American West.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

## VOCABULARY:

**federal policies:** \_\_\_\_\_

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**Homestead Act:** \_\_\_\_\_

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**Pacific Railroad Act:** \_\_\_\_\_

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**Morrill Land Grant Act:** \_\_\_\_\_

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**Desert Land Entry Act:** \_\_\_\_\_

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**National Reclamation Act:** \_\_\_\_\_

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**U.S. Bureau of Reclamation:** \_\_\_\_\_

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**Derby Dam:** \_\_\_\_\_

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**Newlands Project:** \_\_\_\_\_

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## ENRICHMENT ACTIVITY

Draw a line to match each word with a definition.

**Derby Dam**

law passed in 1902 to assist farmers in irrigating arid lands

**National  
Reclamation Act**

donated lands to states and territories to establish colleges to teach agriculture and the mechanical arts

**U.S. Bureau of  
Reclamation**

name given to Truckee-Carson Irrigation Project to honor its supporter, Senator Francis Newlands

**Newlands  
Project**

law passed in 1877 giving 640 acres to any man who could irrigate part of it and grow crops

**Homestead Act**

granted sections of land to private investors to build railroads across the U.S.

**Desert Land  
Entry Act**

diverted Truckee River water into a canal to irrigate desert land to grow crops

**Pacific  
Railroad Act**

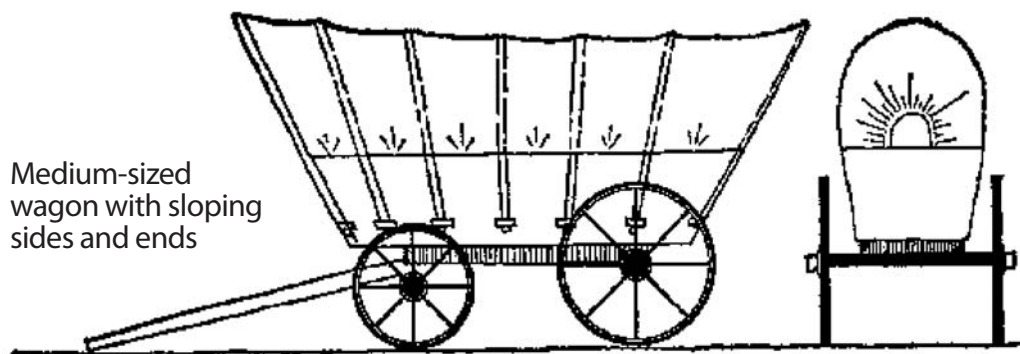
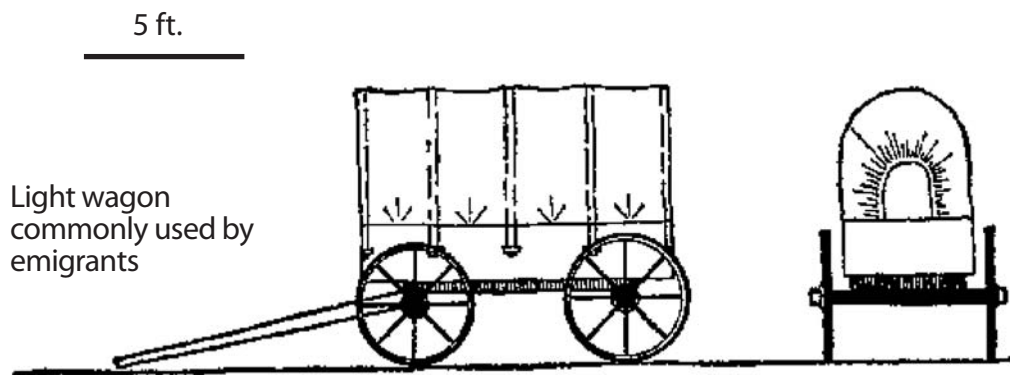
federal agency created in 1902 to oversee reclamation projects in the West

**Morrill Land  
Grant Act**

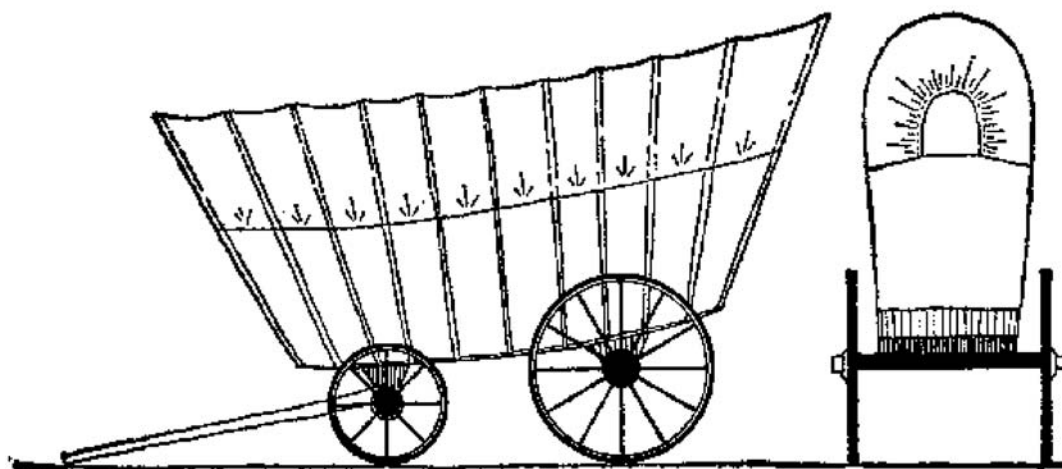
law passed in 1862 that provided emigrants 160 acres of land if they could farm it for 14 months

## ENRICHMENT ACTIVITY

Organize into cooperative learning groups. Study the illustrations of the covered wagons available to emigrants. Using the measurement scale, estimate the dimensions of each wagon. Which wagon type do you think was used most often on the Emigrant Trail? Explain your answer.



Conestoga wagon  
(rarely used in the migration)



### Types of Wagons

Source: <http://ourworld.compuserve.com/homepages/trailofthe49ers/wagons.htm>

## 48

**This much food is suggested for each adult in the group:**

— Jacqueline Williams, *Wagon Wheel Kitchens*

BUSHEL — US dry measurement equal to 4 pecks or 2,152.4 cubic inches

[illegible]

## ENRICHMENT ACTIVITY

Work in cooperative learning groups to analyze the role of federal policies in shaping early attitudes toward water use in the American West. Record your discussion and share with the larger group.

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## ENRICHMENT ACTIVITY

In cooperative learning groups, investigate the Pony Express route through Nevada. Access the website address: <http://www.xphomestation.com/maps.html>. Use the website information to:  
a) estimate how many days were required to deliver mail from Sacramento to Salt Lake City and  
b) describe three Pony Express stations in northwestern Nevada.

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## LESSON 6

# Early Water Conflicts

### LEARNING OBJECTIVES

- Analyze the effects of mining and federal policies on the lifestyle of the early Northern Paiute.
- Describe the conflicts between the early Northern Paiute and non-Indians in northwestern Nevada.
- Develop an appreciation for difficulties early Northern Paiute faced living on reservations.
- Summarize U.S. policy efforts to encourage American Indians to practice agriculture.

50

*Once their hunting was restricted to reservation lands, the Northern Paiute struggled to find adequate food supplies year round.*

The mining boom in California and Nevada, combined with federal policies to settle the west, changed the Northern Paiute way of life. The development of land and water for mining, agriculture and building attracted large numbers of non-Indians to the area.

At first, the Northern Paiute continued their nomadic lifestyle, hunting and gathering food. In time, however, with larger numbers of settlers, many plants used as food by the Northern Paiute were grazed by settlers' cattle and sheep. Miners and settlers who cut piñon trees for firewood reduced the amount of pine nuts, a major food source for the Northern Paiute. As available food sources dwindled, hostilities and conflicts erupted between the Northern Paiute and settlers.

In 1859, the United States government set aside lands for the Paiute of Pyramid Lake, Walker River and Walker Lake. The creation of **Indian reservation lands** restricted the Northern Paiute in their traditional search for food. Food shortages became a serious problem on reservations. Some settlers also became "squatters," illegally living on reservation lands bringing their cattle, sheep and horses with them. The friendly relations that once existed between the early Northern Paiute and first emigrants faded.



## FAMOUS PEOPLE

### Sarah Winnemucca: Paiute

(1844-1891)

❖ "The traditions of our people are handed down from father to son. The Chief is considered to be the most learned, and the leader of the tribe. The Doctor, however, is thought to have more inspiration. He is supposed to be in communication with spirits ... He cures the sick by the laying of hands, and prayers and incantations and heavenly songs. He insures new life into the patient, and performs most wonderful feats of skill in his practice ... He clothes himself in the skins of young innocent animals, such as the fawn, and decorates himself with the plumage of harmless birds, such as the dove and hummingbird ..."

Source: Hopkins, 1883 (republished 1994). *Life Among the Paiutes: Their Wrongs and Claims*.

In the spring of 1860, after a particularly hard winter, these hostilities peaked in a war between settlers and the Northern Paiute at Pyramid Lake. The conflict was ignited by an incident involving the kidnapping and assault of two Paiute girls from Pyramid Lake. A Paiute man from Pyramid Lake accidentally found the girls and returned to Pyramid Lake to report the girls were being held prisoners at a nearby trading post owned by non-Indians. A group of Pyramid Lake Paiute men went after the girls and in setting the girls free, killed six non-Indians at the trading post.

Settlers in Virginia City quickly formed a vigilante group to attack the Pyramid Lake Paiute. The Paiute outnumbered and defeated them. One month later a larger more organized company of soldiers from Nevada and California attacked the Paiute. Although many Northern Paiute and non-Indian settlers died in this war, settlers considered it a victory. After the war, Fort Churchill was built along the Carson River to prevent future battles between the Paiute and settlers.

After the war at Pyramid Lake, the Northern Paiute ceased their nomadic hunting and gathering lifestyle. Hunger, however, remained a serious problem on reservations.

## Adapting to Reservation Life

In the early 1900s, tourism provided some economic relief for the Paiute at Pyramid Lake. The close proximity of Pyramid Lake to Reno and Lake Tahoe, in particular, helped to make Pyramid Lake a popular destination. Because of its prized Pyramid Cutthroat trout, a relative to the Lahontan Cutthroat trout at Walker Lake, many tourists and sports fishermen traveled to fish at Pyramid Lake. While this activity provided income for the Pyramid Lake Paiute, it also contributed to the over-fishing of the trout population.

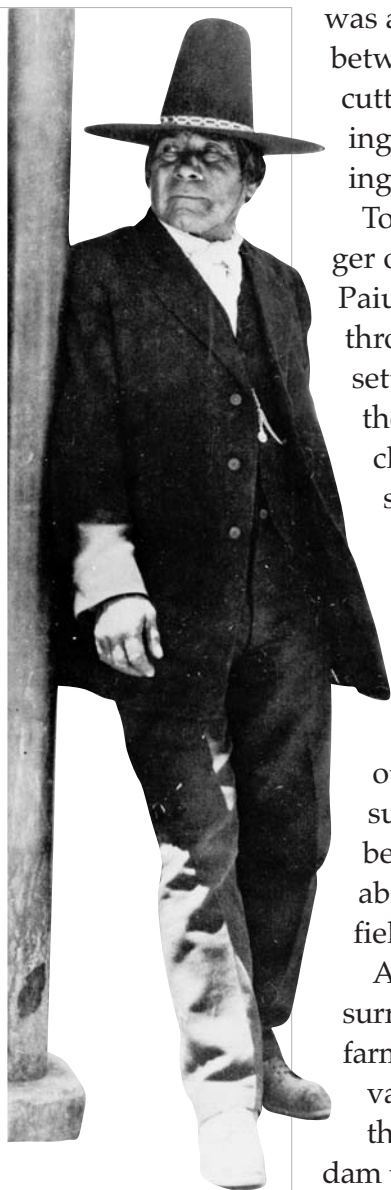
The diversion of water from the Truckee River to irrigate cropland along the Carson River also affected fish spawning at Pyramid Lake.



## FAMOUS PEOPLE

**Wovoka**  
(1856-1932)

❖ A member of the Walker River Paiute, Wovoka was known as a "medicine man." He became an international religious prophet when he founded the Ghost Dance Religion, which was adopted by the Sioux and other western Indian tribes in the 1880s and 1890s. The Ghost Dance Religion featured special chants or songs and a very precise dance pattern. Wovoka preached the Ghost Dance Religion to Native Americans to help them manage their losses and conflicts over land with non-Indians. The religion taught that one day Native Americans would once again live freely upon the land and non-Indians would disappear.



By the early 1900s, lake levels at Pyramid Lake had dropped significantly and the Pyramid Cutthroat trout were declining in numbers.

In 1908, a federal court issued the **Winters Rights Decision**, which declared that non-Indians could not legally use or interfere with Indian tribes' use of water. While this policy was an attempt to protect Indian water use, between 1938 and 1944, the Pyramid Lake cutthroat trout became extinct due to lowering lake levels, over-fishing during spawning periods and water pollution.

To relieve economic depression and hunger on the Walker Lake Reservation, the Paiute living there caught Lahontan Cutthroat trout to sell to nearby towns and settlements. For a time this trade helped the Walker River Paiute to purchase clothing, horses, rifles for hunting and supplies to build houses.

## Agriculture and the Early Northern Paiute

Agriculture was unknown to the early Northern Paiute. Crops grown by other early western American Indians, such as corn, squash and beans could not be grown in the Great Basin without the ability to move water from the rivers to fields to irrigate crops when needed.

As time passed and settlers converted the surrounding river valleys into productive farmland, food shortages increased on reservations. The Paiute at Walker Lake asked the United States government to build a dam to irrigate their 323,386-acre reservation. The reservoir would allow them to store and release water for irrigation to grow crops for

food, trade and to feed their own cattle, sheep and horses.

In 1934, the United States Indian Service (Bureau of Indian Affairs) constructed an earthen dam on Walker River above Schurz creating Weber Reservoir. The reservoir was intended to store enough water to irrigate all farmland allotted to the reservation at Walker Lake. Unfor-





*Northern Paiute living around lakeshores, marshes and wetlands made small boats from cattails and tules to use for hunting waterfowl and for fishing. They handcrafted their boats with great care and attention to detail.*



Unfortunately, the construction of Weber Dam prevented the Lahontan Cutthroat trout from swimming up Walker River to spawn and, in time, significantly reduced the number of Lahontan Cutthroat trout at Walker Lake.

To address their economic problems and food shortages, the Paiute living upstream of Walker Lake in Mason and Smith valleys also turned to agriculture. For years following the settlement of Mason and Smith Valleys, many Paiute women and men worked as laborers on farms and ranches. Then, in 1934, the federal government passed the **Indian Reorganization Act**, which gave Indian tribes on reservations the authority to govern themselves. Under this policy, the Walker River Paiute acquired the Campbell Ranch reservation in Mason Valley. Although the 1,631-acre reservation was considered small compared with many ranches in the area, it provided the Walker River Paiute with irrigated farmland on which they could grow crops and livestock.

Similarly, in 1944 a federal court order called the Orr Ditch Decree recognized water rights for Pyramid Lake reservation to use for irrigation. However, none of this water was allowed to enter Pyramid Lake.

## DID YOU KNOW?

❖ In 1887, the federal government passed the **General Allotment Act**. The policy divided reservation lands controlled collectively by tribes into parcels of land owned privately by tribal members. The intent was to encourage Indians to begin farming by allocating parcels of land to individual tribal members in 160-, 80- and 40-acre parcels. In Nevada, allotments were as little as 20 acres. While some Indians desired to farm, others found it was not compatible with their culture or way of life. Many found farming too difficult with such small allotments and without proper equipment and tools. The policy was later amended to allow Indians to sell their parcels. The policy resulted in opening reservation lands for non-Indian purchase and settlement. By the time the policy was repealed in 1934, American Indians in the U.S. had lost nearly two-thirds of their original reservation lands.

LESSON 6: REVIEW AND ENRICHMENT

1. Analyze how the California gold rush and mining boom affected the lifestyle of the early Northern Paiute.

2. Explain why hostilities developed between the Paiute and settlers.

3. Describe life on the reservations at Pyramid and Walker lakes in the late 1800s and early 1900s.

4. Summarize U.S. government actions to encourage American Indians to irrigate and farm reservation lands.

VOCABULARY:

Winters Rights Decision:

General Allotment Act:

Orr Ditch Decree:

Indian Reorganization Act:



## ENRICHMENT ACTIVITY

Work in cooperative learning groups to analyze how federal policies affected the lives of the early Northern Paiute. Record your discussion and share with larger group.

[illegible]

# Understanding Water Rights<sup>4</sup>

### LEARNING OBJECTIVES

- ▶ Demonstrate a basic understanding of water rights based on the Doctrine of Prior Appropriation.
- ▶ Define beneficial use, consumptive and non-consumptive use of water resources.
- ▶ Explain how water supplies are predicted annually.
- ▶ Construct a set of rules for determining how to allocate a scarce resource.

*By digging a network of ditches, early farmers irrigated their fields by flooding them with water diverted from rivers.*

**A** water right is a way to decide who has the right to use water and how it is used. Water rights enable farmers, industries, communities, Indian reservations, wildlife and recreation areas, or others, to use a specific amount of water. There is no ownership of the water but rather the privilege to use it.

Water rights and western land settlement are closely related. Since the first emigrants arrived in the arid west over 160 years ago, water has been the critical link to survival. Without water rights, emigrants considered most lands in Nevada as useless.

In Nevada, as in most western states, the **Doctrine of Prior Appropriation** regulates water use. This water law was created during the time federal policies were passed to settle the American West. The doctrine is based on the idea of allocating the right to use water by seniority, that is, “first in time is first in right.” Those who were first to arrive and stake claims to mines or land also staked a claim to the water resources. As long as they could prove a **beneficial use** for the water,



<sup>4</sup> The following lesson is adapted from The Watercourse (Nelsen et al 2000).

they acquired and maintained the “prior” or “senior” right to water resources.

In the 1800s, beneficial uses were considered primarily gold and silver mining, food production and lumber production. Water right holders had to make continuous beneficial use of their water right in order not to lose it. This aspect of water law remains in effect today.



*To support and encourage irrigated agriculture in Nevada's high desert, the Truckee Canal carried water from the Truckee River to meet the Carson River at Lahontan Reservoir.*

## Predicting Water Supply

Water supply in the West can vary significantly from year to year. Snowmelt from the Sierra Nevada accounts for about 76 percent of water supply for northwestern Nevadans who depend upon flows from the Truckee, Carson and Walker rivers. Water supply, or **runoff** from snowmelt, is collected, stored and delivered to irrigators and communities throughout the irrigation season, typically from April 1 through October 30. Warmer temperatures make this period an ideal time to plant, grow and harvest crops. It is also the driest period of the year. Without adequate water deliveries, crop yields are reduced. During periods of **drought**, or significantly less precipitation than normal, crops may not survive. Other water users who rely on water supply for power generation, as well as industrial and domestic use, also need a reasonable prediction of water supply.

Both manual and automated snow surveys are conducted annually as part of a centralized forecasting system to predict water surpluses or shortages. **SNOTEL** remote sites are designed to automate snow surveys that consist of a shelter, antenna, solar panels, batteries, radio transmission or telemetry equipment, snow pillow, precipitation gauge and temperature sensor. Automated measuring devices convert the weight of snow that accumulates on snow pillows and produces an estimate of the snow's water equivalent. This measure is the actual amount of water in a given volume of snow and is used to forecast future stream flow.

### DID YOU KNOW?

❖ An **acre-foot of water** refers to a unit of measure. It means 12 inches or one foot of water needed to cover one acre of land or 43,560 square feet.

## LESSON 7: REVIEW AND ENRICHMENT

1. What is a water right?

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2. Why do we have water rights in the western United States?

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3. What is the Doctrine of Prior Appropriation and how is it used to establish water rights?

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4. Explain three examples of beneficial water use common in the 1800s.

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### VOCABULARY:

**Doctrine of Prior Appropriation:** \_\_\_\_\_

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**beneficial use:** \_\_\_\_\_

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**SNOTEL:** \_\_\_\_\_

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**discharge:** \_\_\_\_\_

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**drought:** \_\_\_\_\_

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**runoff:** \_\_\_\_\_

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## ENRICHMENT ACTIVITY

Work in cooperative learning groups to develop rules for allocating a limited resource. Begin with half the group, a full bottle of drinking water and matching number of paper cups. Repeat this exercise:

1. with the entire group, distribute matching numbers of cups and a full bottle of water and
2. with the entire group, distribute matching numbers of cups and a half-bottle of drinking water.

Discuss and record rules you develop to determine how to allocate the water. Discuss problems that arise.

[illegible]



## LESSON 8

# Water Use in Nevada

### LEARNING OBJECTIVES:

- List current uses for water resources in Nevada.
- Analyze the effects of population growth on water usage and water issues in Nevada.
- Define the Endangered Species Act and Clean Water Act and contrast these policies with earlier federal policies governing water resource use.
- Hypothesize how attitudes toward water use may change over the next 100 years.

*Water resources in Nevada currently provide a wide range of emerging beneficial uses, including water parks.*

Nevada is the driest state in the nation. Rivers, streams and lakes or **surface waters** provide more than half (60%) of Nevada's total water supply. The remaining 40 percent of water supplies are provided by water flowing underground called **ground water**. Some areas in Nevada depend upon ground water for 100 percent of their water supplies.

Nevada's available water is heavily used and under great demand. Agriculture, cities, towns and industries currently are the primary water users.

Water shortages and water quality have become critical issues in most western states. There are more conflicts over water than ever before in the American West. These conflicts usually end with one interest group suing another for increased water rights and, more recently, for improved water quality.

Water is used for several different purposes in Nevada.

- Water is used to supply homes and businesses in surrounding towns and cities.
- Water is used to irrigate crops. These crops include alfalfa and other



hay crops, onions, garlic, melons, grapes and other vegetables.

- Water is used for watering livestock such as horses, dairy cattle, beef cattle and sheep.
- Water is used for wildlife habitat.
- Water is used for water recreation such as swimming, fishing and boating.
- Water is used to provide other recreation such as irrigated golf courses and parks.

## Population Growth and Nevada's Water

Since the United States was founded, population has increased steadily. Since the 1700s, people from all over the world have emigrated to the U.S. in search of job opportunities, religious freedom and to join families.

The United States Census Bureau (2002) currently estimates the nation's population at 287,400,000. By 2050, the population is expected to increase to 413,500,000.

In 2000, Nevada's share of the nation's population was estimated at 1,998,257. The majority of Nevadans live in urban areas including Las Vegas, Reno and Carson City. Rural areas located near these larger urban centers are growing rapidly, however, providing open space necessary to build industries, houses, businesses, schools and hospitals.

The availability of water resources in Nevada to meet the needs of growing cities and towns remains a question. Nevada is still the driest state in the U.S. and most of its water resources remain legally bound to irrigated agricultural lands.



*Increasingly, water demand in Nevada includes boating, swimming and fishing in addition to agriculture and mining.*

## Changing Attitudes toward Water Use

Compared with earlier times, Nevada currently contains economic activity other than agriculture and mining. In Nevada's rural counties and communities, however, agriculture and mining remain vital to their overall economic health. Individuals involved in agriculture and



❖ Known as “The Father of our National Parks,” **John Muir** (1838-1914) is considered America’s most influential conservationist. Muir immigrated to America from Scotland. In the late 19th century, he explored California’s Sierra Nevada. In 1892, Muir formed the Sierra Club, an environmental interest group organized to protect American wilderness.

*“No synonym for God is so perfect as Beauty. Whether as seen carving the lines of the mountains with glaciers, or gathering matter into stars, or planning the movements of water, or gardening — still all is Beauty!”*

— John Muir from  
*John of the Mountains*, 1938.

mining are concerned that water supplies may be inadequate to continue serving their interests as they have in the past. Families and businesses located in these rural communities are concerned that they may not have adequate water supplies to continue their way of life.

In contrast, Nevada’s urban areas are also concerned about obtaining adequate water supplies. A family of five currently consumes about 325,851 gallons of water per year or 1 acre-foot. Plentiful water supplies are essential to support population and economic growth.

In addition to these concerns, the U.S. government has implemented federal policies over the last 50 years, which have affected how the public considers water resources. One example is the **Endangered Species Act** enacted in 1973. This policy seeks to identify and protect wildlife species that are threatened or are in danger of becoming extinct. The policy was inspired by a growing environmental movement in the 1960s. This movement shaped the beginning of a change in attitude toward water resources. Rather than utilizing water to grow crops, produce timber, generate electricity or support commercial and residential growth, water resources increasingly are considered as wildlife habitat to be protected for wildlife use.

Another federal policy that continues to shape attitudes toward water resources is the **Clean Water Act**, enacted in 1972. An earlier version of the policy was enacted in the 1960s. The Clean

Water Act established water pollution law for the United States. Water pollution reduces water quality and affects how people and wildlife benefit from water use. The goal of the Clean Water Act is to achieve clean, fishable and swimmable rivers, streams and lakes in the United States.

Other indicators in the latter 20th century also reflect changes in attitude toward water use. These indicators involve the following:

- The number of farmers has decreased while the size of farms has increased. In many states, large businesses or corporations rather



than small farms produce crops and livestock.

- **Consumptive use** of water has become an important issue for water rights holders. Consumptive use of water is that amount of water that is diverted from a river making part of it unavailable for others to use. Consumptive uses can include livestock watering ponds, cropland irrigation, domestic wells and fishponds.
- **Nonconsumptive use** is also called **in-stream** use of water resources. Nonconsumptive uses include water to produce electric power, wildlife habitat and fisheries to protect water quality.

In western states where cities are growing rapidly and the number of farms and farmers is decreasing, there are strong differences of opinion regarding beneficial uses of water. Farmers and ranchers continue to irrigate land for crops and livestock. Businesses and families located in growing cities have increased urban and domestic demands for water. Water is also used to supply electric power. The number of environmental interest groups to protect water resources has also increased.

Many environmentalists demand water for the protection of fish and wildlife species in various locations in the American West, in addition to improved water quality for human usage. Irrigated agriculture is increasingly questioned as a beneficial use of scarce water supplies. Similarly, others question the protection and conservation of wildlife species and habitats as a beneficial use of scarce water supplies.



*Ranching, once an important part of Nevada's economy, must compete with other demands for scarce water resources.*

*Today, the protection of wildlife habitat is a beneficial use of water resources.*



## LESSON 8: REVIEW AND ENRICHMENT

1. List various uses for water in Nevada.

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2. Which of these uses for water involve you personally?

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3. Describe the ways in which attitudes towards water resources have changed since the first emigrants arrived in Nevada during the 1840s.

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### VOCABULARY:

**surface waters:** \_\_\_\_\_

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**ground water:** \_\_\_\_\_

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**Endangered Species Act:** \_\_\_\_\_

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**Clean Water Act:** \_\_\_\_\_

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**consumptive use:** \_\_\_\_\_

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**nonconsumptive use:** \_\_\_\_\_

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## ENRICHMENT ACTIVITY

Work in cooperative learning groups. Use your library and Internet to critique news stories or websites that discuss the Endangered Species Act (1973) or the Clean Water Act (1972). Find one example of how either policy affects how water resources are managed. Share the example with the larger group.

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, and the page is completely blank except for the lines themselves.

In cooperative learning groups discuss your feelings and ideas about water shortages or water quality issues. Hypothesize ways in which our attitudes toward water resources may continue to change over the next 100 years.

[illegible]

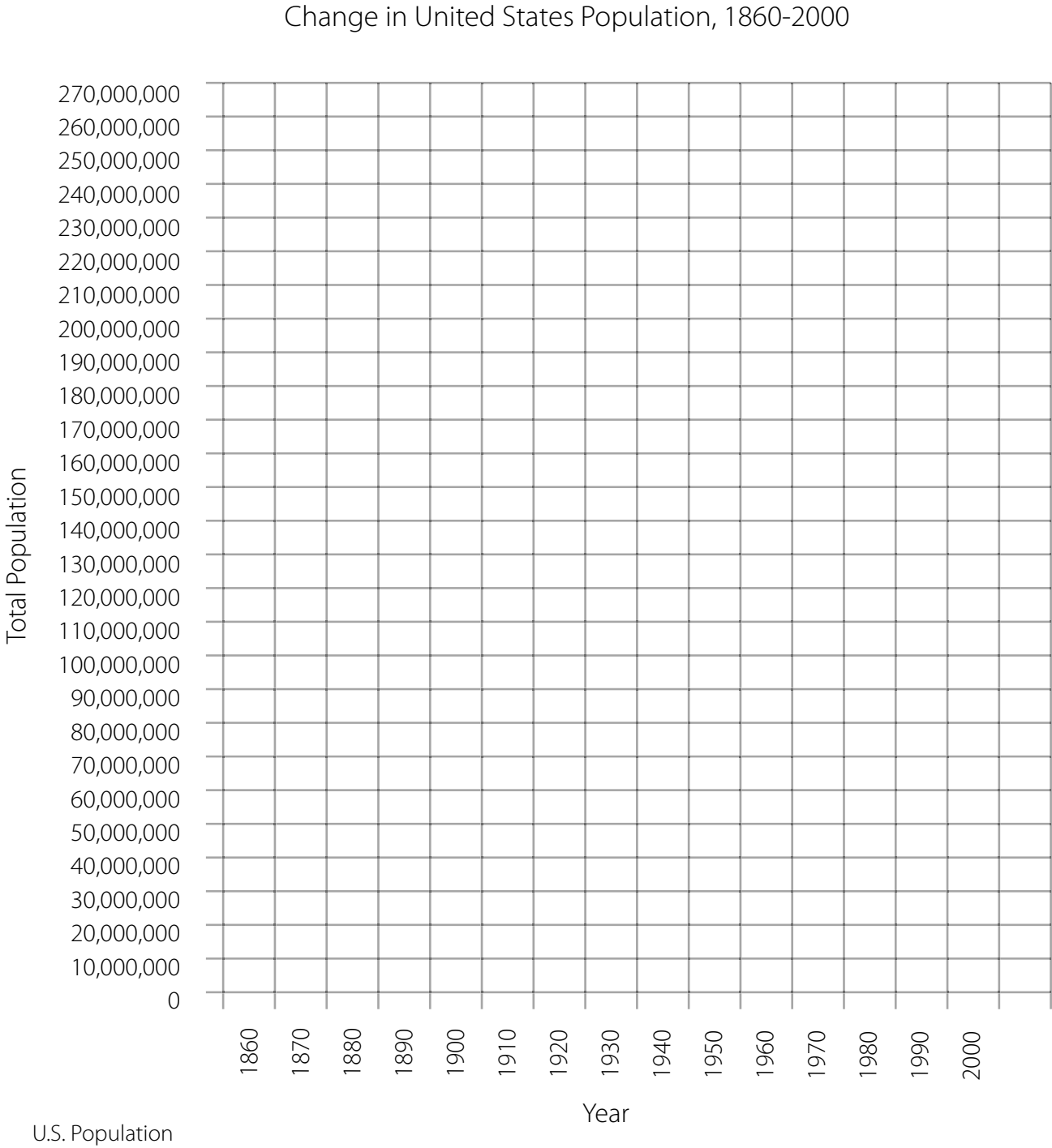
# ENRICHMENT ACTIVITY

Work in cooperative learning groups to investigate population growth in Nevada and the U.S. Use the United States Historical Census Data Browser located at: [<http://www.census.gov/population/www/documentation/twps0056.html>]. Record the total population figures for Nevada and the U.S. from 1860 to 1960. Create a table using three columns. In column 1, enter the year (for example, 1860, 1870, 1880, etc.). In column 2, enter the total population for the U.S. and in column three, the total population for Nevada.

Year	Total Population for the U.S.	Total Population for Nevada

ENRICHMENT ACTIVITY *continued*

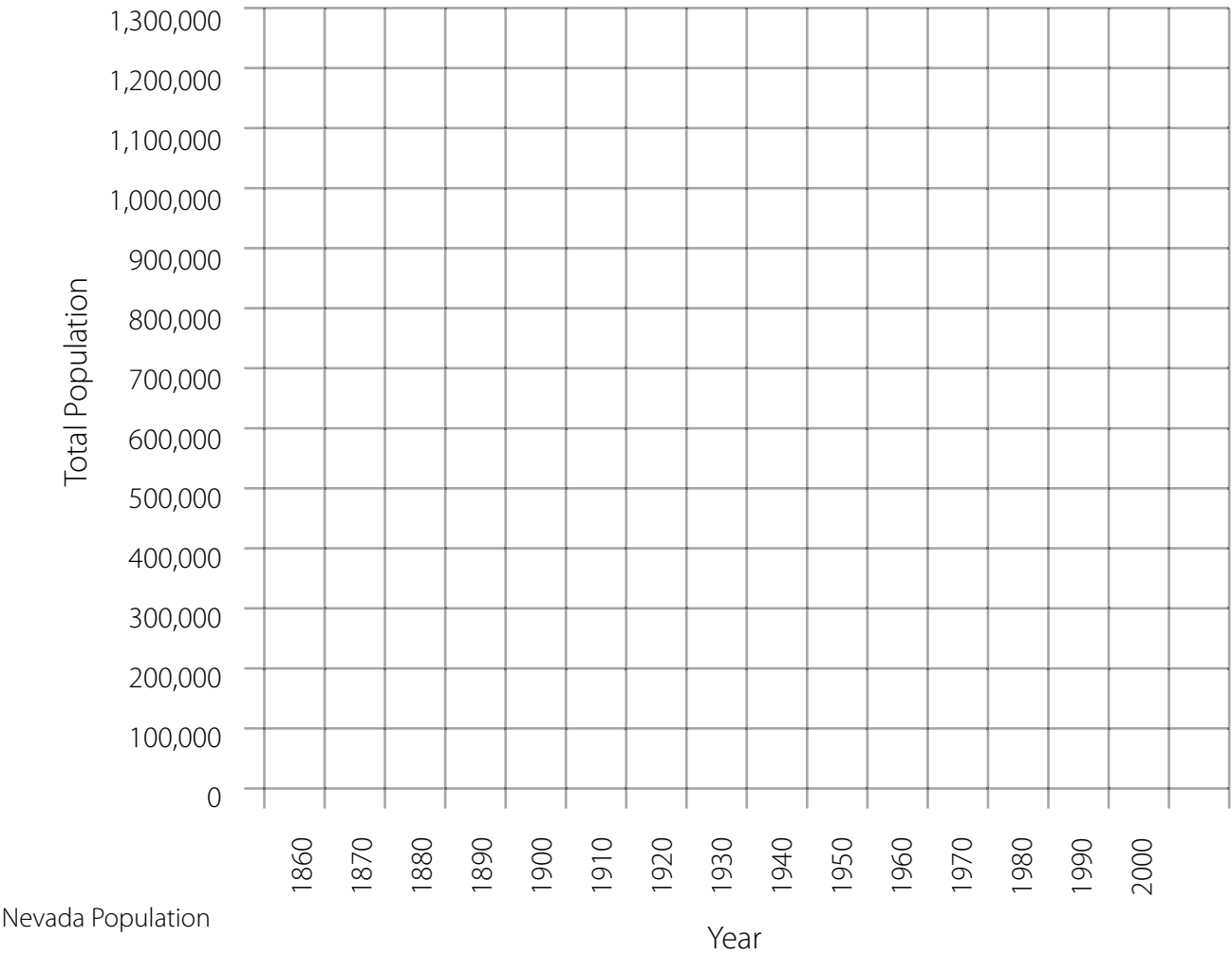
Use the graph provided to illustrate your research results for U.S. population growth. Discuss your results with the larger group.



**ENRICHMENT ACTIVITY** *continued*

Use the graph provided to illustrate your research results for Nevada population growth. Discuss your results with the larger group. What does your research indicate about population growth in Nevada and the U.S.? What do these results suggest about water resources and water usage in Nevada?

Change in Nevada Population, 1860-2000





## LESSON 9

# Water Quality Issues

### LEARNING OBJECTIVES:

- Define non-point source pollution and explain how it threatens water quality.
- List common non-point source pollutants in northwestern Nevada.
- Explain how urban development, mining and agriculture may contribute to non-point source water pollution.
- Explain and justify the use of best management practices, including precision agriculture and integrated pest management, to control non-point source pollution.

*Rapid urban development in northwest Nevada increases the demand for water to supply homes, businesses and industry.*

Experts believe that the leading cause of water quality problems in the United States is **non-point source pollution**. That is, as water flows across land and underground it collects salts, soil, nutrients, organic material, pesticides and metals along the way. As these substances are collected through runoff and are deposited into rivers and lakes, they can possibly harm water quality. Non-point source pollution is difficult to control because it is difficult to identify the pollution source or “point” of discharge. Water quality research indicates that urban development, mining and agriculture may contribute to non-point source pollution.

## Urban Development

Urban development can potentially harm water quality in a number of ways. The rapid growth of residential housing and commercial development on former agricultural lands can remove important ground cover. Paved roads, sidewalks, parking lots and other hard surfaces cannot absorb water and can increase water runoff carrying pollutants with it into nearby streams and rivers. The increase in



runoff can increase erosion making streams and rivers wider.

Wetlands, such as ponds and marshes, are often drained and filled to enable both urban growth as well as agriculture. This loss of wetlands reduces the amount of pollutants that are filtered out before runoff reaches streams and lakes.

The population in Nevada's cities is expected to rapidly increase over the next several decades. As in most western states, the amount of farmland and open space in Nevada is being converted to residential subdivisions and industrial and commercial development. This growth is likely to increase the amount of non-point source pollutants that find their way into the water supply. In industrializing and high-tech communities, industrial solvents, such as oils, soaps, as well as heavy metals may end up in nearby waters. Even urban gardens can contribute large amounts of pesticides normally associated with agricultural activities.

**Sustainable community development** is becoming a model for building ideal communities worldwide. Sustainable community development is a comprehensive approach to growth management. The approach suggests that people desire to build and live in communities that are conscious of food and water sources. They plan ways to manage residential and commercial growth to protect natural resources.

Sustainable communities support local agriculture that provides easily accessible high quality food supplies produced through minimal or nonuse of pesticides or inorganic fertilizers. They plan for economic growth, job creation, transportation and housing, with a clear understanding of their current and future land and water supply needs. Typically, areas are set aside where no building is allowed in order to provide open space for recreation, community gatherings and/or agriculture. Sustainable communities require its residents to work together to create a long-term plan for managing its natural resources.



*Water intensive landscapes, such as parks and golf courses, provide urban recreation but demand significant amounts of water to develop and maintain.*



## Mining

Water is used in mining gold, silver, copper, sand, or coal from the earth to wash rock and remove the desired minerals. Arsenic and mercury, used to mine gold, silver and copper, can add excessive amounts of metals to water resources.

Many older, unprofitable mines

*Actions taken to correct potential non-point source pollution from abandoned mine sites have been expensive and usually controversial.*

in Nevada have been abandoned. In addition to gold and silver, Nevada's mines have produced copper and zinc. These metals and other mine wastes routinely wash from abandoned sites. In large quantities they are toxic to humans, fish and wildlife.

It has been difficult to resolve non-point source pollution from abandoned mines, as many owners are either bankrupt or deceased. The responsibility for cleaning these sites has fallen to taxpayers

whose tax dollars help support government agencies such as the Environmental Protection Agency (EPA). Several actions taken to correct these problems throughout the U.S. have been expensive and usually controversial.

## DID YOU KNOW?



❖ In the 1800s, salt cedar or tamarisk was introduced in northwestern Nevada as an ornamental tree. Tamarisk is now considered an invasive weed species that uses large amounts of water and squeezes out other desirable native plants. It has since spread along the Walker River from Wabuska to Walker Lake. In 1997, the Walker River Paiute Tribe reported there were approximately 1,600 acres of salt cedar on its reservation above Walker Lake. The tribe is creating a strategic plan to control this weed.

## Agriculture

Some activities in agriculture, if not properly done, may contribute to non-point source pollution. These non-point source pollutants include excess nutrients from fertilizers, sediment from soil erosion, pathogens from livestock manure, pesticides and salts from soils.

Fertilizers are applied to croplands to add **nutrients** to soils, such as phosphorous and nitrogen, to improve fertility and plant health. This practice can increase the amount and quality of crops produced. Incorrect use of fertilizers on agricultural lands can add too many nutrients to the soils, which can end up in nearby rivers and lakes. In Nevada, excess nutrients such as nitrates and phosphates, are currently considered the most common non-point source pollutant. Excess nutrients can promote aquatic plant growth, such as algae. Too much aquatic plant





growth uses large amounts of oxygen in water that would otherwise be available to fish. Less available oxygen can reduce fish numbers.

**Sediment** pollution is caused by excessive soil erosion, which occurs when rock and soils break apart and are carried away by water, wind, gravity or ice. Sediment in rivers, streams and lakes can cloud water and reduce the number of plants that fish need to survive. Sediment is considered the second leading non-point source pollutant in Nevada's waters.

Soil erosion is a natural ongoing process. Poor land management can include excessive livestock grazing, failure to maintain ground cover such as grasses and other plants, and lack of an effective weed control program.

When weeds, particularly **invasive weeds**, are left uncontrolled, they can weaken soils along stream banks and increase soil erosion. Today Nevada faces many problems with invasive weed species. These are weed species that are not native to Nevada and so have no natural enemies or control mechanisms. They are difficult to control and are very aggressive overtaking other desirable and native plants. Examples include tall whitetop and tamarisk.

While animals grazing plants is a natural process, when kept in one place too long, animals can damage grasses and other plants that cover and hold soils in place. As plants become smaller and fewer due to overgrazing, soil erosion and runoff may increase. Stream banks may then fall away, which in time widens streams making them shallower. Wider, shallower stream flows can lead to higher water temperatures, which can harm some fish species and other water wildlife.

*Potential non-point source pollutants from agriculture can include excess nutrients from fertilizers, sediment from soil erosion, pathogens from livestock manure, pesticides and salts from soils.*

## **DID YOU KNOW?**

### **Holistic Resource Management (HRM)**

is a way to manage livestock grazing. Allen Savory introduced the concept in the U.S. in the 1970s. HRM suggests that short periods of intense grazing followed by short rest periods can actually improve soils and plant life. Many U.S. livestock ranchers practice HRM and similar managed grazing with positive results on water quality.



*Precision agriculture technology includes the use of weather monitoring stations that provide farmers with current information about temperature, humidity, solar radiation and wind speed and direction.*

**Pathogens** are considered the third most common non-point source pollutant in Nevada. Pathogens are bacteria from animal and human wastes that in large amounts can cause disease and illnesses in humans. When animals are allowed to graze for long periods close to rivers and streams, their wastes can become concentrated

in a small area and carried to streams through runoff. Animals and waterfowl sometimes deposit manure directly into streams.

**Pesticides** are chemicals that are necessary to control weeds and other undesirable things that harm crops. Farmers use pesticides to control weeds that threaten valuable crops. Government agencies use pesticides to control weeds on recreational and other public lands. Over use or improper use of pesticides can damage water quality.

Poor irrigation practices can increase **salinity** or the amount of salts moved from croplands into nearby rivers and lakes. Salinity, in large quantities, can harm water quality which in turn can be harmful to people and animals who drink the water and the wildlife that live in the water. Salinity or high salt content is common in Nevada because the soils are naturally high in salts. As water used to irrigate these soils is returned to the river, it can carry salts with it increasing the amount of salts in downstream rivers and lakes.

## Water Quality Management Plans

Many states currently require water quality management plans for mining and agricultural operations. Many of Nevada's agricultural producers are cooperating with government agencies, surrounding industries, communities and other interests to voluntarily develop water quality management plans that include their farm lands as well as entire river basins or watersheds.

**Best management practices** are proven and accepted methods that farmers and ranchers can use to control potential non-point source pollution. Grazing management systems, maintaining ground cover or desirable grasses and plants, manure management strategies, integrated pest management (IPM) and updated irrigation systems are examples of best management practices that can be used on agricultural lands to help control non-point source pollution.

Integrated pest management, or **IPM**, involves a strategic approach to



weed and pest control. It requires farmers to continually monitor their lands to inventory the population of invasive weeds.

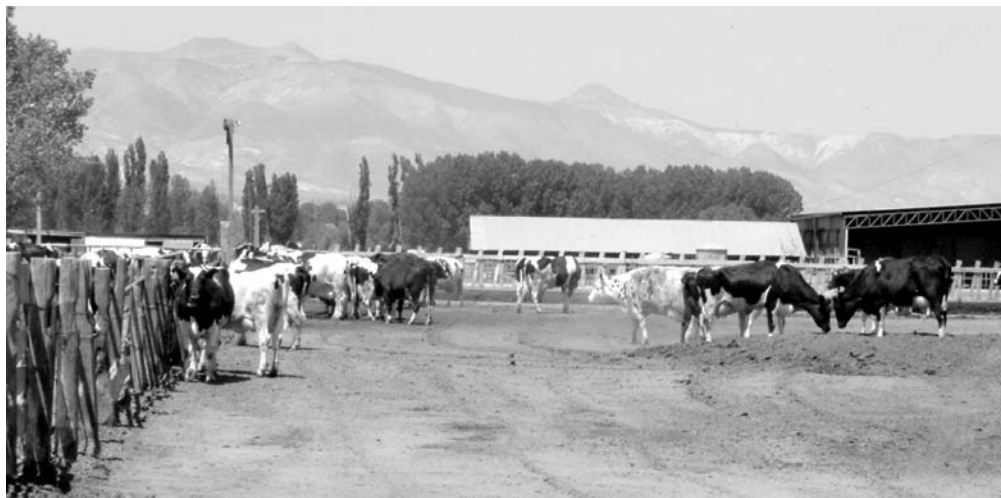
Alternatives to pesticides are recommended and include hoeing, pulling, mowing, mulching and grazing. However, if pesticides are required to control weeds, as is often the case with invasive weeds, IPM provides guidelines for selective and correct usage following all pesticide label precautions and instructions.

**Precision agriculture** is a modern approach to improving farm management practices. It combines computer mapping software and satellite technology with strategic and sound farming practices. It involves the use of global positioning system (GPS) satellite receivers and geographic information systems (GIS). This technology is used to collect and map information about fields, including soil characteristics, weather patterns, growing conditions, previous crop yields and land slope.

Using maps generated from GPS and GIS technology, soil samples are taken and analyzed in order to specify soil strengths and weaknesses. Farmers can use the information to pinpoint precisely where within a field to apply fertilizers and pesticides rather than treating an entire field.

Precision agriculture may help to reduce the amount of fertilizers and pesticides applied and purchased which in turn reduces the amount that may end up in water supplies. Precision agriculture may also help to increase crop yields. Barriers to widespread adoption of precision agriculture, however, include the cost of the GPS and GIS technology as well as knowledge required to operate the equipment and utilize the resulting information.

**Organic farming** is also a recent enterprise in Nevada. Organic farming means that crops and livestock are produced without the use of pesticides, fertilizers, growth hormones or additives. Nevada's Department of Agriculture has the authority to certify agricultural products as organic. Any organic product that is sold in Nevada has to pass a strict set of standards before it is certified organic.



*Livestock producers in Nevada voluntarily control for potential non-point source pollutants by utilizing best management practices.*



*Precision farming combines modern computer software and hardware with sound management decisions in order to improve agricultural production practices and protect natural resources.*

## LESSON 9: REVIEW AND ENRICHMENT

1. Experts believe that the current cause of water quality problems in the United States is:

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2. Describe activities that potentially contribute to non-point source water pollution.

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3. List 5 non-point source pollutants found in Nevada's rivers and lakes:

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4. Explain how invasive weeds can harm water quality.

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5. Explain how unplanned urban and residential growth may contribute to water pollution.

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6. Explain the concept of sustainable community development.

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7. Explain how sustainable development might improve water quality.

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## VOCABULARY:

**water quality management plan:** \_\_\_\_\_

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**best management practice(BMP):** \_\_\_\_\_

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**non-point source pollution:** \_\_\_\_\_

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**nutrients:** \_\_\_\_\_

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**sediment:** \_\_\_\_\_

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**invasive weeds:** \_\_\_\_\_

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**pathogens:** \_\_\_\_\_

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**pesticides:** \_\_\_\_\_

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**salinity:** \_\_\_\_\_

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**geographic information system:** \_\_\_\_\_

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**global positioning system:** \_\_\_\_\_

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**organic farming:** \_\_\_\_\_

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**precision agriculture:** \_\_\_\_\_

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In cooperative learning groups, use the Internet resources provided in this publication to investigate at least two *best management practices* to help control non-point source pollutants. Record findings and share with the larger group.

[illegible]

## ENRICHMENT ACTIVITY

Use Internet Resources provided to discover information about *precision farming*. Summarize the goals of precision farming and list three examples of precision farming.

[illegible]



# Water Conservation Issues

## LEARNING OBJECTIVES:

- Develop an awareness of current pressures for Nevada's farmers to conserve water.
- Describe and contrast three common irrigation methods used in Nevada.
- Develop an awareness of water conservation choices for urban and domestic water users.
- Use the home water audit provided to analyze daily water usage.

**W**ater scarcity is one of the most pressing issues facing the American West. Water conservation is likely to become a critical issue in the future. We all need water in order to live. Water conservation involves making choices about how we use water in our daily lives.

## Irrigation Choices for Agriculture

Farmers and ranchers in Nevada face increasing pressure to conserve water used to irrigate agricultural lands. In addition to farmers and ranchers, environmentalists, urban and domestic water users, utility companies and industries need water resources. The increase in competition for water resources suggests that efforts must be made to conserve water. Conserving water through irrigation sometimes involves investment in new irrigation technology and requires learning new options.

In arid western states, there are at least three irrigation methods from which to choose. Irrigation methods are selected based on costs of equipment, installation and operation. Choices may also be influenced by the amount of knowledge needed to adopt a new method.

**Surface irrigation:** Early irrigation methods were based on gravity moving water from streams through ditches dug to field edges. When the water reached the fields, it flowed over the field's surface. Fields had to be prepared so that the water would spread through all parts of the field equally. The method was the earliest used because it is simple and does not require power or expensive water delivery equipment. More recently, many farmers have lined water delivery ditches with concrete to move water faster to reduce the amount lost to evaporation and seepage into ditch banks and vegetation.

**Microirrigation:** Microirrigation is also called drip irrigation. Water is delivered to fields in drops or trickles through pipes and tubing. This method can conserve large amounts of water but can be costly to install and maintain. It also requires knowledge of method operation.

**Sprinkler irrigation:** Sprinkler irrigation delivers water to fields through pressurized pipes to a

## DID YOU KNOW?



❖ In efforts to conserve water, some farmers in Nevada have installed soil moisture monitors and weather stations in strategic locations in fields. This precision approach allows farmers to measure growing conditions more carefully and irrigate crops at ideal times based on weather and soil conditions.



sprinkler device. The idea is to imitate rainfall. Less water evaporates through this method than through surface irrigation and requires less monitoring once the sprinklers are set in place. Sprinklers may be costly to purchase, install and maintain. They also require power to operate.

*Surface or flood irrigation is widely used in the west.*

## Urban and Domestic Water Use

In western states, water for urban and domestic consumption often comes from streams, lakes and reservoirs many miles away. Water is delivered, treated, used and then treated again before being released. Droughts, increases in population and water conflicts can create water shortages for urban and domestic water users.

Water conservation practices are based on awareness of how much water is used and how that amount of water can be reduced. Citizens can learn to use less water through increased awareness and conservation practices.

A **water audit**, or a reasonable estimation of how much water is used for various daily activities, can help citizens to understand how much water they use. A water audit is a good place to begin in building water conservation awareness.



## Sprinkler irrigation examples

*Solid set*



*Pivot*



*Wheel line*

82

## Microirrigation examples



*Subsurface drip*

*Surface drip*



## LESSON 10: REVIEW AND ENRICHMENT

1. Explain the pressures Nevada's farmers face to conserve water.

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2. Describe three irrigation methods and explain which is used most commonly in Nevada and why:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

### VOCABULARY:

**surface irrigation:** \_\_\_\_\_

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**sprinkler irrigation:** \_\_\_\_\_

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**micro irrigation:** \_\_\_\_\_

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**water audit:** \_\_\_\_\_

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## Home Water Audit: How Much Water Do We Use? Part I

Water Use	Column A Predicted # of water uses per day	Column B Actual # of uses per day	Column C # of gal. per use	Column D Actual # of gal. used per day (B x C = D)
Brush teeth for two minutes, water running			6 gallons	
One toilet flush			5 to 7 gallons	
Wash dishes by hand, rinse in running water			20 gallons	
Shower			5 gallons/minute	
One dishwasher cycle			12 to 15 gallons	
Bath			30 gallons	
Wash hands, water running			3 gallons	
One clothes- washing cycle			50 gallons	
Get a drink with water running			1/4 gallons	
Water lawn 10 minutes			75 gallons	
Wash car with hose running			10 gallons/minute	
				Total

1. Write down any other water uses that are not listed. Research to find out how many gallons of water that use requires.
2. Think of how often you use water every day. In Column A, write down how many times you think you conduct a particular activity each day.
3. Throughout the day, record how many times you actually use water for these activities. Enter these numbers in Column B.
4. Multiply the number of times you actually use water by how many gallons each use generally requires.
5. Add all the numbers in Column D.
6. Write your answer in the last box in Column D. This is the estimated number of gallons of water you use every day.

Source: Nelson, D., et al. 2000. The Watercourse. Conserve Water! (Educators' Guide).



## Home Water Audit: How Much Water Do we Use? Part II

Water Use	Column A Water Consumption Action (suggested or your own action)	Column B Actual # of uses per day	Column C Estimated # of gal. per use		Column D Actual # of gal. used per day (B x C = D)
			Without conservation action	With conservation action	
Brush teeth for two minutes, water running	Brush and rinse, water not running		6 gal.	1/2 gal.	
One toilet flush	Low-flush toilet		5-7 gal.	3 gal.	
Wash dishes by hand, rinse in running water	Wash dishes and dip in pan of water to rinse		20 gal.	5 gal.	
Shower	5 minutes of low-flow showerhead		*5 gal./min.	12 gal./min.	
One dishwasher cycle			12-15 gal.		
Bath			30 gal.		
Wash hands, water running	Turn off water between wash and rinse		3 gal.	1/2 gal.	
One clothes-washing cycle	Adjusted water level		50 gal.	25 gal.	
Get a drink with water running	Pour glass from water pitcher in fridge		1/4 gal.	1/16 gal.	
Water lawn 10 minutes			75 gal.		
Wash car with hose running	Use bucket, sponge, and controlled-flow nozzle		10 gal./min.	5 gal. total	
					Total

\* 5 gal. x length of shower in minutes = total water used.

\*\* 10 gal. x number of minutes hose is running = total water used.

1. Write down any other water uses that are not listed.
2. Conduct your daily water activities, but think of ways in which you could conserve water. Several suggestions are listed in the chart.
3. Add up the total number of gallons in Column D.
4. Compare the total number of gallons in Column D with the number of gallons you used on Water Audit Part I.
5. How many gallons did you save in one day by practicing a few simple water conservation actions?
6. How many gallons would your family save in one day if everyone participated in these water conservation actions?
7. How many gallons would your family save in one month?

Source: Nelson, D., et al. 2000. The Watercourse. Conserve Water! (Educators' Guide).

## ENRICHMENT ACTIVITY

In cooperative learning groups, design ways in which individuals can change their lifestyles to use less water. Discuss how these changes can affect water shortages.

[illegible]

# Current Water Conflicts

**T**he Truckee, Carson and Walker Rivers each lie at the center of controversy surrounding water usage, shortages and water quality. These conflicts have evolved over many years. To better understand the conflicts it is necessary to explore and understand the events underlying the conflicts. While current issues involve water usage, shortages and quality, many issues involve historical events. These events include the mining boom, federal land grants and settlement policies, the Paiute War and the National Reclamation Act. At the time of these events, no one could have anticipated the issues that would arise and conflicts that would develop decades later.

## Truckee and Carson River Conflict

In 1844 when John Fremont first saw Pyramid Lake at the mouth of the Truckee River, he reported that the [Pyramid Cutthroat] trout were plentiful and weighed around 40 pounds. As settlement of northwestern Nevada continued through the 1800s and early 1900s, federal policies stimulated settlement further through irrigated farming. In 1905, The Truckee River was diverted away from Pyramid Lake to join the Carson River, which was dammed to create Lahontan Reservoir. These waters were dedicated to irrigate land in order to grow crops and livestock to feed a growing population and to attract more people to the area.

### LEARNING OBJECTIVES:

- ▶ Summarize events leading up to the current water conflict involving the Truckee and Carson Rivers.
- ▶ Summarize events leading up to the current water conflict involving the Walker River.
- ▶ Compare similarities and contrast differences between the conflicts outlined above.
- ▶ Develop and recommend possible outcomes for both conflicts.

*When Captain Fremont arrived at the mouth of the Truckee River, he was impressed by the appearance of the great rock formations and vast size of Pyramid Lake.*



Reservation lands set aside for the Pyramid Lake Paiute in 1859 restricted their nomadic hunting and gathering lifestyle. The Pyramid Lake Cutthroat Trout provided ample food for the tribe and made the reservation a nationally acclaimed fishery. In the 1950s, however, due to river diversions lowering the lake level and over fishing by both non-Indians and Indians, the Pyramid Lake Trout became *extinct*.

Even though the Lahontan Cutthroat Trout was introduced into

### DID YOU KNOW?



❖ **Cui-ui** is a large plant eating fish that only occurs in Pyramid Lake. The cui-ui is a lake dweller that swims upstream each spring to spawn. The cui-ui can live up to 50 years and weigh up to 7 pounds. It is one of three remaining species of the family [Chamistis, L.]. Of the three, its habitat is most intact, offering the best chances for species recovery. A recovery plan is currently approved that requires water to be acquired to elevate Pyramid Lake and improve fish passage into Truckee River.

Pyramid Lake in attempts to reestablish a fishery, the lake's popularity was in decline. To complicate matters, in 1967, the cui-ui fish were listed as an *endangered species*. The cui-ui were unable to access the Truckee River and swim upstream to reproduce, putting it in danger of becoming extinct. Water diverted to the Newlands Project by Derby Dam had reduced Pyramid Lake's elevation and created, in many years, a large deposit of sand and silt to form at the mouth of the Truckee River blocking the fish passage upstream.

In 1968, the Pyramid Lake Paiute Tribe filed the first of a series of legal actions claiming that water was being illegally diverted to the Newlands Project and reducing flow into Pyramid Lake. In 1973, a federal court ordered the Bureau of

Reclamation to deliver more water from Truckee River to Pyramid Lake. Finally, in 1982, a federal court ruled that water from Stampede Reservoir, located in the Truckee River headwaters, was to be used strictly for Pyramid Lake to help re-establish the lake as a fishery for cui-ui and stocked Lahontan Cutthroat Trout.

Farmers responded to tribal lawsuits in order to protect their water rights. Many farmers now believe they are the victims of changing attitudes toward water use and federal policy regulating water use.

In addition, the cities of Reno, Sparks, Fernley and Carson City have

grown at rapid rates and support large numbers of private homes, businesses and industry. Utility companies that provide electricity to these cities, have necessarily been added to the list of critical water users. Utility companies remain interested in acquiring water to support future growth.

Finally, environmental interests are concerned about the fate of an area previously known as Stillwater Marsh. Stillwater Marsh is one of the last remains of ancient Lake Lahontan. In the mid-1800s, explorers and settlers found the area rich with large numbers of cattails, fish and birds, in addition to the Toidikadi or Northern Paiute who lived in this area. As irrigated farms increasingly replaced marshlands, native animals and plants grew scarce. The Newlands Irrigation Project further reduced water flowing into the marsh. In 1948, the U.S. Fish and Wildlife Service, along with the Nevada Fish and Game Commission, joined with the Truckee Carson Irrigation District to develop Newlands Project lands for wildlife and grazing. These lands became the Stillwater Wildlife Management Area.

In the 1980s, a series of negotiations were held involving the Pyramid Lake Tribe, U.S. Bureau of Reclamation, Newland farmers, Sierra Pacific Power Company, U.S. Fish and Wildlife and other interests. The purpose of the negotiations was to resolve the longstanding conflict over the diversion of water from Truckee and Carson Rivers and the effects of water diversions for irrigation.

The negotiations resulted in the **Truckee-Carson-Pyramid Lake Water Settlement Act**. This act awarded \$40 million to the Pyramid Lake tribe for economic development. However until a final operating agreement is reached involving all negotiating parties, the settlement funds are not available for tribal use. The negotiating parties continue to work toward reaching an operating agreement.

The settlement also set aside 77,500 acres at Carson Sink to establish the **Stillwater National Wildlife Refuge** and water to supply the refuge in order to protect its wildlife. The refuge seeks to purchase water rights in order to sustain additional refuge acreage to support wildlife and plant populations.

## Walker River Conflict

Evidence shows that about 4,700 years ago and, then again, about 2,600 years ago, Walker Lake completely dried up. What caused this to happen is not exactly known. It may have been natural forces causing the river to overflow at its banks near Wabuska. Scientific evidence indicates that about 5,000 years ago the Walker River flowed through the Adrian valley into the Carson River and covered the





Since 1882, Walker Lake's surface elevation and water quality have declined challenging the lake as a viable fishery for the Lahontan Cutthroat Trout.

The Lahontan Cutthroat Trout (right) at Walker Lake is listed as a threatened species, meaning that it may become endangered in the foreseeable future.

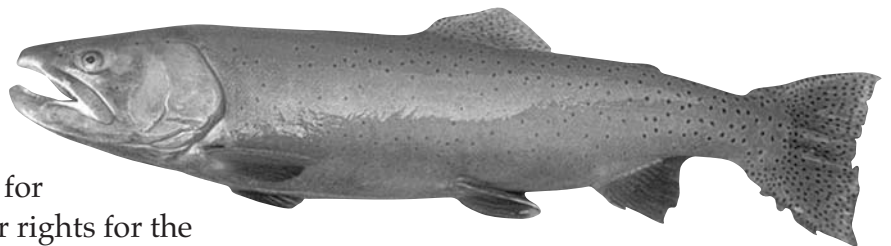
Carson Sink with water to a depth of about 80 feet. This is called a **pluvial event**. It indicates that either the climate was much wetter than normal or the banks of Walker River shifted to allow water to overflow for a period of time. Alternatively, Walker Lake may have dried up due to an extensive period of drier than normal weather conditions.

Walker Lake is facing similar problems today. The water level is dropping. Since 1882, Walker Lake's surface elevation and water quality have declined steadily. There is a build up of **total dissolved solids**, especially salts making the lake's water an unproductive fishery for Lahontan Cutthroat Trout. The Walker Lake Lahontan Cutthroat Trout is listed currently as a *threatened species* meaning that it likely will become

endangered in the foreseeable future.

The social issues involving Walker Lake are more complex than 4,700 or even 2,600 years ago. As the case with many western rivers, Walker River has provided water to irrigate farmland, mine minerals and supply growing cities and towns throughout its watershed for the past 100 years. As also the case with many western rivers, Walker River has been over-allocated. There are more water rights claims than there are water supplies to satisfy those claims.

In 1992, the United States joined with the Walker River Tribe to file claims for storage water rights for the Weber Reservoir (1933) and for a senior water right to irrigate lands returned to the reservation in 1936 that were a part of the original reservation created in 1859. All water



right holders upstream of the reservation are defendants.

There are 2,100 acres of irrigated farmland on the reservation, which are primarily 20-acre allotments. With additional water rights, however, the reservation could irrigate an additional 8,000 acres.

This additional irrigated acreage would increase reservation income. The tribe would also like to update and rebuild Weber Dam, which is currently listed as an aging and dangerous dam structure. A new dam would enable the tribe to increase the size of their storage reservoir to improve irrigation flows and their capacity to manage floodwater.

Walker Lake is located in Mineral County, Nevada. The Walker Lake Working Group, an environmental interest group organized to protect Walker Lake and its wildlife, partnered with Mineral County government in 1994 to file a new and senior claim to water rights. The purpose of this legal action is to increase water that reaches Walker Lake annually by establishing a minimum lake level at Walker Lake. Since the Walker Lake Working Group seeks to protect the Lahontan Cutthroat Trout population at Walker Lake, they would also like to see a device installed at Weber Dam called a “fish ladder” to enable the fish to swim upstream to spawn. Since lower lake levels have also resulted in poorer water quality at the lake, the Walker Lake Working Group filed suit against the Nevada Division of Environmental Protection in 2001 for failure to enforce non-point source pollution provisions of the Clean Water Act.

If either or both the Walker River Tribe or the Walker Lake Working Group win their lawsuits, farmers upstream from Walker Lake will have less water to irrigate farmland. This will affect their ability to produce crops. This, in turn, may hurt the economic health of communities upstream where many farms, agricultural employees and agricultural related services are located.

The Walker River conflict is further complicated by an increase in residential development in the area. Because the Walker River Basin offers a quiet rural lifestyle and comparatively lower real estate prices, it has become a popular destination for retirees. Many of these retirees are concerned that if Walker Lake receives more water, farmers will simply pump groundwater to make up for the loss of surface water rights. Continuous and increased groundwater pumping, they believe, would lower the water table in the Walker River system and harm domestic wells that residents in agricultural valleys rely upon for water supplies.



*The Walker River Paiute Tribe would like to update and rebuild Weber Dam, listed currently as an aging and dangerous earthen dam structure. A new dam would enable the tribe to increase the size of their reservoir, improve irrigation flows and increase their capacity to manage floodwater.*

# LESSON 11: REVIEW AND ENRICHMENT

1. Work in cooperative learning groups to create a timeline of events leading up to the current water conflicts involving the Truckee and Carson Rivers.

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2. Work in cooperative learning groups to create a timeline of events leading up to the current water conflicts involving the Walker River.

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VOCABULARY:

Truckee-Carson-Pyramid Lake Water Settlement Act: \_\_\_\_\_

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Stillwater National Wildlife Refuge:

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pluvial event: \_\_\_\_\_

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total dissolved solids: \_\_\_\_\_

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## ENRICHMENT ACTIVITY

Working in cooperative groups, share timelines to:

1. categorize similarities and contrast differences between the conflicts and
2. develop and recommend other outcomes.

[illegible]

## ENRICHMENT ACTIVITY

Work in cooperative learning groups. Use the Internet resources provided to:

1. describe the life cycle of Cui-ui and Lahontan Cutthroat Trout and
  2. explain and contrast differences between *extinct*, *threatened* and *endangered* wildlife species.
- Share your results with the larger group.

[illegible]



# Collaborating to Manage Water Conflicts

**S**ome of the most difficult problems facing future Nevadans involve water shortages and water quality. As Nevada continues to grow, demands for water will increase. Farmers are unlikely to give up water rights. The Northern Paiute are likely to continue to demand more water to reestablish fisheries and/or irrigate more reservation lands. Environmentalists will continue to make new claims on water to protect water quality and wildlife. Problems with water shortages and water quality are perhaps the greatest challenge Nevadans face.

## Understanding Water Conflict

Water shortages and quality problems quickly lead to conflict. The conflict arises largely from disagreement and uncertainty regarding solutions to the problem. It also arises from disagreement about who is right or wrong. Individuals also form groups to assert a position. They begin to form strong feelings and perhaps even begin to dislike other groups who disagree with them. Sometimes groups take the conflict personally. A circle of distrust and dislike is formed. Around and downward the circle spirals fueled by anger, frustration and blame.

Unfortunately, this downward spiral does nothing to correct the water problem or resolve the conflict. The downward spiral does not produce any solutions. In fact, the downward spiral can only worsen the conflict. In order to manage water problems and look for solutions, it is important to recognize this spiral and step outside it.

### LEARNING OBJECTIVES:

- Explain how water shortages and water quality problems lead to conflict.
- Demonstrate an understanding of the downward spiral of unmanaged conflict.
- Summarize steps to manage conflict collaboratively.
- Define the term stakeholders and explain their role in managing conflict collaboratively.

*Future Nevadans will face continued conflict surrounding water shortages and water quality issues.*





*Youth can make a difference by learning about water resource issues and acquiring the skills needed to manage conflict collaboratively.*

Specific steps can be taken to stop the downward spiral. These steps require taking responsibility for cooperatively learning about the problem and collaborating to manage the conflict. The first step is to identify stakeholders.

## What are Stakeholders?

When it comes to water conflicts, **stakeholders** are anyone with a “stake” or interest in finding solutions to the conflict. In the Truckee, Carson and Walker Rivers, stakeholders include the Northern Paiute, non-Indian farmers, factories, fishermen and boaters, environmentalists, and the average homeowner with a desire to water the garden or lawn. Every person who depends on water from these rivers is a stakeholder. With such a large and diverse collection of stakeholders, it is no wonder water conflicts are complex. Still, to approach problems cooperatively and manage conflict collaboratively means including all stakeholders.

Excluding stakeholders can only worsen a conflict. Those who are excluded can work to undermine any collaborative effort and keep others involved in a downward spiral.

### DID YOU KNOW?

❖ Water shortages and water quality problems will likely become the biggest challenge Nevadans face in the future.

## Additional Steps to Manage Conflict

Additional steps to manage conflict collaboratively include efforts to learn cooperatively about conflict in order to clarify the problem and its underlying issues. It requires stakeholders to understand their stake in the conflict.

Cooperative problem solving provides numerous benefits. It provides each stakeholder opportunities to learn to listen more carefully, learn to speak more carefully, understand the causes of the conflict, generate creative ideas and feel more committed to finding satisfying solutions together.

Once stakeholders have been identified, they must work cooperatively to:

- Describe the conflict.
- Learn about the problem and causes of conflict.
- Ask one another “why am I concerned about this problem?”
- Ask one another “what can I do to improve the situation?”

## LESSON 12: REVIEW AND ENRICHMENT

1. Why are water conflicts likely to continue in the future?

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2. Describe the “downward spiral of conflict.”

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3. List five actions to collaboratively manage conflict.

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- 2) 

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- 3) 

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- 4) 

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- 5) 

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4. Describe the benefits of addressing problems underlying the conflicts.

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5. What is a stakeholder?

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6. Why is it important to include all stakeholders in collaborative efforts to manage conflict?

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## 98

[illegible]

CALMING THE WATERS • Loretta Singletary

## LESSON 13

# Values and Facts

Conflict over water arises out of differences in ideas, attitudes and beliefs. Each has a place in our personal value system. Our personal value system influences how we think about problems and how we approach problem solving. Our value system helps us to express who we are.

When stakeholders come together to cooperatively work on water problems, they naturally bring with them different value systems. These differences in values often are discovered to be the root of the conflict. To approach problem solving cooperatively requires all stakeholders to first recognize that different stakeholders have different values. They each have something different and very real “at stake.” Not until all stakeholders recognize and accept that each stakeholder has a valid interest at stake will the problem be solved by cooperatively and collaboratively working together.

## Working with Facts

Responsible stakeholders will cooperate with one another to jointly find facts to learn about and understand the problems underlying the conflict. **Joint fact-finding** is a critical part of collaboratively managing conflicts.

Care must be taken that in searching for facts we look for reliable information. It is important to find more than one source of information. We must be careful to consider if information is current and accurate. The information should not **advocate** or support any stakeholder’s particular interest or position. Credible information provides facts that help explain issues that underlie the conflict without taking sides in the conflict.

### LEARNING OBJECTIVES:

- Explain how personal values shape attitudes towards conflict and conflict management.
- Contrast the differences between interests and positions in conflict situations.
- Explain how joint fact-finding can help manage conflict.

*In practicing joint fact-finding, interested stakeholders seek credible information to provide facts but avoid advocating a particular solution.*







*Scientific facts must balance with stakeholder values to manage conflict collaboratively.*

## Balancing Facts and Values

Cooperatively managing water conflict requires everyone involved to balance facts about the problem with values or feelings about the problem. Water use and other natural resource problems cause strong feelings to be expressed because natural resources are shared resources. We all want clean air, plenty of clean water, beautiful mountains and valleys, fresh and wholesome foods, and enough personal space to live, work, and recreate.

To work with facts means to seek out, sort through, organize, and share truthful and credible information that might help others to better understand the problem. To balance values with facts requires us to be honest with one another about our concerns—why do we feel a particular way about the problem instead of focusing on finding an instant solution to the conflict.

### DID YOU KNOW?

❖ Water conflicts cause strong feelings to be expressed because water resources are shared resources. We all want plenty of clean water.

## Focus on Interests — Not Positions

Each stakeholder must think about and be able to speak about their **interests** in water. This means telling others how you feel about the water issue and why — not how to solve the problem. Stating your solution to the water conflict is called a **position**. Taking a position is not a part of cooperative problem solving.

LESSON 13: REVIEW AND ENRICHMENT

1. What is a personal value system?

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2. How do our personal value systems shape our attitudes toward water conflicts?

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3. Explain the difference between an “interest” and a “position.”

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## ENRICHMENT ACTIVITY

Work in cooperative learning groups to discover and report three facts about:

1. Walker Lake,
2. Pyramid Lake and
3. Stillwater Refuge.

Practice joint fact-finding skills to locate and present your findings to the large group.

[illegible]

# DAWG to step up efforts to de-list Lahontan cutthroat<sup>6</sup>

*Request for USFWS DOCUMENTS PART OF THE PROCESS; GROUP'S President fears trout recovery effort could eventually lead to Walker River being declared a threatened river habitat.*

**By Keith Trout**  
News Editor

**T**he local Dynamic Action on Wells Group (DAWG) and its president, David Haight, have received over 19,000 pages in eight boxes of information from the U.S. Fish and Wildlife Service (FWS) about the Lahontan Cutthroat trout recovery efforts; and an analysis of that information is part of the group's effort to delist the fish.

The LCT was initially placed on the federal endangered species list about 30 years ago but was changed to the threatened list to facilitate management for recreational purposes by the Nevada division of Wildlife.

DAWG sought information about the LCT recovery as part of a Freedom of Information Act (FOIA) request and hopes to use the information to halt the current recovery efforts and to de-list the fish from the threatened list.

Haight said the continued recovery efforts, as part of the federal Endangered Species Act (ESA), could threaten agriculture and Walker River water diversions for irrigation upstream from Walker Lake. He noted at this point it appears the group might have to consider legal action if it is deemed necessary for its efforts.

Haight, who relies on a domestic well for his water supply, said that reducing diversions, with water staying in the river, could negatively impact Mason Valley groundwater and domestic wells. He said the impacts on the area groundwater and wells of water not being used for irrigation has been ignored by those involved, including Walker River Basin Environmental Impact Statement (EIS) being prepared for the Bureau of Land Management, which has the options of buying upstream water rights to provide supplemental water to Walker Lake.

In response to DAWG's request for information, the FWS said 28,000 pages had been identified overall, and 19,691 pages were sent to DAWG attorney William Schaeffer in December. Haight said FWS said some documentation couldn't be released now, with one reason being that some of the paperwork was under the control of the U.S. Army.

Haight said the trouble with current efforts to get water in an effort to preserve Walker Lake, mainly through water rights buyouts, is that those buyouts would seriously hurt Mason and Smith Valleys. He has also gone so far as saying it would "result in the destruction (of agriculture) of Mason and Smith Valleys" and has often said the water desired would only have a temporary effect and wouldn't permanently save the terminal lake.

Haight said the steps proposed to get more water to the lake

would also "destroy domestic wells" in the areas, noting the replenishment of the groundwater from irrigation would be lost with less diversions, and that farmers would also be using ag wells more often, putting a second drain on the aquifer.

According to DAWG studies, the domestic wells would go dry in the southern end of the valley first, then the northwest section, and then the "Poverty Flats" area.

Haight also charged said of the Walker settlement talks or negotiations, "It is their duty to show in any agreement made that it will now affect domestic wells," noting domestic wells are not even mentioned in the initial administrative draft of the Walker River EIS.

Haight charged the danger of the LCT recovery effort and water transfers is that if the transfers are approved for the benefit of the threatened fish, then "they can declare the entire Walker River system as a threatened fish species habitat."

He added, "With the initial transfer of water for the benefit of the fish, they can come upstream and declare (the river) threatened species water under the Endangered Species Act."

He also charged there is a potential that might result from the settlement talks, saying, "That's the danger of these negotiations."

Haight said with the way things are going and the federal programs (EIS and LCT recovery), "It appears the only solution to saving Mason Valley and Smith Valley is through legal actions."

He also said that according to the information he has heard or seen for the saving of Walker Lake, such as the Thomas Report, about 70,000 acre-feet per year is needed each year (although some reports have listed figure around 50,000 acre-feed per year).

However, he said the optional steps suggest to augment the river water going to the lake would produce very little and "They're all worthless," he said of those other steps.

Haight said he heard through John Singlaub, manager of the Carson City BLM Field Office, that cloud seeding would only produce about 5,000-6,000 acre-feet of water for the lake, although others have said more could be produced.

Another option he said he has heard is to use more agricultural wells on the Walker River Paiute Tribe reservation and to pump the additional water to the lake. He said he has figured that using the existing four wells available and pumping 24 hours a day, 365 days a year, those wells would only produce about 6,500 acre-feet per year.

Other options he cited are to use water from the Cottonwood Creek, now owned by the U.S. Army Ammunition Depot in Hawthorne, and pumping water from the Whiskey Flats area; but he estimates those would only produce about 9,000 acre-feet per year. He said those options combined would still leave 50,000 acre-feet to come from the river, and with what he said was a conservative ration of 3:1 (water rights obtained versus water actually reaching the lake), that would mean 150,000 acre-feed of water rights would be needed.

<sup>6</sup> Mason Valley News, Friday, Jan. 3, 2003. Pages A1, A10

## ENRICHMENT ACTIVITY

Read the news story on the preceding page aloud. Work in cooperative learning groups to:

1. list interests of the DAWG group and
2. list interest of others competing for water.

Analyze the competing interests and critique the solutions offered to resolve the conflict. Separate interests from positions given in the news story.

[illegible]



# Language is Power

The words we speak are more powerful than we can ever imagine.

Words can hurt someone's feelings or build their confidence.

Words can give shape to new ideas and help find solutions to difficult problems. Words can also damage relationships and worsen conflicts.

It is important to recognize the power of language and to use words carefully. Stakeholders who seek to manage conflict collaboratively need to create a set of **ground rules** to encourage and support positive communication. Positive communication helps to provide an atmosphere of mutual respect and creativity in problem-solving situations.

There are many examples of ground rules useful in managing conflict. Some examples include the following:

- Do not repeat your statements.
- Do not interrupt others.
- Encourage others to speak.
- Respect individual viewpoints.
- Start statements with "I" rather than "you."
- Avoid blaming others when you speak.
- Stick to the meeting agenda.
- Be specific when you speak and provide examples.
- Invite questions to your statements.
- Disagree openly with others but refrain from using harsh language.
- Share discussions with others unable to participate.

### LEARNING OBJECTIVES:

- ▶ Develop an appreciation for the power of language and communication in conflict management.
- ▶ Explain the purpose of ground rules in conflict management.
- ▶ List skills for becoming effective listeners and speakers.
- ▶ Summarize the role of a facilitator in conflict management.

## LANGUAGE

Ground Rules:

- ❖ Do not repeat your statements.
- ❖ Do not interrupt others.
- ❖ Encourage others to speak.
- ❖ Respect individual viewpoints.
- ❖ Start statements with "I" rather than "you."
- ❖ Record the discussion.



*Practicing positive communication provides an atmosphere of mutual respect and creativity in problem-solving situations.*



*It is important that the facilitator encourage and support dynamic group discussion without voicing his or her personal opinions or ideas.*

*A facilitator practices active listening, repeating and summarizing what someone says in order to clarify that statement and help others understand.*

## What is a Facilitator?

It is important to choose a person who can help facilitate the discussion. This is especially true when the discussion surrounds a complex conflict and emotionally charged issues. A **facilitator** is someone who sees to the details of managing discussions among stakeholders. This sometimes requires constructing a meeting agenda to provide guidance for topics to be discussed and how much time will be allowed for discussion. A facilitator can help stakeholders create a set of ground rules and sees to it that the ground rules are followed. A facilitator may ensure that the discussion is recorded so that the information can help in later discussions.

A facilitator does not make decisions for the group. He or she must not voice their opinions or ideas about solutions to the problems or how to resolve the conflict.

A facilitator practices **active listening**. This means that the facilitator often immediately repeats or summarizes what someone says in order to clarify the statement and to help others understand the statement. A facilitator also summarizes what has been said periodically in the discussion to help keep the discussion focused.

# Communication skills are needed to manage conflict

## EFFECTIVE LISTENING SKILLS:<sup>1</sup>

### • **Stop talking**

Concentrate on what others are saying without interrupting them or changing the subject.

### • **Ask questions**

Ask the person speaking to give more details or explain their ideas.

### • **Understand the other person**

Review what they have said and put into your own words what you have heard. This helps to review, summarize and understand what the other person has said.

### • **Be aware of and control your emotions**

Avoid arguments, criticism and jumping to conclusions.

### • **Be aware of and control your body language**

Positive communication suggests that we maintain eye contact with the person who is speaking. Wandering eyes and excessive body movement generally indicates you are not listening.

## EFFECTIVE SPEAKING SKILLS:<sup>2</sup>

### • **Speak slowly**

Present ideas one at a time, in an organized and logical manner.

### • **Speak clearly**

Choose words that are meaningful for listeners and that share your feelings or ideas.

### • **Be aware of your body language as you speak**

Maintain eye contact with listeners. Avoid moving around, shuffling papers or distracting listeners with excessive body movement.

### • **Speak to make others feel good**

Avoid hostile and unproductive comments about others or the situation. Show respect for others' opinions by remaining considerate and sensitive with your statements about the problem.

### • **Ask questions**

Ask listeners if they understand what you are saying, rather than if they agree with you.

<sup>1</sup> Source <http://www.ctic.purdue.edu/kyw/brochures/leading.html>

<sup>2</sup> Source <http://www.ctic.purdue.edu/kyw/brochures/leadingcom.html>

LESSON 14: REVIEW AND ENRICHMENT

1. What is meant by the *power of language*?

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2. How can positive communication skills help in cooperative problem solving?

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3. What are *ground rules* and how can they help support positive communication?

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4. List five steps to improve listening skills:

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5. List five steps to improve speaking skills:

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6. What is a facilitator and what role does a facilitator play in a group setting?

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7. How does the facilitator practice active listening?

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8. What is the purpose of a meeting agenda?

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## ENRICHMENT ACTIVITY

Work in cooperative learning groups to create a set of ground rules for a group of stakeholders who are meeting to manage a conflict. You may use any conflict described in this publication or a current conflict from your experience at school, work or in your community. Record your results and share with the large group.

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# Reacting to Conflict

### LEARNING OBJECTIVES:

- ▶ List and explain three levels of understanding conflict.
- ▶ Develop an awareness of your reaction to conflict.
- ▶ Develop an awareness of how others may react to conflict.
- ▶ List and describe seven guidelines for working together.
- ▶ List and describe seven steps to develop the skills needed to manage conflict cooperatively.
- ▶ Demonstrate an understanding of effective communication strategies that make effective leaders.

Conflict can make some people feel anxious and uncomfortable. It is important to recognize that people come from various walks of life. Each person varies in communication skills in addition to how they respond to conflict. It is not unusual for people involved in conflict to jump to conclusions and become impatient with efforts to collaborate. It is also not unusual for people to hear and accept only those ideas that support what they believe already. This avoids having to think about an old problem in a new way. People can also behave unpleasantly becoming demanding or cynical about the process of conflict management.

In order to manage water conflict collaboratively, each stakeholder must be aware of and understand your reaction to conflict as well as understanding how others react to conflict:

- How do you react to conflict?
- How do others involved react to conflict? Do they get angry or just walk away quietly?
- What are others' interests?
- What are the positions that have been stated?

### CONFLICT

- ❖ Understand your reaction to conflict.
- ❖ Understand how others react to conflict.
- ❖ Understand where decision-making power is and strive to become a positive part of that power.

*Stakeholders learn to manage conflict through recognizing and understanding their reaction to conflict as well as how others may react to conflict.*



# Reaction to conflict can be improved through the use of positive communication

## Work together effectively:

### • Meeting management

Manage time allowed for meetings and problem solving activities.

### • Make a decision

Learn when and how to close the group's discussion and come to a decision.

### • Stay focused

Stay on task so that energy is not wasted on unrelated discussions or activities.

### • Limit your time

Set a time limit for brainstorming ideas, discussion and investigative activities.

### • Don't judge

Share ideas freely-don't evaluate or criticize ideas early on in the problem-solving process.

### • Track ideas

Follow up by identifying, as a group, those ideas that are most promising.

### • Keep a record

Record the progress and outcomes of all cooperative activities.<sup>1</sup>

## Manage conflict collaboratively:

### • Don't react to conflict

Instead of behaving like an enemy, reduce angry feelings by genuinely listening to all stakeholders' sides of the issue.

### • Show compassion

Put yourself in the shoes of others for a few minutes to better understand what they want and why.

### • Satisfy everyone

Ask stakeholders who are totally against a particular idea for a solution to solve the problem so that all interests are satisfied.

### • Consider the benefits

Review the benefits of agreeing on a solution that everyone finds satisfying.

### • Consider the consequences

Review the consequences of not solving the problem.

### • Use the best information

Always seek and use the best information available to help all stakeholders make sound decisions rather than emotionally charged decisions.

### • Respect differences

Recognize and accept that each stakeholder may have a different value system.

<sup>1</sup> Source <http://www.ctic.purdue.edu/kyw/brochures/leadingcom.html>



*In conflict situations, communication strategies are the foundation for becoming a skillful leader.*

- Are alternative solutions accepted by all or are some openly dissatisfied?
- Who has decision-making power?
- How can I make a positive contribution to the decision-making process?

## Becoming a Leader in the Process

A leader can be anyone who has a desire to help find solutions to difficult problems in order to manage conflicts. Leaders in water conflict management have included, among others, farmers, lawyers, tribal activists, environmentalists, teachers, homemakers, teenagers and elected officials. All stakeholders can play a leadership role in managing water conflicts.

Effective leaders are not born, but evolve by learning about and practicing effective leadership skills. These

skills include understanding and practicing positive communication as both a listener and a speaker. Communication strategies are the foundation for becoming a skillful leader. This is especially true in conflict situations. Such communication strategies include:<sup>2</sup>

- **Start the cooperative problem solving process** — Try to help the group focus on common goals that are manageable, encourage learning about the issues that work toward solving the problem.
- **Find values that everyone shares** — Shared values help stakeholders to see that although they may differ in opinions, they have common values that connect them as human beings. For example, we all want clean water that is safe to drink.
- **Encourage others to lead** — Effective leaders do not do everything themselves. They recognize others' skills and talents and encourage others to take an active leadership role in the cooperative problem-solving process.
- **Encourage group decision-making** — Effective leaders do not make decisions for the group but instead they help their partners determine and commit to the problem solving goals and tasks. This is best accomplished through effective communication strategies.

Effective communication strategies are based on positive communication but also include an understanding of ethics. Ethics refer to a moral code of conduct we as human beings choose to follow in life. Obvious ethics include respect for self and respect for others. The best way to practice this ethic is to put yourself in the place of others. Ask yourself how you would feel if you were in someone else's shoes.

<sup>2</sup> Source <http://www.ctic.purdue.edu/kyw/brochures/leadingcom.html>

## LESSON 15: REVIEW AND ENRICHMENT

1. List the three levels of understanding conflict:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

2. List seven guidelines for working together to manage conflict:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_
- 7) \_\_\_\_\_

3. List seven steps to develop the skills necessary to manage conflict collaboratively:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_
- 7) \_\_\_\_\_

4. Explain effective communication strategies that develop effective leadership.

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Work in cooperative learning groups. Select a conflict featured in this publication. Each person in the group plays the role of a stakeholder involved in the conflict. The conflict can be historical or current. Practice conflict management skills discussed in this publication to: identify stakeholders, find facts, share values and brainstorm several possible outcomes to the conflict that satisfy each stakeholders' interests.

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



## ENRICHMENT ACTIVITY

Work in cooperative learning groups. Select a current conflict in your class or school. Practice the skills and process described in this lesson to create several possible outcomes that satisfy the group.

[illegible]

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# Internet Resources

## **BUREAU OF MINING REGULATION AND RECLAMATION**

<http://ndep.nv.gov/bmrr/bmrr01.htm>

Nevada Division of Environmental Protection  
Bureau of Mining  
333 West Nye Lane, Room 154  
Carson City, Nevada 89706-0851  
Phone (775) 687-4670  
Fax (775) 684-5259

## **CONFLICT RESOLUTION EDUCATION, INC.**

<http://www.resolutioneducation.com/>

CRE, Inc.  
P.O. Box 17241  
Urbana, IL 61803  
Richard Bodine, Director  
Email: [dick@resolutioneducation.com](mailto:dick@resolutioneducation.com)  
Phone (217) 384-4118

## **GENERAL INTRODUCTION AND HYDROLOGIC DEFINITIONS**

<http://water.usgs.gov/wsc/glossary.htm>

Manual of Hydrology: Part 1. General Surface-Water Techniques

## **THE GREAT BASIN INSTITUTE**

<http://www.unr.edu/artsci/ceah/gbi/>

Great Basin Institute /099  
University of Nevada, Reno  
Reno, NV 89557-0331  
775.784.1192  
FAX: 775.327.2307  
E-mail: [keir@unr.edu](mailto:keir@unr.edu)

## **INTERNATIONAL CENTER FOR COOPERATION AND CONFLICT RESOLUTION**

<http://www.tc.columbia.edu/~icccr/>

Teachers College at Columbia University  
525 West 120th Street  
New York, NY 10027  
Phone: (212) 678-3289

## **MISSOURI PRECISION AGRICULTURE CENTER**

<http://www.fse.missouri.edu/mpac/>

University of Missouri-Columbia  
257 Agricultural Engineering Bldg.  
Columbia, MO 65211  
Phone: (573) 882-1138 / Fax: (573) 882-1115  
Email: [mpac@missouri.edu](mailto:mpac@missouri.edu)

## **NATIONAL CENTER FOR CONFLICT RESOLUTION EDUCATION (NCCRE)**

<http://www.nccre.org/>

Illinois Bar Center  
242 S. Second Street, Springfield, IL 62701  
Russell Brunson, Development Director  
Email: [brunson@nccre.org](mailto:brunson@nccre.org)  
Phone (718) 832-1262

## **NATIVE WATERS: AN AMERICAN INDIAN WATER RESOURCES EDUCATION PROJECT**

<http://www.nativewaters.org/>

Contact us: [nativewaters@montana.edu](mailto:nativewaters@montana.edu)  
Native Waters  
201 Culbertson Hall, P.O. Box 170575  
Montana State University  
Bozeman, MT 59717-0575  
(406) 994-3911



*For centuries, the Northern Paiute practiced traditional fishing at the mouth of the Truckee River at Pyramid Lake.*

#### **NV BUREAU OF WATER QUALITY PLANNING**

<http://www.ndep.nv.gov/bwqp>

Clean Water Act Information  
Nevada Division of Environmental Protection  
333 West Nye Lane, Suite 138  
Carson City, NV 89706-0851  
Email: [tporta@ndep.state.nv.us](mailto:tporta@ndep.state.nv.us)  
Phone (775) 68706396

#### **NEVADA DIVISION OF WATER RESOURCES**

<http://water.nv.gov/>

Department of Conservation and Natural Resources  
123 W. Nye Lane, Room 246  
Carson City, NV 89706-0818  
Telephone: (775) 687-4380  
FAX: (775) 687-6972

#### **NEVADA RIVER CHRONOLOGY PUBLICATION SERIES**

<http://water.nv.gov/Water%20planning/nvchrono.htm>

Accounts of historical events occurring on the Truckee, Carson and Walker Rivers. For information on obtaining a printed copy of these Nevada river chronologies, contact the Nevada Division of Water Resources: One World Our World  
<http://www.1wow.org/>  
Phone (800) 910-KIDS

#### **PONY EXPRESS SCHOOLHOUSE**

<http://www.xphomestation.com/school.html>

#### **SCIENCE IN YOUR WATERSHED**

<http://water.usgs.gov/wsc/>

USGS Science for a Changing World  
U.S. Department of Interior  
U.S. Geological Survey

#### **SUSTAINABLE COMMUNITIES NETWORK**

<http://www.sustainable.org/>

E-mail: [info@sustainable.org](mailto:info@sustainable.org)

#### **TAKE A STAND CD**

[http://ojjdp.ncjrs.org/testmtv/mtv\\_new.html](http://ojjdp.ncjrs.org/testmtv/mtv_new.html)

This interactive CD allows teens to learn about conflict resolution through role-plays and music tracks from many popular musicians.

#### **TOP 10 WATERSHED LESSONS LEARNED**

[http://www.epa.gov/owow/watershed/](http://www.epa.gov/owow/watershed/lessons/toc.htm)

[lessons/toc.htm](http://www.epa.gov/owow/watershed/lessons/toc.htm)

Environmental Protection Agency's Office of Wetlands, Oceans, & Watersheds  
Revised August 4, 1997  
URL: [/owow/lessons/toc.html](http://www.epa.gov/owow/lessons/toc.html)

#### **UNIVERSITY OF NEVADA COOPERATIVE EXTENSION**

<http://www.unce.unr.edu/>

#### **U.S. ENVIRONMENTAL PROTECTION AGENCY'S SUSTAINABLE ECOSYSTEM AND COMMUNITY**

<http://www.epa.gov/ecocommunity/>

U.S. EPA  
Community Based Environmental Protection  
1200 Pennsylvania Avenue, NW  
Mail Code 1807T  
Washington, DC 20460  
202-566-2182  
Fax: 202-566-2220

#### **U.S. PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY**

<http://www.whitehouse.gov/ceq/>

The White House  
1600 Pennsylvania Avenue NW  
Washington, DC 20500  
202-456-1111  
Fax: 202-456-2461  
President George W. Bush: [president@whitehouse.gov](mailto:president@whitehouse.gov)  
Vice President Richard Cheney: [vice.president@whitehouse.gov](mailto:vice.president@whitehouse.gov)

#### **USGS 10293000 E WALKER R NR BRIDGEPORT, CA**

[http://waterdata.usgs.gov/nv/nwis/uv/](http://waterdata.usgs.gov/nv/nwis/uv/?site_no=10293000&PARAMeter_cd=00060,00065)

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#### **REAL-TIME DATA FOR NEVADA**

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#### **YOUTH M-POWER**

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# Glossary

**ACRE-FOOT.** A unit for measuring the volume of water used or stored, is equal to the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or 325,851 gallons.

**ACTIVE LISTENING.** Describes a way of listening that focuses entirely on what the other person is saying, and confirms understanding of both the content of the message and the emotions and feelings underlying the message, to ensure that understanding is accurate.

**ADVOCATE.** To defend or maintain a cause.

**AGAI DICUTTA.** Paiute name for “trout eater” referring to the Northern Paiute who lived on the north shore of Walker Lake where Lahontan Cut-throat Trout were abundant.

**AZTEC.** People who dominated central Mexico at the time of the Spanish conquest. Their language belonged to the Nahuatl subfamily of Uto-Aztecan languages.

**BASKET MAKER CULTURE.** Name given to the members of an early Native North American culture because of their extensive practice of basket making.

**BENEFICIAL USE.** Right to enjoy the use of something, such as water in a stream, even though the title to the property in which the use exists is held by another.

**BEST MANAGEMENT PRACTICES.** One or more approved practices for controlling Non-Point Source (NPS) Pollution as defined by the 1977 Clean Water Act (CWA).

**BRACKISH.** Having a somewhat salty taste, especially from containing a mixture of seawater and fresh water.

**BUREAU OF RECLAMATION.** Federal agency established under the Reclamation Act of 1902 to promote regional economies in western states by developing water and related land resources. The original purpose of developing and executing irrigation projects in arid and semiarid regions of the West has been expanded to include developing and executing projects to provide municipal and industrial water supplies, hydroelectric power generation and transmission, water quality improvement, flood control, navigation, and river regulation and control. The bureau is the second largest producer of hydroelectric power in the United States.

**CLEAN WATER ACT.** More formally referred to as the *Federal Water Pollution Control Act*, the Clean Water Act is the basic water pollution control policy for the United States. Originally based on the *Water Quality Act* of 1965, which began setting water quality standards. The 1966 amendments to this act increased federal government funding for sewage treatment plants. Additional 1972 amendments established a goal of zero toxic discharges and “fishable” and “swimmable” surface waters.



*The Northern Paiute continue their basket artistry using willows from nearby rivers and streams.*



**COMSTOCK LODGE.** Rich deposit of silver in northwestern Nevada, named for Henry Comstock, part owner of the property on which it was discovered in June 1859.

**CONSERVATION STORAGE.** Storage of water for later release for useful purposes such as municipal water supply, power, or irrigation in contrast with storage capacity used for flood control.

**CONSUMPTIVE USE.** That amount of water that is diverted from a river to be consumed making part of it unavailable for others to use. Consumptive uses can include livestock watering ponds, cropland irrigation, domestic wells and fishponds.

**CUBIC FEET PER SECOND.** A unit expressing rates of water discharge. One cubic foot per second is equal to the discharge of a stream of rectangular cross section, 1 foot wide and 1 foot deep, flowing water an average velocity of 1 foot per second.

**CUI-UI.** Cui-ui is a fish species that attain lengths of about 2 feet and weights of about 6 lbs. Its head is relatively large, wide and flat. The upper lip is very thin, with the lower lip represented by folds on either side of the head. It has small eyes and coarse scales. Cui-ui are confined to Pyramid Lake, Nevada, and only enter Truckee River during spring spawning from April-June.



*The construction of Derby Dam on the Truckee River initiated the first desert reclamation project in the United States.*

**DERBY DAM.** Constructed in 1903 by the Bureau of Reclamation, diverts the water from the Truckee River for irrigation use. It is a part of the Newlands Project named in honor of Nevada Senator Francis G. Newlands, who worked for passage of the Reclamation Act in 1902. Derby took its name from a nearby Southern Pacific Railroad station.

**DESERT LAND ENTRY ACT.** Federal policy passed in 1877 to encourage and promote the economic development of the arid and semiarid public lands of the western United States. The policy encouraged individuals to apply for a desert-land entry to reclaim, irrigate, and cultivate arid and semiarid public lands.

**DISCHARGE.** The volume of water that passes a given point in a given period of time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute, or cubic meters per second.

**DIVERSION.** The taking of water from a stream or other body of water into a canal, pipe, or other conduit.

**DOCTRINE OF PRIOR APPROPRIATION.** Established legal water rights for most western states by giving the first person to actually use water from a stream the first right to such water. If the first user does not consume all of the water, then the second and later users can appropriate water for their needs. The water right is not necessarily tied to land ownership.

**DROUGHT.** Deficient precipitation over an extended period of time.

**EMIGRANT TRAIL.** From 1843 until 1859, and to a lesser extent until 1869 when the transcontinental railroad was completed, the Humboldt River was the major highway across Nevada. It has been estimated that some 200,000 people took this difficult route to California between 1840 and 1860, the greatest peacetime migration in history. The journey to California usually began at Independence, Missouri around the first of May.

**ENDANGERED SPECIES ACT.** Federal policy passed in 1973 intended to protect species and subspecies of plants and animals that are of “aesthetic, ecological, educational, historical, recreational and scientific value.” It may also protect the listed species’ “critical habitat”, the geographic area occupied by or essential to, the protected species. The *U.S. Fish and Wildlife Service (USFWS)* and the *National Marine Fisheries Service (NMFS)* share authority to list endangered species, determine critical habitat and develop recovery plans for listed species.

**EVAPORATION.** Process by which water is changed from a liquid or a solid state into a vapor state.

**FACILITATOR.** Someone who helps a group to fulfill its purpose and complete its activities.

**FEDERAL POLICIES.** Laws created and enacted by elected officials of the United States or federal government.

**FORTY-MILE DESERT.** The treacherous 40 miles of desert located between the Humboldt Sink and Truckee River. Emigrants faced this difficult section of land along the final stretch of the Emigrant Trail between Missouri and California. There were actually two Forty Mile Deserts. The original passage extended from Humboldt Sink to Truckee River. Later, a second trail was opened between Humboldt Sink and Carson River. Both were described by emigrants to be flat, sandy, stretches of alkaline flats where little to no water or grasses were found for at least forty miles.

**GAUGING STATION.** A particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are obtained

**GENERAL ALLOTMENT ACT (ALSO CALLED DAWES ACT).** Federal policy passed in 1881 granting land or *allotments* to individual Native Americans, replacing communal tribal holdings. Sponsored by U.S. Senator H. L. Dawes, the policy hoped to encourage Indians to practice agriculture and become a part of American culture. Allotments could be sold after a 25-year period, and “surplus” land not allotted was opened to settlers. Within decades, following the passage of the act, the majority of what had been tribal land in the West was in non-Indian ownership.

**GIS.** An acronym for Geographic Information System. A computer software system that maps geographic information and can analyze geographic data. Geographic Information Systems have many uses including government, tourist information, education, environmental information, engineering and marketing.

**GLACIER.** Bodies of land ice that consist of recrystallized snow accumulated on the surface of the ground, and that move slowly down slope.

**GPS.** An acronym for Global Positioning System. GPS is a satellite navigation system used to determine ground position or location. Though it was created and originally used by the U.S. military, GPS is now available to the

public. Information collected using a GPS can illustrate various subject matter.

**GROUND RULES.** Rules of procedure to help govern the behavior of a group activity or discussion.

**GROUND WATER.** Water that collects underground from which wells, springs, and ground-water runoff are supplied.



**HOMESTEAD ACT.** Federal policy passed in 1862, which provided for the transfer of 160 acres of unoccupied public land to each homesteader for a very small fee after five years of residence; land could also be acquired after six months of residence at \$1.25 an acre. The government had previously sold land to settlers in the West to raise revenue. As the West became politically stronger, however, Congress was pressured to guarantee free land to settlers. The law expired in all states by 1976 except Alaska, where it ended in 1986.

**INDIAN REORGANIZATION ACT.**

Federal policy passed in an attempt

to secure new rights for Native Americans on reservations. The policy was designed to restore to Native Americans management of their land assets to prevent further depletion of reservation resources; to build a sound economic foundation for Native American reservations; and to return to the Native Americans self-government on a tribal basis.

**INDIAN RESERVATION LANDS.** Federal or public land which was allocated to Native American tribes as authorized under the United States Department of Interior. Because the land remains Federal land, it is not subject to state law.

**INSTREAM USE.** (See nonconsumptive use)

**INTEREST.** A right, title, or legal share in something; a concern.

**INTEGRATED PEST MANAGEMENT (IPM).** An alternative to pest control practices which rely exclusively on pesticides. IPM integrates cultural, mechanical, physical, biological and chemical pest control techniques to prevent and suppress pest problems. The goals of IPM are to manage pests, reduce adverse impacts of pest control on human health, the environment, and non-target organisms and to do this in an economical manner.

**INVASIVE WEEDS.** Refers to non-native plants that interfere with cultivation and other land management objectives.

**IRRIGATION.** The controlled application of water to cultivated lands to supply water requirements not satisfied by rainfall.

**JOINT FACT-FINDING.** Techniques to help stakeholders resolve their disagreements over technical facts regarding a conflict or its underlying issues. In joint fact-finding, the scientific experts and the stakeholders develop and

*Passage of the Homestead Act in 1862 inspired many emigrants to settle down and farm in the arid western territories of the United States.*

implement a joint strategy for answering key questions, based upon generally agreed-upon scientific methods.

**KIN-CLIQUE.** A social structure made up of family members or a few families who were related to one another by marriage.

**KOOYOOE TUKADDU.** Paiute name for “cui-ui eater”, referring to the early Northern Paiute Indians who lived along the shores of Pyramid Lake where the cui-ui fish were abundant.

#### **LAHONTAN CUTTHROAT TROUT.**

Lahontan cutthroat trout are a stream spawning fish species. The only trout native to the Lahontan sub-basin of the American Great Basin and were historically found in the Carson, Humboldt, Truckee, and Walker Rivers, and their tributary lakes and streams. At the beginning of the 19th century, Lahontan cutthroat trout were abundant and widespread. In the 1900 century, loss of habitat, over fishing, and introductions of non-native fishes have reduced stream and lake populations to approximately 10.7% and 0.4%, respectively, of their original habitat. Habitat loss and the adverse impacts of non-native fishes continue to be the primary threats to these fish.

**LAKE LAHONTAN.** About 12,500 years ago, Lake Lahontan covered a vast portion of Nevada. Pyramid Lake and Walker Lake remain as remnants of Lake Lahontan. At its peak surface elevation which occurred approximately 65,000 years ago, Lake Lahontan covered an estimated 8,655 square miles in northwestern Nevada. This Ice Age lake was fed by the flows of the Truckee, Carson, Walker, Humboldt, Susan and Quinn rivers, attained a maximum surface elevation of approximately 4,380 feet above mean sea level (MSL), and reached a maximum depth of at least 886 feet where Pyramid Lake (in the Truckee River Basin), the lowest point in the system, now remains. Lake Lahontan also covered the Lahontan Valley Wetlands (Stillwater National Wildlife Refuge in the Carson River Basin) to a depth of 500-700 feet, covered the site of the Fallon town site (also in the Carson River Basin) by almost 420 feet, created a pool in Walker Lake (in the Walker River Basin) some 520 feet deep.

**MICROIRRIGATION.** The universal term for drip, trickle or microspray irrigation systems. It is a growing technology, which has the potential to maximize crop productivity, conserve soil, water and fertilizer resources while also protecting the environment.

**MORRILL LAND GRANT ACT.** Federal policy enacted in 1862 that donated land to states and territories in order to establish colleges to teach agriculture and mechanics.

**NEWLANDS PROJECT.** First projects built by the U.S. Bureau of Reclamation. Involved the construction of Derby Dam on the Truckee River (completed in 1903) to provide irrigation water and Lahontan Dam on the Carson River (completed in 1915) to produce electricity for the project.



*The early Northern Paiute were a matrilineal society in that women played important leadership roles within kin-cliques.*



*In 1862, the Pacific Railroad Act was passed to encourage development of western territories by improving the transportation of people and supplies.*



#### **PACIFIC RAILROAD**

**ACT.** Federal policy passed in 1862 to aid in the construction of a railroad and telegraph Line from the Missouri River to the Pacific Ocean. Land grants were made, excluding mineral rights, of every alternate odd numbered section, to the amount of five alternate sections per mile, on each side of the route.

#### **PATHOGENS.**

Disease-producing agents that can be found in animal and human wastes. Generally, any viruses, bacteria, or fungi that cause disease.

**PERENNIAL STREAM.** One, which flows continuously.

**NOMADIC.** A member of a group of people who move from one place to another rather than living in one place all of the time.

**NON-POINT SOURCE POLLUTION.** Pollution discharged over a wide land area, not from one specific location and occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up soil particles and pollutants such as nutrients and pesticides. Some of the polluted runoff infiltrates into the soil to contaminate the groundwater below. The rest of the runoff deposits the soil and pollutants in rivers, lakes, wetlands, and coastal waters.

**NONCONSUMPTIVE USE.** Water usage that includes electric power production, wildlife habitat, fisheries and zones to protect water quality.

**NUMA (NUMU).** The early Northern Paiute word for *human being* or *The People*.

**NUTRIENTS.** An element or compound essential to life, including carbon, oxygen, nitrogen, phosphorus, and many others.

**ORAL TRADITION.** Unwritten accounts of events used as a way to record cultural history for the purpose of teaching future generations. Oral traditions are sometimes used to teach important lessons about behavior, such as differences between right and wrong.

**ORGANIC FARMING.** An approach to farming based on biological methods that avoid the use of synthetic crop or livestock production inputs; also a broadly philosophical approach to farming that puts value on ecological harmony, resource efficiency and non-intensive animal husbandry practices. Farmers who wish to have their operations certified as organic so that they can organically label their products as organically produced currently follow standards and submit to inspections by private or state certified organizations.



**PESTICIDE.** Any chemical used for the control of specific organisms, such as, insects, weeds and plant diseases.

**PINE NUTS.** Edible seed of various species of nut pines or piñon trees. The nuts have a thin red-brown shell and range in size from about 3/4 inches to about 1 and 1/2 inches. Pine nuts, or Indian nuts, were an important food for some early Native Americans and are still harvested in quantity both for food and for trading. They are picked from the ground, taken from squirrel caches, or extracted by hand from the cones. Some pine stands are in danger of depletion because insufficient seeds are left for reproduction.

**PIÑON TREES.** Any of the various low-growing pines (as *Pinus quadrifolia*, *P. cembroides*, *P. edulis*, and *P. monophylla*) of western North America having edible seeds.

**PLEISTOCENE.** The most recent glacial event that began about 2 million years ago and ended 10,000 years ago. At its maximum, the ice mass reached heights of 13,000 feet and sea levels dropped to approximately 430 feet below current levels.

**PLUVIAL EVENT.** A natural event characterized by abundant rain.

**POSITION.** A point of view adopted and held to.

**PRECIPITATION.** Discharge of water in the form of sleet, hail, snow or rain from the atmosphere.

**PRECISION AGRICULTURE.** An approach to agricultural management that requires the use of new technologies, such as global positioning (GPS), sensors, satellites or aerial images, and information management tools to assess and understand variations in soil characteristics in a field. Information collected may be used to more precisely evaluate optimum seeding rates, estimate fertilizers and other input needs and to more accurately predict crop yields.

**PUGWI DICUTTA.** Paiute name for “fish eater” referring to Northern Paiute who lived on the south shore of Walker Lake.

**RAIN.** Liquid precipitation.

**RAIN SHADOW.** Lee side of a mountainous barrier, which receives considerably less precipitation than the windward side.

**RECLAMATION ACT.** The Reclamation Act of 1902 provided federally supported irrigation projects. Additional aims of the reclamation program include hydroelectric power generation, recreation, and flood control.

**RESERVOIR.** A pond, lake, or basin, either natural or artificial providing storage, regulation and control of water.

**RETURN FLOW.** That part of irrigation water that is not consumed by the user or lost by evapotranspiration and which returns to its source or another body of water.

**RIPARIAN.** Pertaining to the banks of a stream.

**RUNOFF.** Precipitation that appears in surface streams. It is the same as stream flow unaffected by artificial diversions, storage, or other manmade works in or on the stream channels.

**SALINITY.** Concentration of salts, usually sodium chloride, in a given water

sample, usually expressed in terms of the number of parts per million (ppm) of chlorine (Cl). Although the measurement takes into account all of the dissolved salts, sodium chloride (NaCl) normally constitutes the primary salt being measured.

**SEDIMENT.** Caused by soil erosion, which occurs when rock and soils break apart and are carried away by water, wind, gravity or ice.

**SIERRA NEVADA.** Rugged mountain range that cuts across a portion of Nevada south of Carson City. Sierra is Spanish for “mountain range” while Nevada is Spanish for “snowcapped.”

**SNOTEL.** Snowpack Telemetry (SNOTEL) site. A remote, automated measurement tool operated and maintained by the U.S. Department of Agriculture, *Natural Resources Conservation Service (NRCS)* in the western United States to assess snowpack accumulation and potential stream flow. The concept is based upon the relationship between the water content in the snowpack and spring runoff under certain assumptions. Forecasts of runoff are made through the coordination of hydrologists with the NRCS and the *National Weather Service (NWS)*. A typical SNOTEL site consists of: (1) a precipitation measurement tube which measures the actual level of precipitation in inches of equivalent water; (2) a snow “pillow” which measures the weight of the snowpack and therefore its water content, and (3) the measurement and transmitting equipment which send the data to NRCS collection offices.

**SNOW.** A form of precipitation composed of ice crystals.

**SPAWN.** To produce offspring especially in large numbers

**SPRINKLER IRRIGATION.** A pressurized irrigation system where water is distributed through pipes to the field and applied through a variety of sprinkler heads or nozzles. Pressure is used to spread water droplets above the crop canopy to simulate rainfall.

**STAKEHOLDER.** A person who is concerned with the outcome of a conflict because of some effect it has on them. Ideally, every stakeholder should be accounted for and participate somewhere in the conflict management process.

*In addition to gathering nuts, seeds, roots and berries, early Northern Paiute hunted on foot, fished and trapped waterfowl to provide food for their families.*



#### **STILLWATER NATIONAL WILDLIFE**

**REFUGE.** A federally owned and managed refuge of 77,500 acres set aside in 1991 to provide habitat for fish and bird species. The refuge is managed by the U.S. Fish and Wildlife Service who continue to seek and purchase water rights to sustain the refuge.

**STORAGE.** Water retained for future use.

**STREAM.** Water flowing in a natural channel.

**STREAM GAUGING.** The process and art of measuring the depths, areas, velocities, and rates of flow in natural or artificial channels.

**STREAM-GAUGING STATION.** A gauging station where a record of the discharge from a stream is obtained.

**SURFACE IRRIGATION.** Early irrigation method based on gravity moving water from streams through ditches dug to the edges of fields. When the water reached the fields, it flowed across the field's surface. Fields had to be prepared so that the water would spread through all parts of the field equally. This remains a common irrigation method in the U.S. and other countries.

**SURFACE RUNOFF.** That part of the runoff which travels over the soil surface to the nearest stream channel.

**SURFACE WATER.** Water on the surface of the earth.

**SURVIVAL CULTURE.** Term that describes a people or culture whose daily activities revolved around searching for food and water.

**SUSTAINABLE COMMUNITY DEVELOPMENT.** Describes efforts to guide community development and economic growth in an environmentally sound manner, with an emphasis on natural resource conservation.

**TABOOSI TICUTTA.** Paiute name for "ground-nut eater" referring to the Northern Paiute who lived alongside the Walker River in what is present day Smith and Mason Valleys.

**TOIDIKADU.** Paiute name for "cattail eater" referring to the Northern Paiute who lived in the Carson Sink wetland area where cattails were abundant.

**TOTAL DISSOLVED SOLIDS.** All the solids (usually mineral salts) that are dissolved in water. TDS are used to evaluate water quality.

**TRANSPIRATION.** The quantity of water absorbed, transpired, and used directly in the building of plant tissue, within a specified time. It does not include soil evaporation.

**TRIBUTARIES[Y].** A river or stream that flows into a larger river or lake.

**TRUCKEE-CARSON-PYRAMID LAKE WATER SETTLEMENT ACT.** Settlement reached through a series of negotiations in the 1980s involving the Pyramid Lake Tribe, U.S. Bureau of Reclamation, Newland farmers, Sierra Pacific Power Company, U.S. Fish and Wildlife and other interests. The purpose of the negotiations was to resolve the longstanding conflict over the diversion of water from Truckee and Carson Rivers and the effects of water diversions for irrigation. The act awarded \$40 million to the Pyramid Lake tribe for economic development. Until a final operating agreement is reached (Truckee River Operating Agreement or TROA) involving all negotiating parties, however, the settlement funds are not available for tribal use. The negotiating parties continue to work toward reaching an operating agreement. The settlement also set aside 77,500 acres at Carson Sink to establish the Stillwater National Wildlife Refuge and necessary water to



*Early Northern Paiute created clothing from the wild plants available to them, including tules and sage brush.*



supply the refuge in order to protect its wildlife. The refuge continues to seek water to purchase in order to sustain additional refuge acreage in support of wildlife and plant populations.

**UTO-AZTECAN.** Uto-Aztecán refers to a family of languages that includes languages spoken over the western third of the U.S., much of Mexico and parts of Guatemala. Some of the most important languages in this group are Hopi, Nahuatl, Shoshoni, Comanche, Ute, Paiute, Pima/Pagapo, Tarahumara and Yaqui.

**WATER AUDIT.** A procedure that combines flow measurements and surveys in an attempt to give a reasonably accurate accounting of all water entering and leaving a system. An audit can provide a reasonable estimation of how much water is used for various daily activities helping citizens to understand how much water they use in order to increase water conservation awareness and conservation efforts.



*Early Newlands Project farmers dug networks of irrigation ditches to direct diverted river water to their fields.*

**WATER RIGHT.** A legal and conditional privilege of a landowner to use the water adjacent to or flowing through his property. The privilege, also known as riparian rights, may be modified or even denied because of the competing needs of other private-property holders or of the community at large. There is no private ownership of such water in most cases, and hence it cannot ordinarily be impounded and sold. The owner, however, may use the water for his ordinary private purposes, such as stock watering or irrigation, and then return the unused residue. In certain parts of the United

States—especially in the arid and semiarid regions of the Southwest—the prior appropriation rule applies, and the first user of water, whether or not he owns land abutting the water, has the unrestrained right to it without regard to his neighbor’s needs.

**WATER YEAR.** In Geological Survey reports dealing with surface-water supply, the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ended September 30, 1959, is called the “1959 water year.”

**WINTERS RIGHTS DECISION.** Federal court order that declared in 1908 that non-Indians could not legally use or interfere with Indian tribes’ use of water

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