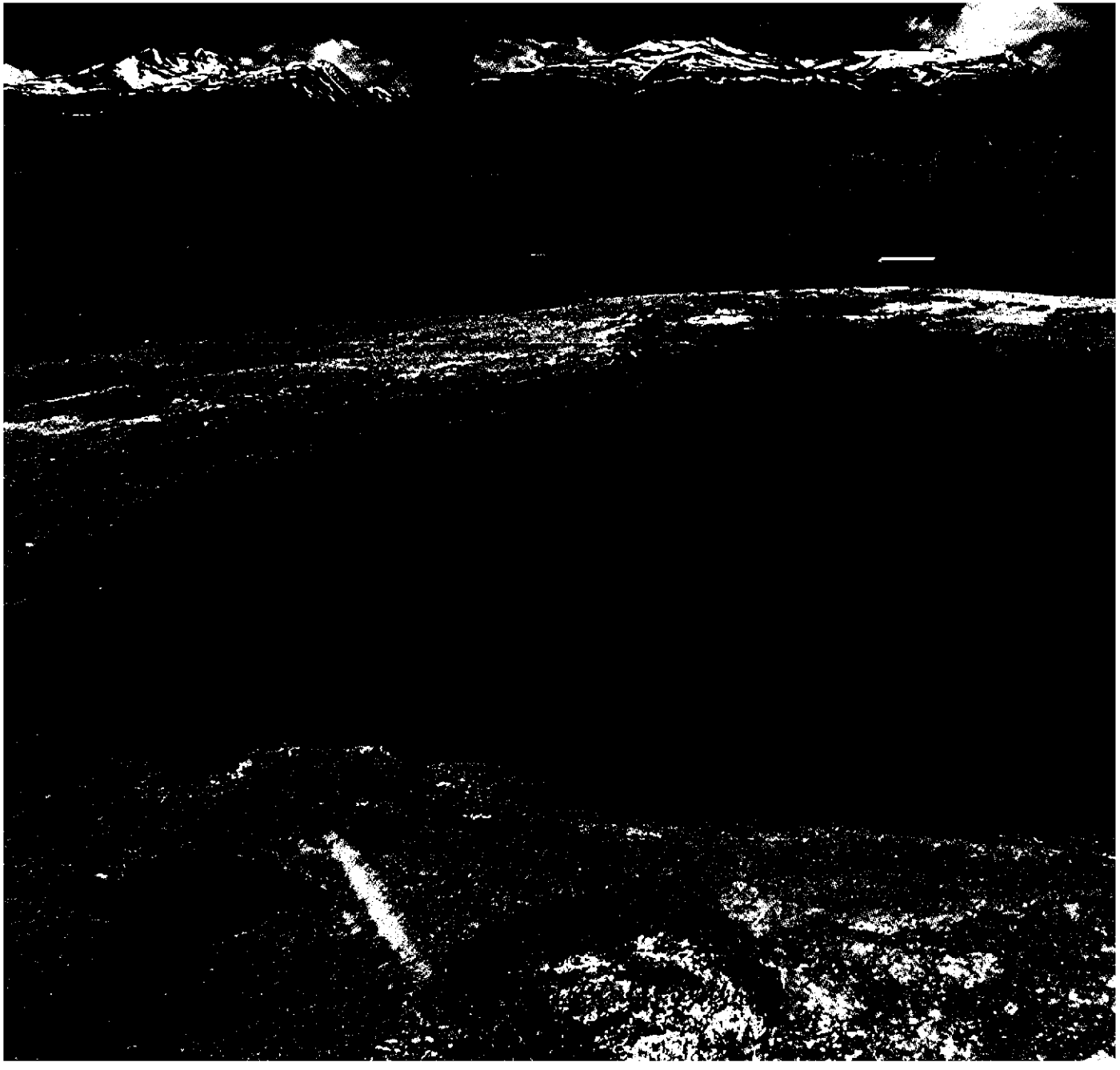

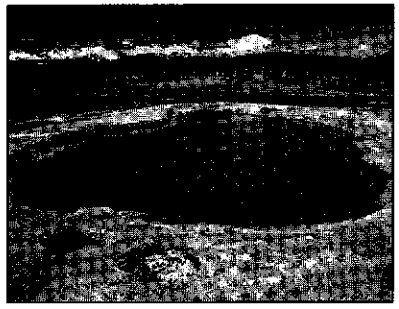

(Front Cover)
Travertine Hot Springs in the upper watershed near Bridgeport.

(Back Cover)
Walker Lake, the terminus of the Walker River.

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Department of Water Resources
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State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

WALKER RIVER ATLAS

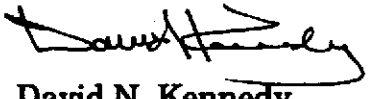
June 1992

FOREWORD

The Walker River, shared between California and Nevada, has had an interesting history of water rights disputes dating back to the days of the early cattle companies' competition for water for their livestock. Today the California reach of the river, part of which has been included in the state's system of wild and scenic rivers, is perhaps best known for its recreational opportunities.

In the past few decades, the concept of establishing an interstate allocation of the waters of the Walker River has been pursued with varying levels of effort. A proposed allocation was negotiated at one time but was not implemented, and the Walker River was not included in the recent federal legislation that made an interstate allocation of the neighboring Truckee and Carson Rivers. The most recent interstate Walker River activity has, instead, involved water quality and fishery issues associated with river operations.

This atlas is the result of information gathered by the Department of Water Resources during work on the California-Nevada interstate water management planning program. The atlas provides background information for people interested in historical conditions that have shaped present-day water rights and also reviews existing water uses.



David N. Kennedy
Director

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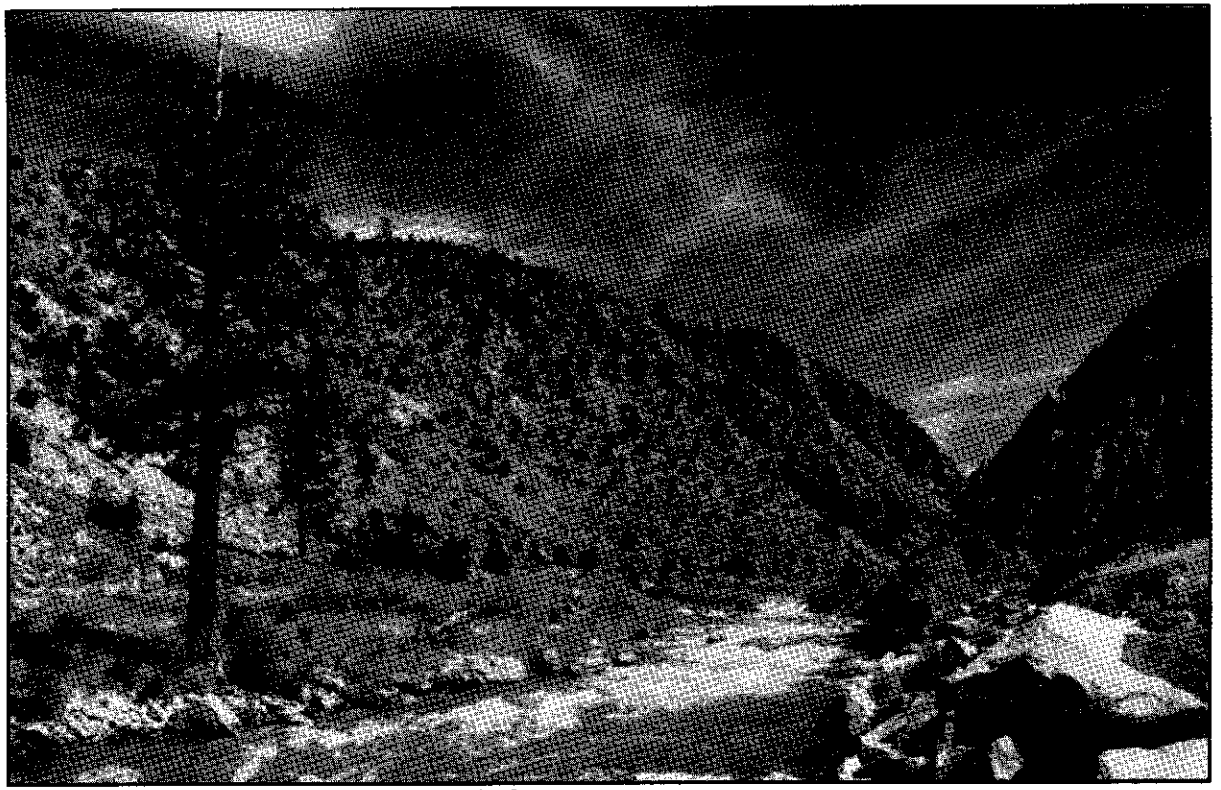
INTRODUCTION

The Walker River has its headwaters in California's high Sierras north of Mono Lake and terminates in a desert lake in Nevada. The Walker is a relatively small river by California standards, in places resembling more stream than river, but is an important water source to arid western Nevada. The river's existence is best known to local residents and to devotees of trout fishing; travelers through the eastern Sierras are more apt to be familiar with the celebrated attractions of Lake Tahoe to the north and Mono Lake to the south.

Water is a scarce commodity on the eastern slopes of the Sierras, and disputes over rights to the use of Walker River water began soon after the basin's settlement by miners and cattle ranchers. Water rights disputes have been complicated by the river's interstate nature and by the differences in water rights administration laws of California and Nevada. Attempts to make an allocation of the river between the two states began in the 1950s and continued through the 1980s; the river was not, however, included in the federal water rights settlement legislation that recently laid the framework for allocation of the Truckee and Carson rivers. At present, an interstate allocation of the Walker River does not appear to be a high priority among local water users.



West Walker River in the upper watershed.

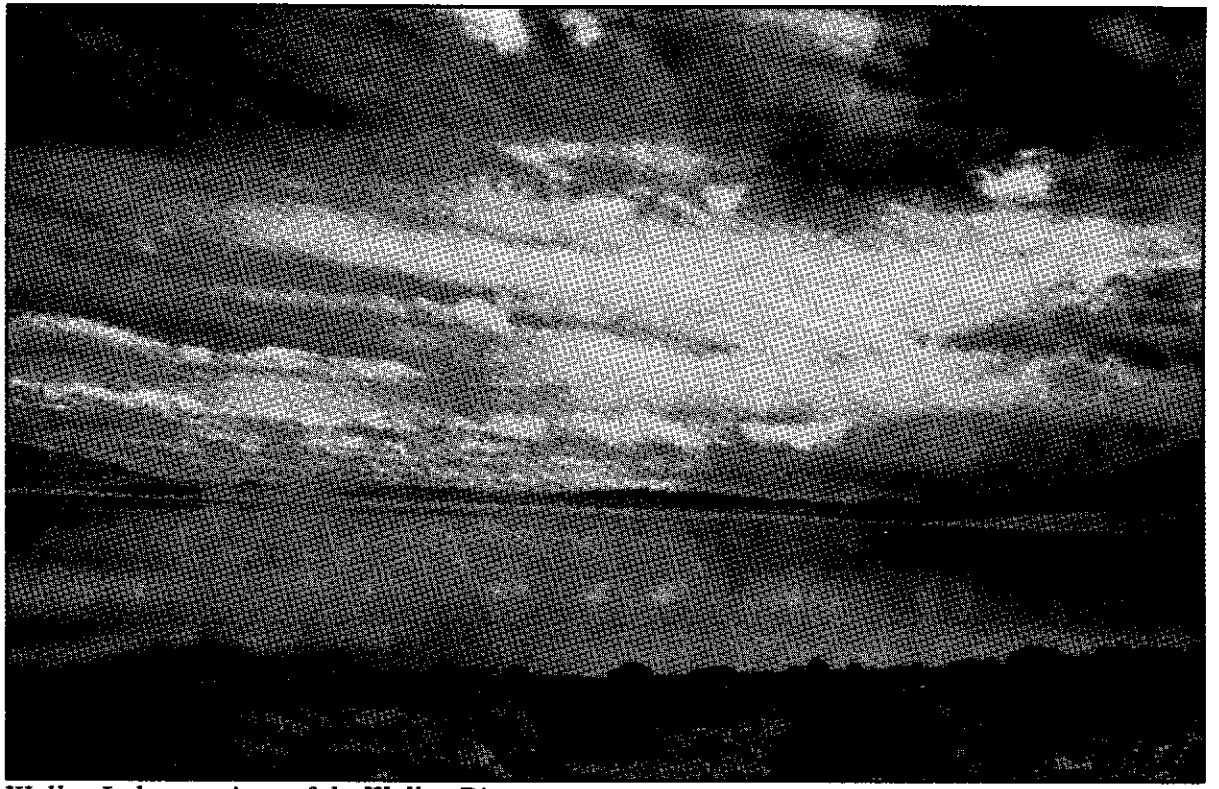
The first major water development in the Walker drainage area occurred in conjunction with the mining boom of the 1860s. Miners originally lured to western Nevada by the Comstock bonanza fanned out over the surrounding area in search of precious metals, leading to establishment of mining camps such as Aurora and Bodie. Water, hauled by wagon to some of the mining camps, was needed to supply this rapid influx of fortune-seekers, and to grow

Joseph Walker

Joseph Walker was a fur trapper and explorer who, in 1833, traveled from the vicinity of the Great Salt Lake to California, passing through the Walker and Carson River watersheds seeking a way across the Sierras. He did encounter the Walker River and did travel through some of the desert lands in the eastern part of the watershed, but apparently he did not come upon Walker Lake. Walker returned to this area in the 1840s, when he served as a guide for John C. Fremont's second expedition to map the western frontier. Geographic features named after Walker include the river and the lake, a small town, Walker Mountain, and Walker Creek.

the crops needed for their support. Today the waters of the Walker River and its tributaries sustain diverse uses — serving water for agriculture, providing municipal water supply for the small communities in the basin, furnishing river and reservoir recreational water uses, and supporting fish and wildlife habitat.

This atlas presents information gathered by the California Department of Water Resources as part of its work on the interstate allocation issues. The intent of the atlas is to provide a brief introduction to the characteristics of the Walker River and its watershed for those not familiar with the region and to provide references for further information. Figure 1 shows the general location of the Walker River watershed, and Figure 2 is a map of the watershed itself.



Walker Lake, terminus of the Walker River.

Figure 1
LOCATION MAP SHOWING WALKER RIVER AND VICINITY

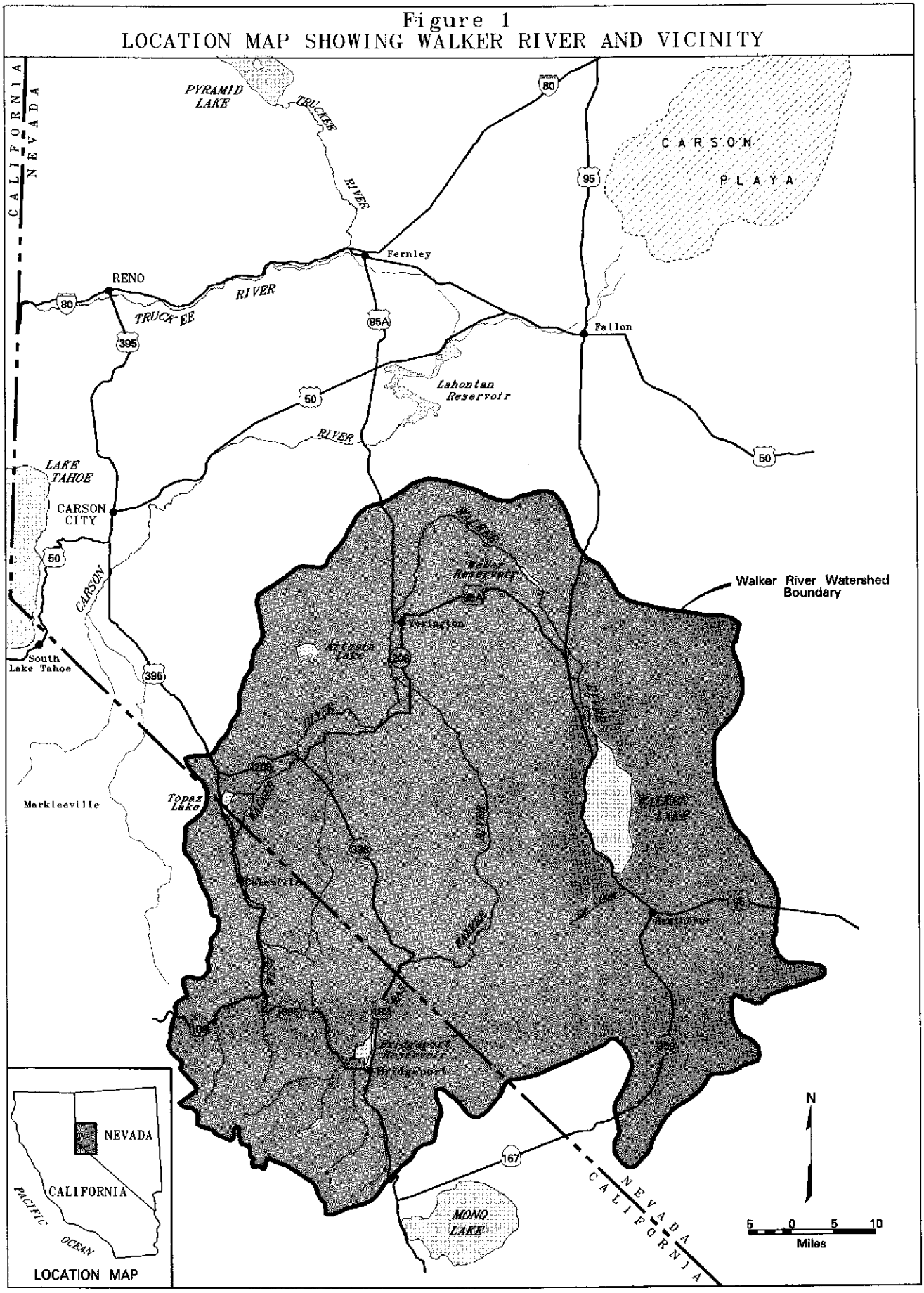
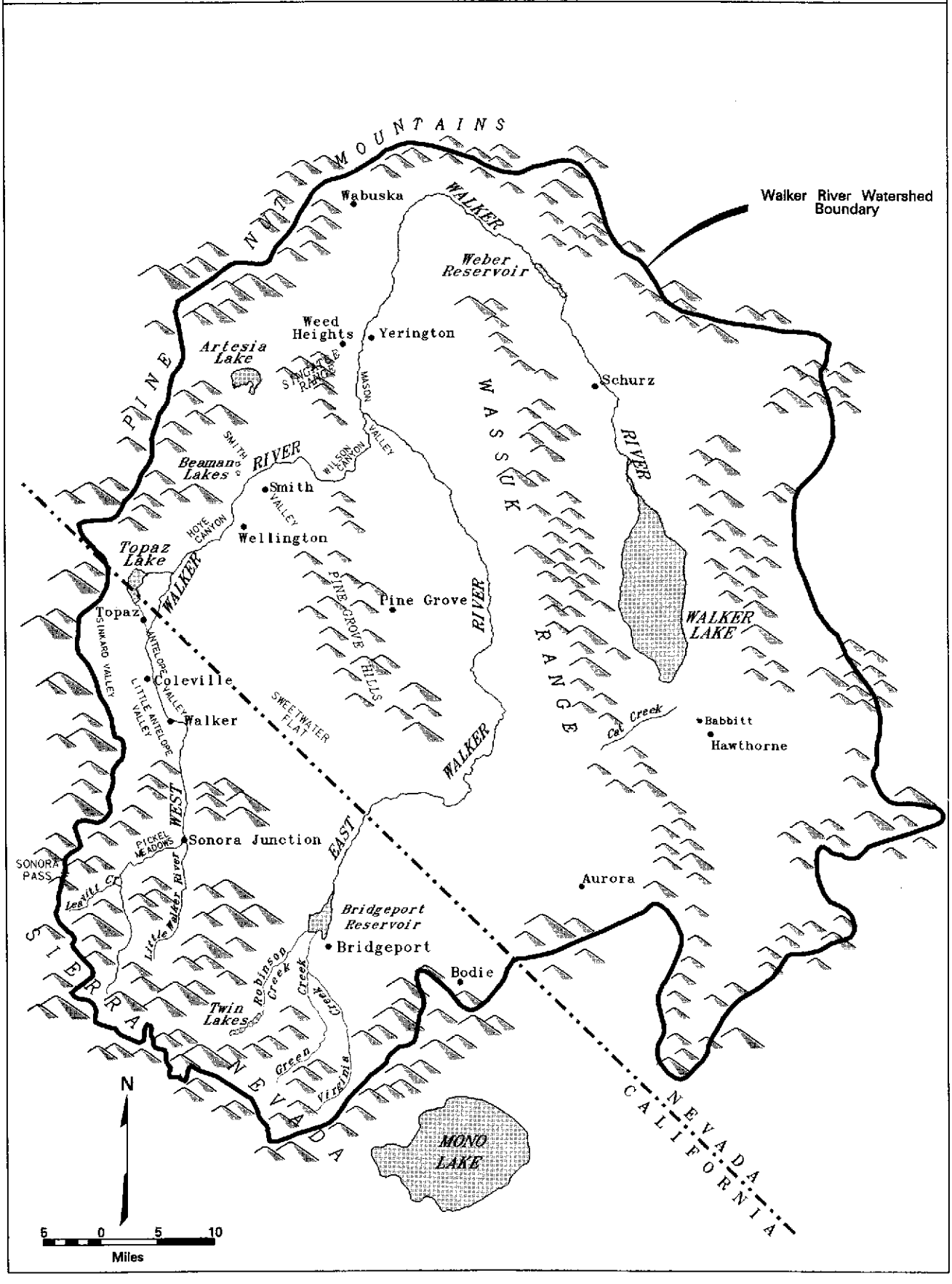


Figure 2
THE WALKER RIVER WATERSHED



Chapter 1

THE RIVER AND ITS ENVIRONMENT

This chapter traces the path of the Walker River from its headwaters in California's Sierra Nevada mountains to its terminus, Walker Lake in Nevada. Chapter 2 describes in greater detail the more significant lakes and reservoirs mentioned here.

The Walker River is divided into two forks in the upper watershed — the East and West Walker River — both of which arise in the Sierras. The upper watershed in California is in the northern part of Mono County. A characteristic shared by both forks of the river at the watershed's higher elevations is their steep gradients, or slopes of their channels, as shown in Figure 3. Another shared characteristic is the number of small lakes along the sierran crest, a few of which have been converted to reservoirs by construction of low dams across their natural outlets. The lakes, some of which reflect past glaciation, share the area with other geographic features whose names explicitly reflect their glacial origin —

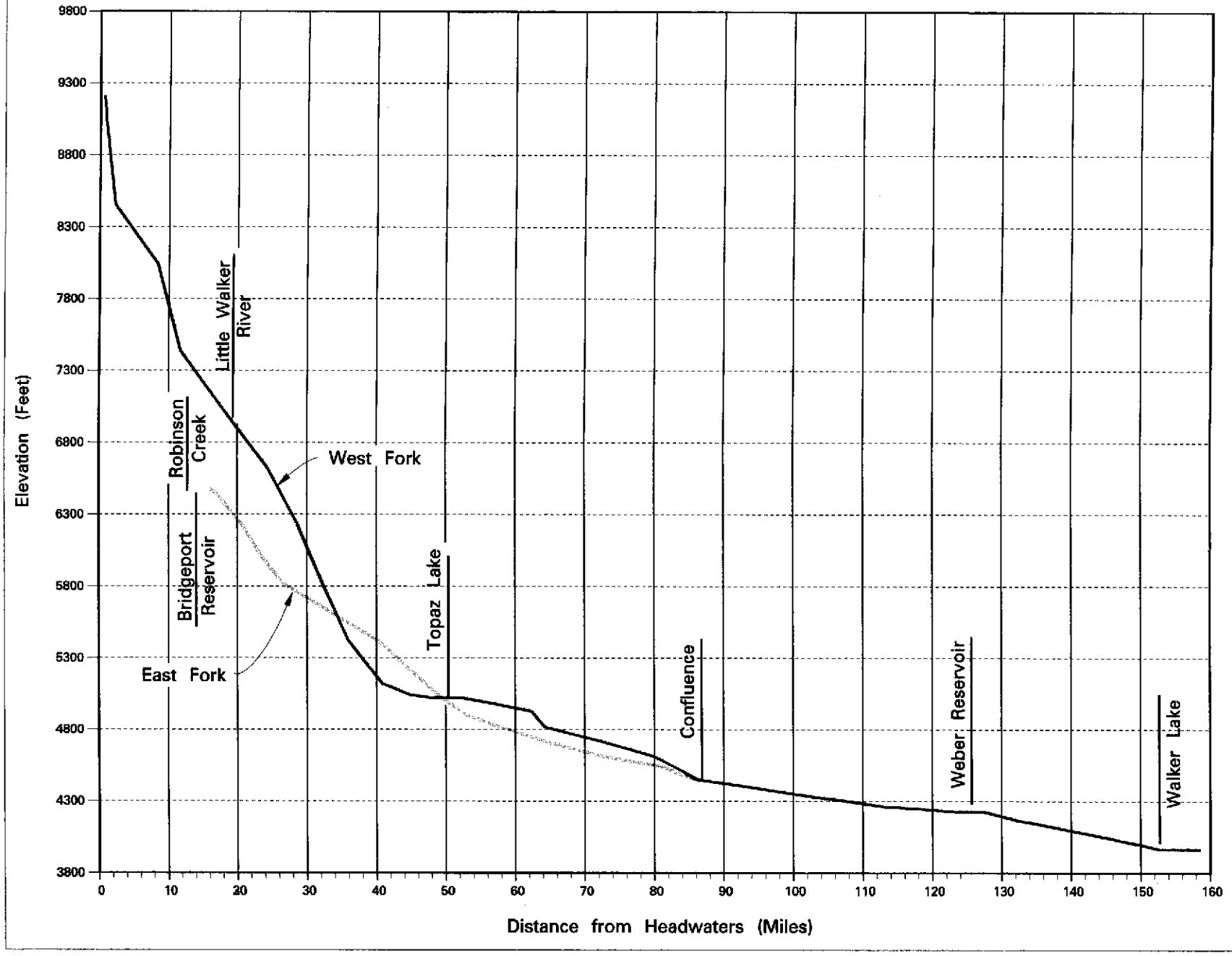
An Early Perspective of Mono County

Although Mono County was traversed by a number of explorers and early immigrant parties, little settlement occurred in the area until local mining booms began to attract permanent residents, who established farms and trading centers to supply the miners. The area's remoteness and harsh winters discouraged many of those who passed through from establishing permanent residence. The following description of Mono County comes from a *California Historical Society Quarterly* article entitled "Early History of Mono County", referenced in Appendix 2.

"The land of Mono is 'a strange country where one is impressed with the idea that he has come too soon... [where] all nature wears a primitive aspect... [and where] all, except a few valleys and mountain meadows, is a wilderness, silent and vacant, over which the mirage dances, and the sandstorm sweeps.'

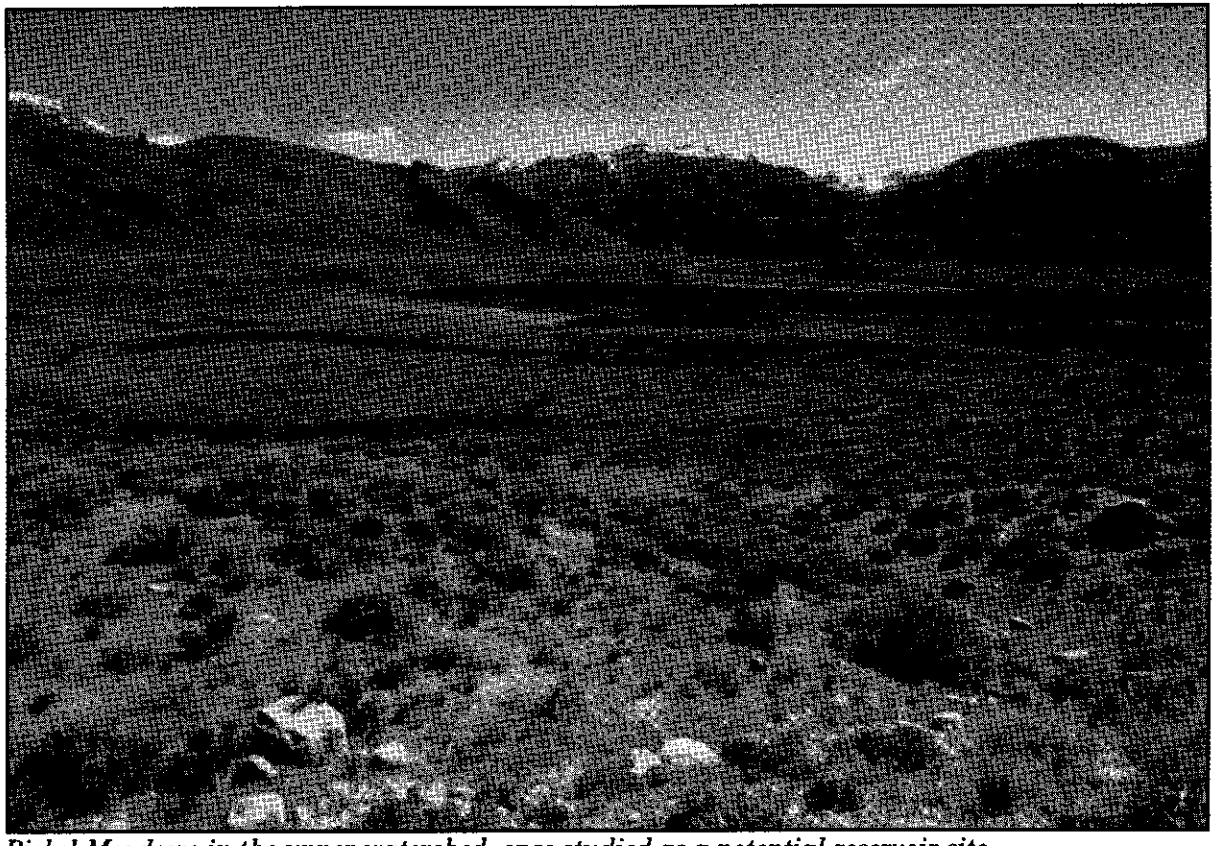
Thus did Henry Degroot in 1860 describe the region which was soon to become the County of Mono, California. Nor do his words seem less appropriate today. From glaciated peaks, two of which, Lyell and Dana, rise more than 13,000 feet, the east wall of the Sierra Nevada drops a full half of that distance, practically without topographical interruption and without enough trees to disguise either the suddenness or the steepness of the descent. It is not to be wondered that Degroot, accustomed, as were most of the early visitors, to the heavily forested easier slopes facing the Pacific Ocean, should find the scene primitive and depressing. At various step-like levels among boulders left by glaciers, lie small spring- and snow-fed lakes — crystal clear but lonely ('vacant') and cold; the cheeriest note on the whole landscape is sounded by creeks which escape from them and pursue melodious courses, sometimes under canopies of aspen, to meadows at the base of the great wall, whence they drain into Mono Lake, or to Walker River northward, or to the Owens River flowing south. Beyond the narrow green strip which the water reaches, sage-covered hills and valleys spread eastward into the arid stretches of the Great Basin."

Figure 3
LONGITUDINAL PROFILE OF THE WALKER RIVER



Matterhorn Peak, Cirque Mountain, Kettle Peak, and Hanging Valley Ridge.

The West Walker River is the larger of the two forks. Its headwaters, surrounded by a cluster of small lakes, lie high in the mountains south of Sonora Pass,on the eastern side of the sierran crest. From the headwaters area, the West Walker flows downward to join Highway 108 at Leavitt Meadows, a high alpine valley bearing signs of past glacial activity. The Little Walker River, an important upper watershed tributary, has its confluence with the West Walker in the meadows. Leavitt Meadows and the adjoining Pickel Meadows have been studied in the past as potential reservoir sites, because they are the only sizable high-elevation valleys and the steep gradient of the river in this reach would permit development of hydroelectric power. The U.S. Marine Corps Mountain Warfare Training Center is in Pickel Meadows, providing an indication of the area's harsh winter climate.



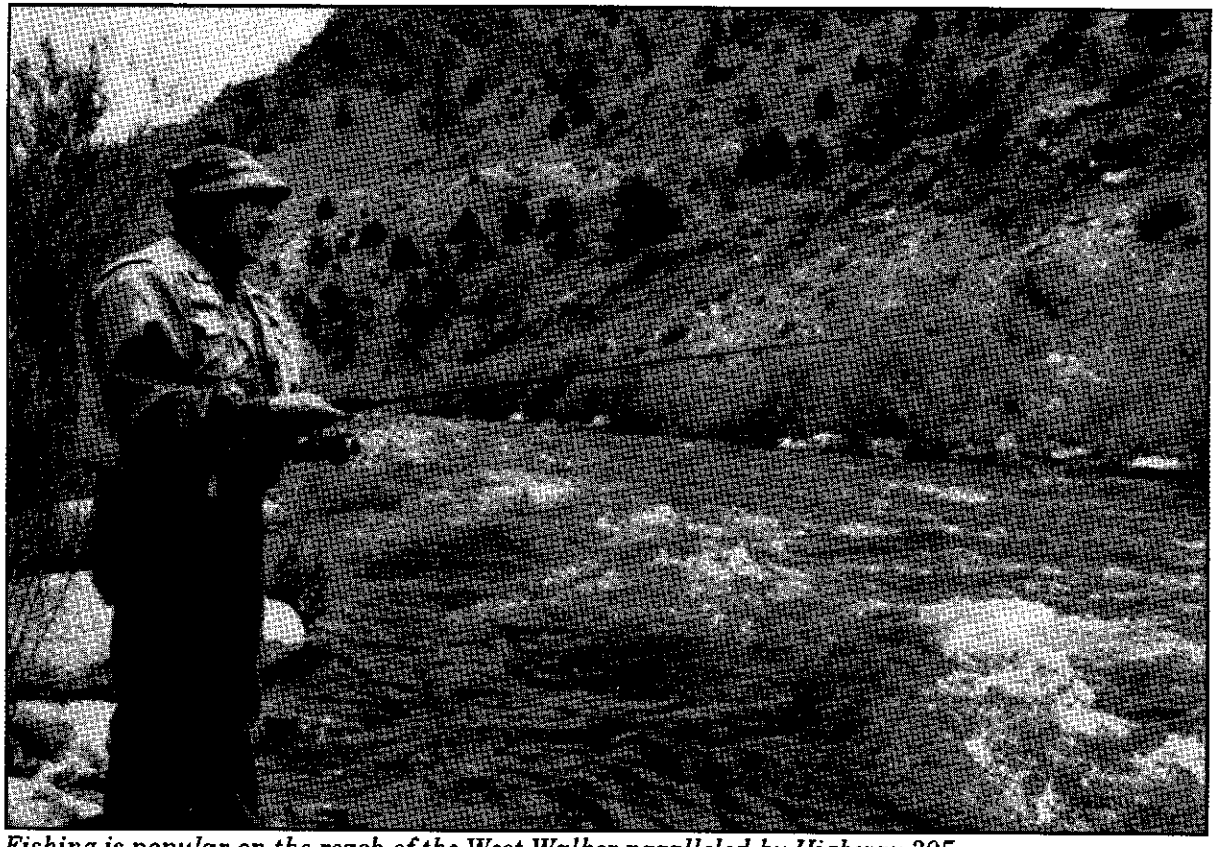
Pickel Meadows in the upper watershed, once studied as a potential reservoir site.

Part of this upper segment of the West Walker was recently added to California's Wild and Scenic River System. The designated section spans about 33 river miles from Tower Lake at the headwaters area downstream to the confluence with Rock Creek, near the hamlet of Walker on the edge of Antelope Valley. A segment of Leavitt Creek (slightly over 5 miles) is also included in the designation. The California Wild and Scenic Rivers Act of 1972 requires that certain rivers possessing extraordinary scenic, recreational, fishery, or wildlife values be preserved in their free-flowing states. The act prohibits construction of dams, reservoirs, and most water diversion facilities on river segments included in the wild and scenic river system. Thus, no water development could occur today at Leavitt and Pickel Meadows.

Near the junction of Highways 108 and 395, the West Walker turns sharply northward and flows through a canyon cut in the surrounding volcanic rocks. Highway 395 shares the canyon with the river; the easy access afforded by the paved highway makes this reach of

the river a popular spot for anglers. Below the canyon, the river enters the head of Antelope Valley, the only large agricultural area on the West Walker in California. This valley, which extends across the stateline into Nevada, contains the very small settlements of Walker, Coleville, and Topaz. Pasture lands and alfalfa fields dominate the valley floor; water is served to these lands from canal and ditch systems diverting directly from the river and its tributaries.

Most of the upper watershed in California is characterized by steep, rugged terrain; there are but few valleys large enough to support agriculture (most often livestock grazing). Antelope Valley, adjacent Little Antelope Valley, and Slinkard Valley are the largest areas of historical or present agricultural use on the California side of the West Walker. These valleys lie in the transition zone from the Sierras on the west to the basin and range geomorphic province on the east. The contrast between the two regions is marked. Conifers dot the steep slopes of the West Walker's canyon above Antelope Valley; at the other end of the valley the river passes through flats covered with sagebrush and scrub.



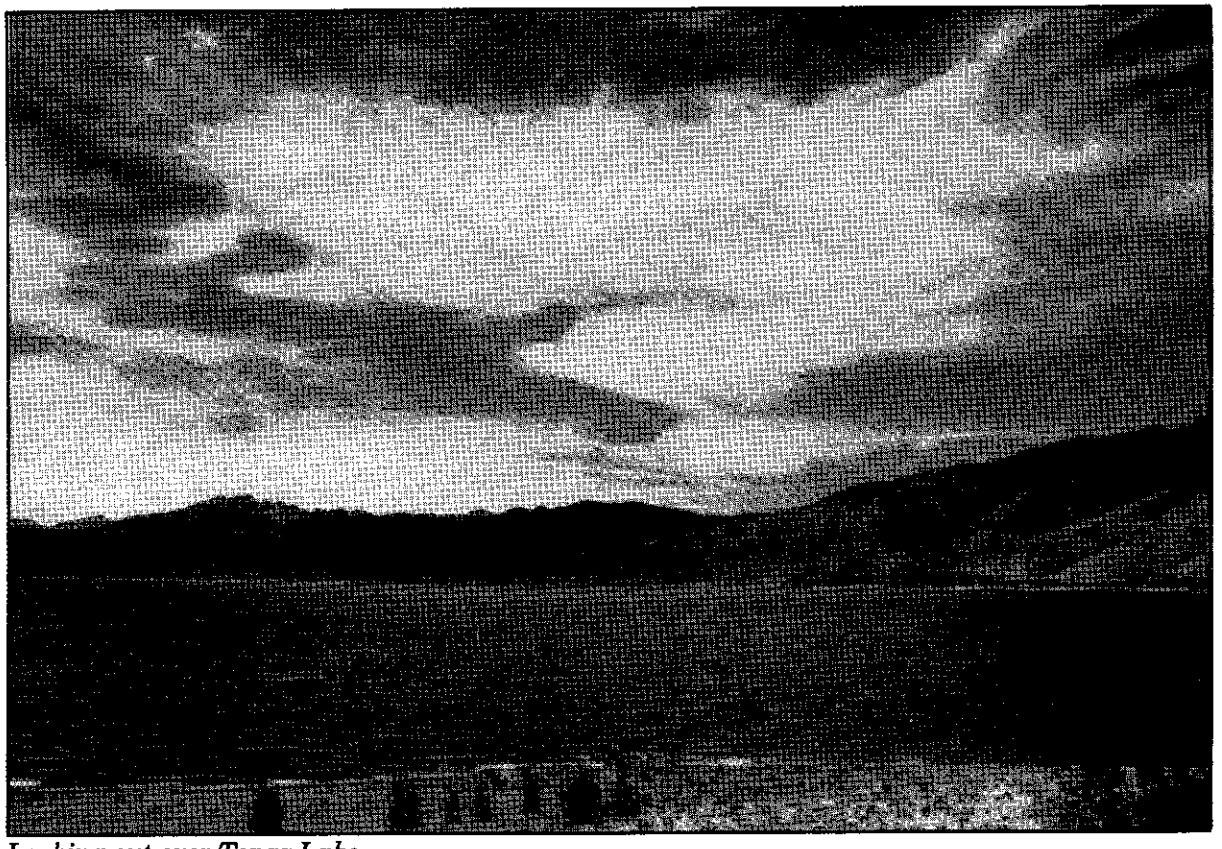
Fishing is popular on the reach of the West Walker paralleled by Highway 395.

Lost Cannon Creek

Lost Cannon Creek flows into the West Walker at the head of Antelope Valley near Walker. The creek, and the nearby Lost Cannon Peak, commemorate one of the expeditions led by explorer John C. Fremont. Fremont and his party had made a second trek through the Sierras in 1843-44, searching for routes across the West. They passed through Bridgeport Valley and ultimately made their way to Sutter's Fort in Sacramento. The party hauled an army howitzer with them all the way from Missouri, until the rugged terrain surrounding the West Walker finally forced them to abandon their artillery in Deep Creek Canyon above Antelope Valley. Despite the name of the creek, the "lost cannon" was recovered in 1861 and taken to Virginia City for display.

There is a diversion of water from the West Walker in Antelope Valley to serve Nevada agricultural users — into Topaz Reservoir, an offstream storage reservoir that straddles the stateline. Topaz Reservoir occupies a topographic low point in a closed basin, which formerly contained a small natural lake known as Alkali Lake. Walker River Irrigation District developed Topaz Lake by constructing a canal to divert water from the West Walker in California into this closed basin; water is released back into the river via a tunnel and canal on the Nevada side. Storage of irrigation water began in 1921.

Today Topaz Lake is a striking sight to the traveler on Highway 395 — a large blue expanse of water perched on the edge of an arid desert valley. A small recreational residential community has grown up around the eastern side of the lake. Topaz is the only large lake or reservoir in the West Walker's upper watershed. The lake is a popular spot for boating and fishing.



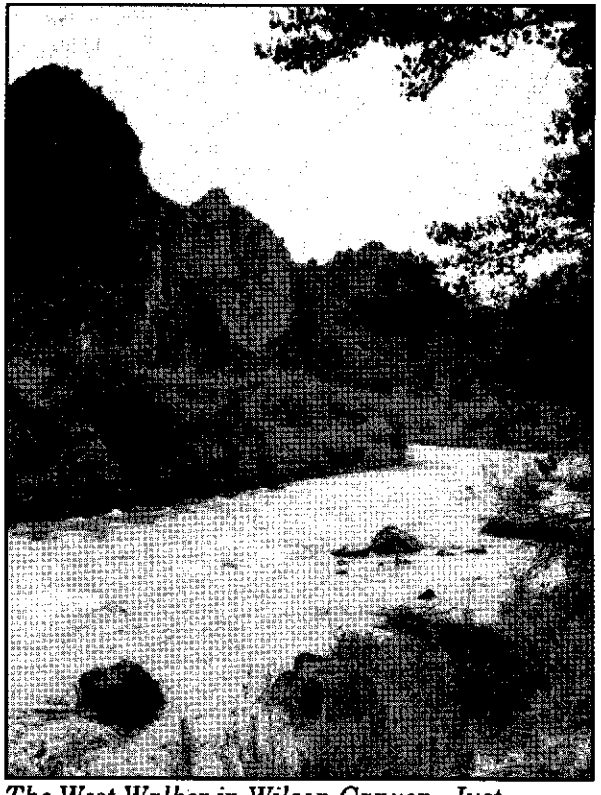
Looking out over Topaz Lake.

The West Walker enters Hoye Canyon below Antelope Valley; Hoye Bridge above the canyon is the location of an important streamflow gage. The river passes the small town of Wellington and flows through Smith Valley. Smith Valley was named after members of the Smith family who settled here in 1859, spending their first winter in the valley in a house they constructed of tules. The valley, initially noted for its livestock grazing potential, soon became an important agricultural area — historically irrigated from the Walker and its tributaries and more recently irrigated from ground water sources as well. Desert Creek was formerly a significant tributary to the river in Smith Valley, but diversion of the creek's water for agricultural use now minimizes the creek's inflow to the river. The irrigated lands in Smith Valley offer a striking contrast to native vegetation on the arid, scrub-covered ranges on either side of the valley.

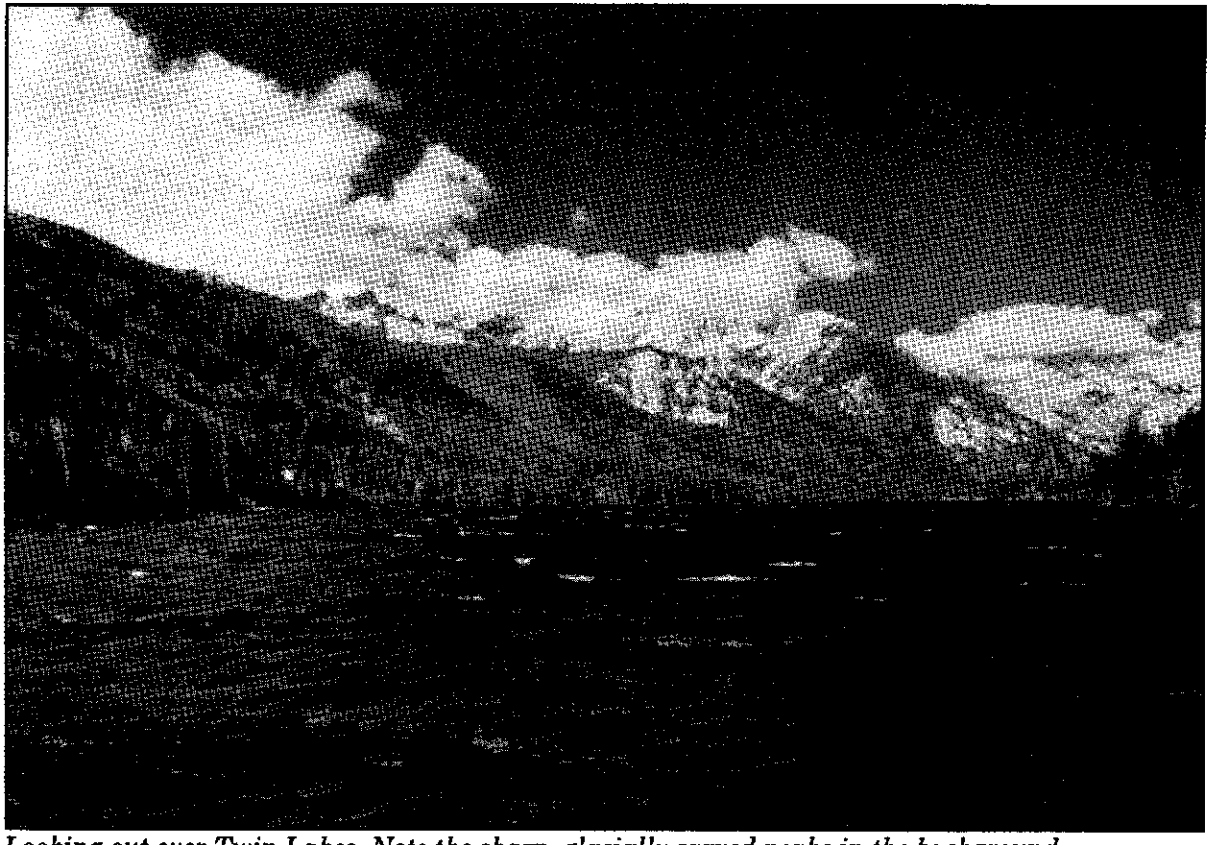
Artesia Lake lies at the valley's north end; this shallow lake is a remnant of a larger Pleistocene lake that once occupied Smith Valley in wetter geologic

times. The lake, surrounded by a wildlife management area, is now fed primarily by ground water and can go dry in some years. In wetter years, a cluster of springs at the base of the Pine Nut Mountains on the lake's western edge provide a visible source of lake inflow. There are also hot springs at the base of the hills, a short distance south of Artesia Lake. A resort known as Hinds Hot Springs was operated here in the late 1800s.

Smith Valley also harbors another wetlands area — the Beaman Lakes. This cluster of small lakes or ponds is believed to have been caused by irrigation in the valley, since it is not shown on the earliest maps of the region. Water supply to the lakes comes from excess applied irrigation water, agricultural drainage water, and discharge of ground water. A drainage canal to the West Walker was constructed in 1948 to lower water levels in the area so that some of the agricultural land being flooded could be reclaimed.



The West Walker in Wilson Canyon. Just upstream of the canyon, the river passes a scenic badlands terrain, with eroded hills in pastel hues.



Looking out over Twin Lakes. Note the sharp, glacially carved peaks in the background.

Leaving Smith Valley, the West Walker passes through scenic Wilson Canyon and flows into the southern end of Mason Valley. Smith and Mason valleys are the two major agricultural areas served by the Walker River in Nevada — the West and East Walker combine to form the mainstem Walker River in the southern part of Mason Valley.

The East Walker River has its headwaters to the south of the West Walker in Mono County. At the highest elevations, the East Walker's headwaters include a portion of the Hoover Wilderness Area, known for its many small lakes that are favorite hiking and camping destinations. The largest of the recreational lakes in the upper watershed are Upper and Lower Twin Lakes on Robinson Creek, an important tributary of the East Walker. Green Creek and Virginia Creek are other important tributaries in the watershed above Bridgeport Valley.

The high elevation, upper watershed tributaries coalesce in Bridgeport Valley; some smaller tributaries also reach the valley from the lower, and more arid, Bodie Hills area on the valley's east side. This southeastern corner of the upper watershed is composed almost entirely of Pleistocene volcanic rocks that contain a number of thermal springs, some hot and some merely warm. Thermal springs often contain high concentrations of dissolved minerals in their water, since the solubility of these substances increases with increasing water temperature. A locally well-known hot springs just outside Bridgeport is called Travertine Hot Springs, after the extensive colorful deposits of travertine that have built up over the years. (A portion of this hot springs area is pictured on the front cover.) The travertine is a form of calcium carbonate precipitated out of the hot water as it cools upon reaching the ground surface. The travertine at this site, colored by minerals in the water and by biological action, has been quarried for use as decorative stone.

Travertine Hot Springs. The light-colored materials in the background precipitated out of solution from the thermal waters.

Glacial Vestiges

The area surrounding Bridgeport contains much evidence of past glaciation during the Pleistocene Epoch, the period of geologic time immediately preceding today's Recent, or Holocene, Epoch. Geologists describe glacial activity in the Sierras in terms of the different time periods at which the ice advances occurred. The Bridgeport area is thought to bear traces of the Tioga, Tenaya, Tahoe, Mono Basin, and Sherwin glaciations. The youngest of these events, the Tioga, occurred some 10,000 years before the present. Glacial features visible in the area include:

- Glacial Till. Till is the mixture of rocks, boulders, and soil picked up by a moving glacier and carried along the path of the ice advance. The glacier deposits this till along its path — on the sides of the ice sheet, at the toe of the glacier when it recedes, and across valley floors when the ice sheet melts. These till deposits are akin to the footprint of a glacier and are used to track the movement of glaciers. Parts of the Bridgeport Valley floor are covered with till deposits overlain with more recent alluvial soil deposited by the river and streams. These till deposits can be good sources of ground water, if they do not contain significant amounts of impermeable clays.

- Moraines. Moraines, which can be subdivided into many different types, are deposits of glacial till. Lateral moraines are the ridges of till that mark the sides of the glacier's path. Terminal moraines are the material left behind by the farthest advance of the glacier's toe. Each different period of glaciation leaves behind its own moraines — lateral moraines belonging to several glaciations can be seen in the canyons of the East Walker's main tributaries (such as Green Creek) above Bridgeport Valley. The small reservoir at Dynamo Pond occupies a space enclosed by moraines.

- U-Shaped Valleys. U-shaped valleys are characteristic of glacial erosion — valleys eroded by stream action are typically V-shaped. A good example of a U-shaped valley is the one occupied by Robinson Creek below Twin Lakes.

- Hanging Valleys. Hanging valleys can be created when smaller tributary glaciers join the main ice sheet. Since the main glacier is larger and heavier than the tributary one, the main glacier will erode more deeply into its valley than will the tributary in its own valley. After the ice melts, the tributary valley will be left hanging part of the way up the wall of the larger canyon that it intersects. Many waterfalls in the high Sierras, including well-known ones at Yosemite National Park, occur at the juncture of a hanging valley with a larger canyon. There are two spectacular hanging valleys (occupied by Cattle Creek and Horse Creek) on the south side of the steep canyon above Upper Twin Lake. In addition to the waterfalls at the ends of these valleys (most photogenic during the spring runoff period), there is also a waterfall within Horse Creek Valley itself.

- Cirques. A cirque is a smallish, rounded depression with steeply sloping sides carved into the rock at the top of a ridge where a glacier has its head. After the period of glaciation ends, the cirque may contain a small remnant of the former glacier, or it may fill with water and become a lake. The term "tarn" is also used to describe lakes that have formed in cirques. Numerous unnamed cirque lakes or tarns dot the upper watershed, including the unnamed tarn on the side of the appropriately named Cirque Peak.

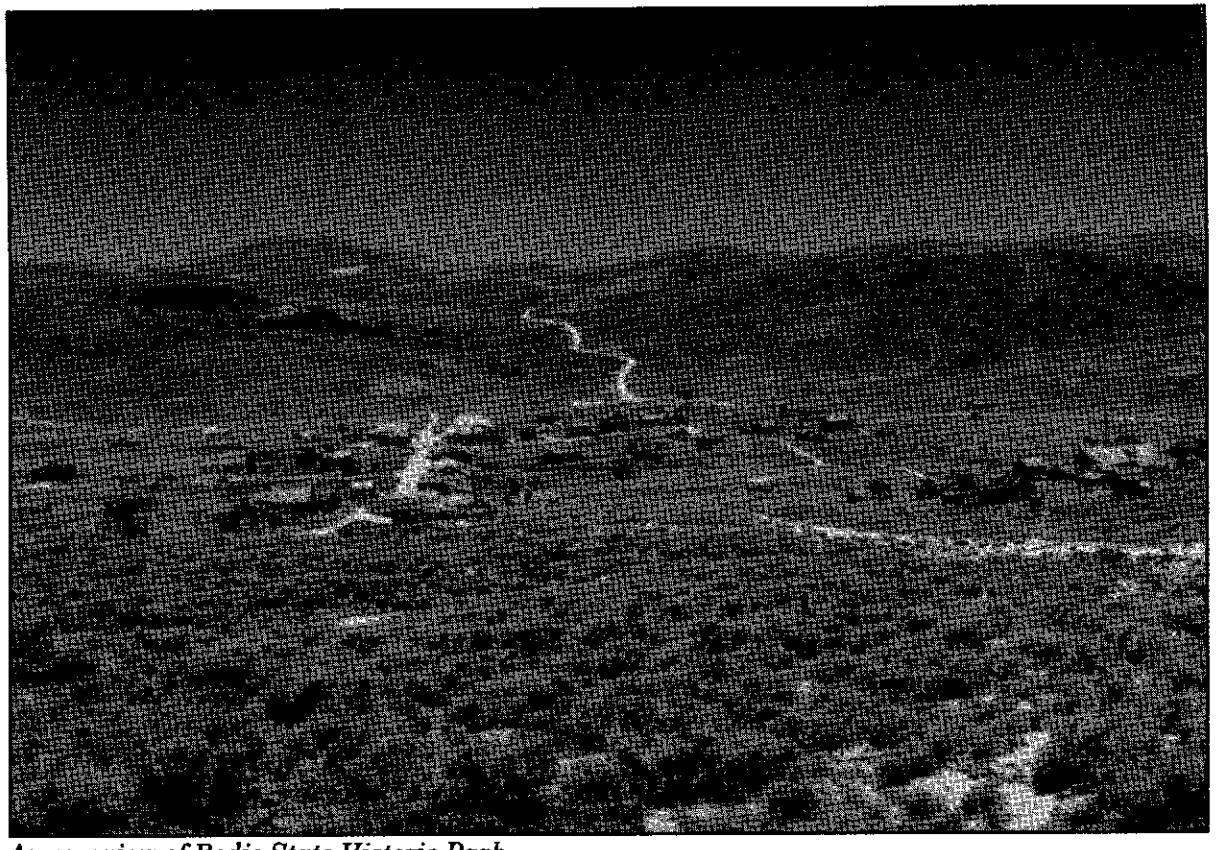
Winter in Mono County

"Blow, blow, thou winter wind....
Freeze, freeze thou bitter sky."

The route through Bridgeport Valley to the mines of the Bodie Hills and of Aurora, Nevada, was at one time a well-traveled thoroughfare. A number of early accounts were written about travel on the route, and many took special pains to mention the severity of the winters, highlighted by the Shakespearean quotation above. Mark Twain passed through the area as a sightseer and as a prospector. This excerpt from his tales in *Roughing It* is quoted from "Early History of Mono County".

"There are only two seasons... and these are, the breaking up of one Winter and the beginning of the next.... Under favorable circumstances it snows at least once in every single month in the year, in the little town of Mono. So uncertain is the climate in Summer that a lady who goes out visiting cannot hope to be prepared for all emergencies unless she takes her fan under one arm and her snow shoes under the other.... And they do say that as a general thing when a man calls for a brandy toddy there, the bar keeper chops it off with a hatchet and wraps it up in paper, like maple sugar."

The East Walker and its tributaries in Bridgeport Valley provide irrigation water for the valley, primarily for pasture and alfalfa. Like Antelope Valley on the West Walker, Bridgeport Valley is the only significant agricultural area on the East Walker in California. The town of Bridgeport is the county seat of Mono County and a supply center for summer tourists and travelers on Highway 395. Bridgeport Reservoir, at the valley's north end, is the only large water supply reservoir on the East Walker and, like Topaz Reservoir, serves agricultural lands in Nevada. Bridgeport Reservoir was constructed in 1924 by Walker River Irrigation District.



An overview of Bodie State Historic Park.

Bodie

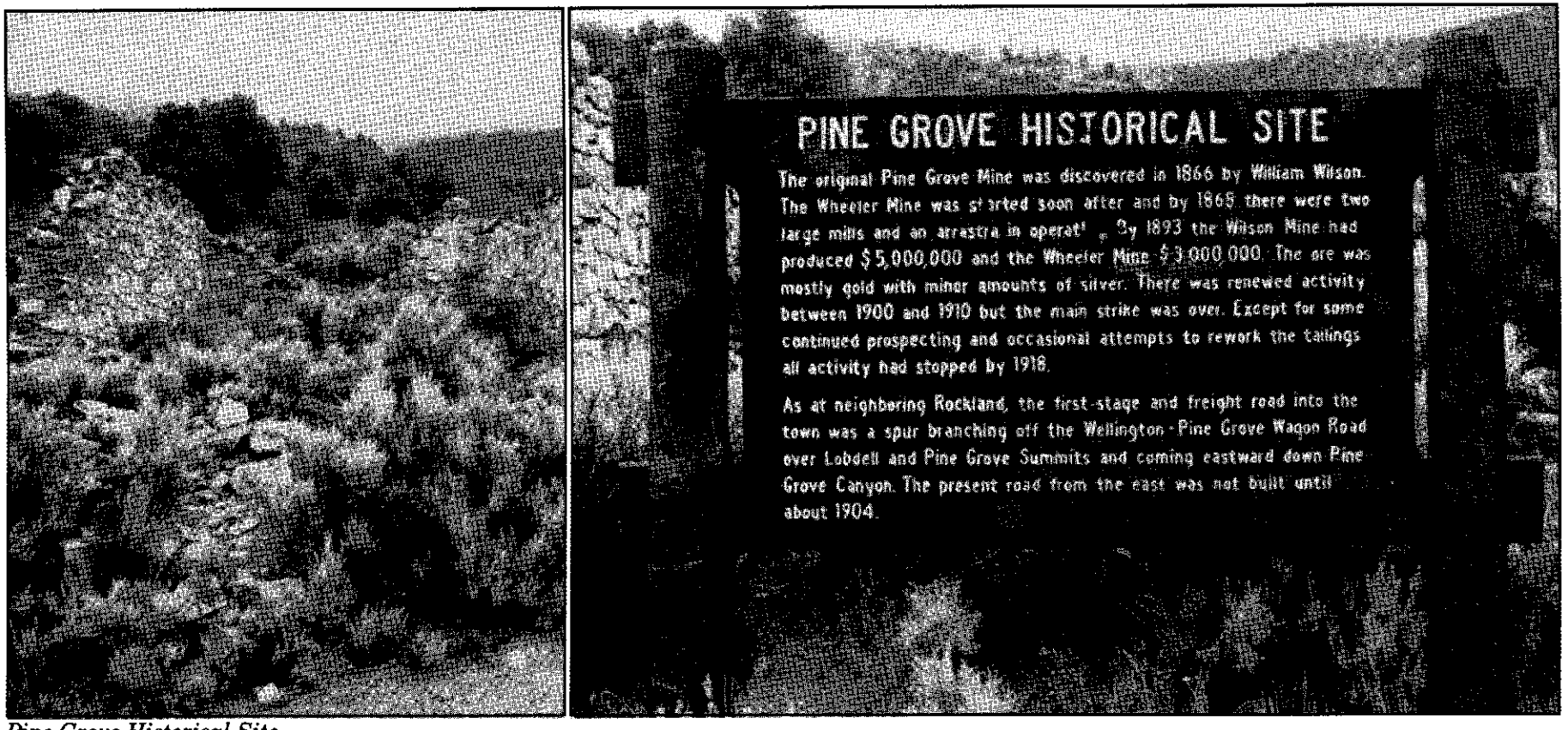
Bodie State Historic Park lies about 20 miles by road southeast of Bridgeport. The town was named after Waterman S. Body, a placer miner who made the first discovery of gold in the area, in 1859, and froze to death in a snowstorm soon afterward. This ghost town, preserved in a state of arrested decay, seems as remote today as it must have been to the miners who flocked there in the 1870s when the gold boom began. The strike at Bodie came at a fortunate time, occurring as some of the luster was beginning to wear off the Comstock boom in Virginia City to the north. Hordes of would-be miners were lured from the Comstock to Bodie by tales of its possible riches, swelling its population to about 10,000 in 1880. (Today the population of nearby Bridgeport numbers only about 500.) The mining boom lasted about a decade; Bodie was said to be second only to the Comstock in productivity of its mines. Limited mining activity continued after the boom, but few people remained in the town, much of which was destroyed by fires in 1882 and 1932. Bodie was a ghost town by the end of the 1930s and was added to California's State Park system in 1962. The buildings remaining today constitute perhaps 5 percent of those in the town at its heyday.

Bodie's location was the major reason for the rapid dwindling of its population after the gold boom went bust. Save for the presence of the ore deposits, a more unlikely location for a pioneer townsite would be hard to find. There was no water supply, except for a few wells attempted in later years; the town's water supply was hauled in by wagon. (Today water for the State Park is brought in by pipeline from a spring several miles distant.) Wood for fuel was scarce — firewood seekers stripped the neighboring hills of their few scrubby pines. The stamps of the town's 10 ore mills were fueled by wood-fired boilers because there was no water power available; wagons brought in the wood to fuel the mills and to timber the mines. Early descriptions of Bodie invariably comment on the harsh winters, made more severe by the town's exposed, high elevation location. Wind speeds of over 100 miles per hour have been recorded, sub-zero night-time lows are the norm in winter, and snow closes the road to the town in most winters.

Hardships encountered by the miners who created the town (and who gave it its rough reputation) are illustrated in the following two excerpts from Grant Smith's *Bodie; Last of the Old-Time Mining Camps*.

> *"Bodie was located ... in a range of barren, wind-swept hills, entirely devoid of vegetation, save for the ever-present sage brush. A more uninviting region it would be difficult to imagine. The altitude at the town was 8374 feet; the mines were from five to seven hundred feet higher. The climate was severe, except for some glorious days in midsummer. In winter, cold winds and snow swept it incessantly, and in summer the dust was too often in motion. The greater part of the town was built on a flat at the base of Bodie Bluff, and extended for perhaps half a mile up and down the flat on either side of the wide main street. Part of the town crept up the hill toward the mines."*
>
> *"But the winter of 1878-1879 was a terrible one. Bodie was one hundred and ten miles from the railroad at Carson City, and all supplies of every kind had to be hauled for long distances. Until the 'excitement' arose, in the summer of 1878, the camp was comparatively small and accommodations were of the poorest sort; consequently the winter found thousands of people poorly housed, poorly fed, with little employment, and with nothing to do but hang around the saloons and gamble and fight and get drunk and lie out in the snow and die. Hundreds died that winter from exposure and disease, and nearly as many lost their lives by violence."*

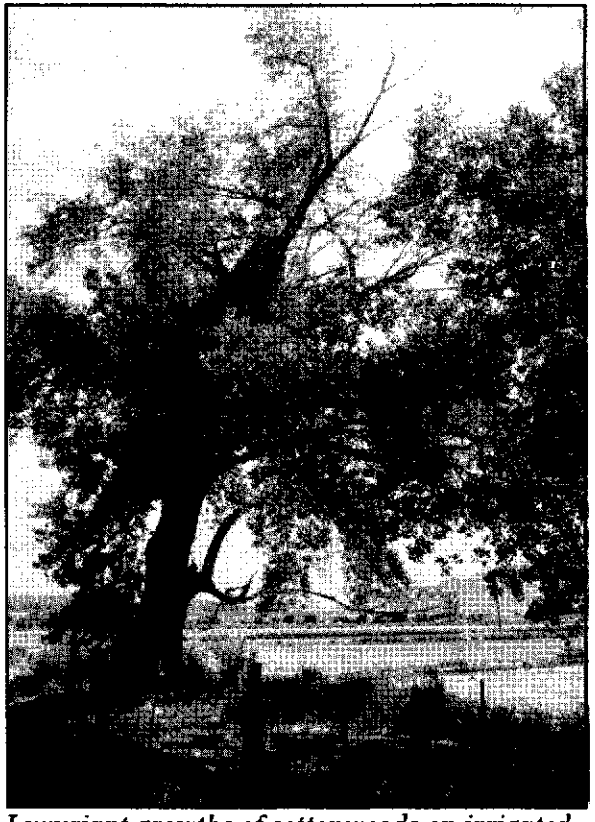
Water released or spilled from Bridgeport Reservoir travels about 7 miles down the East Walker before reaching the stateline. The river bends eastward soon after crossing the stateline and cuts through the Pine Grove Hills, a historically important mining area, before turning again northward. The river traces its path along a narrow valley floor prior to reaching Mason Valley proper; the bottomlands of this small, isolated river valley support agriculture in the form of alfalfa and livestock production. Today's unpaved road that follows much of this reach of the river once linked Mason Valley with two important mining areas — the Pine Grove Hills and the Aurora area to the south.



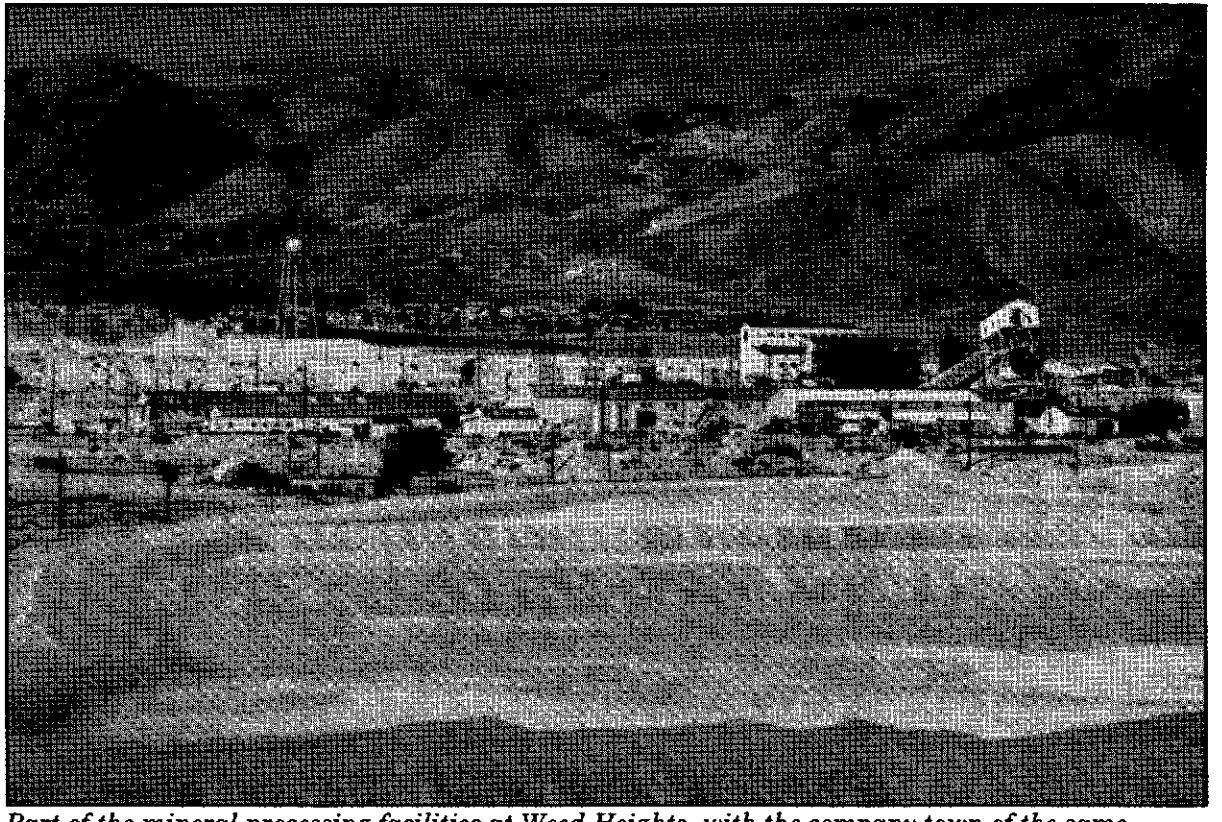
Pine Grove Historical Site.

Mason Valley (like its twin, Smith Valley to the west) was early recognized as an attractive location for cattle-raising. Mason Valley was named for Hoc Mason, who settled there in 1860 with a herd of cattle driven over the Sierras from California. The valley remains an important agricultural center today; Yerington, county seat of Lyon County, is located in the middle of the valley. Mason and Smith valleys together constitute the largest areas of irrigated land in the Walker's watershed in Nevada. The Singatse Range, which divides these two valleys, offers an example of the region's aridity — there is virtually no surface water available in this range and insufficient precipitation to support even the stands of piñon pines in the hills to the west. The irrigated valley floors, in contrast, sustain cottonwood trees of great girth.

The East and West Walker meet to form the mainstem Walker River in the lower part of Mason Valley. The river flows northward through the valley, passing a very visible reminder of this century's copper mining boom in the area — the enormous tailings piles of the copper mine at Weed Heights, which overlook the valley floor from the edge of the Singatse Range. Mining and agriculture have historically been the mainstays of



Luxuriant growths of cottonwoods on irrigated lands at the south end of Mason Valley stand in sharp contrast to the arid Singatse Range.

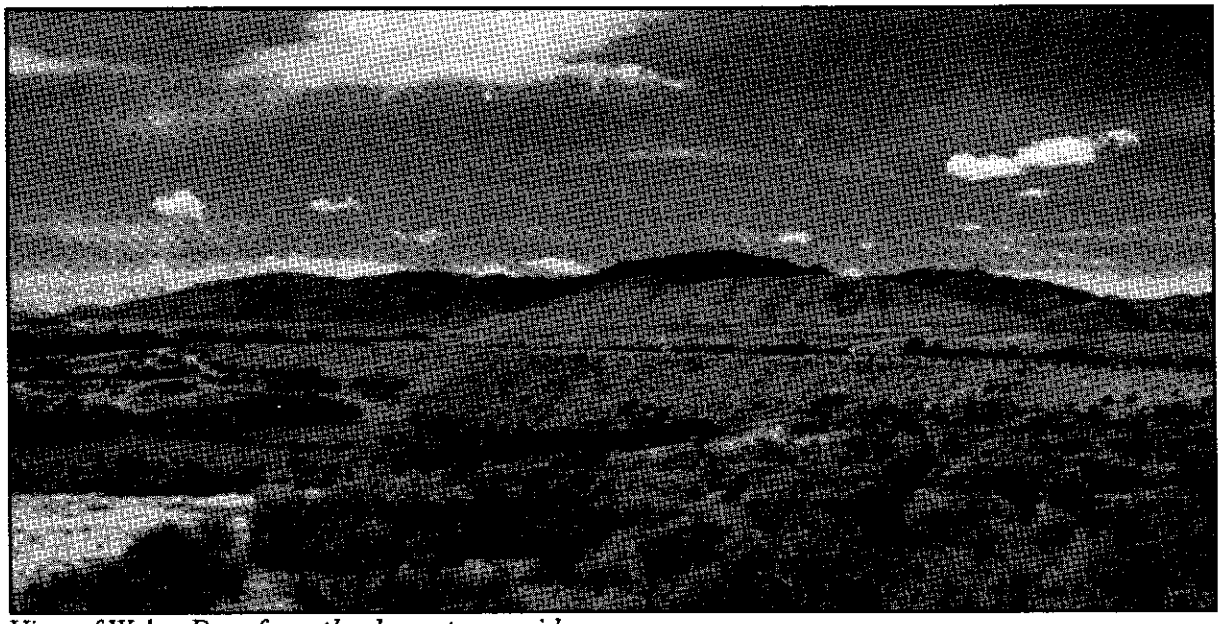


Part of the mineral processing facilities at Weed Heights, with the company town of the same name in the background, at the base of the Singatse Range.

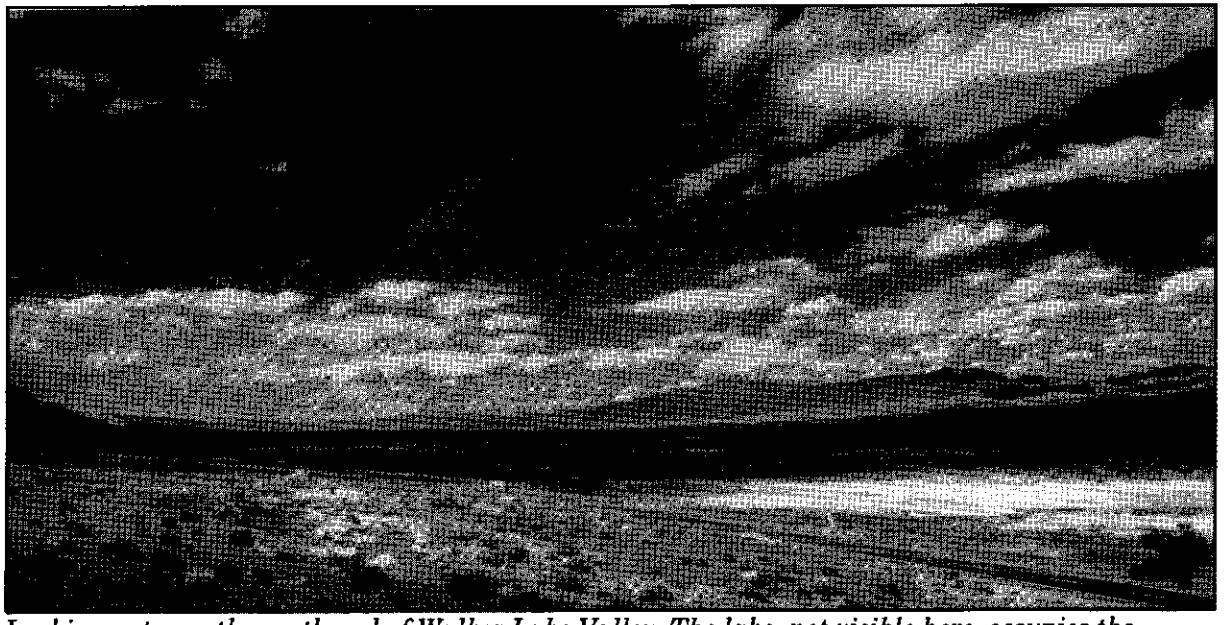
the area's economy. The Singatse Range has hosted several mining boomlets; the ruins of the Thompson Smelter at the north end of the valley near the railroad siding of Wabuska date back to an earlier period of mining.

Near Wabuska, waters of the Walker River can overflow into the Carson River basin to the north — either as a result of excess irrigation water applied in Mason Valley or because of surplus water in the valley in wet years. The overflow occurs via Adrian Valley, a narrow, low-lying flat connected to the north end of Mason Valley above Wabuska. This water eventually reaches the Carson River just above Churchill Valley. It has been suggested that the Adrian Valley drainageway is a former channel of the Walker River, perhaps dating from a fluctuation in stage of the prehistoric Lake Lahontan.

Leaving Mason Valley, the Walker River turns eastward and enters the Walker River Indian Reservation, which includes the northern end of the valley above Walker Lake. The river almost immediately makes a pronounced bend to the south, skirting the edge of the Wassuk Range and cutting deeply into the soft sediments that have created a miniature badlands topogra-



View of Weber Dam from the downstream side.



Looking out over the north end of Walker Lake Valley. The lake, not visible here, occupies the valley's southern end.

phy in places along the channel. On the reservation, the river flows into Weber Reservoir, a small reservoir with an as-built capacity of 13,000 acre-feet. Weber Reservoir, named after an engineer who made studies of the site in 1915, was completed in 1935 to provide irrigation water to reservation lands. The dam is operated by the U.S. Bureau of Indian Affairs. Weber Reservoir, which essentially retains water in a short stretch of the former river channel, is the only reservoir on the mainstem Walker River.

Below Weber Reservoir, the river meanders along the bottom of the valley, its channel marked by groves of cottonwoods and willows and in places deeply incised into the valley sediments. The river passes the small town of Schurz, a supply center for the reservation, before reaching its terminus at Walker Lake.

Walker Lake is bounded on its west side by the near-vertical fault scarp of the Wassuk Range; Highway 95 traverses the lake shore in a sidehill cut along the mountainside. Although the lake's primary use is recreation, there has been minimal recreational development in the area. There is a marina on the west shore, and supplies are available at the small towns of Babbitt and Hawthorne south of the lake. These towns are supported by the federal government's ammunition depot located here; the site was chosen in 1928 because of its remoteness from populated areas. Travelers on Highway 95 at the lake's south end can see the numerous small bunkers and dugouts for ammunition storage that dot the landscape. For most of its history, the ammunition depot was operated by the Navy, which subsequently turned it over to the Army; today the facility is operated by a federal contractor.

One Visit to Walker Lake

The description below of a visit to Walker Lake is taken from Dan De Quille's 1889 *A History of the Comstock Mines*, which also discusses the surrounding area of western Nevada. The road mentioned in the quotation is the Carson and Colorado Railroad, constructed in the 1880s to link the booming Virginia City region with mining towns farther south, such as Bodie and Aurora. The railroad did not reach the Colorado River (or even Bodie), as its original promoters had hoped, but it did reach the town of Hawthorne and initially terminated near the ghost town of Candelaria to the south. Hawthorne was established by the railroad at a meeting-point among routes heading to various mining camps and served as a transportation center for moving goods to the mines.

"Wabuska is a thriving little place at the edge of Mason Valley, one of the finest agricultural and grazing regions in the State, the Walker River affording excellent facilities for irrigation. After leaving Wabuska, Walker Lake is soon reached. The road passes along the eastern shore of the lake nearly its whole length, affording many fine and picturesque views. It is a beautiful sheet of water, but lacks trees and vegetation, hardly a green thing being seen on its shores, except at the upper end, at and about the mouth of the Walker River.

Hawthorne... is situated about 3 1/2 miles beyond the foot of the lake. Although only a little more than eight years old, the town is beginning to present a comfortable appearance. It stands on a plain the soil of which at the time the town was laid out seemed to be nothing better than pure sand, yet on such a foundation has been conjured an oasis of shady groves, blooming grounds, and productive gardens."

The wide-open spaces at Walker Lake make it popular with boaters and water skiers.

Walker Lake is one remnant of the Pleistocene Lake Lahontan[1] — as are Pyramid Lake and the Carson Playa to the north. Lake Lahontan at its greatest extent is estimated to have covered over 8,000 square miles of northwestern Nevada, indicative of a much wetter climate in the area than exists today. In the valley now occupied by modern Walker Lake, Lahontan is estimated to have reached a maximum depth of about 530 feet, in comparison to Walker's maximum depth today of a little over 100 feet. Traces of the former Lake Lahontan can be seen in some valleys, where old shorelines are incised high on the surrounding mountains. Lake Lahontan receded as the regional climate became more arid, finally leaving only vestiges of its former self in some of the deepest river-fed valleys.

These vestiges of Lake Lahontan are terminal lakes, or sinks, meaning they occupy a topographic low and water leaves them only by evaporation[2]. Under natural conditions, the water level of a terminal lake varies annually with inflow to the lake. In wet periods lake levels rise, and in dry periods they decline. Pyramid Lake, the Carson Playa, and Walker Lake (like Lake Lahontan) have all been in a period of recession in this century. The decline in lake levels may reflect short-term variations in climatic conditions and most certainly reflects upstream diversions of river water for agricultural use. Walker Lake has declined 126 feet, from an estimated water surface elevation of 4083 feet in 1882 to today's elevation of 3957 feet.

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1 A variety of geographic features in Nevada bear Lahontan as part of their names. The name recognizes the explorer Baron La Hontan.

2 Evaporation from the surface of Walker Lake consumes a significant amount of water. Average annual evaporation from the lake is estimated at 4 feet per year, while average annual precipitation is only 4 to 5 inches per year.

Chapter 2

LAKES AND RESERVOIRS

This chapter describes the more significant lakes and reservoirs in the Walker River watershed. The descriptions illustrate the wide range of geomorphic conditions in the watershed — from the tarns of the Sierras to lakes surrounded by desert scrub and sagebrush. The two reservoirs owned by Walker River Irrigation District — Bridgeport and Topaz — are the only large reservoirs in the watershed, although they are dwarfed by Walker Lake, at the river's terminus. The small lakes and reservoirs of the upper watershed together constitute only a minor fraction of the storage capacity available in the larger reservoirs, and they do not play a significant role in river operation. The major points at which the river's flow can be controlled are the Walker River Irrigation District reservoirs on the East and West Walker and Weber Reservoir on the mainstem Walker River.

More information on the reservoirs located partly or entirely in Nevada can be found in *Water for Nevada, Hydrologic Atlas,* prepared by the U.S. Geological Survey and State of Nevada and referenced in Appendix 2.

The Small Sierran Reservoirs

Water development in the region began when agricultural users, primarily livestock companies, constructed a few small reservoirs high in the headwaters area. Some of these reservoirs were formed by constructing low dams across the natural outlets of existing lakes to enlarge their storage capacity. Rights to water stored in these reservoirs, the newest of which is now more than 80 years old, were subsequently incorporated in the federal court decree (informally referred to as Decree C-125) described in Chapter 5. Figure 4 shows the locations of these small reservoirs with decreed water rights[1]. Figure 4 also shows one small reservoir — Dynamo Pond — not included in the decree but having historic significance as an abandoned hydropower production site.

The dam height and reservoir water right values provided in Table 1 highlight the small size of the facilities with decreed water rights. The priority date or dates shown for each facility reflect the first time a claim was made for use of the water, which approximately coincides with the time at which the first dam was constructed at the site. As might be expected given the age of these facilities, several of the original small earthfill or rockfill dams have been rebuilt or enlarged. Thus, two water storage priority dates are shown for Upper and Lower Twin Lakes, the first

1 Over the years, there have been some alterations to place names in the region. There are several variations in the spelling of Lobdell and Poore Lakes; the name of Black Lake has been changed to Junction Reservoir, to reflect its location at Sonora Junction, where Highways 108 and 395 meet. All figures in this report reflect present U.S. Geological Survey nomenclature, while the text of the report uses the names as they are shown in the decree.

Figure 4
DETAIL OF SELECTED FEATURES OF UPPER WALKER RIVER WATERSHED

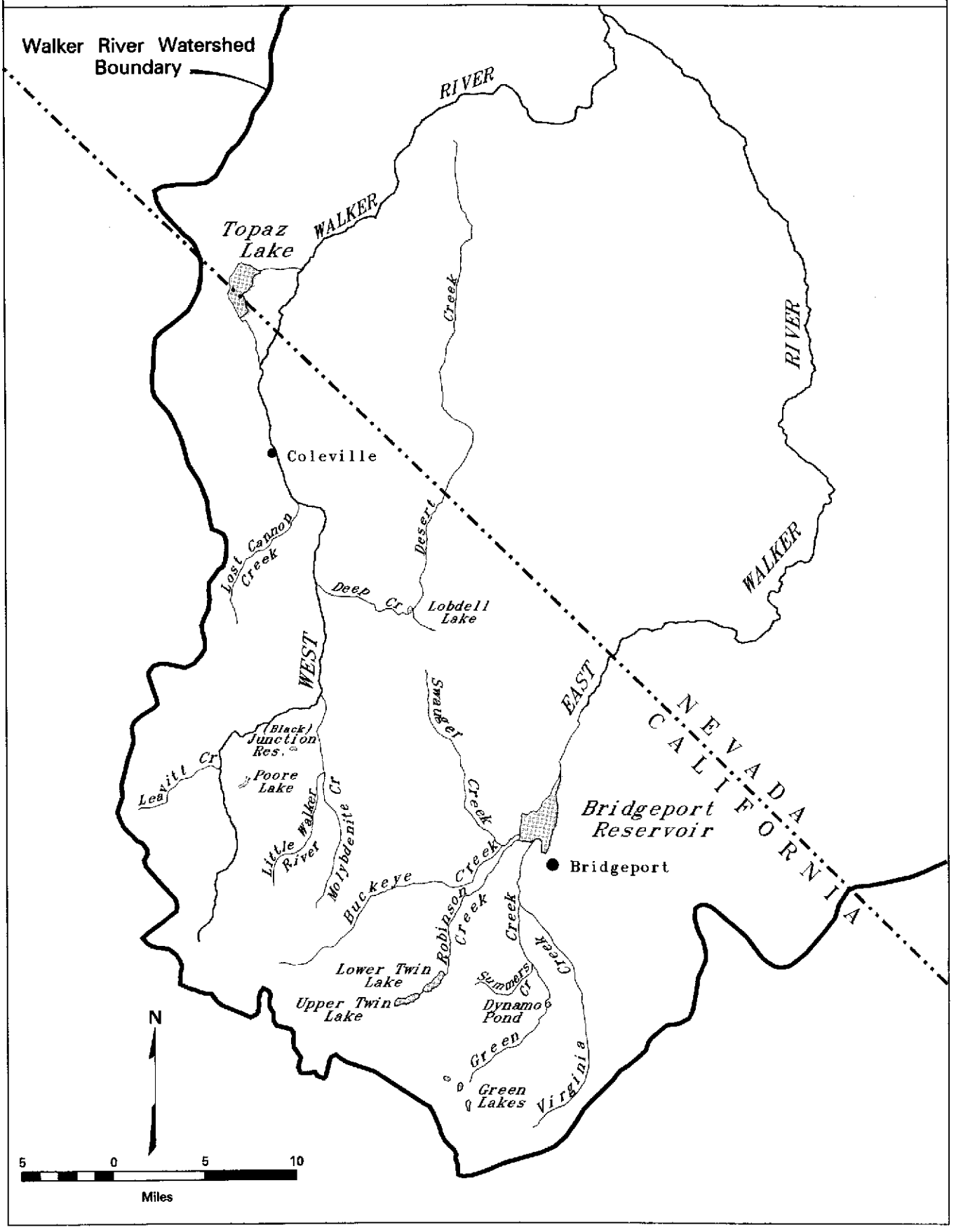
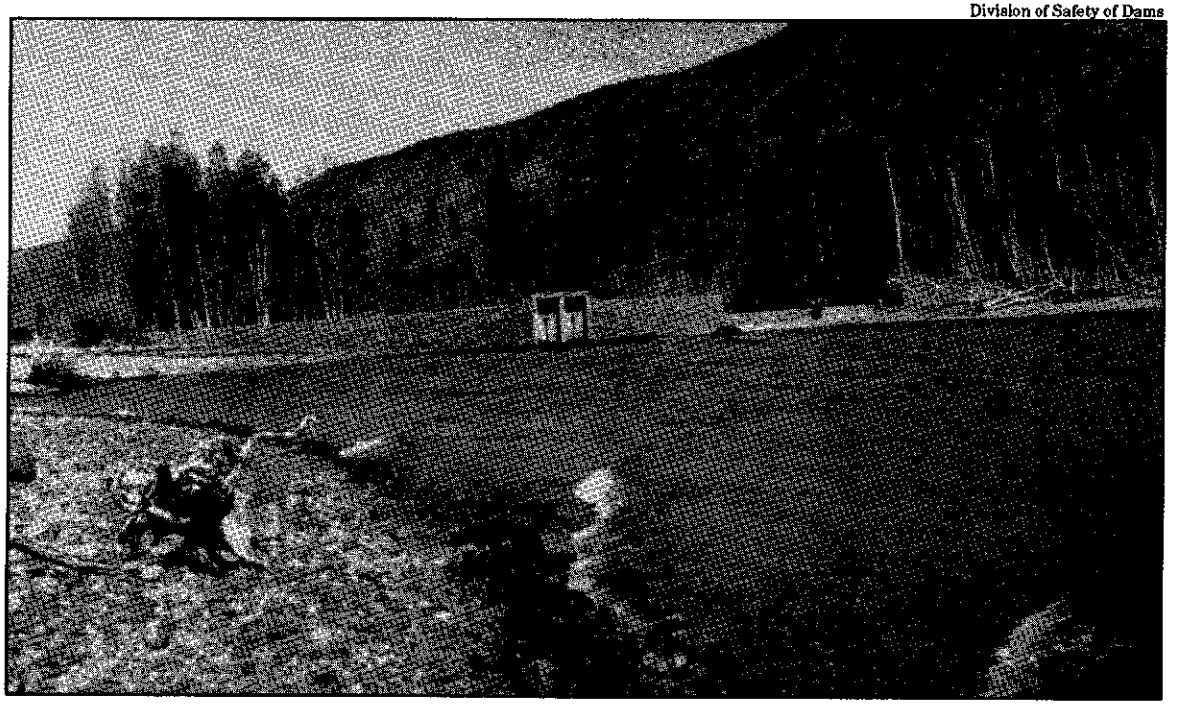


Table 1
SMALL SIERRAN RESERVOIRS IN DECREE C-125

Reservoir Name	Water Source	Dam Height *(Feet)*	Decreed Storage Right *(Acre-Feet)*	Priority	Decreed Place of Use of Stored Water
Black Reservoir	Black Creek	18	350	1907	Sonora Junction Area
Green Lakes[1]	Green Creek	N/A	400	1895	Bridgeport Valley
Lobdell Lake	Deep Creek	27	N/A[2]	1864	South End of Smith Valley
Poore Lake	Poore Creek	23	1200	1901	Antelope Valley Area
Lower Twin Lake	Robinson Creek	16	4050[3]	1888, 1905	Bridgeport Valley
Upper Twin Lake	Robinson Creek	14	2050[3]	1905, 1906	Bridgeport Valley

1 Green Lakes is actually a cluster of three small lakes — East Lake, West Lake, and Green Lake — whose collective storage right is 400 acre-feet.
2 Lobdell Lake's storage right is specified in the decree based on a diversion right of 6 cubic feet per second from Deep Creek. Actual physical storage capacity of the reservoir is 640 acre-feet.
3 Subject to conditions specified in the decree, these reservoirs also have refill rights.

Division of Safety of Dams



A 1931 view of the dam at Upper Twin Lake.

priority dating back to the original size of the reservoir and the second reflecting subsequent enlargement of storage capacity.[1]

These decreed reservoirs, all of which are privately owned, still serve agricultural uses, although complementary recreational uses may be supported. Lands that may be irrigated with the stored water are specified in the decree; their general location is indicated in Table 1. Black Reservoir, for example, occupies a topographic low point at the edge of a meadow area where a small dam was constructed to provide a head[2] of water for irrigating adjacent pasture lands. Water from Lobdell Lake, in contrast, is used on lands some miles distant from the reservoir — the high elevation of the reservoir site (over 9200 feet) facilitates delivery of water down steeply sloping Desert Creek to the south end of Smith Valley.

All of these small reservoirs except Black Reservoir and Dynamo Pond are surrounded by federal lands managed by the U.S. Forest Service, and there is public access to the sites, at least to hikers. The Twin Lakes are the most readily accessible of the reservoirs and are the only ones reachable by paved road. These scenic lakes, which have a scattering of privately-owned land around part of their shorelines, are a popular recreational destination in the upper watershed. Recreational development in the area includes a resort/summer home area and several campgrounds. A hiking trail beginning at the upstream end of Upper Twin Lake follows Robinson Creek into the Hoover Wilderness Area.

Walker River Irrigation District Reservoirs

Bridgeport Dam, on the East Walker River, was completed by the irrigation district in 1924. This 63-foot-high earthfill dam impounds a relatively shallow reservoir (about 30 feet deep at the dam) of nominal 44,000 acre-foot capacity. Construction of Bridgeport Reservoir, as well as that of Topaz Reservoir, was an outgrowth of the litigation that led to issuance of the 1919 decree in the suit described in the sidebar on page 30. Agricultural water users involved in the litigation had recognized that upstream storage would be needed to sustain the river's flow during the summer irrigation season, when the natural flow dwindled to a trickle. Walker River Irrigation District was formed in 1919 for the purpose of building the storage reservoirs.

The two reservoirs constitute the irrigation district's major facilities. The pre-existing river channel below each of the reservoirs is used to convey stored water to the service area downstream in Nevada. There the water is diverted directly from the river into ditches and canals owned by individual water users or by ditch companies. The service area is in Smith and Mason valleys and along the East Walker's bottomlands below Bridgeport Reservoir.

1 Upper and Lower Twin Lakes also have additional refill rights specified in the decree.

2 Engineers use the term "head" to mean the pressure exerted by a column of water. From an irrigation standpoint, the greater the depth of water stored in a regulating pond or reservoir, the greater will be the pressure available at a water user's ditch or canal, making it easier to convey the water to the land to be irrigated and to move water through the farmer's distribution system.

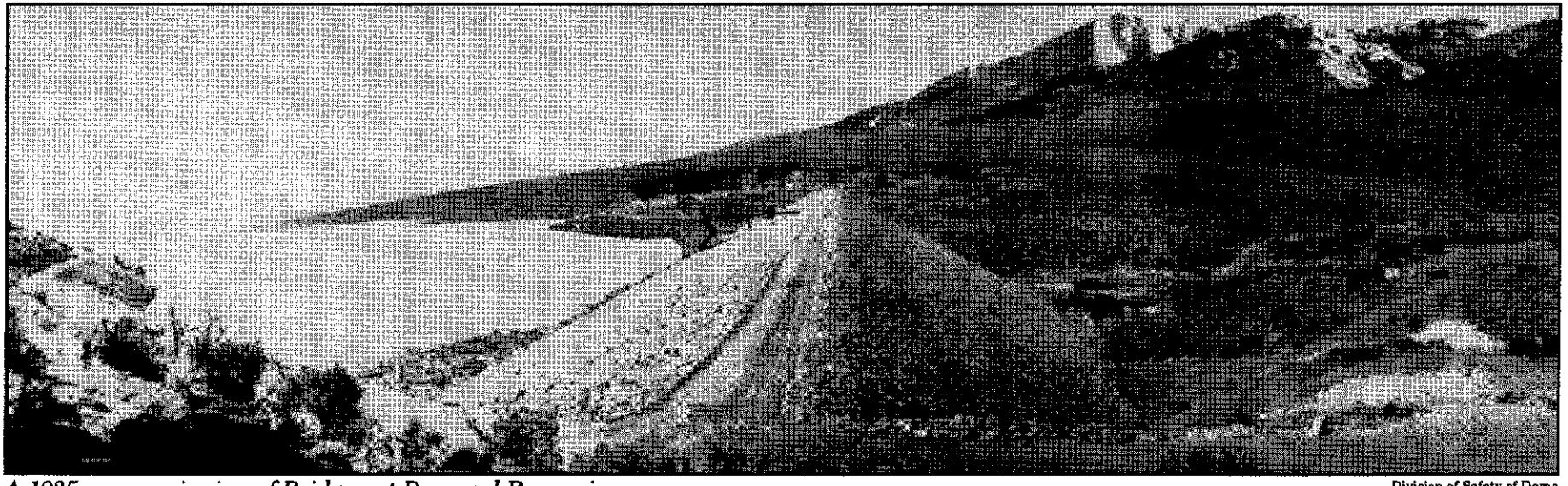
An Early Federal Effort

Nevada was experiencing an economic downturn after the Comstock Lode silver boom collapsed. Promoters of agriculture used this occasion to begin advocating the need for irrigation projects, predicting the state's economy in the future would be based on agriculture rather than mining. A federal role in irrigation project development was established in 1902 when Congress passed the Reclamation Act, creating the Reclamation Service (now the Bureau of Reclamation) and giving it the mandate to promote settlement of the arid west by "making the desert bloom". The Service promptly began studies of potential developments in the western states, including Nevada.

The Service initially examined a potential reservoir project in the Walker watershed, but soon chose not to pursue the project due to an inability to achieve consensus with local water users. Over the years, the Bureau of Reclamation has studied a number of potential projects on the Walker River, but none proved to be attractive enough for serious consideration. The watershed thus has no federal reclamation projects, only local projects. The quotation below, taken from the *Fourth Annual Report of the Reclamation Service, 1904-5*, describes the Service's early efforts.

"At the instance of the farmers in the valley of Walker River, who are involved in litigation over their water rights on account of the insufficiency of the supply for irrigation in the latter part of the season, the Secretary authorized an investigation of the feasibility of storing enough of the flood waters to provide an ample supply to all lands now under cultivation and irrigation. A reservoir site for this purpose was carefully examined and found to be economical of construction, but the land owners have thus far failed to organize a water-users' association, and take the other necessary steps in compliance with the terms of the reclamation act, which are a condition requisite to the commencement of construction. In the meantime, in cooperation with the State engineer, all the irrigated and irrigable lands, together with the two other reservoir sites, are being surveyed and mapped..."

One reason for the difficulty in reaching consensus on this early project was the diversity of the water users' interests. The Walker watershed at this time contained several very large livestock companies, who controlled much of the irrigable land and associated water rights, as well as small, family farms. Early reclamation projects built on the neighboring Truckee and Carson Rivers served a more homogeneous group of family farmers and homesteaders.



A 1925 panoramic view of Bridgeport Dam and Reservoir.

Division of Safety of Dams

The 1936 Decree C-125 grants the irrigation district the right to store 42,000 acre-feet in Bridgeport Reservoir, plus the right to store additional water that may be surplus to other water users under specified conditions. More recently, however, the license issued to the irrigation district by the California Water Resources Control Board limits diversion to storage to 39,700 acre-feet per year, and withdrawals from storage to 36,000 acre-feet. Other California water rights conditions have been imposed as a result of the drought of the late 1980s and early 1990s, when operation of the reservoir caused the downstream fish kills discussed in Chapter 5.

Rights to water stored in Topaz Reservoir are also discussed in Decree C-125, although they are first encountered in the preceding 1919 decree. Antelope Valley Land and Cattle Company had initially begun development of the site, and the water rights associated with it were reserved to the company in this decree (see sidebar, page 30). The company subsequently encountered financial difficulties, leading to the site's sale to Walker River Irrigation District. In the 1936 decree, the irrigation district was granted the right to store 50,000 acre-feet of West Walker water in the reservoir, plus an additional 35,000 acre-feet (based on the then-in-progress enlargement of reservoir capacity and under certain conditions), plus another 200 acre-feet of local inflow. The district holds California water rights to store 57,580 acre-feet of West Walker water, plus the 200 acre-feet of local inflow.

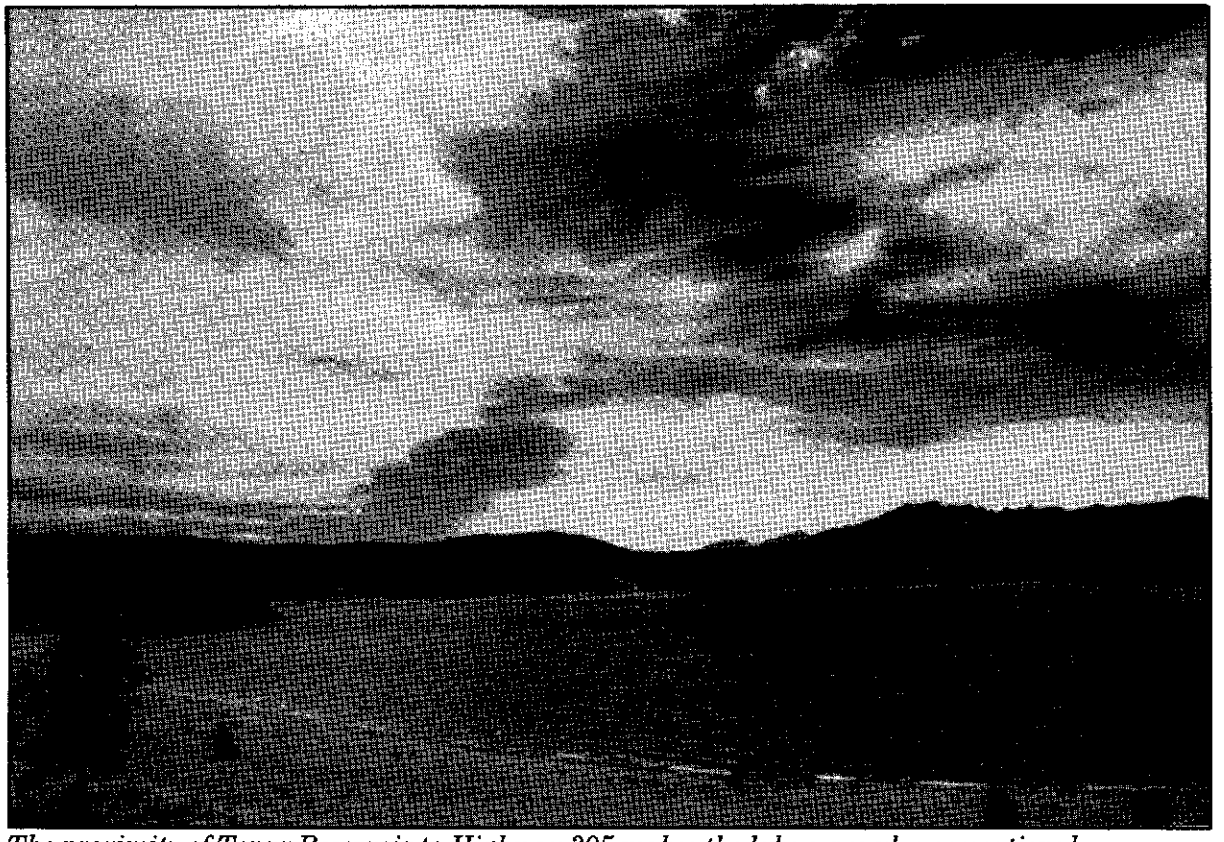
Water was first diverted into this offstream storage reservoir in 1921 — previously the small closed basin occupied by the reservoir had contained a

Division of Safety of Dams

A 1931 bird's eye view of Bridgeport Dam showing both its spillways. The primary spillway, the structure seen on the embankment, is an uncommon type of siphon spillway. The borrow pit used during dam construction (at upper left) also serves as the auxiliary spillway.

small, natural lake called Alkali Lake. The irrigation district built a canal on the California side of the stateline to take water from the West Walker to the reservoir and a 1,200-foot-long tunnel and a canal on the Nevada side to return water to the river. The reservoir has no spillway — all releases must be made via the outlet works tunnel. The storage capacity of the reservoir was increased in 1937, when a small earthen dam was constructed at the reservoir's southeast corner, just on the California side of the stateline.

The reservoir has an operable storage capacity above the elevation of its tunnel outlet of about 60,000 acre-feet; additionally, there is about 59 feet of dead storage below that elevation, amounting to about another 65,000 acre-feet of storage. The reservoir's maximum depth is about 92 feet.



The proximity of Topaz Reservoir to Highway 395 makes the lake a popular recreational destination.

Topaz Reservoir is a locally popular recreational destination; its proximity to Highway 395 makes it easily accessible. The reservoir, named for its striking blue-green color, provides one of the few large-scale opportunities for water-based recreation along the east side of the Sierras. According to the Nevada Department of Wildlife, Topaz receives more angler use (the reservoir is stocked with trout) than any other location in the Nevada portion of the watershed, surpassing even Walker Lake in most years.

Initial Development of Topaz Reservoir

Development of an offstream storage reservoir at Alkali Lake (later renamed Topaz Reservoir) became entangled in legal maneuvering associated with the *Miller et Lux v. Rickey et al.* suit (later renamed *Pacific Live Stock Company et al. v. Antelope Valley Land and Cattle Company et al.*). This litigation had its genesis in the competition for water between two large cattle empires. Thomas Rickey put together his Antelope Valley Land and Cattle Company by acquiring and consolidating lands purchased from early settlers in Antelope and Bridgeport valleys in the upper part of the watershed. Henry Miller of Miller et Lux owned a similar enterprise downstream in Mason Valley. Rickey's attempt to undertake construction of a reservoir at Alkali Lake prompted Miller to begin litigation leading up to the 1919 decree. The suit was based on the premise that the upstream water users were taking more than their fair share of the irrigation water available, and were leaving little in the river for the farmers in Smith and Mason valleys.

The 1919 decree includes a stipulation among the various parties describing the rights of the Antelope Valley Land and Cattle Company to the Topaz site. Two excerpts from that stipulation shown below provide a flavor of the times.

"In case Antelope Valley Land and Cattle Company shall complete Alkali Lake reservoir, it may take a quantity of water from the West Fork of Walker River at low stages in excess of its due proportion, but not exceeding the amount adjudged to it, provided it turns out of the reservoir at the same time a like quantity of water for the use of the other parties, which shall be charged to the shares of stock held by said Antelope Valley Land and Cattle Co. in said reservoir.

In case the reservoir is built, it shall be built by a company formed by Antelope Valley Land and Cattle Company for that purpose. Such corporation shall be controlled by Antelope Valley Land and Cattle Company until said reservoir is constructed to its natural capacity and said stock paid for, and thereafter the same shall be controlled by the stockholder holding said stock. Stock shall be issued for each acre foot of storage capacity of said reservoir."

"All parties hereto shall use their influence in getting the consent of the Government to the use of said reservoir site.

All parties hereto shall use their influence in eliminating the present pending applications before the State Engineer to reservoir said water which are tying up the water, so as to make the building of the reservoir secure."

Weber Reservoir

Weber Reservoir, on the Walker River Indian Reservation in Nevada, is the only reservoir on the mainstem Walker River. Construction of the 43-foot-high earthfill dam was completed in 1935 under supervision of the Bureau of Indian Affairs, which had advocated development of a reservoir to support irrigation of lands on the reservation. The reservoir had an as-built capacity of about 13,000 acre-feet; the U.S. Geological Survey estimated in 1972 that sedimentation had reduced storage capacity to 10,700 acre-feet. The reservoir's maximum depth is about 29 feet.

It was the efforts of the federal government to obtain an irrigation supply for the reservation that led to issuance of Decree C-125 in 1936. The initial 1919 decree quantified four water rights for the reservation, with priorities ranging from 1868 to 1886. A provision was included explicitly permitting the government to buy shares in the then-proposed Topaz Reservoir to supply the reservation:

"Nothing herein contained shall affect or impair the right of the United States Government on the Walker River Indian Reservation to any water of said river and it may, if it desires, purchase its due share of stock in the said reservoir company and its rights shall at all times be respected and preserved by said reservoir company."

The government subsequently brought suit in 1924 against most of the existing Walker River water users (relying in part on the list of decreed users developed in the 1919 litigation), seeking to obtain more water for the reservation. This suit resulted in issuance of the 1936 decree. The reservation was granted a new right with an earlier priority — 1859. Meanwhile other arrangements had been made for construction of Topaz Reservoir, as discussed earlier, leading to selection of the Weber damsite as the best location to serve reservation lands.

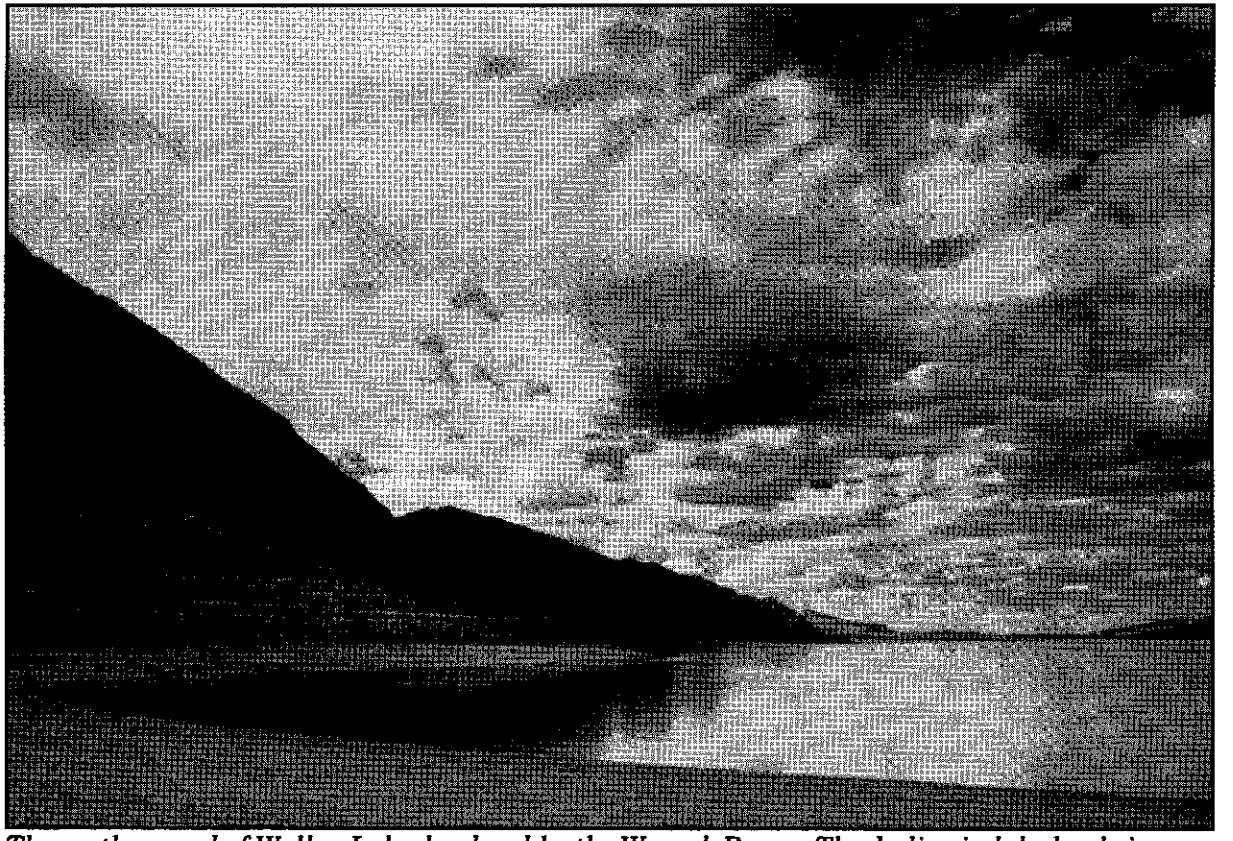
An upstream view of Weber Dam. Weber Reservoir is the only reservoir on the mainstem Walker River.

Walker Lake

The Walker River terminates in Walker Lake, situated in an isolated desert valley. Prehistoric Lake Lahontan once occupied this valley, covering the sites of the present-day small communities of Hawthorne and Babbitt at the south end of the valley. Walker Lake itself has receded since 1882, when it was first mapped by Russell as part of his notable work on the geological history of Lake Lahontan. This shrinkage of Walker Lake is most noticeable at its upstream end, where the shoreline has receded by as much as 7 miles since 1882[1].

Today the lake is about 5-1/2 miles wide and 14-1/2 miles long at its maximum dimensions. The volume of water in the lake is about 2.5 million acre-feet, with a maximum depth of a little over 100 feet. The decline in lake levels has been accompanied by degradation of lake water quality (see sidebar, page 34); water in the lake is not suitable for municipal or agricultural use.

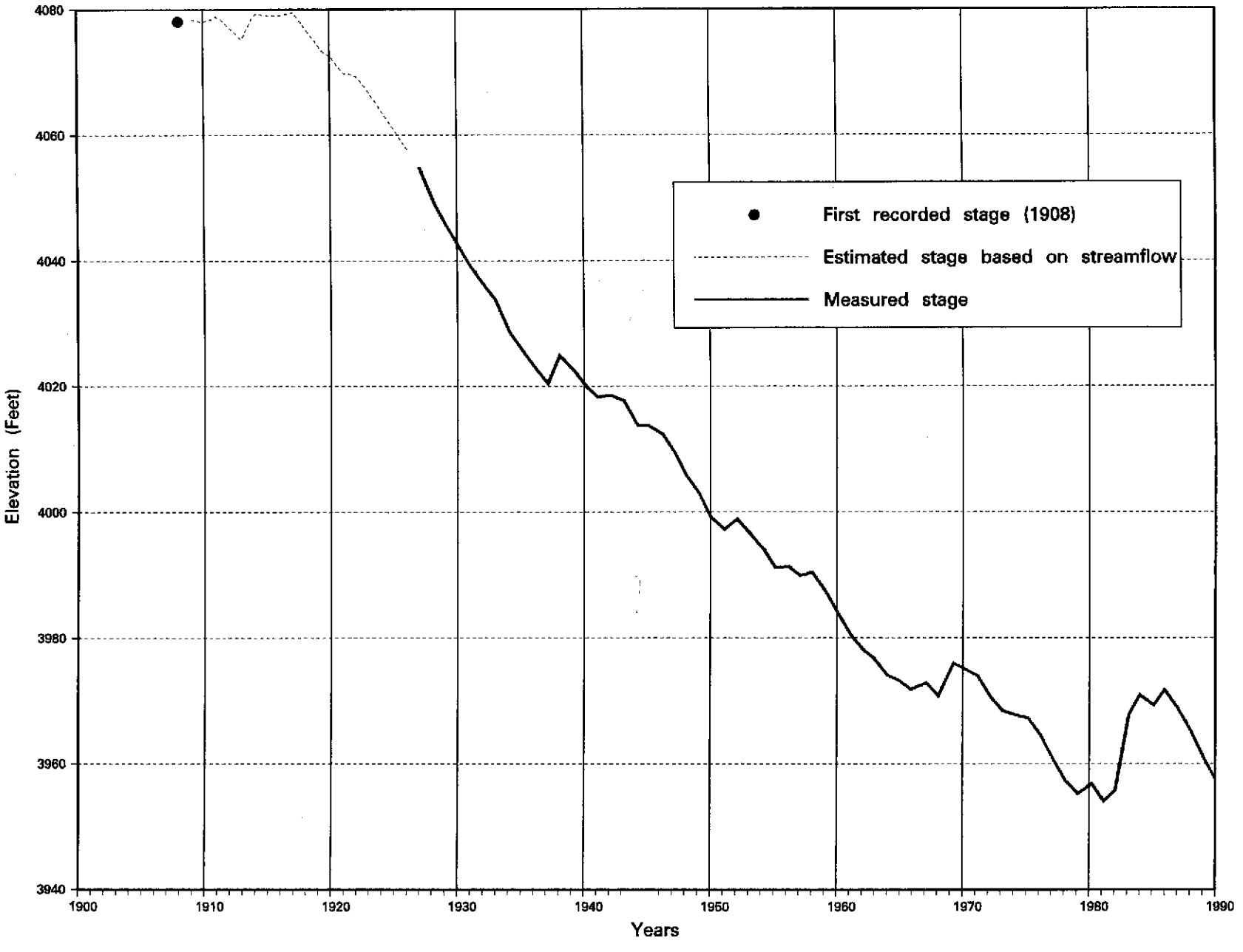
Figure 5 shows the decline in lake levels, attributed largely to upstream agricultural diversions. Lake elevations for the early years of this plot have been estimated based on upstream Walker River flow measurements because regular, periodic measurements of lake elevation were not made until a gage was installed at the lake in 1928. Even today, some hydrologic data for the lake remain lacking, such as measurement of inflow. The nearest key streamflow gage is near Wabuska, more than 30 miles upstream of Walker Lake. Significant irrigation diversions from the river below this gage, combined with channel losses along the river, make estimating lake inflow problematical.



The southern end of Walker Lake, bordered by the Wassuk Range. The decline in lake levels is evidenced by the wave-wash erosion marks on the highway embankment at the base of the mountains.

1 The southern edge of the Walker River Indian Reservation extends to this upper part of the lake, but the reservation does not include the lake.

Figure 5
HISTORICAL WALKER LAKE LEVELS



Walker Lake will continue to recede unless water management practices are altered upstream or unless the climate changes dramatically. Various projections have been made for the elevation at which the lake would stabilize, given a continuation of existing conditions. Lake levels will approximately stabilize when average annual evaporation and seepage losses balance average annual inflows. The U.S. Geological Survey, for example, has predicted in the *Hydrologic Atlas* (see reference in Appendix 2) that the lake could stabilize at a maximum depth of about 40 feet, corresponding to a volume of about 600,000 acre-feet. Under these conditions, it is believed that the lake would be saltier than seawater.

Walker Lake's chief use today is for recreation, although its distance from major population centers tends to limit the number of visitors it receives, especially in comparison to more easily accessible bodies of water. Recreational development is relatively sparse at the lake — a visitor's first impression is of open space and the extremely steep fault scarp of the Wassuk Range, which marks the lake's western shore. Winter fishing for Lahontan cutthroat trout is one of the most popular recreational activities; this species of trout is prized by anglers for its large size. In spring and fall the lake is host to migrating common loons, a bird otherwise seen rather infrequently in this area.

Lake Water Quality

One feature common to all terminal lakes is concentration of minerals by evaporation. The total dissolved solids* content of Walker Lake today exceeds 10,000 mg/L, while that of Walker River tributaries in the headwaters area can be as low as 100 mg/L. When Russell sampled Walker Lake in 1882, its concentration was about 2,500 mg/L. In Walker Lake, like other terminal lakes, lake volume is inversely proportional to the water's mineral content. Historically, the declining water level of Walker Lake due to upstream irrigation diversions has been reflected in its increasing mineralization; it is somewhat saline and quite alkaline. Lake levels will continue to decline until equilibrium is reached among evaporation, seepage, and inflows — and mineral content will continue to increase. Concerns have been expressed over effects of increasing mineralization on the lake's fishery, especially on the Lahontan cutthroat trout, considered a preferred fish by anglers. The lake is stocked with these trout; attempts are being made to breed a strain of them that can tolerate the alkalinity.

* TDS is one generalized measure or indicator of the amount of dissolved minerals found in water. The TDS of seawater is usually taken as 35,000 mg/L.

Other Reservoirs

There are a few small storage and distribution system reservoirs at the southwestern end of the valley occupied by Walker Lake. These small catchments, constructed to provide part of the municipal water supply for Hawthorne and municipal/industrial water supply for the ammunition depot, impound waters of minor creeks, some ephemeral. These creeks drain short canyons in the Wassuk Range; the steep slopes of the canyons contribute to localized erosion and sedimentation problems, including filling of the reservoirs with sediment.

The largest of the small reservoirs, located on Cat Creek, serves the ammunition depot and has a capacity of about 1100 acre-feet. Capacities of the others are on the order of hundreds of acre-feet. Water rights for these small reservoirs were not included in Decree C-125, which did not cover any lands downstream of the Indian reservation.

Chapter 3

CLIMATE AND HYDROLOGY

This chapter presents a brief overview of the climate and the surface and ground water hydrology of the Walker River basin. Readers interested in more detail on these subjects are encouraged to consult the references listed in Appendix 2.

Watershed Setting

Geomorphically speaking, the Walker River watershed makes a transition from the Sierras on the west to the Great Basin on the east. The upper watershed is characterized by steep, rugged peaks, dominantly granitic, with some volcanic and metavolcanic rocks. Past glaciation is evidenced by erosion patterns seen around the high peaks and by the wealth of glacial till deposited downstream. Elevations along the sierran crest typically range from 10,000 to 11,000 feet, with a few of the highest peaks — Dunderberg and Twin Peaks, for example — exceeding 12,000 feet. Figure 6 shows contours of elevation for the watershed.

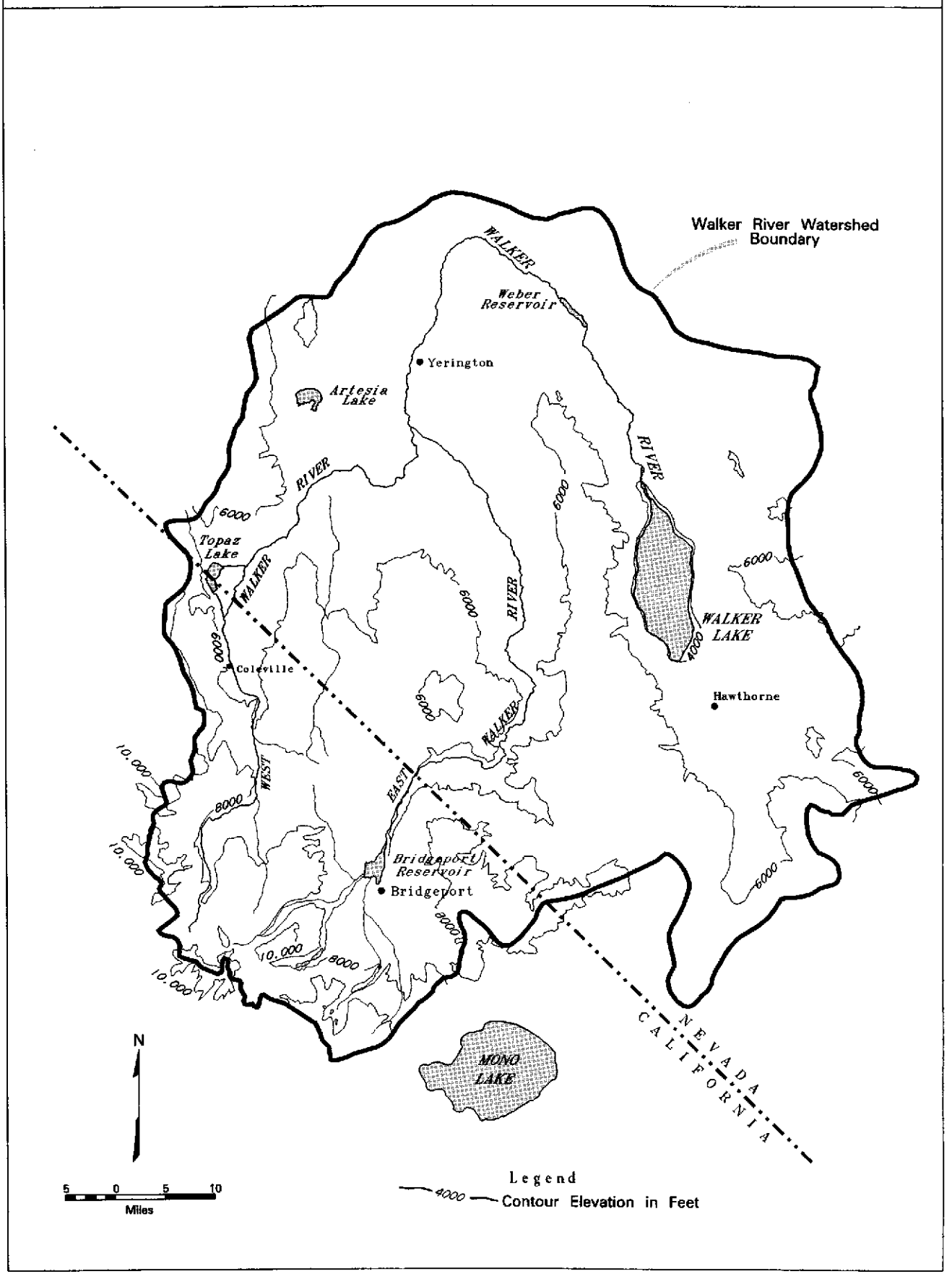
The larger upper watershed valleys — Bridgeport, Antelope, and the Sonora Junction area — are filled with a mixture of alluvial deposits carried down by the tributaries and with material transported by glaciers. The valleys range from 5,000 to 7,000 feet in elevation, and are surrounded by relatively high ranges. The transition from one geomorphic province to another is most evident here and is characterized by a complex pattern of faulting and juxtapositions of different rock types. This transition zone gradually gives way to typical basin and range topography toward the east.

In this watershed, the basin and range topography is characterized by north-south trending fault block mountain ranges with prominent exposures of volcanic, metavolcanic, and intrusive (especially quartz monzonite) rocks, separated by narrow valleys. Faulting has downwarped the valleys, creating intermontane valleys such as Smith and Mason valleys, which are gradually filling with sediment eroded from the ranges. Walker Lake occupies another of the intermontane valleys — faulting that helped create the valley is strikingly evident on the eastern face of the adjoining Wassuk Range. This range ascends to elevations nearly as high as those of the sierran crest; Mount Grant, a local landmark, exceeds 11,000 feet. Typical elevations in the lower fault block mountain ranges are on the order of 6,000 feet in the Singatse Range and 8,000 feet in the Pine Grove Hills. Valley floor elevations are at the 4,000- to 5,000-foot level.

Climate

The high elevation areas in the Sierras are the coldest and wettest part of the watershed; the area to the east lies in the rain shadow of the Sierras and is much more arid. The difference in precipitation from west to east is graphically demonstrated by the change in vegetation — from conifer woodlands in the Sierras to sagebrush scrub in the desert valleys. Rainfall in the high Sierras can be measured in

Figure 6
CONTOURS OF ELEVATION



feet, while some of the driest communities, such as Hawthorne and Yerington in the eastern watershed, receive only about 5 inches of rain per year. Figure 7 is an isohyetal map of the watershed. (Isohyets are contours of equal average annual precipitation.)

The basin's climate is characterized by long, very cold winters, particularly in the Sierras, and by short, moderate to warm summers. Precipitation follows a seasonal pattern, primarily occurring from late October through early May. Summer thunderstorms are common but seldom produce significant amounts of precipitation over a wide area. Winter precipitation above the 5,000-foot elevation usually takes the form of snow.

Temperatures can vary widely in the region, as shown by the maxima and minima of record illustrated below.

Location	Maximum Temperature (°F)	Minimum Temperature (°F)
Bridgeport	96	-37
Smith	102	-27
Yerington	105	-26
Hawthorne	110	-16

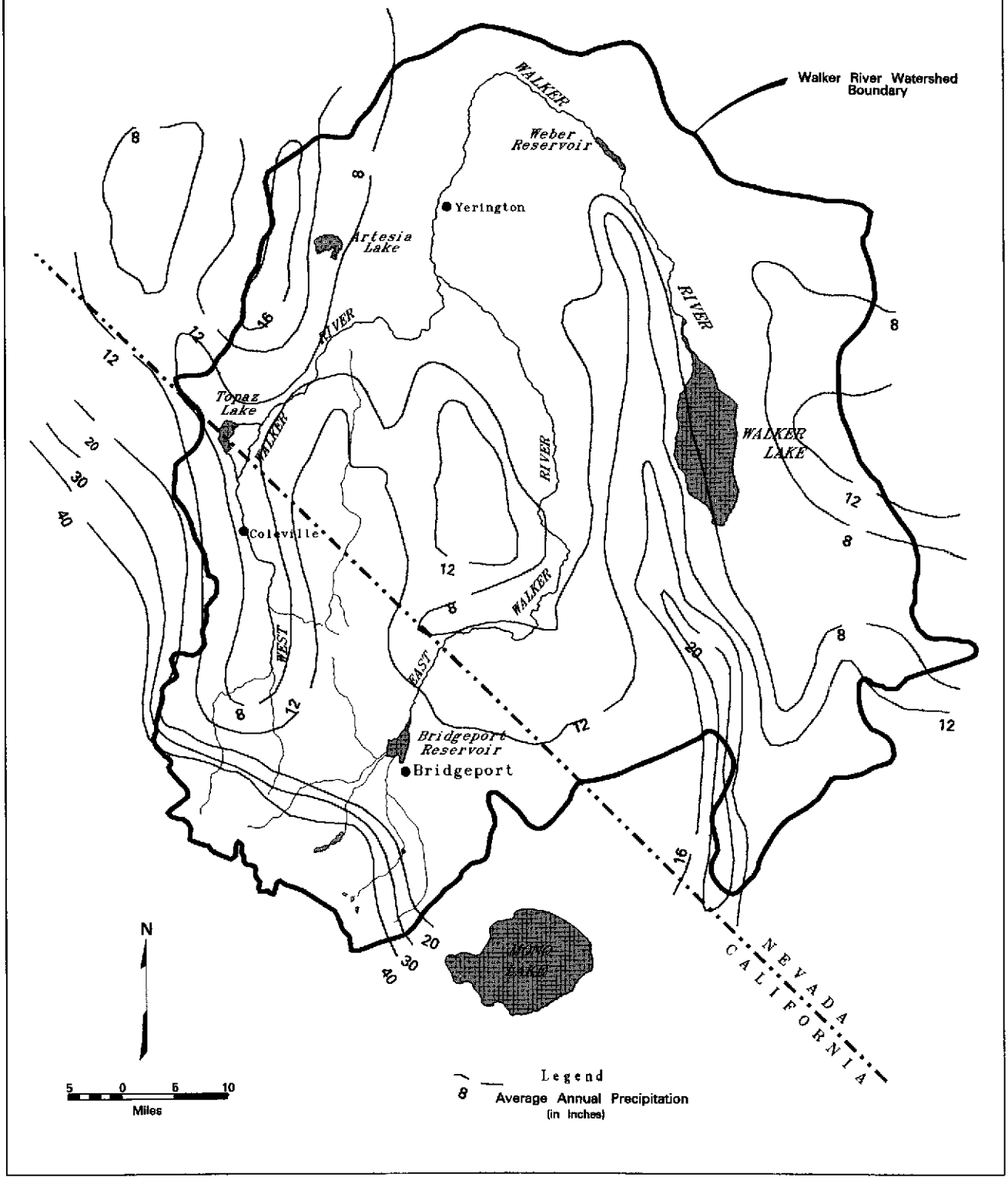
Normal winter lows in the Sierras routinely fall below freezing, while summer highs in the lower watershed sometimes exceed 100°F.

Another way of looking at climatic conditions is furnished by the following table, adapted from U.S. Department of Agriculture information, which shows the estimated number of frost-free days per year at selected locations in the watershed. This information is usually used to evaluate an area's agricultural potential or suitability for certain types of crops, but it also serves to indicate relative differences in climate.

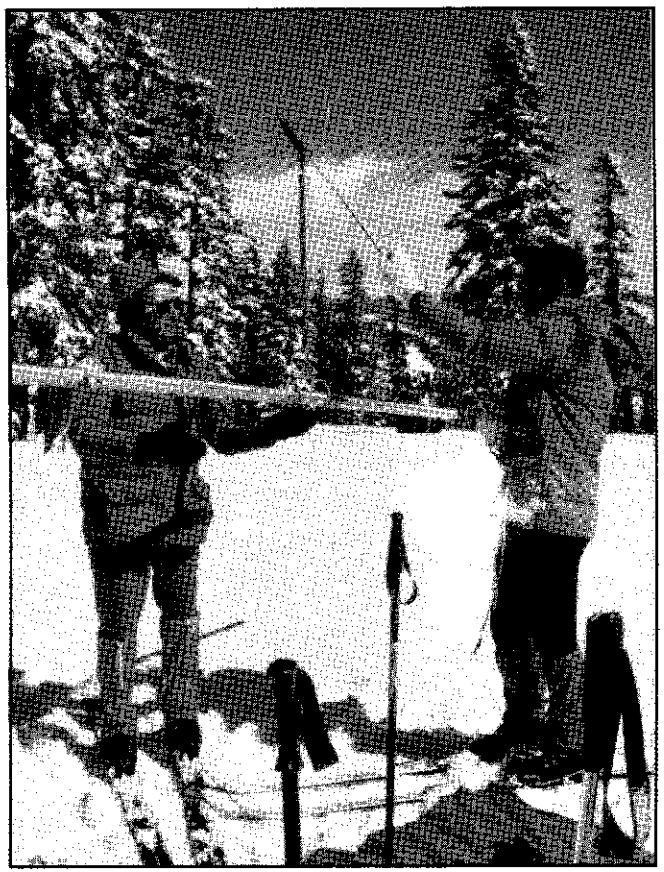
Location	Elevation (feet)	Frost-Free Season (days)
Bridgeport	6,420	51
Yerington	4,375	107
Schurz	4,124	112
Hawthorne	4,186	135

Remote sensing of data is now being used to augment manual measurement of snow courses. This snow pillow, filled with an antifreeze mixture, will provide data to be telemetered to a remote computer system.

Figure 7
ISOHYETAL MAP



In Decree C-125, the number of frost-free days was used as a guide in establishing the irrigation season for water rights administration purposes. In the colder, upper watershed — above the Coleville gage on the West Walker and above Bridgeport Reservoir on the East Walker — the irrigation season was defined as March 1 to September 15; below these points it was extended to October 31.



Department of Water Resources snow surveyors measure the water content of the snowpack. This information is used in forecasting spring runoff.

Snow Surveys

Snow surveys are widely used to forecast water supply, by estimating snow water content in winter and spring and using the data to predict the volume of snowmelt runoff. Data are collected both manually and automatically, as shown in the accompanying photographs. Manual collection of water content data entails skiing to a snow course site and coring through the snowpack with a special sampling device. The sampler is then weighed in the field to determine water content. Automatic sensors use a snow pillow, where the weight of snow resting on a pillow is transmitted by radio/microwave or other communications linkage to a computer system. Snow pillows are useful in locations where winter access is difficult, and they can provide instantaneous updates of information. They can, however, be subject to vandalism; bears have been numbered among the culprits.

California and Nevada are both involved in cooperative snow survey programs, where a variety of entities — state and federal agencies, water districts, power utilities, and private organizations — jointly collect and share survey data and forecasts. In California, for example, the Department of Water Resources operates and maintains certain snow courses and telemetered installations on the west side of the Sierras and collects data from them to forecast water supplies for the State Water Project. In Nevada, the U.S. Soil Conservation Service uses forecast data from its stations on the east side of the Sierras to estimate supplies for agricultural areas such as the Walker watershed. Some locations in the Walker watershed where the Soil Conservation Service operates measurement stations are Virginia Lakes Ridge, Lobdell Lake, Sonora Pass Bridge, and Leavitt Meadows.

Surface Water Hydrology

Most runoff in the watershed is derived from the upper elevations in California, where precipitation is greatest. Figure 8 is a map of the watershed showing average annual flows at selected points along the river, based on U.S. Geological Survey stream gaging data. Table 2 shows maximum and minimum annual flows at key stream gages. It should be noted that drier or wetter years certainly could have occurred before reliable, periodic streamflow measurements were made on the river system; little data are available prior to 1910.

In historical times, significant dry periods occurred in 1924-1925, 1928-1934, 1960-1961, and 1976-1977[1]. The major irrigation supply reservoirs — Topaz and Bridgeport — were completely drained of their operable storage on several occasions during these dry periods. The Walker River itself has ceased flowing at the Wabuska gage in 1924-25 and 1931, when upstream irrigation diversions had taken all of the river's flow in these dry years.

At the opposite extreme, there have been a variety of floods in the watershed. Particularly damaging floods occurred in 1950 and 1955, although floods that cause widespread damage throughout the entire watershed are relatively uncommon, in contrast to the wetter watersheds farther north in the Sierras. Monetary damage from flooding is also mitigated by the limited amount of urbanized land in the watershed; most flooding occurs on agricultural lands. Types of floods in the Walker watershed include general rain floods, snowmelt floods, and localized flash floods often associated with summer thunderstorms. The estimated maximum instantaneous peak flows recorded at some sites are shown in Table 3.

Table 2
MINIMUM AND MAXIMUM ANNUAL FLOW AT THREE KEY LOCATIONS

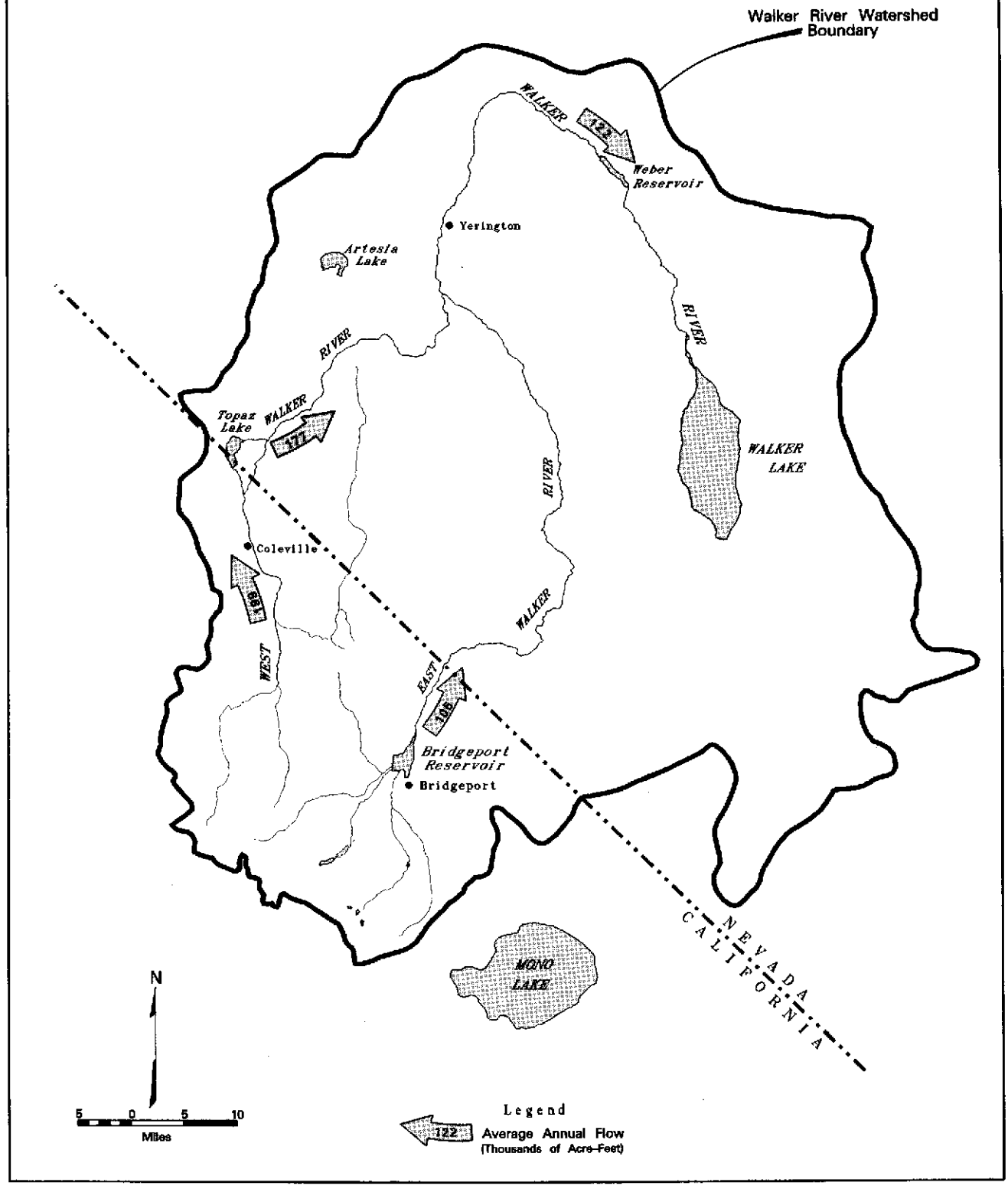
Minimum Annual Flow			Maximum Annual Flow		
Gaging Station	Acre-Feet	Year	Gaging Station	Acre-Feet	Year
East Walker River near Bridgeport	27,149	1931	East Walker River near Bridgeport	320,717	1983
West Walker River near Coleville	53,940	1977	West Walker River near Coleville	407,700	1983
Walker River near Wabuska	9,350	1931	Walker River near Wabuska	602,500	1983

Table 3
INSTANTANEOUS PEAK FLOW AT THREE KEY LOCATIONS

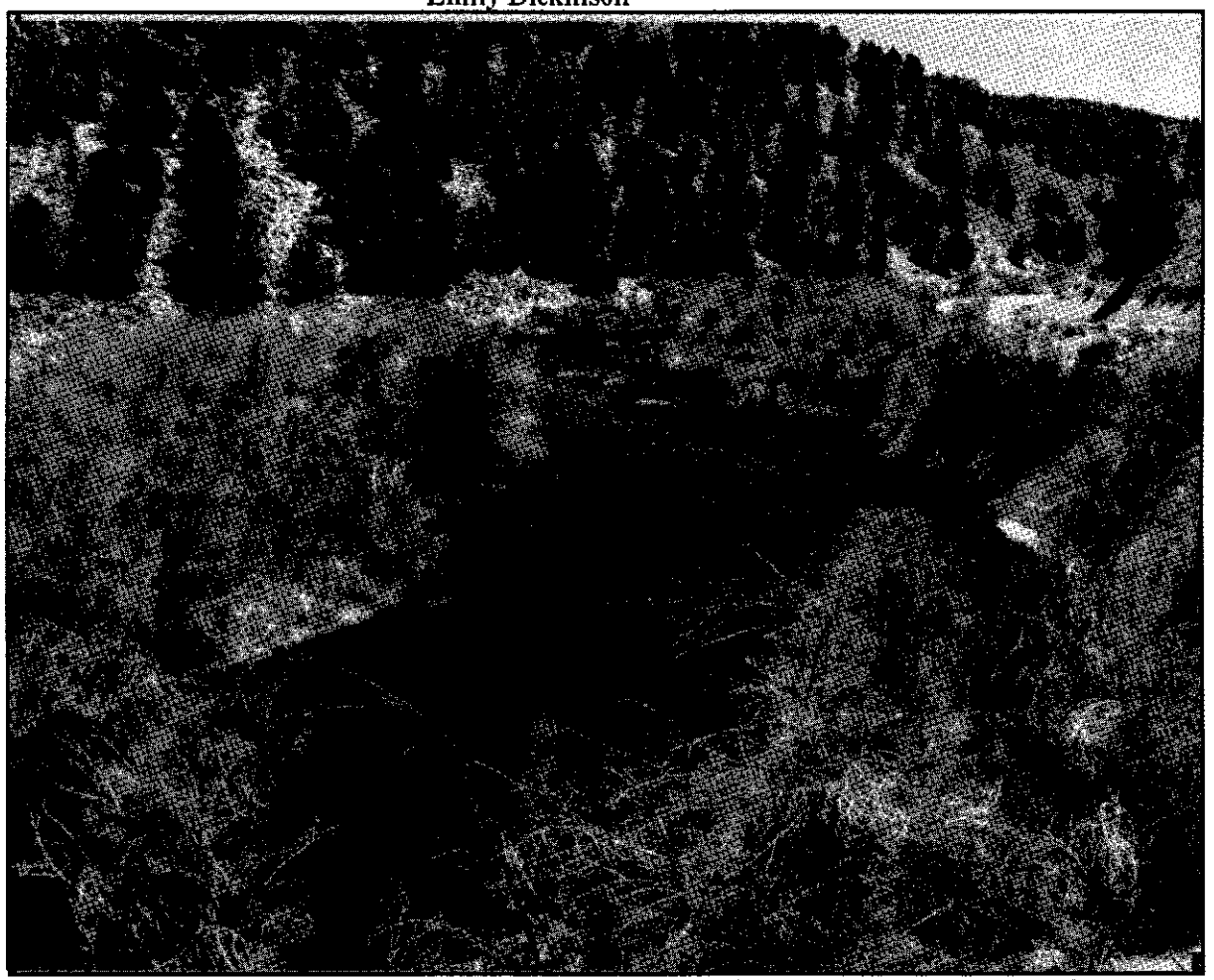
Gaging Station	Instantaneous Peak Flow (cfs)	Year
East Walker River near Bridgeport	1,390	1963
West Walker River near Coleville	6,500	1937
Walker River near Wabuska	3,280	1906

1 The drought of the late 1980s and early 1990s may surpass these other periods in severity. At the time of this writing in 1992, the drought remains with us, and we do not yet have the complete hydrologic data with which to evaluate its severity.

Figure 8
AVERAGE ANNUAL STREAMFLOWS AT SELECTED LOCATIONS



"Then look out for the little brook in March,
When the rivers overflow,
And the snows come hurrying from the hills,
And the bridges often go."
—Emily Dickinson



This typical reach of the West Walker in the upper watershed illustrates the uncontrolled nature of the stream. Parts of Antelope Valley downstream flood even from relatively small storms, because there is no upstream flood control. Small communities in the valley, such as Coleville and Walker, are vulernable to flood damage.

Flood damage from the general rain floods is most significant in the upper and middle parts of the watershed, in areas such as Antelope, Bridgeport, Smith, and Mason valleys. In California, low-lying lands in Antelope Valley (mostly agricultural lands) flood in even relatively small rainstorms. The upper watershed in California has essentially no upstream flood protection, since the high sierran reservoirs are not operated to provide flood control and are too small to be of significant benefit. Spring snowmelt floods tend to be most felt in Smith and Mason valleys. Bridgeport and Topaz reservoirs, although not operated for flood control, are large enough to provide some incidental flood protection for these areas. Some of the greatest monetary damage from flooding has been associated with the summer flash floods of the Walker Lake Valley area — particularly at Hawthorne. Here, flash floods arising in the Wassuk Range often turn into mud or debris flows, and the sediment exacerbates damage caused by the floodwaters.

Ground Water Hydrology

Surface and ground water resources are, physically speaking, almost always interconnected to some degree and, in fact, represent two aspects of a single resource. For purposes of water rights administration or technical studies, these two aspects are usually treated separately, but it is important to remember that this distinction is a matter of convenience and not an absolute physical difference.

Given this caveat, it can be noted that ground water provides a portion of the basin's water supply. Most municipal water supply comes from ground water. Many private wells serve individual homes in the watershed, both in the alluvial valley-fill deposits thought of as aquifers[1] in the conventional sense, and in the fracture zones in otherwise less pervious rock. Generally, such individual wells are outside the service areas of municipal water purveyors and are low-yield wells sufficient for the needs of a single dwelling.

Ground water also provides a significant irrigation supply in parts of the watershed, especially in Smith and Mason valleys, where some wells with relatively high yields have been developed. In the past, some sizable extractions of ground water have also been made on the Nevada side of the watershed for mining and ore processing, although these uses are now dwarfed by the agricultural extractions. Agriculture is actually a major contributor to ground water recharge throughout the watershed, in the form of seepage from canal systems and application of water in excess of crop needs. Irrigation water is a particularly important source of recharge in the eastern part of the watershed, where imported surface water supplements the limited recharge available from precipitation alone.

Ground Water Basins in the Watershed

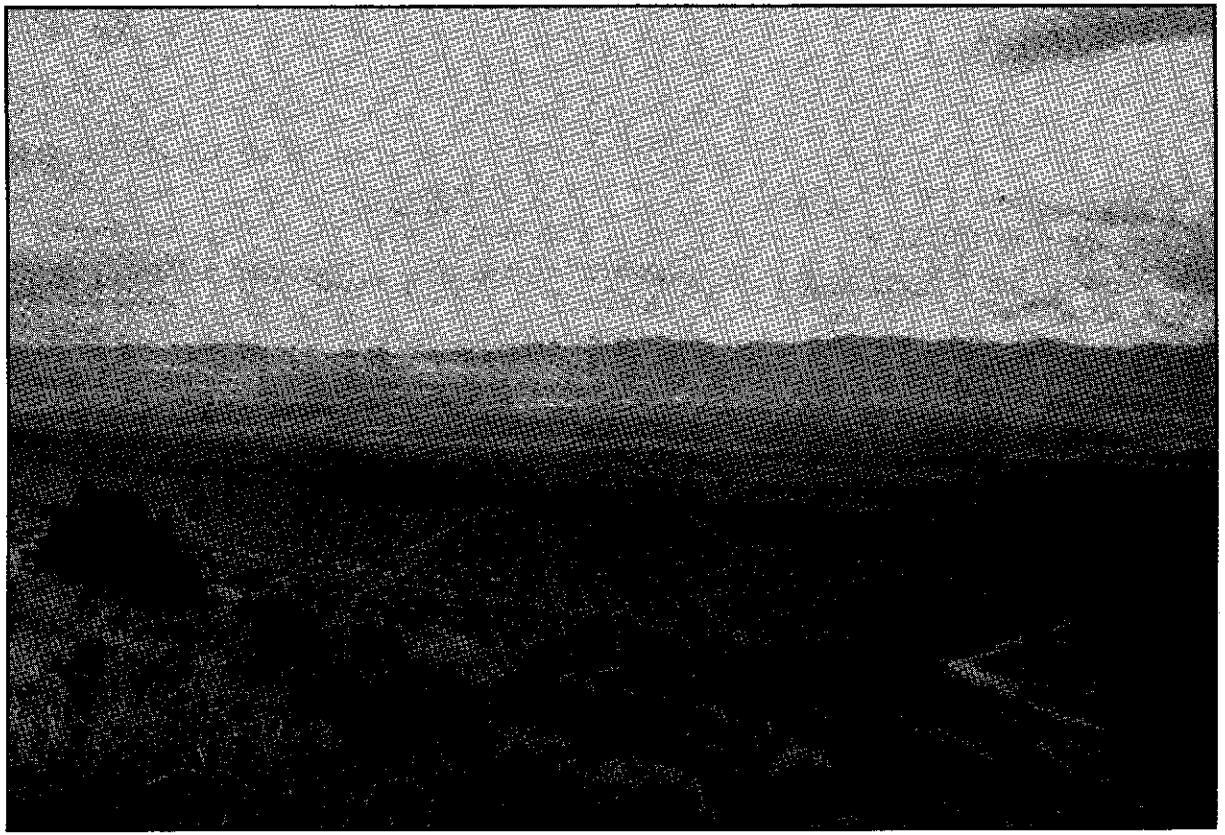
The chief ground water basins in each state are listed below. These basins are valleys filled with significant amounts of water-bearing sediments. Water contained in the basins may or may not be of usable quality — some of these basins have localized areas where the ground water is too mineralized to be used for most purposes under present economic conditions.

In California	In Nevada
Antelope Valley	Sweetwater Flat
Little Antelope Valley	Antelope Valley
Slinkard Valley	Smith Valley
Bridgeport Valley	Mason Valley
Sweetwater Flat	East Walker Bottomlands
	Walker Lake Valley

There are varying amounts of information available about the ground water resources of these basins — information such as the amount of ground water in storage, thickness of the saturated zone(s), depths to water-bearing materials, rate and direction of ground water flow, etc. The most information is available for areas where ground water use is relatively widespread, such as in Smith and Mason valleys and in parts of Walker Lake Valley.

1 In simple terms, an aquifer is a subsurface soil deposit or rock formation that is permeable enough so that water can be economically withdrawn from it to serve some use. Antelope Valley is a ground water basin (*i.e.*, an area underlain by water-bearing alluvium) where significant ground water development is possible.

Historically, ground water availability (in quantities at least sufficient for municipal use) has been good in most of the agricultural areas above Walker Lake Valley, given the existing water use patterns. At the turn of the century, artesian wells[1] could be found in several areas in the watershed; there are still artesian wells, particularly in Smith Valley. Shallow ground water, within a few feet of the surface in some spots, is common in most of the basins — especially in Bridgeport, Smith, and Mason valleys. Irrigation has raised the water table in Smith and Mason valleys to the point where it became necessary to construct extensive agricultural drainage systems to prevent crops from becoming waterlogged. Both the Beaman Lakes and Artesia Lake are local expressions of a high ground water table, where ground water is discharged to the surface.



Looking out over the salt flats of Artesia Lake at the north end of Smith Valley. The shallow lake, managed as a wildlife area, is fed primarily by ground water and does go dry in drought periods (as in this 1991 photo).

Thermal waters are found in some locations, either as natural hot springs or as tapped by wells. Of several thermal springs in the volcanic rocks to the southeast of Bridgeport, the Travertine Hot Springs with its classic terrace deposits is probably the most well known. Farther north, Fales Hot Springs, just east of Sonora Junction, is another well known thermal waters site on the California side of the watershed. In Nevada, Hinds Hot Springs, at the base of the Pine Nut Mountains in Smith Valley, was once the site of a resort. A more recent use of thermal water is occurring in the Wabuska area nearby, where wells have been drilled to supply geothermal power.

1 Artesian wells tap a confined aquifer where the water is under sufficient pressure to cause it to flow upward to the ground surface.

Chapter 4

DEVELOPMENT AND LAND USE

Urban development in the California portion of the watershed is minimal and is clustered around the town of Bridgeport, the Mono County seat, whose year-round population is on the order of 500 to 600. There are no incorporated cities on the California side of the watershed; local governmental services are provided by Mono County or by special districts. The watershed in California is entirely within the northern part of Mono County. Population of the Walker basin portion of Mono County has grown slowly from 808 in the 1960 census to 1,900 in the 1990 census, reflecting the sparsely inhabited nature of this mountainous region. Outside of Bridgeport, most of the remaining California residents are dispersed throughout Antelope Valley.

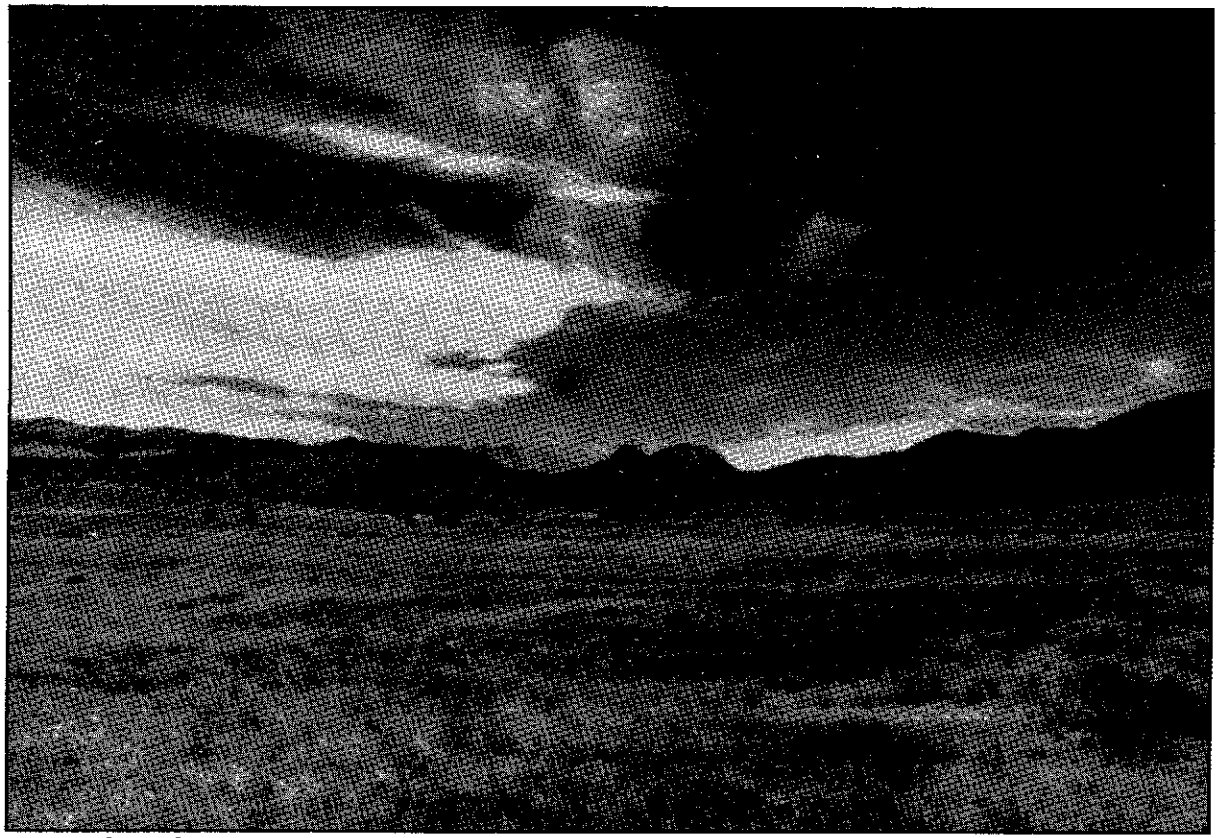
The federal government is the major land owner in both states, owning about 90 percent of the watershed overall. On the California side, most federal lands are under management of Toiyabe National Forest, and most privately owned lands are concentrated in Bridgeport, Antelope, Slinkard, and Little Antelope Valleys and in the Sonora Junction area.

Recreation and government are the mainstays of the California region's economy. The extensive Forest Service landholdings offer a wide variety of

Department of Parks and Recreation

National Forest lands in the upper watershed provide habitat for many species of wildlife, including large mammals such as bears and mountain lions.

hiking and camping opportunities, augmented by private campgrounds at locations such as Twin Lakes. Fishing is popular, especially along the reach of the West Walker paralleled by Highway 395 and at Topaz Lake. More remote areas can be reached by horsepacking; trips are offered by Forest Service concessionaires. The town of Bridgeport, an important summer supply center for travelers on Highway 395, has a small year-round population supported in part by county government and by state highway maintenance employment. The U.S. Marine Corps Mountain Warfare Training Center at Pickel Meadows is also an important year-round employer.



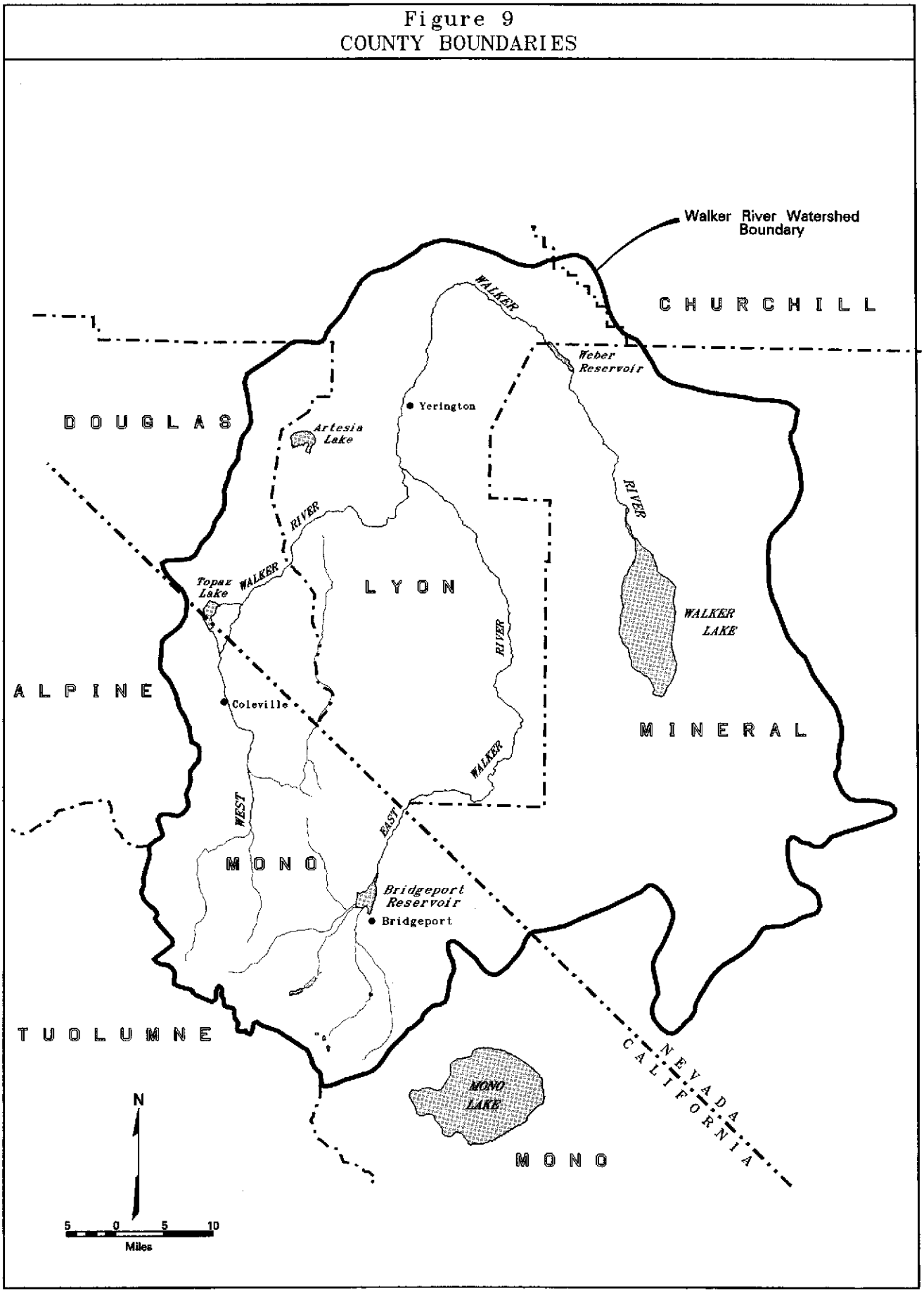
Livestock production is the most important agricultural activity in the upper watershed. Shown here are grazing lands in Little Antelope Valley.

Agriculture and, to a lesser extent, logging were the historical land uses in the upper watershed after the initial mining booms ceased. Agriculture, primarily cattle raising, continues today on the privately owned valley lands. Pasture irrigation is the largest single use of agricultural water.

Part of the West Walker River — from its headwaters area to the edge of Antelope Valley — and a stretch of Leavitt Creek were recently added to California's Wild and Scenic Rivers System. The California Wild and Scenic Rivers Act prohibits construction of dams, reservoirs, and most water diversion facilities on rivers included in the system.

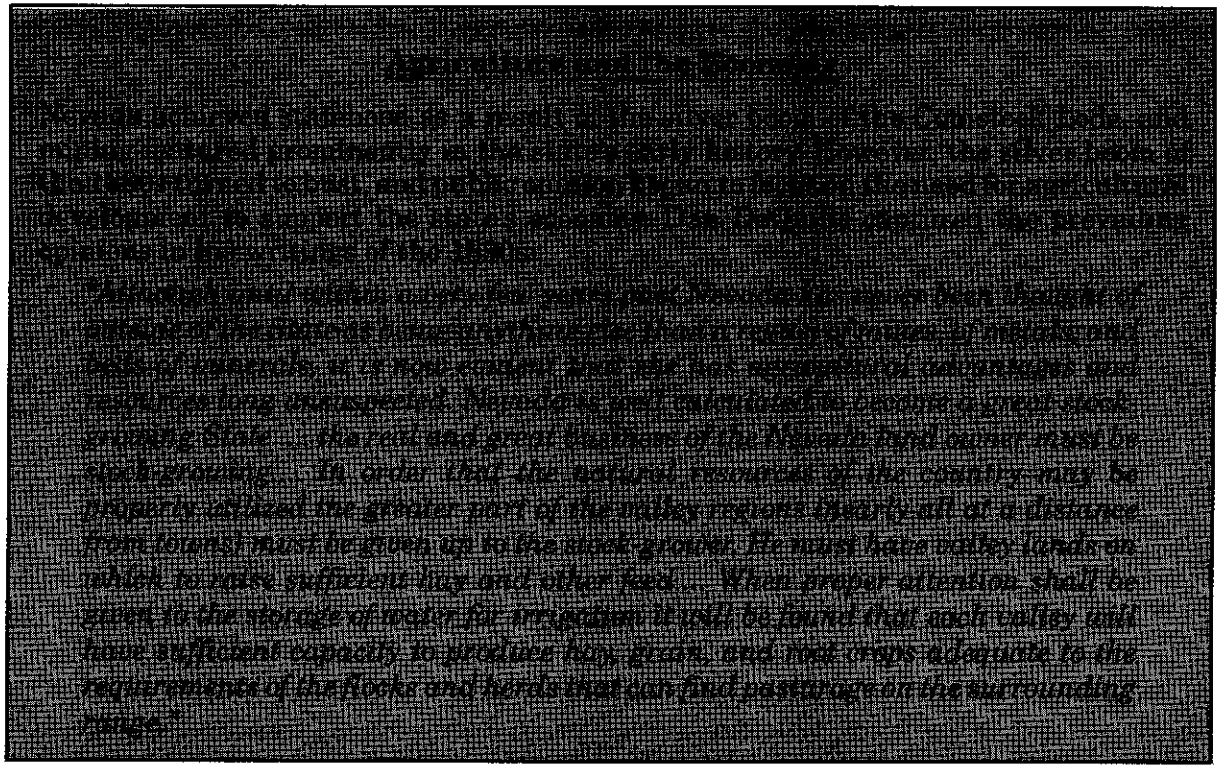
The Walker River watershed in Nevada includes parts of Lyon, Churchill, Douglas, and Mineral counties. County boundaries are shown on Figure 9. The largest residential areas on the Nevada side are Yerington (population 2,367 in the 1990 census) and the Hawthorne/Babbitt area at the ammunition depot. Yerington is the county seat of Lyon County, as Hawthorne is of Mineral County. Most of the small communities on the Nevada side — Yerington, Smith, and Wellington — are residential and trade centers for the surrounding

Figure 9
COUNTY BOUNDARIES



farming regions. Schurz, another small farm town, serves Walker River Indian Reservation. The Hawthorne area has an industrial orientation, now primarily serving the ammunition depot, although it does derive some revenues from recreation at Walker Lake.

Agriculture is the dominant land use on the privately owned lands in Nevada and is also important on the Indian reservation. Livestock production is a major agricultural activity; principal crops are alfalfa and grains, with limited production of vegetables such as onions and potatoes. Pasture irrigation and alfalfa production are the largest agricultural water uses. In addition to the agricultural sector, primary employers include the governmental and service sectors. The ammunition depot has been a large part of the economy of Mineral County.



Mining has, at times, been a driving economic force in the watershed. At present, this industry is relatively quiescent, although it still provides a low level of employment. The largest modern mining operations (excluding sand and gravel) have occurred in the Singatse Range — for iron at the Minnesota Mine (also known as the Standard Slag Mine) and for copper in the Weed Heights area. Weed Heights was created as a company town by the Anaconda Company when it opened the mine and milling facilities[1].

The privately owned lands on the Nevada side of the stateline are clustered in a few principal areas — the Nevada part of Antelope Valley, Smith Valley, Mason Valley, Sweetwater Flat, the bottomlands of the East Walker River above Mason Valley, and a minor amount near Hawthorne. The bulk of the federal land in this region is administered by the Bureau of Land Management, much of whose holdings could be characterized as high desert open space. Other large federal holdings include part of Toiyabe National Forest, Walker River Indian Reservation, and the ammunition depot.

1 Weed Heights was not named for the sparse vegetation in the Singatse Range, but for an official of Anaconda Company.

The Mining Booms

Mining has historically been an important factor in settlement of the Walker River watershed. Rumors of rich strikes initially lured adventurers to this rather remote area and created the markets that encouraged the region's agricultural development. Farming in Antelope and Bridgeport valleys, for example, was stimulated by needs of the mining towns of Aurora, Bodie, and Pine Grove. (The Aurora and Bodie excitements also created a brief logging boom in the area surrounding Bridgeport Valley.) The agricultural economy in Mason Valley has likewise at times been augmented by the several cycles of mining activity in the Singatze Range.

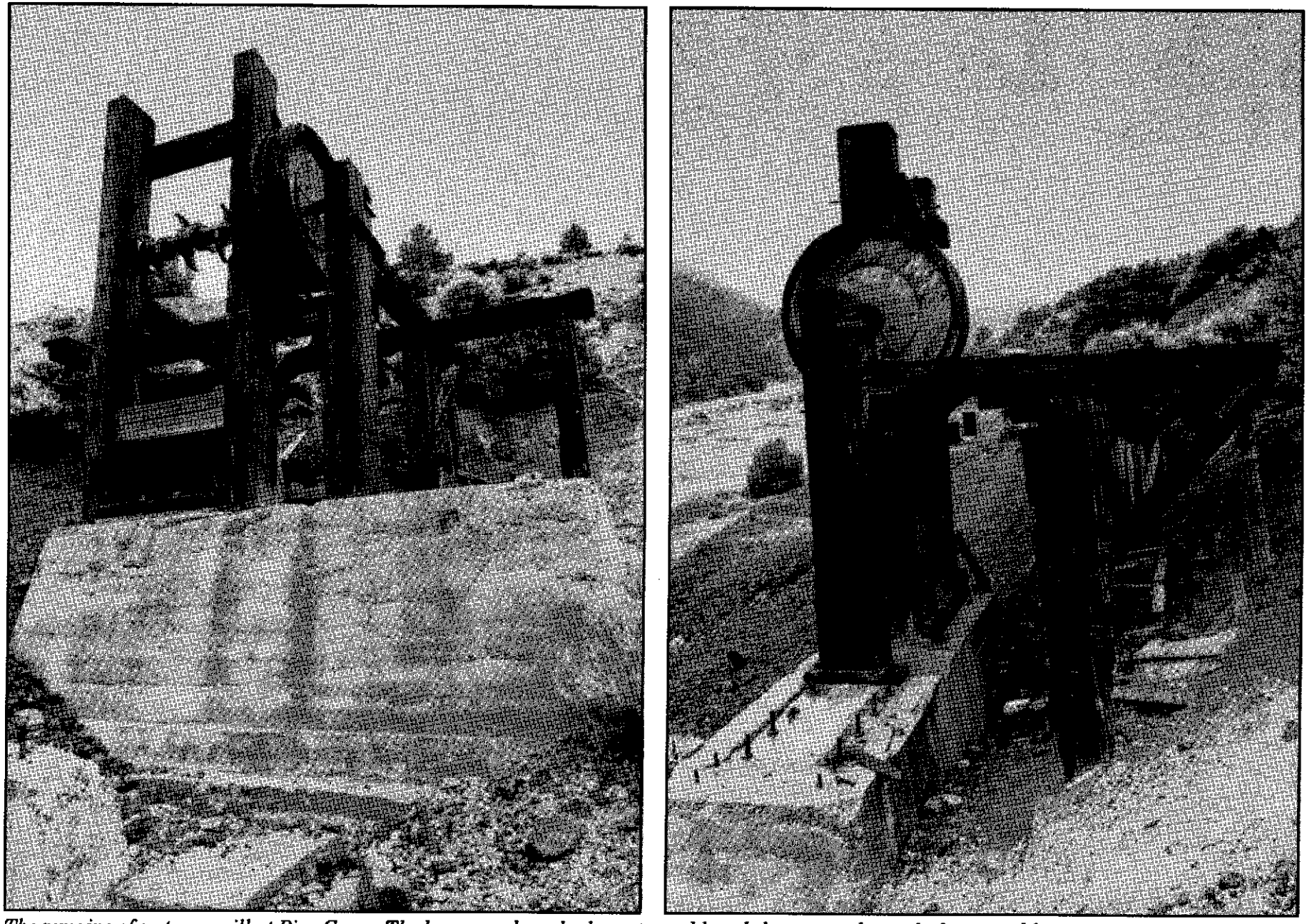
Following is a chronology of the watershed's chief periods of mining activity. There are vestiges of past mining at each of these sites, ranging from the modern town of Weed Heights with its monumental tailing piles to the desolate ghost town of Aurora. Few traces remain of many other small discoveries.

Site	Principal Ore Deposit	Period of Peak Activity
Aurora (Esmeralda District)	gold/silver	1860s
Pine Grove/Rockland	gold/silver	late 1860s/early 1870s
Bodie	gold/silver	late 1870s/early 1880s
Singatse Range/Thompson Smelter	copper	1910s
Singatse Range/Weed Heights	copper	1960s
Minnesota Mine	iron	1950s

The account below, taken from *Roughing It*, describes Mark Twain's short career as a silver miner in Aurora. Twain lived in Aurora briefly and tried his hand at prospecting. He subsequently decided being a newspaper editor in Virginia City was preferable, because it was so much less work:

"I had already learned how hard and long and dismal a task it is to burrow down into the bowels of the earth and get out the coveted ore; and now I learned that the burrowing was only half the work; and that to get the silver out of the ore was the dreary and laborious other half of it. ... This mill was a six-stamp affair, driven by steam. Six tall, upright rods of iron, as large as a man's ankle, and heavily shod with a mass of iron and steel at their lower ends, were framed together like a gate, and these rose and fell, one after the other, in a ponderous dance.... The ceaseless dance of the stamps pulverized the rock to a powder, and a stream of water that trickled into the battery turned it to a creamy paste.... Streams of dirty water flowed always from the pans and were carried off in broad wooden troughs to the ravine.... There is nothing so aggravating as silver milling.... There was always something to do. It is a pity that Adam could not have gone straight out of Eden into a quartz mill, in order to understand the full force of his doom to 'earn his bread by the sweat of his brow.'"

The two photos on page 50 show the remains of a stamp mill similar to the one described by Twain. As his account notes, a water supply is necessary to operate the mill and, if available in sufficient quantities, to turn the shaft to power the stamps as well.



The remains of a stamp mill at Pine Grove. The large wooden wheel was turned by a belt connected to a shaft powered by steam or water. The rotation of the wheel would lift the stamps to crush the ore. The stamps have been removed from this mill, but their crankshaft remains.

Chapter 5

WATER RIGHTS AND WATER PROJECTS

This chapter reviews the history of water rights actions in the basin and covers the water projects that have been considered. Many projects have been studied in this region, principally to provide agricultural water supply to lands in Nevada, but only the Walker River Irrigation District facilities were actually constructed. The interstate nature of this river has added another layer of complexity to project planning and water rights disputes.

Relatively few disputes over water arose in the earliest years of the watershed's settlement, when agriculture was in its infancy and mining was the principal activity. One reason for the paucity of disputes over water supply for mining may simply have been that many of the mining camps had no water supplies over which to debate — water had to be hauled to the camps by wagon. Unlike the Comstock Lode of the Carson River basin to the north, the small stamp mills of the Walker basin were often not powered by water because the chief mining areas were not convenient to the river. Thus, extensive legal disputes over water to power the mills, which characterized the Comstock boom, did not mark the early history of the Walker watershed.

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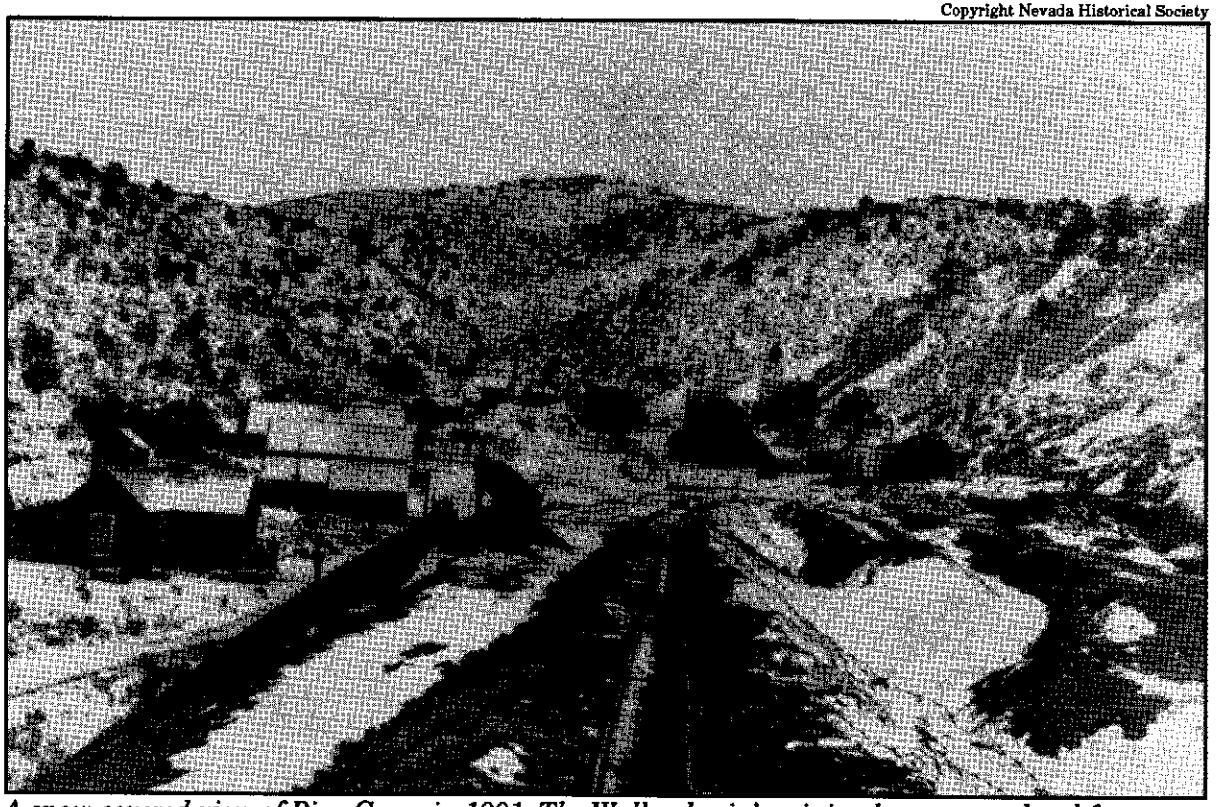

A snow-covered view of Pine Grove in 1901. The Walker basin's mining boom engendered few significant disputes over water, because most of the camps had little water over which to dispute.

Water for the Mills

This 1907 photo shows one of the relatively few water powered stamp mills used in the early mining operations at Aurora. The flume at the extreme right of the photo diverts water from a stream to the large wooden mill wheel. Rotation of the wheel could be used to generate electrical power or to turn a shaft powering the stamps of a mill. In this photo, the stamps are at the lower left. Due to the scarcity of water at most mining camps, mills were more commonly powered by steam generated from wood-fueled burners. The demand for cordwood for fuel and sawn lumber for mine timbers and building construction denuded the Bodie Hills of their piñon pines and made inroads on the tree population of the lower slopes surrounding Bridgeport Valley.

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An outing to a mill at Aurora.

Water power was more commonly used at mills in the wetter upper watershed, where a reliable water supply was available, but these were sawmills rather than ore mills. A number of water-powered sawmills were in operation on the tributaries above Bridgeport Valley, then a shipping and supply center for the mining districts. These mills provided lumber so desperately needed by the mining camps in the rather treeless eastern part of the watershed. Since the mills were located high on the upper tributaries, such as Green and Virginia creeks, their diversions did not conflict with downstream agricultural water users, because water diverted by the mills was returned to the streams above the farmers' points of use.

Significant disputes over water did not evolve until around the turn of the century, when competition among irrigators began to manifest itself. At the same time, there was also a flurry of activity on the irrigation project front, with the nascent Bureau of Reclamation beginning studies of possible federal projects.

Early Agricultural Conflicts

The first agricultural settlers in this region took the obvious approach of choosing the valley lands, which appeared to be most productive and could be readily irrigated. The federal government was encouraging settlement of the western states and territories by establishing public policy such as that expressed in the Homestead Act of 1862 and the Desert Lands Act of 1877, under which lands acquired by the government could be transferred to individual settlers. The initial opening of federal property under these acts created land rushes, as immigrants and existing citizens alike were lured by the promise they could acquire federal land for almost nothing if they were successful in improving it into productive farmland. Reflecting the nation's agrarian legacy, these acts and accompanying public policy were intended to foster the

A Summary of Some Water Rights Concepts

A variety of water rights concepts are mentioned in this chapter. The following information highlights a few basic concepts, particularly those that apply to the Walker River. Readers interested in more detail on this subject are referred to publications listed in the annotated bibliography, Appendix 2.

Water rights in California and Nevada are administered by the state. Agencies performing this function are the State Water Resources Control Board in California and the State Engineer in Nevada — and in some cases the courts. California law recognizes that surface water rights may be held under a variety of doctrines — riparian or appropriative, for example. There is no statewide system for administration of ground water rights, except for ground water that is actually stream underflow or that flows in known and definite underground channels. Use of most ground water in California is unregulated, except in special circumstances where individual basins have undergone special adjudications or where a local ground water management district has been created. In contrast, Nevada has a statewide system for administration of both ground water and surface water rights. Like many other western states, Nevada's water law is based on the appropriative doctrine for both ground water and surface water.

The doctrine of riparian rights is an old one, having its origins in English common law. Persons who own land adjacent to a stream have the right to make reasonable use of the stream's natural flow on those lands within the watershed. (The emphasis on natural flow means that riparian rights cannot be claimed for long-term storage of water in a reservoir, as for example in federal project reservoirs). Riparian users of a stream share the streamflow among themselves, and the concept of priority of use is not applicable. Under drought conditions, the users share shortages. Riparian rights cannot be sold or transferred for use on nonriparian land. No permit is required for riparian use in California, although such users are required to file "Statements of Water Diversion and Use" with the State Water Resources Control Board. (Riparian rights to the waters of a lake — as opposed to a flowing stream — are often called littoral rights.)

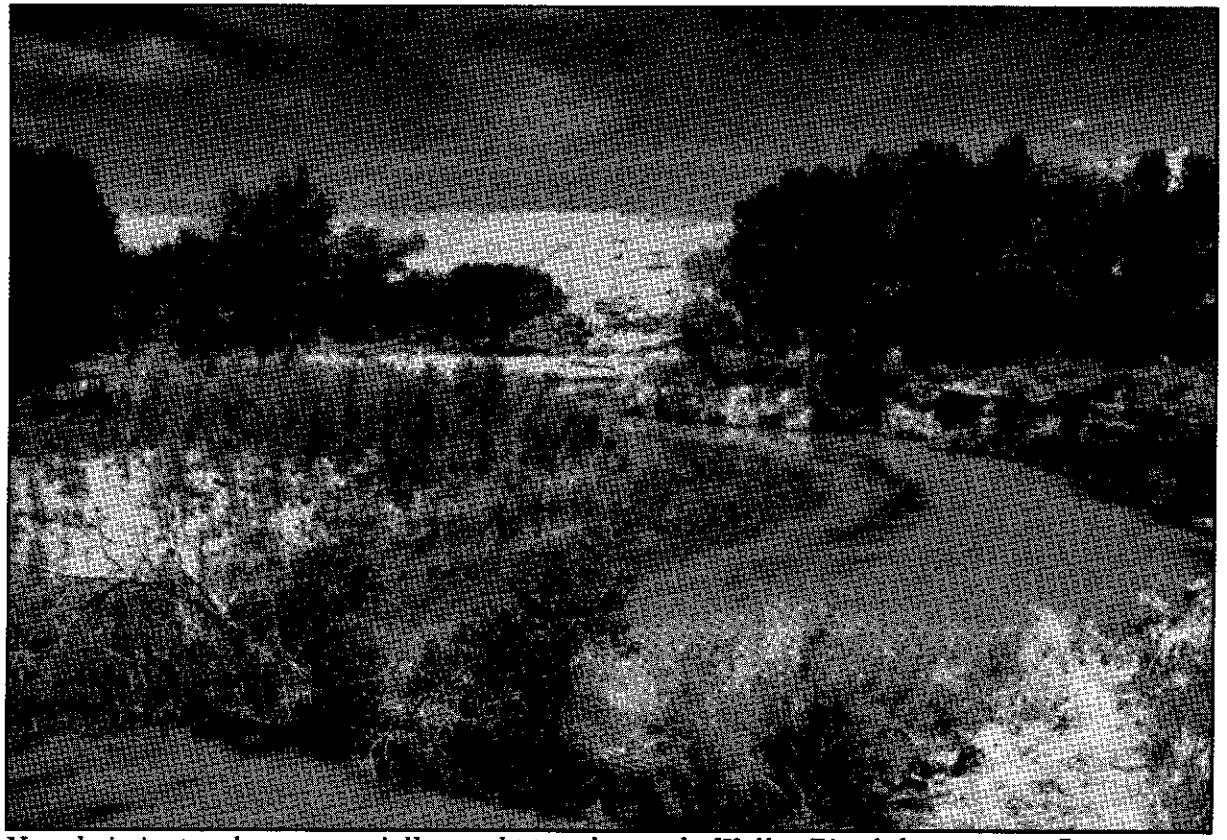
The doctrine of appropriative rights was in common use throughout the arid west as early settlers and miners began to develop the land. The appropriative doctrine is based on the concept of first in time, first in right. The first person to take a quantity of water and put it to beneficial use has a higher priority of right than a subsequent appropriative user. Under drought conditions, higher priority uses are satisfied before junior users receive water. Appropriative rights can be lost through non-use; they can also be sold or transferred apart from the land. Nevada, for example, has had a thriving market for water transfers for a number of years, due to the relative scarcity of water there and, hence, the economic competition for it. A person who claims an appropriative right must file an application with the appropriate state agency. (The permit process in California has changed over time, and appropriative rights are subdivided into pre- or post-1914 rights, because of the difference in their administration.)

Federal water rights occupy a special place in the pantheon of rights. An important 1978 U.S. Supreme Court case (California v. United States) held that the federal government must obtain water rights under state law for reclamation projects, unless state law conflicted with clear congressional directives. As a practical matter, the U.S. Bureau of Reclamation has normally participated in the state permitting process since the inception of the Reclamation Act, and had begun discussions with the states over the rights that might be obtained for the projects it was studying (but ultimately did not build) in the Walker basin.

Federal reserved rights are a category of federal rights, created by federal law. These rights are created when the government withdraws land from the public domain to establish a federal reservation such as a national park or Indian reservation. By this action, the government is held to have reserved water rights sufficient for the primary purpose for which the land was withdrawn.

spread of small farms in the sparsely settled west.

Most of the western lands entered under these programs, however, required irrigation if farming was to succeed, unlike the eastern states where spring and summer rains supplied the crops' water needs. The dry summers of the west, as well as lesser amounts of rainfall, meant a water supply was needed during irrigation season. The earliest settlers in the more arid regions could establish themselves along the banks of watercourses and thus be assured of a water supply, but the remaining areas not convenient to a surface water source could support only seasonal grazing and not subsistence farming. The need for irrigation projects to distribute water to non-riparian lands prompted establishment of private ditch companies and of the U.S. Bureau of Reclamation (see sidebar on page 58).



Nevada irrigators have perennially sought to enhance the Walker River's low summer flows.

In the Walker basin, a number of the homesteaders were bought out by livestock companies, who consolidated the farms and their water rights into major ranching operations. In addition to the properties these companies owned, their ability to use adjacent federal lands for livestock grazing allowed them to leverage their holdings into control of vast amounts of range. The availability of rail haulage, originally established to serve the mining districts, allowed cattle to be transported to markets in California. The livestock industry thrived, eventually leading to formation of two large cattle empires, one in the upper watershed and one in the lower watershed. It was a clash between these two empires that led to the first major conflict over water rights.

Hoc Mason, after whom Mason Valley was named, was one of the first to take advantage of the region's suitability for large-scale livestock production. He put together an operation covering over 30 square miles known as the Walker River Ranch, centered in the Mason Valley area and financed in part by California cattle baron Henry Miller (see

Miller et Lux

German immigrant Henry Miller was the driving force in the prominent partnership of Miller et Lux, a land and cattle company whose holdings included lands in Nevada (in the Walker basin and elsewhere) and in Oregon, as well as major acreage in California's San Joaquin Valley and adjoining Coast Ranges. The company was known not only for its dominance in the cattle industry and the sheer size of its property holdings, but also for its tenacious pursuit of water rights. The company's name crops up in a number of California court actions over water rights. In the Nevada case described in this section, the company had the distinction of arguing against the validity of riparian rights after having just won a significant California court case on the primacy of riparian rights.

Miller's ranching activities are described in *The Cattle King*, a dramatized biography cited in Appendix 2. The biography, actually an encomium, was written by a lawyer long employed by Miller on his water rights and other litigation. Quotations below from that source describe how Miller ran his operation on the Walker River Ranch.

"He found that the key to the entire situation was water. All over the vast range there were little springs, and one of those springs would control a very large area of range land. If some homesteader took up one hundred sixty acres on which one of those springs was located, it would make the land useless for cattle for many miles around it. He, therefore, had all of the springs in the county located and proceeded to obtain title to them."

"My attorneys tell me the law is different up here, you can only hold the water by appropriating it and using it. Use all of it, use it all the time, get it over the land, never mind little fancy ditches, put dams in the streams and flood it over the land, it is cheaper and gives better results."

"'We are going to have a lot of trouble over this water some day,' said Henry Miller. 'I hear that Tom Rickey is getting a lot of land up in the mountains in California and taking the water of Walker River out above us. Pretty soon we won't have any water and then there will be a lot of trouble. Many of these old men are dying and we won't be able to prove our rights, will we?'

'Well, I hadn't thought of that,' said Mr. Mason.

'Get hold of a good lawyer at once,' said Henry Miller, 'and get the testimony of all these oldtimers, so when trouble comes we will be ready for it.'"

sidebar). The combination of a multi-year drought and a particularly severe winter in the late 1880s bankrupted Mason; ownership of Walker River Ranch passed to Miller et Lux. A similar cattle barony was being put together by Thomas Rickey upstream in California. His holdings, eventually known as the Antelope Valley Land and Cattle Company, included much of Antelope Valley and adjoining small valleys, plus extensive acreage in Bridgeport Valley.

Inevitably these two cattle empires came into conflict over the scant summer flows of the Walker River. Matters came to a head when Rickey began to advance his plan to divert West Walker water into the natural reservoir site occupied by Alkali Lake, later named Topaz Reservoir. Miller et Lux filed suit against Rickey in federal district court, alleging the upstream diversions were taking water to which Walker River Ranch was entitled. This suit, filed in 1902, was originally known as Miller et Lux *v.* Rickey, but by the time the judgment was issued in 1919, the suit had been renamed to Pacific Live Stock Company *v.* Antelope Valley Land and Cattle Company. The resultant court decision adjudicating the water rights of the named parties is informally known as Decree 731.

U.S. Geological Survey

A high-altitude aerial photograph of Topaz Lake, the site of the former Alkali Lake. Water is diverted into Topaz at the bottom right of the photo, and is returned to the West Walker via the tunnel and canal visible at the upper right of the reservoir.

Parties to this action also encompassed many, but not all, of the other water users on the river, primarily the smaller agricultural water users; irrigation rights of Walker River Indian Reservation were included as well. During the lengthy period spanned by this case, a special master was appointed by the court to assemble information on the rights of these additional users, and ultimately most of these rights were incorporated in a stipulated judgment that was made part of the decree. Decree 731 addressed essentially only direct diversions from the river and its tributaries; storage rights were not quantified, except for some general provisions on Antelope Valley Land and Cattle Company's storage rights, especially those relating to the prospective Alkali Lake Reservoir.

The decree assigned priorities and amounts of water for irrigating specified lands of the parties and allowed incidental domestic and stock-watering uses to be served under the irrigation rights. Except for the extensive holdings of Antelope Valley Land and Cattle Company, almost all these lands were in Nevada. The only other major subject covered in the decree was an agreement as to how the storage rights for the company's to-be-constructed Alkali Lake Reservoir would be handled. This agreement was subsequently superseded by the dissolution of the company and construction of the reservoir by others. The following quotation from the decree illustrates the lack of specificity with which the small reservoirs in the upper watershed were treated.

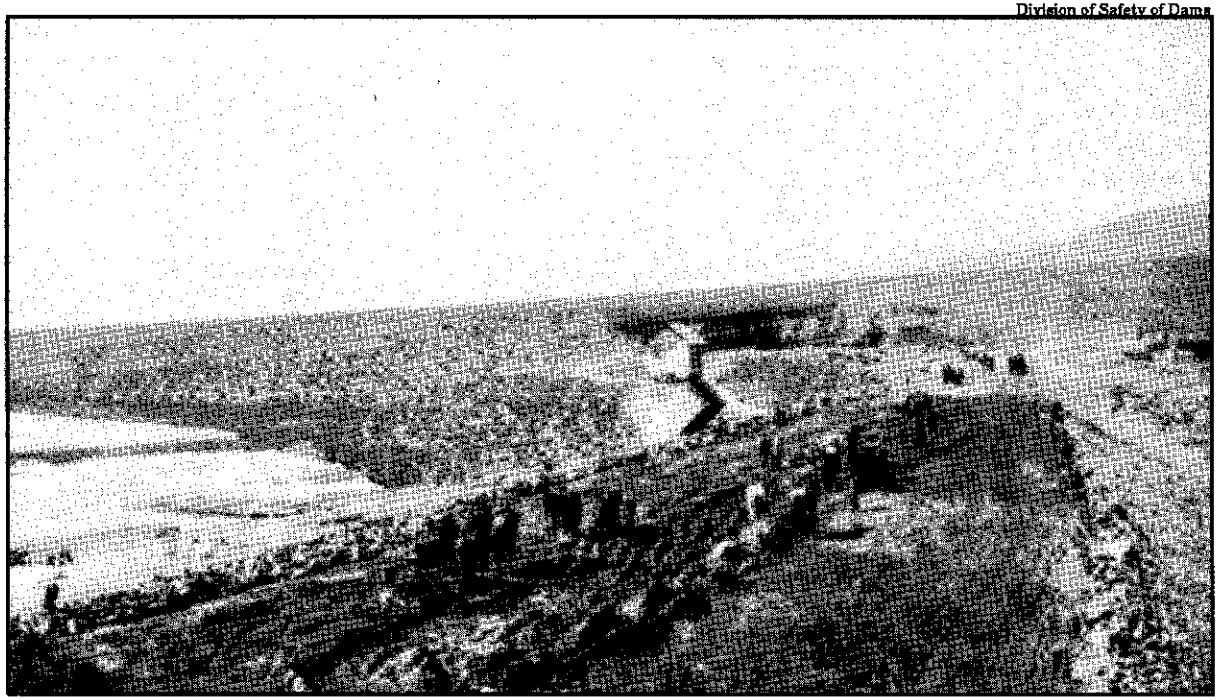
> *"The water now and heretofore reservoired by the Antelope Valley Land and Cattle Company in the several tributaries of Walker River situated above Bridgeport during the winter, or during times when all appropriations herein set forth are supplied, may be used by the Antelope Valley Land and Cattle Company in Bridgeport Valley irrespective of any of the priorities herein set forth, but the same shall not be removed from the watershed of the said river and any surplus or waste therefrom shall be returned to the river, and may be used by the other parties hereto in accordance with their several priorities in and to the waters of said river."*

A Time of Studies and of Construction

The summertime shortage of water that precipitated the legal disputes also lent urgency to studies of potential irrigation projects that had been underway. The Bureau of Reclamation had begun its studies in the watershed just after the turn of the century and continued to examine potential reservoir sites (including Bridgeport and Topaz) for several years thereafter. The Bureau's initial efforts in this region lasted but a few years, because there was not sufficient, unified interest among the water users to support an irrigation project. However, by the time Pacific Live Stock Company *v.* Antelope Valley Land and Cattle Company was winding to a close, conditions had changed somewhat. The litigation itself had highlighted the river's uncertain water supply, and economic conditions were changing the ranching business. Both Pacific Live Stock Company and its counterpart in Antelope Valley were sold to other owners; these large ranches were subsequently disaggregated into smaller parcels, which were sold to both existing farmers and new immigrants to the region.

In Nevada, farmers in Smith and Mason valleys who had banded together for joint representation in the litigation formed a nucleus around which Walker River Irrigation District[1] was formed in 1919, spurred by issuance of Decree 731. The district moved almost immediately to obtain financing and rights to both Bridgeport and Topaz reservoir sites, acquiring the rights to Topaz from liquidation of Antelope Valley Land and Cattle Company. Water was first stored in Topaz in 1921; Bridgeport was completed in 1924. The capital expenses of creating the irrigation district were lessened by its limited scope — it constructed the reservoirs only, and did not build the extensive canal or ditch systems typical of many of its coevals[2].

Division of Safety of Dams



Bridgeport Dam under construction in 1924. Teams are working embankment fill material; the siphon spillway has already been completed.

1 The district is a Nevada agency that serves lands entirely in Nevada, although its reservoirs are located all or part in California.
2 The district did later become involved in some local facilities, primarily for agricultural drainage.

Making the Desert Bloom

The U.S. Bureau of Reclamation, elsewhere a major developer of western water projects, studied several potential projects in the Walker basin, but ultimately built none of them. At times, however, the Bureau has been almost a catalyst for the water development activities undertaken by other agencies, because the federal presence has served to mobilize interests either strongly in opposition to or strongly in support of the project being considered.

The Bureau of Reclamation, earlier known as the Reclamation Service, was created by the Reclamation Act of 1902 as an entity within the U.S. Geological Survey. Its mission was to carry out the public policy of making the desert bloom or, in other words, encouraging settlement of the arid west (then comprising 13 states and 3 territories) by providing irrigation projects so the land could support settlers. The following quotations from the *First Annual Report of the Reclamation Service*, published in 1903, provide a flavor of the times.

> *"To remedy this evil [meaning the earlier lack of planning for water supply and water rights when subdividing public lands for homesteading], so that the remaining public lands will furnish the greatest possible number of homes, is an object worthy of the sustained effort of enlightened and patriotic citizens.... The development of water for irrigation is a matter of concern to all citizens of the United States, since they are the great landowners, and, as such, are, or should be, interested to see that their lands are put to the best uses. It is their duty also to guard these vast tracts, the heritage of their children.... Unquestionably it is a duty of the highest citizenship to provide a hundred homes for independent farmers, instead of permitting the land to be occupied as one or two great stock ranches, controlled by nonresidents, and furnishing employment to only a few nomadic herders.*
>
> *The pioneer settlers on the arid public domain chose their homes along streams from which they could themselves divert the water to reclaim their holdings. Such opportunities are practically gone. There remain, however, vast areas of public land which can be made available for homestead settlement, but only by reservoirs and mainline canals impracticable for private enterprise. These irrigation works should be built by the National Government. The lands reclaimed by them should be reserved by the Government for actual settlers.... The distribution of the water, the division of the streams among irrigators, should be left to the settlers themselves, in conformity with State laws and without interference with those laws or with vested rights."*

The annual report goes on to describe some of the projects the Reclamation Service was considering in the western states:

> *"The situation in Nevada is further complicated by the fact that much of its water supply comes from across the State line on the west.... Thus to utilize the spring floods it will be necessary to construct reservoirs in California and take the waters out upon lands in Nevada."*

In California, many of the individual landowners who acquired former Antelope Valley Land and Cattle Company property joined together in 1926 to form Antelope Valley Mutual Water Company, in which their water rights were pooled. A mutual water company is a privately owned entity under California law, in which shares in the company are issued to members in proportion to their acreage. The water company, which serves an area perhaps 20 percent of the size served by the Walker River Irrigation District, obtains its water supply from direct diversion of surface water. Although the water company has expressed interest over the years in participating in water projects proposed by others, its small size and consequent lack of funding have precluded it from developing its own storage facilities.

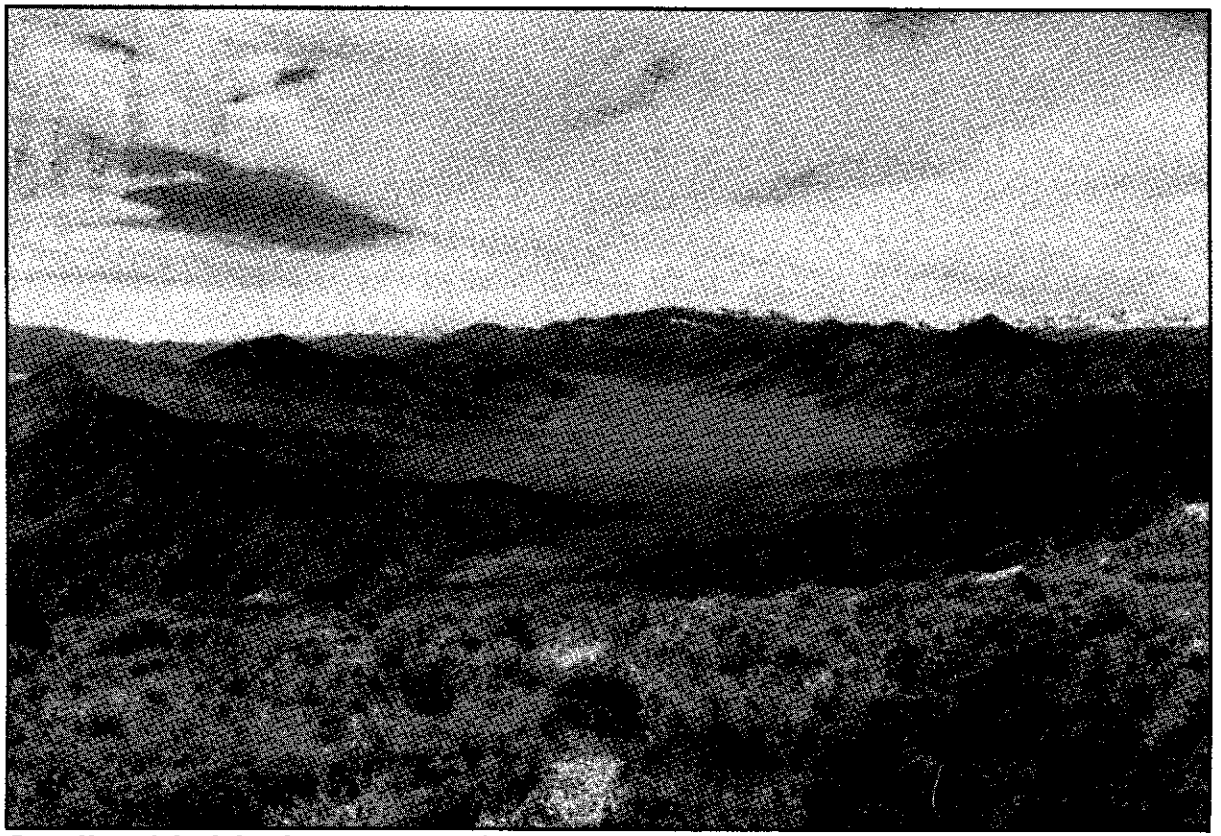
Although sporadic studies continued on other potential irrigation projects, the drought of the late 1920s and early 1930s, coupled with the economic uncertainties of the 1930s, discouraged serious pursuit of projects that would entail large expenditures. Also, existing water users who were having difficulties obtaining enough water for their crops were wary of adding more potential water users on a river system already experiencing shortages. The only project constructed during this time was a special-purpose one — Weber Reservoir on Walker River Indian Reservation. Construction of this reservoir was an outgrowth of another round of litigation over water rights, started by the federal government to improve the reservation's water rights.

Decree C-125

Only a few years elapsed between completion of one water rights lawsuit and commencement of the next. Decree 731, in 1919, was soon followed by a 1924 federal district court suit known as United States of America *v.* Walker River Irrigation District *et al.* This litigation culminated in issuance of Decree C-125 in 1936. Parties to this action included most water users on the river, including parties to Decree 731 or their successors in interest. The federal government brought this action on behalf of the Indian reservation, even though the government's Indian agents had participated in determining the reservation's water rights as established in Decree 731.

As with the earlier decree, Decree C-125 assigned priorities and amounts of water for irrigating specified lands of the parties. The water rights recognized in the earlier decree are covered, as are additional rights not contained in Decree 731. The federal government was successful in its effort to obtain more water for the reservation — although the amount of water allotted to the tribe was changed only slightly, the priority of the right was made the most senior on the river.

Decree C-125 is characterized by considerably more detail than found in the earlier decree, especially as regards reservoir storage rights. Additional tributaries are covered in Decree C-125, and more attention is given to the upper watershed, where the former holdings of the Antelope Valley Lands and Cattle Company were located. The decree also explicitly provides for one out-of-basin diversion into the Mono Lake watershed to the south. This irrigation diversion, near Conway Summit, has historically been on the order of 1,000 acre-feet per year. A rather lengthy provision is made for nonconsumptive hydropower rights in the upper watershed, on riparian lands on the West



One effort of the federal government in litigating Decree C-125 was to attempt to include most of the water users in the decree. The earlier Decree 731 omitted many existing irrigators. Some lands, however, were still not included in Decree C-125, such as the picturesque Slinkard Valley shown here. Lands in the valley are irrigated from Slinkard Creek and by ground water extractions.

Walker River and some small tributaries[1].

The storage rights covered in the decree include those for the reservoirs listed in Table 1 (in Chapter 2), as well as those for Topaz and Bridgeport reservoirs. The decree has, in fact, a special section on the rights of Walker River Irrigation District, which includes the storage rights recognized today for those reservoirs, plus other storage rights conditioned upon approval of then-pending applications with the State of California. Most of the prospective additional rights covered in these applications, including those for the proposed Leavitt and Pickel Meadows reservoir sites, ultimately were not issued to the district. Approval of any rights for the Leavitt and Pickel Meadows sites has, in any case, now been precluded by the California designation of that reach of the West Walker as wild and scenic.

The following excerpt from the decree describes its scope, as issued.

"This decree shall be deemed to determine all of the rights of the parties to this suit and their successors in interest in and to the waters of Walker River and its tributaries, except the undetermined rights of Walker River Irrigation District under its applications to the State Water Commission of the State of California and the undetermined rights of the applicants for permits from the State Engineer of the State

1 These rights for power generation have not been exercised — as discussed in Chapter 6, there have been no modern uses of water for hydropower production in the watershed.

of Nevada hereinabove specified, and it is hereby ordered, adjudged and decreed that none of the parties to this suit has any right, title, interest or estate in or to the waters of said Walker River, its branches or its tributaries other than as above set forth, excepting the undetermined rights of Walker River Irrigation District and the several applicants for permits from the State Engineer of the State of Nevada."

It should be noted that, although the decree encompasses water rights in both states, it is not an interstate allocation of the waters of the Walker River. Neither state was a party to the decree. The decree only quantifies individual rights (almost entirely for agricultural use) of parties to the litigation and does not address rights perfected under state law by persons who are not successors in interest to parties holding decreed rights. The decree adjudicates surface water rights only, as is typical for that period — it does not address ground water use. As is also typical of the period, the decree does not condition water rights for protection of instream beneficial uses of water, nor does it contain operational constraints on the reservoirs with respect to instream uses. The decree made no provision for storage rights on Walker River Indian Reservation, although Weber Reservoir had been constructed by the time the decree was issued. The decree also did not address any lands below the Indian reservation, thus surface water used in the Hawthorne area is not covered in the decree.

Decree C-125 remains the chief regulatory control on the Walker River today. The decree is administered in the field by a watermaster service under jurisdiction of the federal district court.

A Time of Studies but No Construction

The post-World War II economic boom spurred a renewal of interest in studies of water projects that had been put aside during the depression and war years. Numerous studies of reservoir sites and canal systems were conducted by various parties to serve a variety of purposes, with agricultural water supply always being the cornerstone of any proposed project. These studies spanned a period ranging from the 1940s through the 1970s. None of the projects studied was ever constructed, and construction of the frequently studied reservoir sites on the West Walker in California is now precluded by the state's Wild and Scenic Rivers Act.

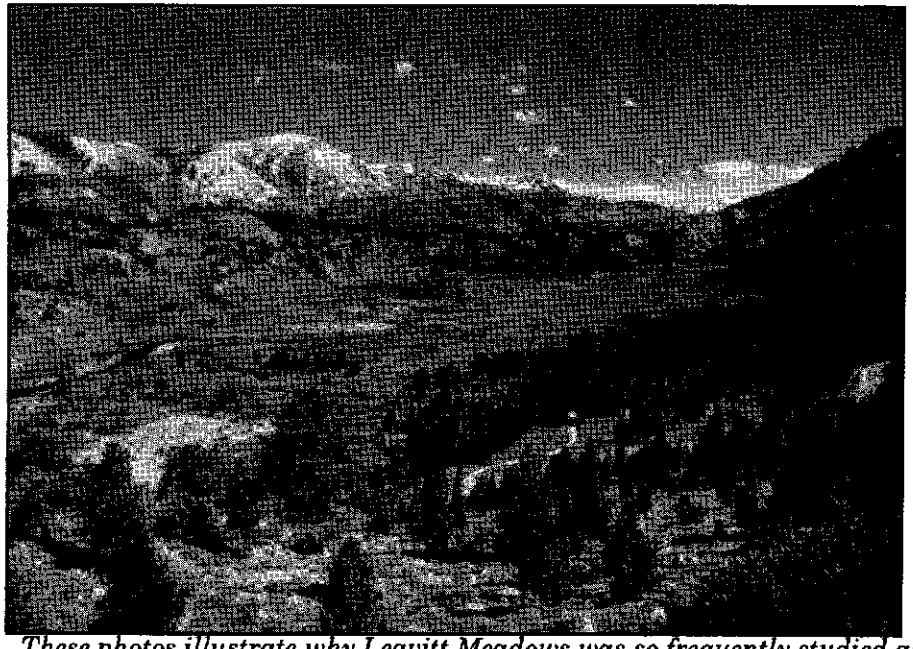
A primary reason studies did not translate into facilities was cost, particularly the limited repayment and financing capabilities of this dominantly agricultural area. Almost all of the formulations of larger projects incorporated some form of hydropower production, because the power generation revenues would be needed to make the projects affordable. In fact, one 1955 Division of Water Resources (predecessor of the Department) memorandum reviewing the Bureau of Reclamation's proposed Walker River Project noted that:

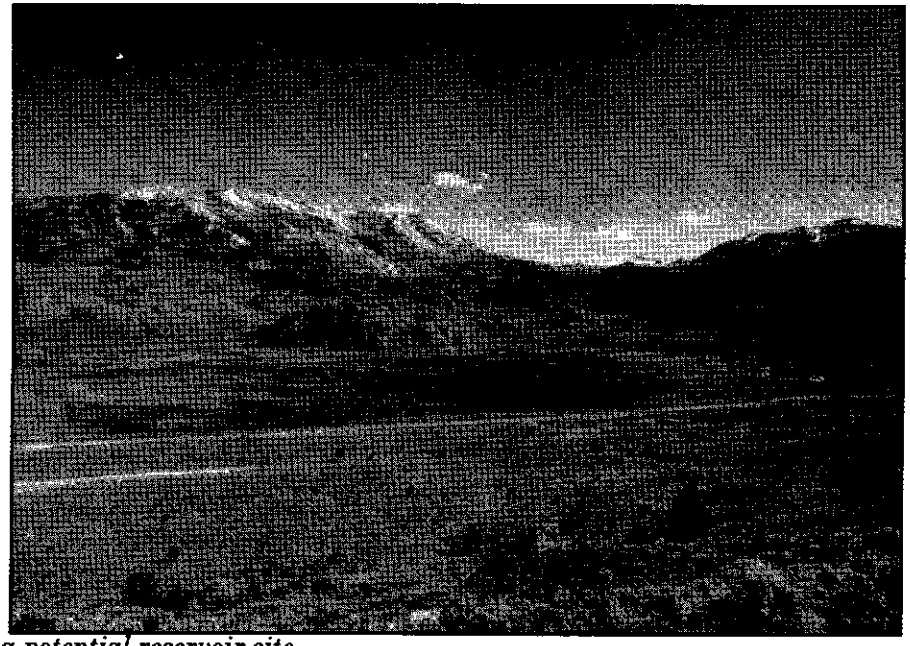
"Because of the limited repayment capacity of irrigators in the Walker River Basin, storage facilities above Antelope Valley will have to be financed largely from power revenues and federal contributions for flood control."

The limits of the irrigators' financial capabilities had, in fact, been demonstrated earlier by the difficulties experienced by the Walker River Irrigation District during the depression. Then, an expansion in irrigated acreage

triggered by construction of Topaz and Bridgeport reservoirs, the need to repay bonds used to finance their construction, and the drought of the late 1920s and early 1930s all combined with worsening economic conditions to cause the irrigation district to default on its bond payments. The district was ultimately able to recover by obtaining a loan from the federal government and by reducing its irrigated acreage to only the most productive lands.

The desire to supplement water supplies for existing irrigated lands was still, however, a goal in the minds of many water users — and with the economic boom of the post-war years, expansion of lands under cultivation was viewed as something to be reexamined. The Bureau of Reclamation once again pursued its studies of potential federal reclamation projects in the watershed, while the irrigation district studied several reservoir sites that could be used to serve its existing lands. The Department of Water Resources examined potential projects on the West Walker in California to serve lands in California not supplied by the irrigation district[1], partly in response to the interstate compact negotiations discussed in the following section. The Department's efforts were limited to initial studies on behalf of local water users — the water users themselves, not the Department, would have had to be responsible for





These photos illustrate why Leavitt Meadows was so frequently studied as a potential reservoir site.

1 Walker River Irrigation District was formed under the laws of Nevada to serve lands only in that state. Historically, there had been no interest for the district to be expanded to serve the upper watershed area in California.

financing and constructing any facilities. Other agencies, such as the U.S. Soil Conservation Service, U.S. Army Corps of Engineers, and U.S. Geological Survey also undertook some limited investigations of reservoir sites.

Table 4 summarizes the sites most studied for agricultural water supply purposes during this period. A few other reservoir sites of significant size were also evaluated, such as the Ravenal site on the East Walker in Nevada, but these sites received little more than reconnaissance evaluations. Other, much smaller, sites have been examined for special purposes such as localized flood and erosion control, primarily by the Soil Conservation Service. Typically, the most promising sites in the table have been evaluated for a range of possible reservoir sizes and by more than one agency, reflecting the greater level of effort expended on these sites. In some of the studies, especially those of the Bureau of Reclamation, several reservoir sites were intended to be

Table 4
RESERVOIR SITES STUDIED

Site Name	Location	Agencies Studying	Reservoir Capacity (acre-feet)	Comments
Pickel Meadows	West Walker, California	DWR USBR WRID USCE	75,000-160,000	
Leavitt Meadows	West Walker, California	DWR USBR SCS	25,000-40,000	
Roolane	West Walker, California	DWR SCS	26,000-35,000	Site of existing Roosevelt and Lane Lakes
Mountain Lakes	Upper watershed, California	DWR	2,200 combined	Enlarge 7 existing small lakes
Hoye Canyon	West Walker, Nevada	USBR WRID	75,000-91,000	Several sites studied in this area
Hudson	Wilson Canyon, West Walker,Nevada	WRID	16,000	
Upper Piute Meadows	Headwaters area, West Walker	USGS	50,000	
Strosnider	East Walker, Nevada	WRID SCS	10,000-46,000	
Willow Flat	Headwaters area, Little Walker River	SCS	20,000	

combined into one water project, together with canal systems, hydropower plants, and other associated facilities.

Studies by the Bureau of Reclamation of potential projects in the Walker basin culminated in the 1964 publication of a report, *Walker River Project, Nevada-California,* which focused on development of the West Walker at the Pickel Meadows, Leavitt Meadows, and Hoye Canyon reservoir sites for the primary benefit of water users downstream in Nevada. The Department of Water Resources released *Bulletin 64, West Walker River Investigation,* in the same year. This report also focused on possible development of the Pickel and Leavitt Meadows sites, but with the purpose of serving agricultural lands in California. The obviously conflicting goals of these studies helped to highlight the need for an interstate forum to address future water development in the basin, because neither California nor Nevada water users would allow a project to go forward if that project precluded their ability to develop water supplies for their own areas. This subject of competing water projects was an impetus to include the Walker River in the interstate compact negotiations over rivers of the eastern Sierras, negotiations that began in the 1950s as a result of disputes over Truckee River water supply.

Studies of potential reservoir sites, particularly by Walker River Irrigation District, continued during the years spanned by compact negotiations and ratification attempts. The district continued to seek a site where it could build its own facility to serve its existing Nevada clientele without involving other parties, such as the federal government. During the 1960s and into the 1970s, the district gave serious consideration to constructing a dam in Nevada near Hoye Bridge in Hoye Canyon, a proposal that generated much public interest — and, on the California side of the stateline, opposition. This proposed reservoir, to be located just downstream of Topaz Lake, would have been operated in conjunction with Topaz to provide supplemental water to existing water-righted lands. The Hoye Canyon proposal was vehemently opposed by California irrigators, who feared it would deprive them of the ability to construct a project on the West Walker in California. The extent of their objections was illustrated by the California Legislature's passage of an Assembly Concurrent Resolution on the subject in 1961 (see sidebar). The project continued to be considered into the 1970s, when it was tabled, and was discussed at some length in the interstate compact negotiations.

Assembly Concurrent Resolution 97

Assembly Concurrent Resolution 97 was the California Legislature's response, in 1961, to the possibility of conflicting water development projects on the Walker River system. The resolution is excerpted in part below.

"WHEREAS, The States of California and Nevada, through interstate compact commissions representing each state, are presently engaged in negotiating an interstate compact relating, among other things, to the distribution and use of the waters of the West Walker River, which arises in California and flows into Nevada; and

WHEREAS, One of the objectives of said negotiations is to settle by interstate agreement a controversy between the two states respecting the amounts of water of the West Walker River which should equitably be allocated to each state; and

WHEREAS, Water users and landowners in the California portion of the West Walker River Basin, lying within the County of Mono, are in great need of supplemental water supplies and there will also be need in the future for water for domestic and recreational development in said basin, and it is in the interest of the State of California that an adequate share of the presently unused waters of said river be allocated to California for said purposes; and

WHEREAS, Despite the fact that said negotiations are still in progress and the issue of the apportionment of the waters of said river has not been resolved between the two states, the Walker River Irrigation District of the State of Nevada on April 4, 1961, authorized the issuance of bonds and is proceeding actively with plans to sell said bonds and construct the proposed Hoye Canyon Dam and Reservoir project on the West Walker River in Nevada as soon as possible; and

WHEREAS, The purpose of said project is to store virtually all the presently unused waters of said West Walker River which are capable of development, for the sole benefit of water users and landowners of said district in Nevada, thus depriving California of any further benefits from said river, and

WHEREAS, The equitable rights of California to an adequate share of the waters of said river would be gravely prejudiced by the sale of said bonds and the construction of said project; and

WHEREAS, A suit by the State of California against the State of Nevada in the United States Supreme Court for an equitable apportionment of the waters of said river may be the only means to preserve the equitable rights of California to the waters of said river against the threat posed by said proposed sale of bonds and construction of said project by said Walker River Irrigation District before the issue of apportionment of water between the States of California and Nevada is resolved by interstate negotiation; now, therefore, be it

Resolved by the Assembly of the State of California, the Senate thereof concurring, That the Attorney General of the State of California be and hereby is requested to file an action by the State of California against the State of Nevada in the United States Supreme Court for an equitable apportionment of the waters of the Walker River when, in his judgement, such an action is necessary in order to preserve the equitable rights of the State of California to the waters of the West Walker River against the threats posed by the actions of the Walker River Irrigation District of the State of Nevada relating to financing and constructing said district's proposed Hoye Canyon Dam and Reservoir project; and be it further

Resolved, That the Department of Water Resources be and hereby is requested to render all possible assistance to the Attorney General in preparing and prosecuting such an action...."

Local Views on the Hoye Canyon Project

Quotations below are taken from the *Mason Valley News,* a newspaper based in Yerington. These excerpts illustrate the continued interest in Walker River Irrigation District's proposed projects in its service area.

May 17, 1968

"Attorneys have advised the district that because of the long period of time between previous elector approval — April, 1961 — and the probable increased construction costs, proper procedure would be to again hold a bond election. A bond issue for Hoye construction was approved by WRID voters in 1961 in the amount of $957,000. A 1968 bond election would be open to all district electors. However, each vote must represent five acres or more of water-right ground....

The area development council has, for the past several months, urged WRID board consideration of a reservoir site at Hudson on the West Walker above Wilson Canyon.... A Hudson Reservoir would play a key role as a distribution reservoir and effect savings of water through better management, it is believed."

January 30,1970

"Strong opposition to any upstream water diversion, such as proposed in construction of a storage reservoir in Hoye Canyon on the West Walker was voiced by Mineral County interests during Monday's informal hearing conducted by the Division of Water Resources.... Mineral County interests were among the 100 or more persons attending the session Monday and all voiced opposition to upstream development and diversion of water as detrimental to Walker Lake.... All pointed out the economic impact on the community of Hawthorne and the adverse effect on Walker Lake level of upstream development and diversion of excess or flood waters."

February 2, 1974

"However, as in previous sessions, opinion of water users was split with about one-half favoring construction of Hoye Canyon reservoir combined with the lower level Strosnider Dam site and the other half indicating a wish to construct both the lower level storage sites at Hudson and Strosnider.... The sessions were scheduled by the directors following a meeting with a delegation of water users from Smith Valley who asked WRID to take the offensive and proceed with plans for construction of Hoye Reservoir since they felt nothing would be gained by waiting. Principal spokesman for the group A. Nuti, told the board that 'ranchers were now more than able to finance construction and further delay was uncalled for.'"

"In requesting that the Hoye project be activated, the delegation contended Interstate Compact had not and would not remove legal blocks involved in the construction and further delay would only jeopardize the district's rights at Hoye Canyon."

The Interstate Compact Years

The concept of dividing the waters of rivers on the east side of the Sierras between California and Nevada had been considered on occasion over the years, especially with regard to perennial disputes over Lake Tahoe in the Truckee River basin[1]. The federal government lent a new air of urgency to this concept in the early 1950s, when the Bureau of Reclamation was moving forward with its studies on potential eastern slope water projects — the Washoe Project for the Truckee and Carson rivers (study published in 1954) and the Walker River Project for the Walker River (published in 1964). The discussions generated in response to these studies were the genesis for appointment of a California-Nevada Interstate Compact Commission[2] by each state in 1955. Technical support for the California Commission was provided by the Department of Water Resources.

A congressional statute authorized the states to negotiate a compact and called for appointment of a federal representative to the negotiations. The two commissions worked for about 10 years, together with federal representatives, to develop a draft version of an interstate compact for the Truckee, Carson, and Walker rivers. The basic purpose of the compact was to allocate the waters of these rivers between the two states and to set up a method for administering disputes that might arise over the allocations.

What Is An Interstate Compact?

States administer water rights within their own political boundaries, but the process becomes more complicated when an interstate body of water is involved. An allocation of such a body of water can be made between the two states, acting on behalf of their residents, and then each state can issue water rights to its share of the water using its normal administrative process.

There are three possible ways to achieve an interstate allocation:

- *A suit for equitable apportionment brought by the states in the U.S. Supreme Court,*
- *An interstate compact, or*
- *A congressional act.*

An interstate compact is an agreement negotiated by the two states, adopted by the state legislatures, and then approved by Congress. Interstate compacts have traditionally been a common method of making water allocations in the western states. California examples include the Klamath River Compact and the Goose Lake Compact with Oregon.

The federal role in the negotiations was, at times, confusing. The President had appointed a federal participant to the compact negotiations, but the federal government was relatively inactive in this formal role. On the other hand, the Bureau of Reclamation was active in its studies and development of Truckee River facilities, and issues relating to the Bureau's work were discussed frequently in the negotiations.

Ultimately, the state legislatures of California (in 1970) and Nevada (in 1971) passed legislation adopting the Joint Commission's California-Nevada Interstate Compact. Appendix 1 contains excerpts from the compact on the proposed Walker basin allocation.

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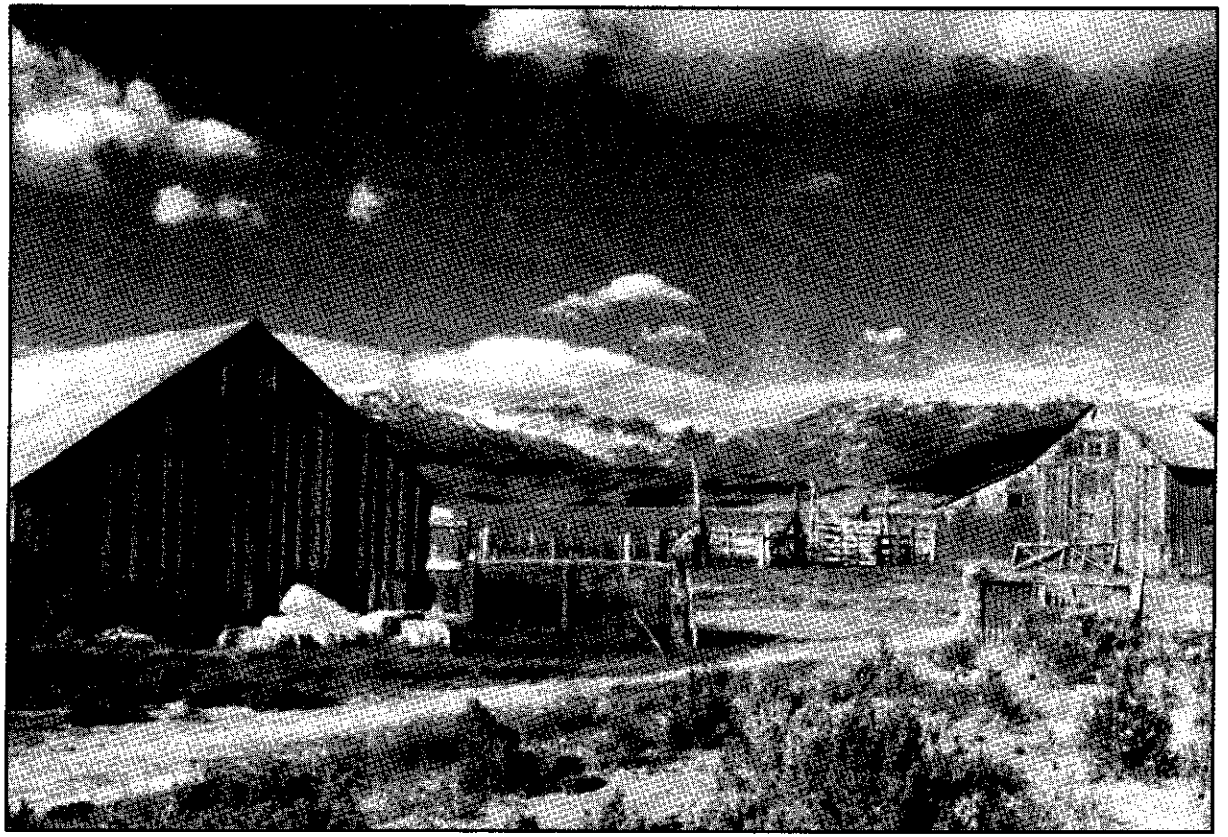
1 More information on this subject can be found in the Department's *Truckee River Atlas* and *Carson River Atlas,* referenced in Appendix 2.

2 When the two commissions met as one body, they were referred to as the Joint California-Nevada Interstate Compact Commission.

In the Walker River watershed, the proposed compact confirmed rights held under Decree C-125, subject to constraints on storage in Bridgeport and Topaz reservoirs. Existing historical diversions and uses of water not covered in the decree were allocated to the state in which they occurred, and provisions were made for storage of water in Weber Reservoir. (Decree C-125 established diversion rights for Walker River Indian Reservation, but it did not address storage rights in Weber.) The compact assumed that new water storage projects would be constructed, particularly on the West Walker, and contained some general principles on allocation of water developed by such projects. So-called "unused water" was to be divided between California and Nevada on a 35/65 percent basis.



One of the major Walker basin issues discussed in the compact negotiations was how to divide future agricultural water supply.

The proposed compact would also have established a permanent commission to administer the compact once it was approved; this body was envisioned as resolving disputes over operation of the allocations and over details of future water development activities. In the Walker basin, for example, the commission was to establish amounts of water for each state from new projects constructed upstream of Topaz Reservoir and to calculate the effect of constructing new facilities on the yield of existing reservoirs. Since the identity of the reservoirs to be constructed had not been determined at the time the compact was written, these provisions were necessarily general rather than specific.

One provision of the compact directed the California Department of Water Resources and the Nevada State Engineer to make a joint review of potential developments of unused water of the West Walker, a project actually performed to some extent during the time the compact was being negotiated. During the decade of the most intense work on the compact, a variety of studies were performed to estimate future water needs, for recreation and fishery uses as well as for agriculture. In California's part of the Walker basin, the Department spent much time on land

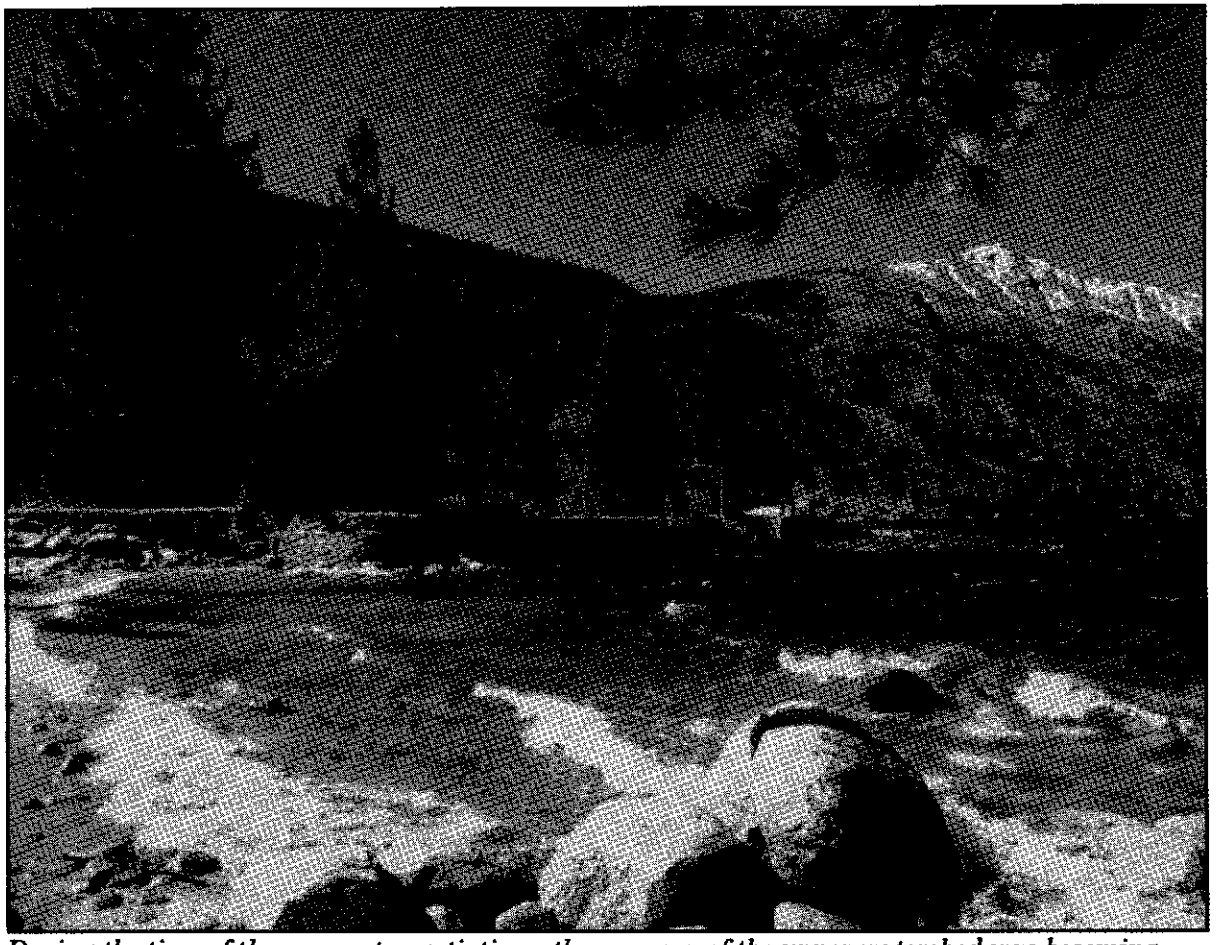
classification and land use studies to estimate the maximum amount of potentially irrigable land and the corresponding ultimate level of water demand.

In the final analysis, however, this effort did not bear fruit because congressional consent to the compact was not forthcoming. Several bills were introduced in Congress seeking ratification of the compact, but none achieved passage. The earlier federal role of quasi-indifference to the compact was changing to one of opposition. One compact provision particularly troubling to federal agencies was the statement that:

> *"The use of water by the United States of America or any of its agencies, instrumentalities, or wards shall be charged as a use by the state in which the use is made."*

This provision, common to earlier interstate compacts, was seen by the states as necessary in recognition of the major federal water use on these east slope rivers and the federal ownership or control of all of the largest reservoirs on the Truckee and Carson rivers.

The compact was also caught in the midst of changing directions in water rights laws and policies. The doctrine of federal reserved water rights was evolving in the courts, and passage of the Endangered Species Act gave the federal government additional responsibilities for listed species. Both of these factors affected claims for water on the Truckee and Carson rivers and contributed to a long series of legal disputes in the two river basins. Disputes over



During the time of the compact negotiations, the economy of the upper watershed was becoming increasingly oriented toward recreation and was shifting away from agriculture as a dominant sector. Twin Lakes is one of the most popular recreational destinations in the upper watershed because trails in the area provide access to the high back-country.

more water to support listed fish species in Pyramid Lake and over operation of a federal reclamation project in the Carson basin upset the balance of interests that had prevailed in the compact negotiations and essentially derailed compact approval.

The last of the bills for which congressional approval was sought was introduced by former Nevada Senator Laxalt in 1986 after failure of his attempts in 1985 to negotiate a settlement of these outstanding issues. With defeat of the 1986 effort, the parties tacitly agreed that pursuing compact ratification was fruitless.

Water interests on the Truckee and Carson rivers persevered, however, and a new set of negotiations was begun in 1986 by Nevada Senator Reid[1]. These negotiations among the state and federal governments and other interests eventually resulted in passage in 1990 of Public Law 101-618, which, among other things, establishes the framework for an interstate allocation of waters of the Truckee and Carson rivers. Walker River water users were invited to participate in this new round of negotiations, but declined to do so. Thus, no further effort has been expended on interstate allocation issues on the Walker River.

One reason for the water users' lack of continued interest in establishing an interstate allocation was that the pressure created by proposed water development projects had abated by the 1980s. Walker River Irrigation District, the last entity to seriously consider constructing new facilities, curtailed its efforts with completion of its reservoir site studies in the early 1970s. There was growing recognition that economic and environmental constraints would limit the possibility of new water development for agriculture in this watershed. Interstate water issues have, instead, shifted to those of the environmental variety discussed below.

Interstate Issues on the Walker River Today

The most recent interstate activity on this river has been a dispute between California agencies and Walker River Irrigation District over operation of Bridgeport Reservoir and its impact on the fishery of the East Walker River. This dispute began in 1988, when California Trout, Inc., a sport-fishing association, filed a complaint with the California State Water Resources Control Board alleging that the irrigation district's dewatering of the reservoir that summer violated several state fish protective statutes and caused a loss of fisheries in the reservoir and in the East Walker, downstream. The district had drained the reservoir, which was already at low levels because of the drought, to supply its Nevada irrigators. This release of warm reservoir water containing large quantities of sediment had caused a fish kill in the East Walker downstream. After the complaint was filed, extensive negotiations took place between the California Department of Fish and Game and Walker River Irrigation District. When negotiations reached an impasse, the Board moved ahead with an investigation and eventual water rights hearing.

Mono County took its own action against the irrigation district while the State Water Resources Control Board's water rights action was being conducted; the district was convicted of

1 California was represented in the negotiations by the Department of Water Resources, with assistance from the State Water Resources Control Board.

Bridgeport Fishery Issues

Fishery issues at Bridgeport Reservoir have surfaced periodically since the dam was constructed. The earliest issues dealt with construction and operation of a fish ladder at the dam, as indicated in the 1940 letter excerpted below. Later, during the time of compact negotiations, minimum reservoir pool and streamflow issues were discussed in conjunction with the application by Walker River Irrigation District for a loan from the federal government under the Small Reclamation Projects Act. Samples of issues discussed are excerpted below.

May 31, 1940,
California Division of Fish and Game letter to California Division of Water Resources

"... when this dam was originally constructed, this Commission [the California Fish and Game Commission] requested the construction of a fish ladder. The District objected, and the offer was made that fish ladder construction would not be required, providing they install a fish screen of suitable size in front of their outlet structure through the dam, and the reason for such alternate proposal was that as this water soon runs into the State of Nevada, and Nevada makes very little provision for the protection of fish, that it was felt that we would retain the fish in California and there would be little of upward moving fish that would desire to pass this point after the lapse of a few years.

At first it seemed to appeal to them but later evidently people in the State of Nevada thought they might lose some fish and they did not avail themselves of this proposal. They countered with the offer to construct a run-around....and this Commission reserved the right, should it prove ineffective, to require the construction of a fish ladder.

In summarizing the events to date, it may be said and the files so show that this district did not at any time really do a good job, nor did they follow out the suggestions made by this Commission."

September 23, 1957,
Department of Water Resources report on WRID's PL 984 loan application

The fish ladder having eventually been constructed, its modification under the proposed PL 984 work became a topic of discussions that soon branched out to include minimum pools and streamflows. The Department's report included comments from the Department of Fish and Game, which emphasized the need to formalize reservoir operations to protect the fishery. One recommendation also covered ramping of reservoir releases:

"Releases to stream flow below the dam shall be made in as uniform a manner as possible consistent with the primary purposes of the project. Changes in rates of release should be made gradually so as to avoid endangering fishermen and other stream users, scouring of the stream channel, stranding of fish, and destruction of fish habitat."

February 5, 1963,
Agreement between Department of Fish and Game and Walker River Irrigation District

This agreement was intended to be incorporated into the District's PL 984 project.

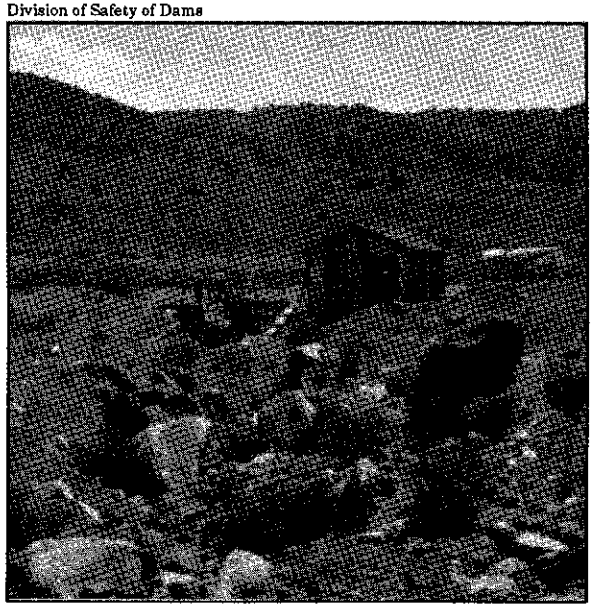
"NOW, THEREFORE, upon the event that the District shall in fact modify said Bridgeport Dam to enlarge the capacity of Bridgeport and accomplish other project purposes as aforesaid, and for so long as the District shall continue and maintain such modifications of said Bridgeport Dam — all as conditions precedent to any effect to be given to this Stipulation and Agreement — the District and the Department hereby stipulate and agree to the following:...

The District shall maintain a minimum pool of 1500 acre-feet in Bridgeport Reservoir for the protection of fishlife, except in dry years as defined ... below. During a dry year the District shall maintain a minimum pool of at least 300 acre feet, provided that by mutual agreement of the parties hereto, the minimum pool provision may be waived."

The agreement goes on to specify minimum streamflow releases, generally the lesser of 50 cubic feet per second or natural inflow during the irrigation season and 8 cubic feet per second the rest of the year, subject to provisions for dry year flows.

California Fish and Game Code misdemeanor violations in the Justice Court of Mono County. Temporary instream flow release requirements were imposed by that court as a condition of the district's probation, and the district was required to remove some of the sediment deposited in the river. The Board completed its hearing process in 1990[1] and amended the district's water rights for storage in Bridgeport Reservoir to include instream flow and minimum reservoir pool requirements. Walker River Irrigation District then brought suit against the Board in the federal district court having jurisdiction over Decree C-125. The suit challenged the Board's authority to impose state law requirements on a water right that the District claimed was fully determined by Decree C-125. Litigation of this case is still underway.

Division of Safety of Dams



A 1932 view of the original fish ladder facilities at Bridgeport Reservoir.

A Summary of Key Dates

1902	Miller et Lux v. Rickey begins.
1919	Decree 731 issued.
1919	Walker River Irrigation District formed.
1924	United States of America v. Walker River Irrigation District begins.
1936	Decree C-125 issued.
1970	California Legislature approves the proposed interstate compact.
1971	Nevada Legislature does likewise.
1988	Dispute over fishery impacts of Bridgeport Reservoir operations begins.
1989	Part of West Walker in California added to state Wild and Scenic Rivers system.

1 With participation by Walker River Irrigation District, California Trout, and Lahontan Regional Water Quality Control Board.

Chapter 6

USES OF THE WALKER RIVER

This chapter highlights some uses of the Walker River system. Both consumptive uses (*e.g.,* agricultural and municipal) and nonconsumptive uses (*e.g.,* recreation) are covered. Although much of this chapter is directed toward surface water use, the use of surface and ground water is inextricably intertwined. River water may recharge a ground water basin, or ground water may contribute to flow in the river or may sustain the level of a lake. In the Walker basin overall, most municipal users are, in fact, supplied from ground water, with surface water supply being largely the province of irrigators[1].

The Historical Perspective

As with many western rivers, the history of the Walker includes a period of exploitation of natural resources — mining and limited lumbering followed by a time of homesteading and agricultural development. The Walker has not, however, advanced to the next level of evolution typical of its companion interstate river basins, that of increasing urbanization. Concern for environmental needs is becoming more visible. Actions are being taken in California to provide recognition for instream beneficial uses of water, and interest is growing in Nevada to prevent continued recession of Walker Lake and the corresponding degradation of its water quality.

The Return Flow Concept

Understanding the concept of return flows is important in the context of water rights. Downstream water users may derive a portion of their entitlements from return flows of upstream users. For this reason, Decree C-125 prohibits transfer of decreed water rights (except for one specified diversion) outside of the basin.

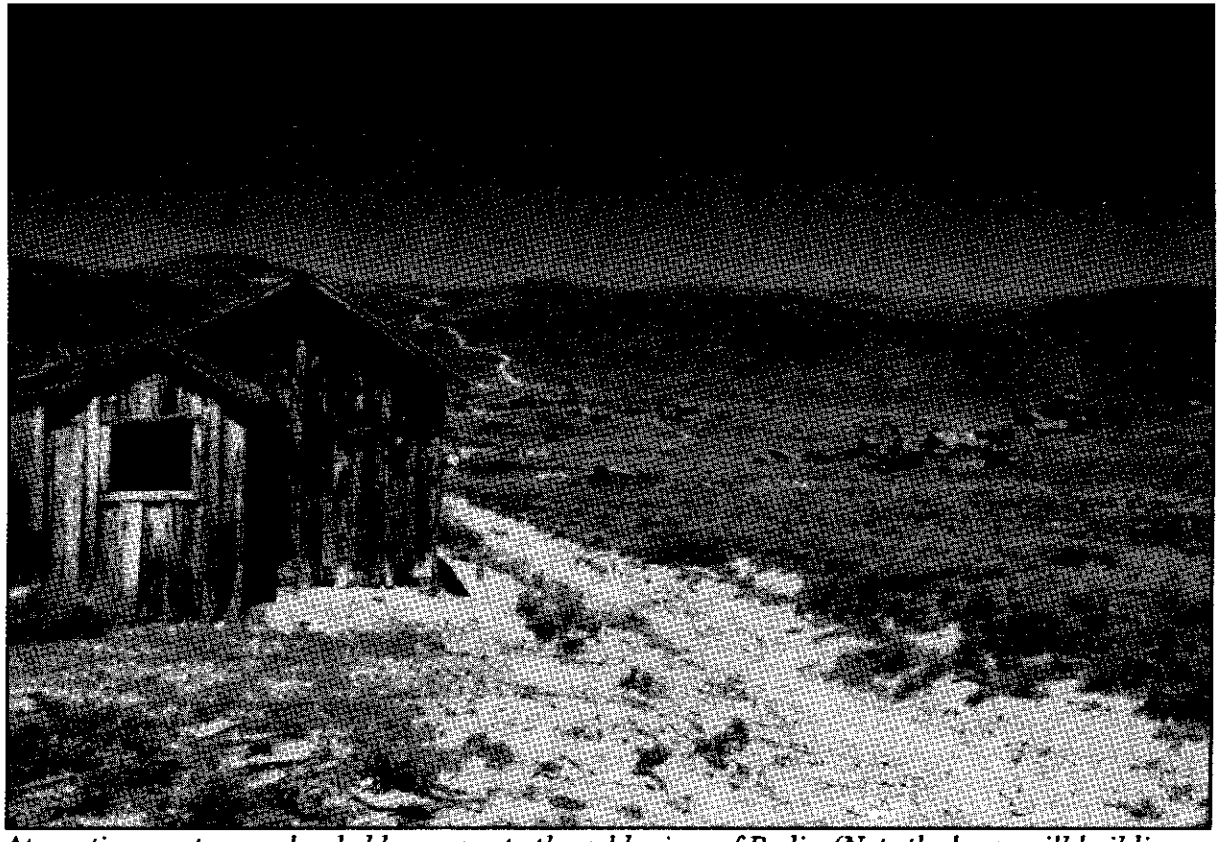
As an example of the use of return flows, consider water diverted for irrigation in California's Antelope Valley. Part of the excess water applied to the land will return to the river in the form of tailwater or agricultural drainage and will be available for reuse by a farmer in Mason Valley, downstream. Some of this "recycled" water will again be returned to the river after its use in Mason Valley and will eventually reach Walker Lake to help support lake levels.

Mining, the motive for initial immigration into the region, was not a large water user because most of the camps were remote from the river and, hence, did not have a significant water supply to develop for powering the mills. Some camps were sufficiently remote that drinking water had to be hauled in by wagon. There was at this time a limited use of tributaries to power individual stamp mills and, more commonly, sawmills in the upper watershed. The earliest large diversions in the watershed were for agriculture, as settle-

1 In terms of total amount of water used, surface water diversions in the basin far overshadow ground water extractions.

ments were established to provide supplies for the miners and as the area's potential for livestock grazing was recognized.

The large cattle baronies that subsequently dominated the watershed made extensive use of water for irrigated pasture by assisting the river's natural tendency to flood low-lying meadowlands in the larger valleys. A practice began of constructing low brush dams and other temporary diversions in the river to turn aside water onto fields to be irrigated, a practice that long continued into more modern times. Eventually, the passage of the livestock empires and the division of the largest ranches into smaller holdings encouraged construction of privately owned canal and ditch systems and formation of Walker River Irrigation District to serve lands in Nevada. Construction of Bridgeport and Topaz reservoirs set the stage for the present water management practices in the basin, which have changed relatively little since that time.



At one time, water was hauled by wagon to the gold mines of Bodie. (Note the large mill building at right of photo). Today Bodie is a recreational "goldmine" for Mono County, emblematic of the economic changes in the upper watershed.

In recent years, the upper watershed in California has become increasingly oriented to a recreation-based economy, as reflected in the support for inclusion of a part of the West Walker in California's wild and scenic rivers system. This designation essentially prioritizes instream beneficial uses of water above any future attempts to develop more water in that area. On the East Walker, recreational and environmental concerns are likewise reflected in the dispute over operation of Bridgeport Reservoir. More attention is also being focused on the recreational value of Walker Lake, and methods to arrest its decline are being studied.

Present-day water uses in the basin are described in the following sections.

State Filings

Water rights for uses described in the following sections are either incorporated in Decree C-125 or are held under the laws of each state. In California, a special type of appropriative right pertains to future use, referred to as a "state filing". The California Water Code directed the Department of Water Resources to, among other things, prepare a statewide plan for development of water resources. Related to this activity was a requirement that the Department make the water rights filings necessary to carry out that plan. In concept, the Department was to make filings for the projects it identified as necessary for orderly development of the state's water resources, and the applications would be assigned to local agencies (such as water districts) that would be created to carry out the projects. Unlike regular filings for appropriative rights, these state filings do not expire through inaction; they are held pending until a local agency makes a request for their assignment to the State Water Resources Control Board.

There are a number of these state filings for possible reservoir sites in the Walker River watershed in California. At the time the filings were made, it was the assumption that the sites would be used for agricultural supply. If, however, a major population boom were to occur in the watershed (presently not a likely possibility), a local agency could request assignment of one of the filings for storage of municipal water supply.

Agricultural Water Use

Agriculture is by far the largest water user in the basin, as reflected in Decree C-125, where almost all of the rights are for irrigation and where it is assumed that incidental domestic and stock watering uses are subsumed in the irrigation rights. Principal crops are irrigated pasture (for livestock production), alfalfa, and grains. In California most irrigation demands are supplied from surface water, with Slinkard Valley being the only area where a significant use of ground water has been made. Surface water is also the major source of irrigation supply in Nevada, with ground water being used mostly as a supplemental source of supply in Smith and Mason valleys, especially in dry years[1].

Table 5 shows estimated acreages with irrigation rights from surface water, as taken from the State of Nevada planning report referenced in Appendix 2.

The acreage actually irrigated in the watershed (both from ground water and surface water sources) is on the order of 110,000 to 120,000 acres, split about 30 percent California and 70 percent Nevada. Walker River Irrigation District serves all irrigated lands in Nevada outside of the Indian reservation[2]; the water-righted acreage served by the district is just under 80,000 acres. Acreage with decreed rights in California includes one long-standing out-of-basin irrigation diversion into the Mono Lake basin to the south.

Duties of water[3] for lands included in Decree C-125 were specified in a 1953 document known as "Rules and Regulations for the Distribution of Water of the

1 Decree C-125 regulates only the use of surface water for irrigation; the decree does not include ground water.

2 Actual irrigated acreage on the reservation exceeds decreed acreage by several thousand acres. The irrigated acreage established in the decree was based on lands irrigated by direct diversion from the river. Construction of Weber Reservoir, whose storage rights were not covered in the decree, has permitted irrigation of additional acreage.

3 The duty of water is the amount of water required to irrigate a given area for a particular crop. The duty is the water supplied to the land, not the water actually consumed by the plants. Duties vary with factors such as soil and crop types and with the efficiency of the irrigation distribution system.

Table 5
ESTIMATED ACREAGES WITH SURFACE WATER IRRIGATION RIGHTS

Location	State	Water Right Acreage
Upper East Walker Watershed above Bridgeport Reservoir	California	26,277
Antelope Valley and Adjoining Upper West Walker Areas	Mostly in California	17,511
Smith Valley Area	Nevada	20,439
Mason Valley Area	Nevada	58,648
Walker River Indian Reservation	Nevada	2,100
Total		124,975

Walker River Stream System Under the Provisions of Paragraph 15 of Decree in Equity, No. C-125". Lands in California above Bridgeport Reservoir on the East Walker (primarily Bridgeport Valley) and above the Topaz Lake intake canal on the West Walker (primarily Antelope Valley and surrounding area) were assigned a duty of 1.6 cubic feet per second per 100 acres of land. The remaining decreed acreage downstream was assigned a duty of 1.2 cfs per 100 acres of land.

The decree's rules and regulations also establish the irrigation season for decreed lands. The season runs from March 1 to September 15 for East Walker lands above Bridgeport Reservoir and for West Walker lands above the Coleville streamflow gauge. The irrigation season is from March 1 to October 31 for the rest of the basin.

There are other lesser agricultural uses of water not covered in Decree C-125 — particularly ground water extractions for irrigation, riparian diversions made under California law, and diversions from minor tributaries in the upper watershed not included in the decree. Lands in Slinkard Valley, for example, have been irrigated from Slinkard Creek, which is not included in the decree, and from ground water. The U.S. Bureau of Land Management also holds California water rights on Slinkard Creek for stock watering. Minor rights such as this one are associated with grazing allotments on federal lands in several locations in the watershed.

The Boundary Question

The County of Mono was created by an 1861 act of the California State Legislature; the mining town of Aurora was established as the county seat. The eastern boundary of the county was to be the stateline between California and Nevada — wherever that was. The stateline had been established by statute but had not, at the time, physically been surveyed on the ground, and exact boundaries were far from certain. The Territory of Nevada was also established in 1861, by an act of Congress. Nevada's Territorial Legislature created a county called Esmeralda County and also established Aurora as the county seat. Aurora, then a booming mining town and a population center for the area, was considered a desirable addition to either county. The citizens of Aurora enjoyed this dual status, even voting in two sets of elections, until 1863 when a survey finally established that Aurora was about 3 miles into Nevada.

Uncertainties about the precise location of the stateline on the ground were common for a number of years along the remote, sparsely populated border areas. This uncertainty is reflected in the description of one 1864 irrigation right in Decree C-125, which is described simply as 100 acres located "between the old and the new statelines".

And on the pedestal these words appear:
"My name is Ozymandius, King of Kings:
Look on my works, ye Mighty, and despair!"
Nothing beside remains. Round the decay
Of that colossal wreck, boundless and bare
The lone and level sands stretch far away.
—Percy Bysshe Shelley

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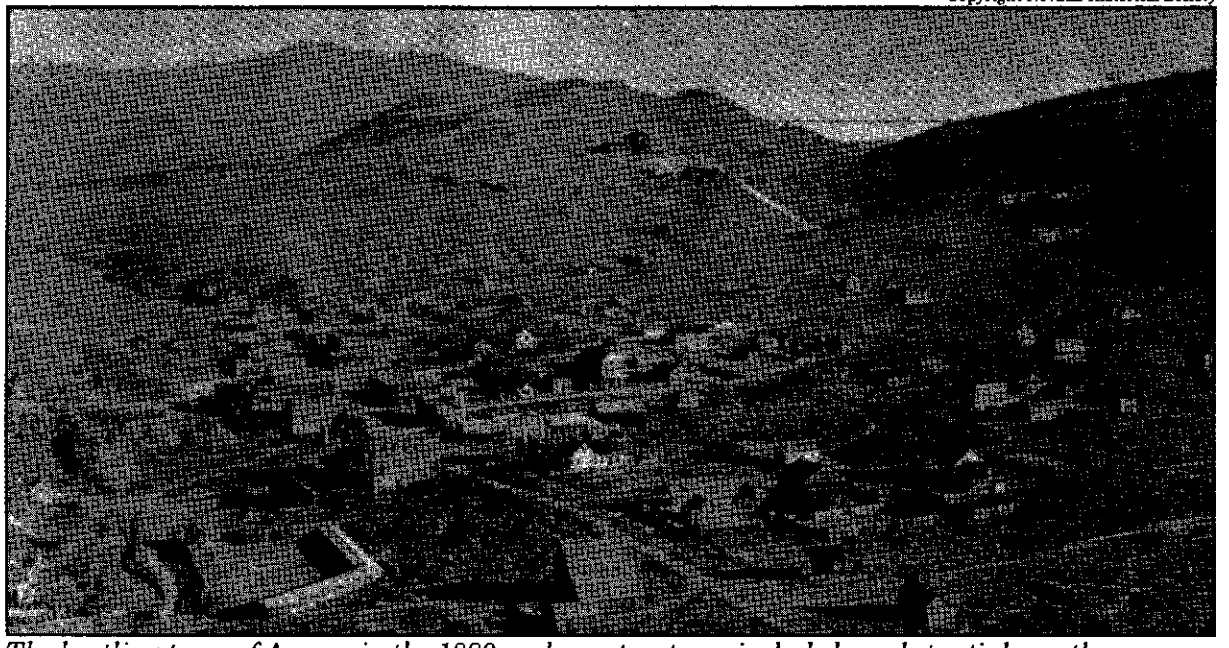


The bustling town of Aurora in the 1880s, whose structures included a substantial courthouse. Today, like Shelley's Ozymandius, almost nothing remains at the site.

Estimating the amount of water actually consumed by agricultural uses, as opposed to that physically diverted or extracted, requires preparation of a relatively detailed water balance that takes into account the return flows from upstream irrigation uses. Such an activity has not been undertaken for the entire Walker basin for some years. One of the more recent calculations was a 1969-level study by the State of Nevada, in which agricultural consumptive use in Nevada was estimated at 133,000 acre-feet, based on diversions and extractions totaling just under 316,000 acre-feet. Agricultural use in the Nevada part of the basin amounted to more than 90 percent of total water use at the time. Although somewhat dated, these figures can be expected to reflect general conditions in the watershed today, because irrigated acreage has remained largely unchanged.

One historical trend in agricultural water use has been the gradually increasing amounts of ground water extracted for irrigation, especially in Smith and Mason valleys. Ground water extractions in Nevada are regulated by the State Engineer, who has the authority to limit pumpage to the perennial yield of the ground water basins, thus placing a cap on potential expansion of ground water use. For the individual irrigator, the decision to use ground water, if available, is based on the economics of pumping as opposed to obtaining surface water. Surface water typically being less expensive, ground water is most often used in dry years when surface supplies are lacking.

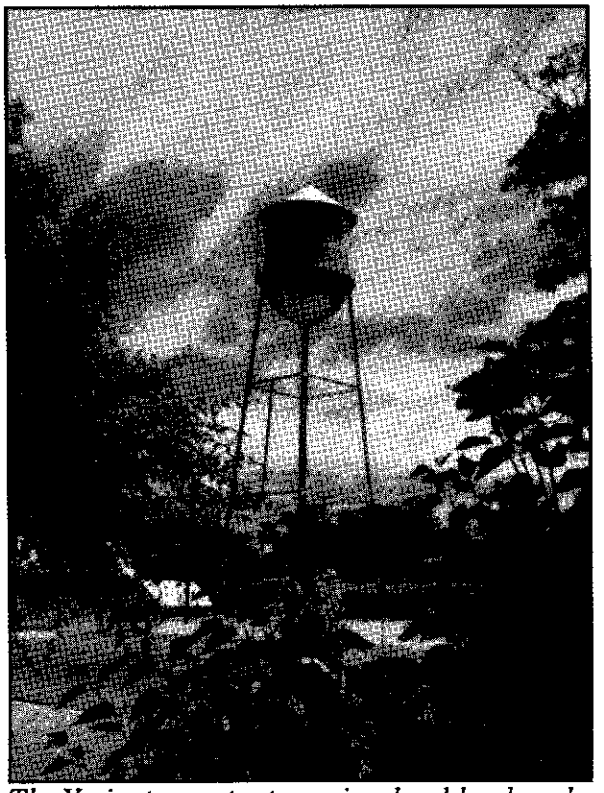
In California, there are substantial amounts of ground water in storage in some valley ground water basins, but relatively little is extracted for agriculture. The shorter growing season at higher elevations lessens to some extent the need to supplement surface supplies.

Municipal and Industrial Water Use

Most municipal and industrial water users in the basin are served from ground water sources; the Hawthorne area, which relies on both surface and ground water, is the only significant exception. Throughout the basin, many homes are served from private wells, especially homes outside of the small communities. These ground water extractions are not regulated in California, nor are they covered in Decree C-125, which does not quantify water for municipal and industrial use. Surface water rights for the Hawthorne area are also established under state law, rather than the federal court decree, because Walker Lake Valley below the Indian reservation was not covered in the decree.

The minor amounts of water put to municipal use are dwarfed by the basin's agricultural water diversions and extractions. Shown below are the 1990 urban water use figures for the larger communities in each state — all derived from ground water extraction.

Bridgeport	243 acre-feet
Yerington	808 acre-feet
Hawthorne	1040 acre-feet



The Yerington water tower is a local landmark.

This reliance on ground water for municipal use, in the past common among small communities because of its low capital cost, is now being encouraged by new water treatment standards. The 1986 amendments to the federal Safe Drinking Water Act required that most surface water supplies be filtered. The filtration requirements are not applied to most ground water supplies, because they are typically less prone to the microbiological contamination often found in surface water. Small communities with a limited rate-payer base are, thus, tending to favor ground water, where available, because treatment costs can be less.

In California, there are few water systems in the basin even large enough to be regulated by state government, rather than by county government. These systems include Bridgeport Public Utility District, the Department of Parks and Recreation water supply for Bodie State Historic Park, and facilities associated with the Marine Corps Mountain Warfare Training Center.

In Nevada, the largest water systems serve the communities of Yerington and Hawthorne. The ammunition depot at Hawthorne has a water system separate from the town's and is the primary user of surface water developed on the minor tributaries (such as Cat Creek) draining the Wassuk Range.

The ammunition depot has been the largest long-term industrial water user in the basin, historically operating in the 2,000 to 3,000 acre-foot per year range. The mining and minerals processing industry has been, varying with economic fluctuations of this cyclical field, the other major user of industrial

water. Ground water is the prime source of supply for mining and minerals processing. A 1918 U.S. Geological Survey publication on the geology and ore deposits of the Yerington District noted:

> *"Owing to the aridity and to its moderate elevation, the Singatse Range is without running water — in fact, the range is so dry that there is only one small spring within it."*

The copper mine at Weed Heights, in the Singatse Range, was a large user of ground water in its milling of the ore. The dewatering system designed to keep the open pit dry for mining also supplied the process water needed for milling. Now that mining has ceased, the pit has been allowed to fill with water (see photo at right).

In general, prospects for meeting future demands for municipal and industrial water supply in the basin appear good, especially given the region's historically low population and remoteness from urbanized areas. Hawthorne has been the one location where concern has been expressed about future municipal supplies, in terms of both quantity and quality; however, use of more expensive water treatment techniques could improve its future water supply picture. In general, the large percentage of agricultural water use throughout the basin opens up the possibility of future acquisition of agricultural rights for conversion to municipal use, if significant growth and residential development were to occur.

The open pit's dewatering system once supplied water for municipal use in Weed Heights, as well as industrial process water. To appreciate the true size of this immense pit, note the ant-sized vehicle on the far wall.

Advances in Well Drilling Technology

Great strides have been made in the technology of drilling water wells since the days of the early pioneers in the watershed. Then, ground water was a little-used resource, except for springs and artesian wells that could be used to water livestock or could be conveniently piped to a residence. (A spring, such as the one shown in the photo on this page, is simply a location where the ground water table has intersected the ground surface at a point of sufficient permeability, and discharge then occurs in the form of surface water.) Early wells were little more than hand-dug pits, which might supply enough water for the needs of a single dwelling but could not meet irrigation needs. Rural electrification and development of the deep-well turbine pump in the early part of this century made reliable supplies of ground water accessible to the domestic user and the irrigator alike. Today, constraints on ground water extractions from a basin (cost of pumping aside) are not the physical limitations of the equipment, but the possibility of overdraft, impairment of water quality, or other environmental impacts. In the Hawthorne area, for example, ground water levels have dropped considerably over the years as a result of pumping and the recession of Walker Lake. This decline in water levels could encourage migration of poorer quality water toward the present extraction area.

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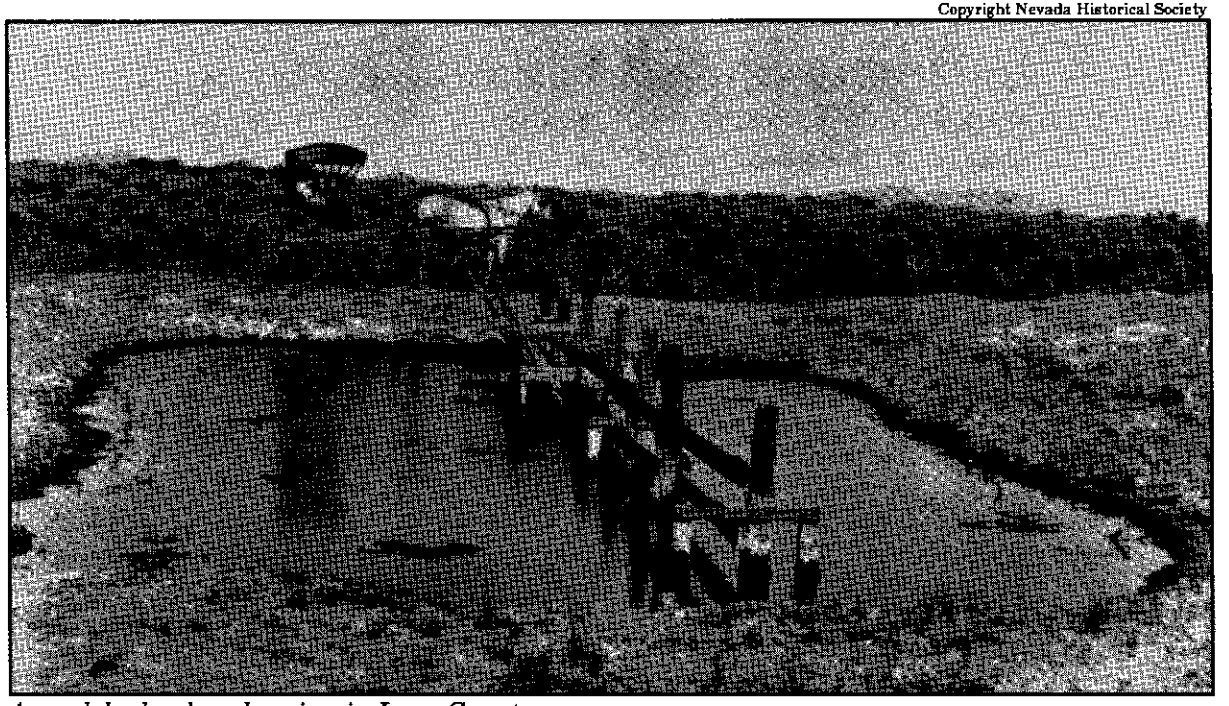


A crudely developed spring in Lyon County.

Power Generation

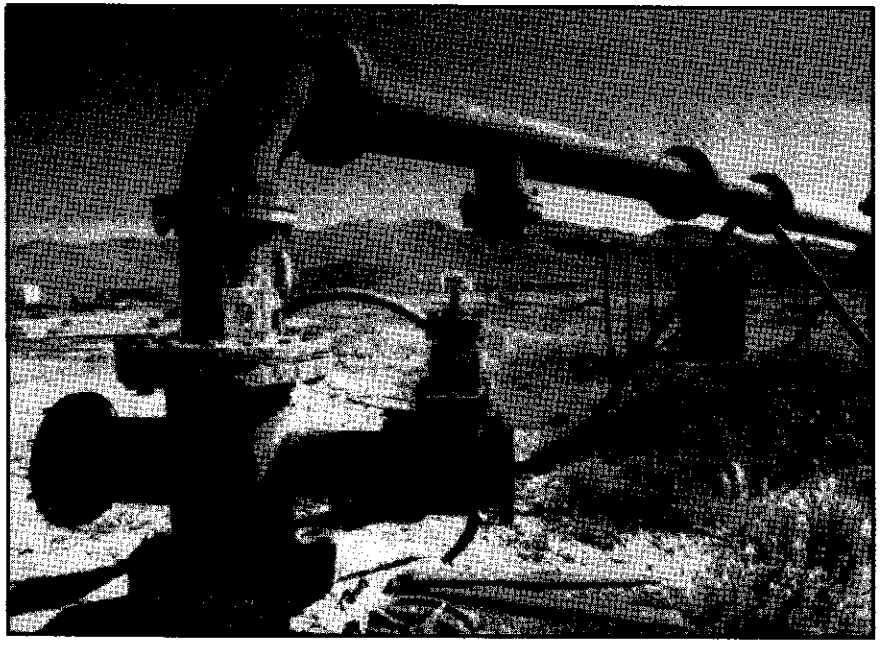
There is presently no commercial generation of hydroelectric power in the watershed. Historically there was limited generation of power in the upper watershed to run sawmills (especially in the Bridgeport area) and ore mills. Dynamo Pond, on Green Creek, is one of the most visible remnants of this early era of hydroelectricity. The three small reservoirs on Green Creek upstream from Dynamo Pond, recently used for agricultural water storage, were constructed just before the turn of the century to regulate water supply for a hydropower plant at the pond. Power was last generated at this historical location in 1941, and no remains of the former plant exist today. There is, however, a current Federal Energy Regulatory Commission license for the site, and water rights have been obtained for a potential new hydropower plant there.

In post-World War II years, there flourished for a time a renewed interest in developing hydropower resources of the upper watershed, especially the West Walker, usually as part of a larger water supply project. The steep drop in elevation of the river and of its tributaries in the headwaters area makes these waters natural candidates for studies on the potential of power generation. The power generation potential was recognized in Decree C-125, where Sierra Pacific Power Company was granted hydropower rights on certain riparian lands that it owned. (These rights have not been exercised.)

With failure of the water supply projects to proceed, the next resurgence of hydropower proposals occurred in response to the energy crisis of the 1970s, when small hydro development boomed. Several applications were subsequently filed with the Federal Energy Regulatory Commission for sites in the West Walker watershed; however, no site has yet reached the construction stage.

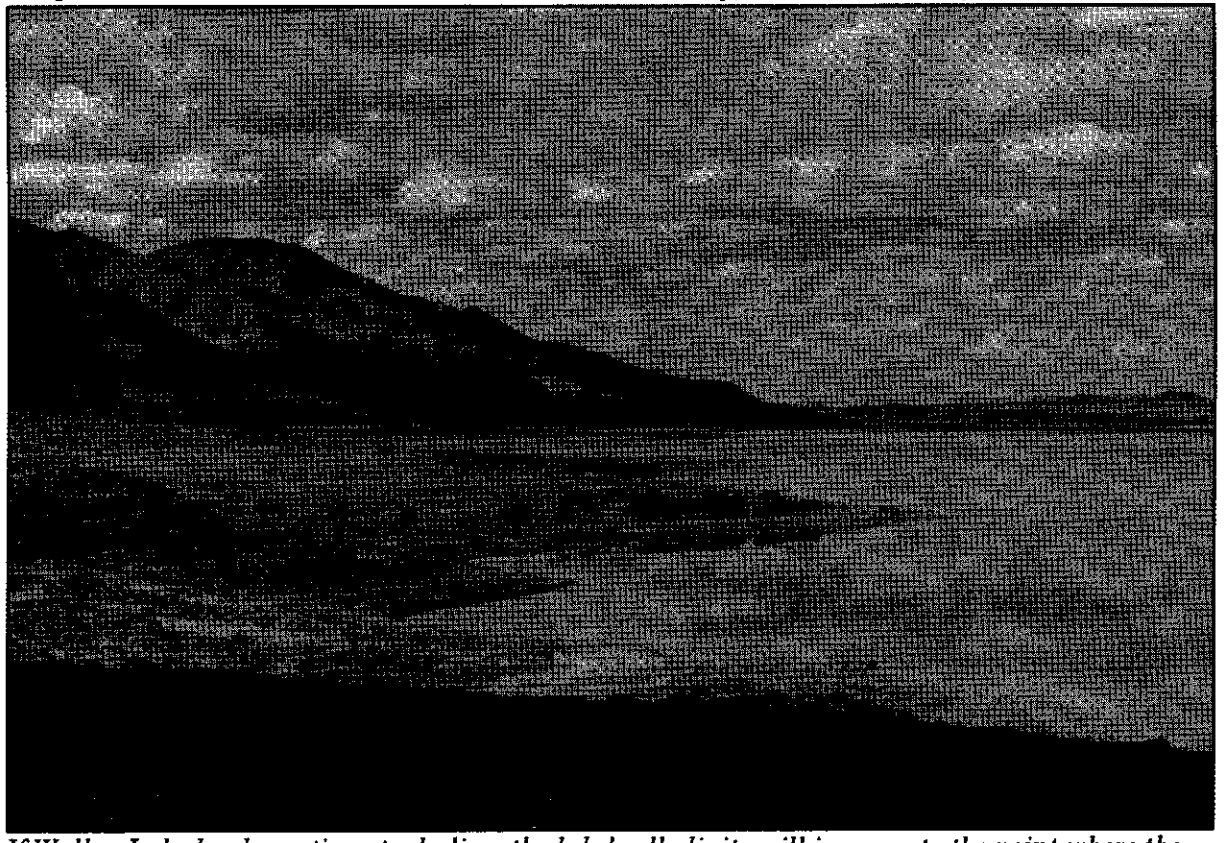
Water power development in the basin today is limited to the geothermal variety. Efforts have been made to develop a geothermal steam field near Wabuska, an area of historical hot springs activity. Limited studies have also been performed on the geothermal potential of the Bodie Hills/Bridgeport area.

The geothermal power development at Wabuska.



Fish and Wildlife Water Use

The Walker River supports a popular recreational trout fishery in the upper watershed in California. The West Walker along Highway 395 receives substantial angler use because of the ease of public access. The stream is heavily stocked with catchable-size hatchery trout by the California Department of Fish and Game, which manages the area as a put-and-take fishery. Native trout species have largely been replaced by rainbow, brown, and brook trout introduced for the recreational fishery, although wild (non-hatchery) trout may be found in some of the high elevation tributaries. On the East Walker, the stretch of the river below Bridgeport Reservoir in California is also a popular trout fishery, as indicated by the recent controversy over operation of the reservoir. The Department of Fish and Game has managed this stretch of the river as a trophy brown trout fishery and provides stocking of hatchery fish. Native species such as mountain whitefish, Tahoe sucker, and tui chub are found in both forks of the river.

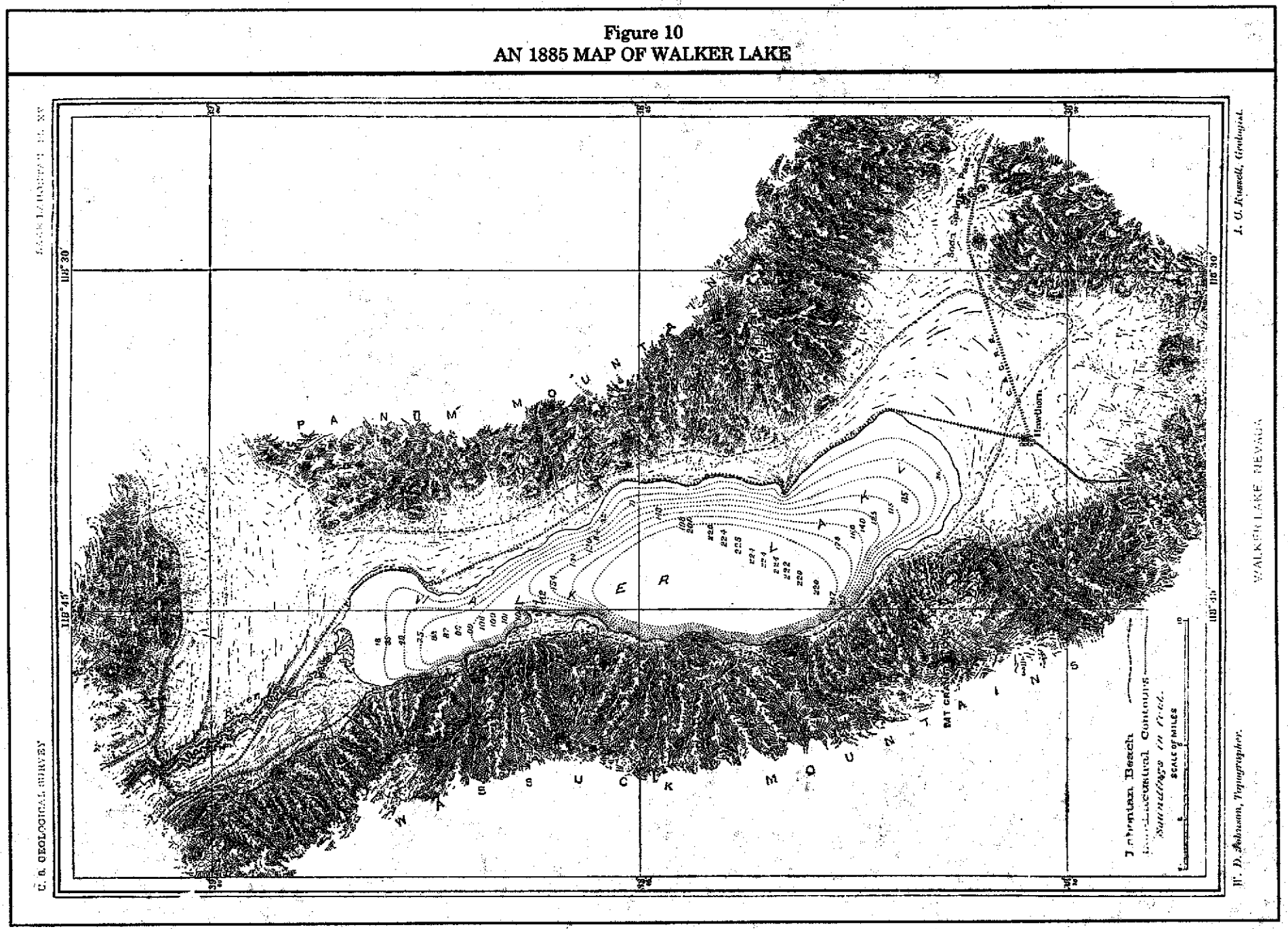


If Walker Lake levels continue to decline, the lake's alkalinity will increase to the point where the present fish population can no longer survive.

Reservoir trout fishing is popular in both Bridgeport and Topaz reservoirs (which have historically been provided with stocking programs), but especially in Topaz because of its greater size and large volume of year-round storage. The Nevada Department of Wildlife has estimated that Topaz alone amounts to about one-third of the river and reservoir angler use on the Walker system in Nevada; Walker Lake is the second most important reservoir or lake fishery. Weber Reservoir, which has a warm water fishery, receives the least use.

Concern has been expressed about the decline of Walker Lake levels and its impact on the lake's fishery, especially from the standpoint of increasing mineralization. Figure 10 is a map of the lake as it existed when mapped by I.C. Russell of the U.S. Geological Survey before the turn of the century. Then, the lake supported a self-sustaining population of Lahontan cutthroat trout.

Figure 10
AN 1885 MAP OF WALKER LAKE



Today, a hatchery program is required to maintain the trout population.

The lake currently supports only three fish species — Lahontan cutthroat trout, Tahoe sucker, and tui chub — all native to the lake. Fish species introduced to the lake over the years for recreational purposes, including Sacramento perch and carp, have not been able to survive the decline in lake levels and no longer exist in the lake. Lahontan cutthroat trout, the largest trout in the West and native to river systems once fed by prehistoric Lake Lahontan, is a species of special interest at Walker Lake. These trout are typically lake-dwellers that migrate into tributary streams to spawn. Pyramid Lake, at the terminus of the Truckee River to the north, is home to another important population of this species.

Before upstream agricultural water development, cutthroats from Walker Lake are reported to have migrated as far upstream as Robinson Creek, above Bridgeport Valley. Not only did upstream agricultural development cause a decline in Walker Lake levels, but reservoir construction reduced the amount of spawning habitat accessible to the trout. Construction in 1935 of Weber Dam a short distance above the lake severely restricted available spawning areas, and was considered the final blow to natural reproduction of the lake's native strain of Lahontan cutthroats. By the late 1940s, very few native trout remained, and the State of Nevada began a hatchery cutthroat trout program for Walker Lake, which continues today.

The Nevada Department of Wildlife has acquired a state water right for flows to support Walker Lake levels. The right has a 1970 priority, which is very junior in comparison to other rights on the river, meaning there will be no water available to supply it in most years. The State of Nevada is considering various alternatives to help maintain the lake, including purchase of existing agricul-

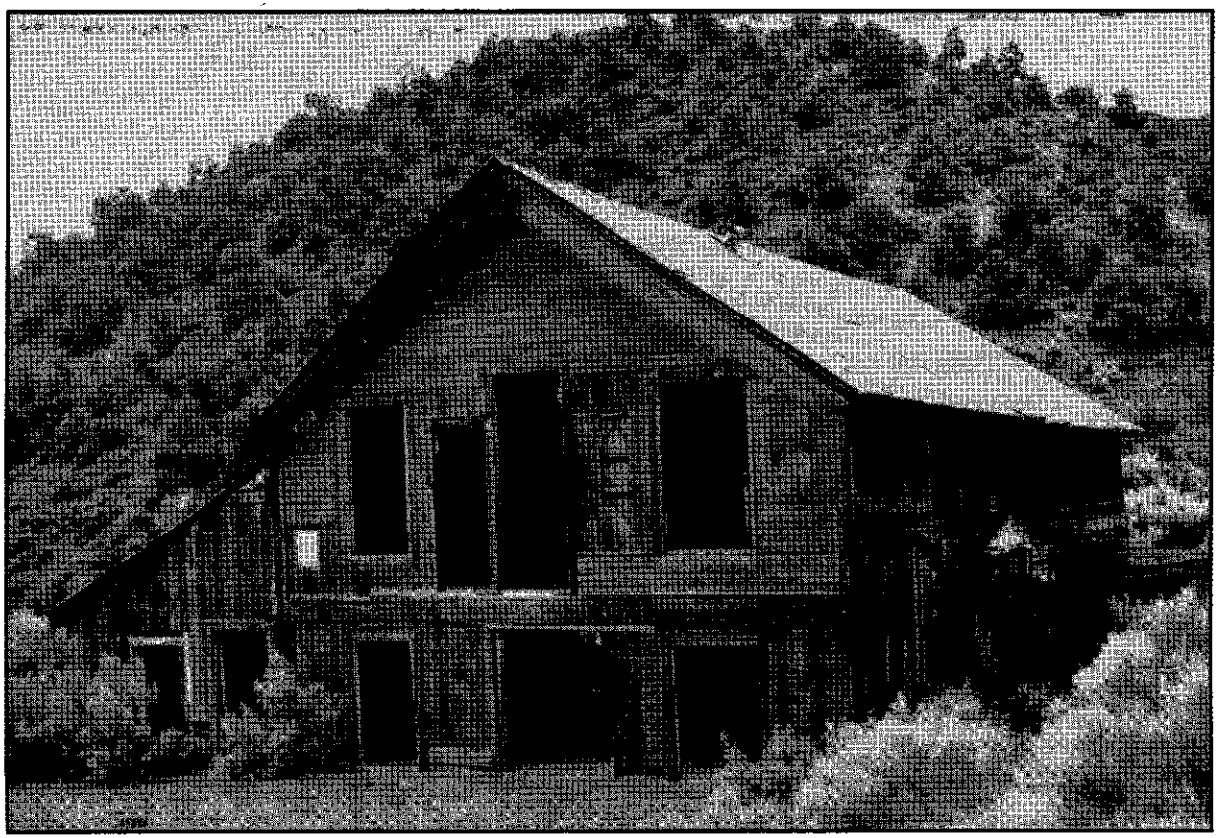
Management of deer winter range is an important wildlife concern in the upper watershed.

tural rights, using funds from a recent bond measure. Nevada Department of Wildlife has also been attempting to breed a strain of its hatchery trout that can tolerate the lake's high alkalinity.

Virtually all the major biological water issues in the basin have focused on fish, rather than wildlife, since the water-dwelling species have far greater water requirements. Land mammals require very small amounts of water in comparison to that needed to support the habitat for aquatic species. Water rights filings have been made on the behalf of wildlife on some springs in the upper watershed, and there is particular interest in matters relating to deer herd management (because deer are a game species actively managed for hunting). As noted in the photo on page 85, there is a managed wildlife area in Little Antelope Valley for deer winter range. Despite the many geographic features along the West Walker in California named after antelope, they are no longer common in the area. Antelope are found in other parts of the watershed, but in much lesser numbers than are deer.

The Mason Valley Wildlife Management Area has surface water rights with a relatively early priority. Although the area is operated primarily for waterfowl, other species make use of it as well.

On the Nevada side of the basin, there are two water-related wildlife management areas — Artesia Lake and Mason Valley Wildlife Management Area. The primary use of both areas is to provide waterfowl habitat and hunting access. Artesia Lake, an area of naturally high ground water levels that receives minor local inflow of surface water, serves primarily as a resting area for migratory waterfowl. The Mason Valley site is part of the former Miller et Lux ranching empire and has early surface water rights as well as a ground water supply. The Nevada Department of Wildlife actively manages the property's irrigation and drainage system to provide a mix of habitat types and to raise grains or grasses to provide cover and food for waterfowl. Other species of wildlife make use of the area as well.



Visits to ghost towns such as Pine Grove can be combined with a trip to the hot springs near Bridgeport.

Recreational Water Use

The upper part of the Walker River watershed is well known for its scenic values and hiking possibilities, with many opportunities for recreational access provided by extensive public landholdings. The small alpine lakes on Forest Service lands, especially those above Bridgeport Valley, are frequent destinations for hikers and horseback riders. The glaciated terrain of this area provides steep slopes to challenge rock climbers in Hoover Wilderness Area and abundant waterfalls to be enjoyed by the less adventurous. The numerous campgrounds in both the East and West Walker basins include a cluster of recreational facilities at Twin Lakes as well as summer home tracts at Twin Lakes, Green Creek, and Virginia Creek. Fishing is a popular pastime, a fact a visitor can deduce by the number of lodging facilities in the area that offer fish cleaning and freezing services. Boating facilities are provided at both Bridgeport and Topaz reservoirs.

The remnants of Nordyke, in Mason Valley, one of the watershed's many historical sites. Sandwiched between the Nevada Copper Belt Railroad and the West Side Canal, this site was associated with an early copper boom in the Singatse Range.

Other popular recreational attractions in the upper to middle watershed are hot springs and ghost towns — a traveler in the Bridgeport area can sample Bodie State Historic Park, the unpreserved ghost town of Masonic, and Travertine Hot Springs in the same trip. Pine Grove and Aurora are other examples of the watershed's unpreserved ghost towns, and there are several unnamed hot springs in the Bodie Hills area.

Walker Lake is the major recreational attraction of the lower watershed. This desert lake offers winter fishing for its Lahontan cutthroat trout plus summer boating and water skiing opportunities. Petroglyphs can be seen in the adjoining Wassuk Range, evidence of earlier visitors to the area.

Chapter 7

FUTURE DIRECTIONS

This last chapter briefly recaps several subjects expected to be of interest in the Walker River watershed in the near future. Significant short-term water management and land use changes do not appear likely, because of the watershed's limited population and scant growth pressures. The large percentage of federal landholdings in the watershed also acts to minimize changes in land use. A trend that is evident is the growing support for allocating water to environmental uses, a trend that is likely to continue as efforts are made to stabilize Walker Lake levels.

Water Supply

There is adequate water supply to meet near-term municipal water needs, although there has been a localized problem with declining ground water levels in the Hawthorne area. In addition to the existing pattern of ground water usage to supply municipal needs, there is the possibility of acquiring future municipal supply by purchase and conversion of present agricultural rights. Much municipal growth in western Nevada's more populated areas is being met by agricultural to urban water transfers, rather than by developing new sources of supply. To some extent, water transfers have been employed for this purpose more frequently on the east side of the Sierras than they have on the west, simply because there is so little surface water available on the arid eastern slope.

Surface water supplies for irrigation may not be as firm as agricultural users might wish. The potential does exist to improve water supplies by conjunctive use of ground water and surface water[1] — something already occurring informally to a degree in Smith and Mason valleys. There is a possibility of developing such a program in California's Antelope Valley, where ground water resources have been little used. There is also the potential to improve the watershed's agricultural supplies by placing more emphasis on water conservation, such as ditch lining, upgrading distribution systems, and irrigation scheduling. Local Resource Conservation Districts can work with the U.S. Soil Conservation Service to implement conservation programs.

Environmental Uses of Water

As outdoor recreation becomes more important to local economies, there is an increasing interest in managing water supplies to provide for environmental uses. The interest in promoting the fishery in the East and West Walker in the

1 Conjunctive use entails storing excess water in wet years in a ground water basin where storage capacity is available and extracting the water in dry years when surface supplies are deficient. Such a program does require that storage space be available in the ground water basin, which is why Bridgeport Valley, with a high water table over much of its area, is not a likely candidate at this time.

Wildlife such as this egret are beneficiaries of the increasing interest in ensuring water supplies for environmental uses.

upper watershed helped achieve wild and scenic designation for a portion of the West Walker and led to the present litigation on the East Walker. Continued expansion of recreational activities in the upper watershed is expected, especially in the rugged high country of the sierran crest. Visitors are realizing that this area offers the glaciated terrain and scenic vistas of Yosemite to the immediate west, but is far less crowded. Interest has been expressed in the past in acquiring some of the high elevation lakes or reservoirs having agricultural water rights, such as Green Lakes, and devoting that water solely to recreational and environmental uses.

There is also interest in acquiring water rights at the other end of the watershed to stabilize Walker Lake levels. The lake's rapid recession in historical times and concomitant degradation of water quality have highlighted the possibility that the lake will become too mineralized to support its present piscatorial inhabitants. Several projections have been made as to the level at which the lake would naturally stabilize under today's conditions, and differing elevations have been proposed as target elevations at which to sustain the lake to continue to provide a fishery. (The lake waters are not only too mineralized now for most fish species, they are also unusable for municipal or agricultural supply.) Water right purchases sufficient to yield an average of 60,000 to 85,000 acre-feet per year at the lake would be needed to achieve the proposed management goal of maintaining the lake at close to or slightly above its present elevation. This amount of water represents a substantial portion of the river's annual flow or, put another way, is greater than the operable storage capacity of Topaz Reservoir.

Interstate Water Issues

Lack of local interest in pursuing an interstate allocation of the waters of the Walker River since the demise of the proposed compact suggests no activity on this subject will soon be forthcoming. The Walker lacks the pressures of urbanization and endangered species water needs that have driven the interstate allocation of water in the Truckee and Carson basins to the north. The limited financial ability of the region to develop new water projects and the elimination via wild and scenic designation of several likely damsites studied earlier have removed the major past source of water supply controversy — competition over building a new water project.

Although the watershed does include interstate ground water basins, there is little present conflict over this resource, since it is not extensively used now. Again, lack of urban development pressures, unlike the situation existing in interstate ground water basins near Reno, has much to do with the absence of conflict.

The dispute between the California State Water Resources Control Board and Walker River Irrigation District over operation of Bridgeport Reservoir and its impacts on fish life is the only significant interstate activity at the present time. This action represents not only a disagreement over the legal rights or authorities of the parties involved, but is also a conflict between competing users of water — traditional agricultural users and environmental interests.

California's Public Trust Doctrine

One example of changes in water allocation policies with changing social values lies in application of the public trust doctrine in California. A well-known 1983 State Supreme Court decision, National Audubon Society v. Superior Court, covered the application of public trust concepts to water rights administered by the State Water Resources Control Board. These concepts include balancing public trust uses of water (e.g., instream flows) against typical consumptive uses of water during the water rights application process. Additionally, the state retains continuing control over use of appropriated water and may reconsider the effect of past allocation decisions on public trust uses. This doctrine is now being used in many administrative and court water rights actions in California. One example is the recent series of court cases surrounding Mono Lake.

APPENDIXES

Appendix 1. Excerpts from the Proposed Interstate Compact

Appendix 2. Sources of Further Information

Appendix 1

EXCERPT FROM THE PROPOSED INTERSTATE COMPACT

This appendix contains the Walker River basin allocations included in the proposed compact,which was ratified by the California and Nevada Legislatures in the early 1970s but never approved by Congress. The excerpt is provided to illustrate the nature of the then-proposed allocations. Since there have been no subsequent efforts to seek an apportionment of the waters of the Walker River, the allocations of the proposed compact remain the most current attempt. Parts of the proposed allocations are no longer applicable, particularly those dealing with possible reservoir construction on the part of the West Walker in California now included in the wild and scenic river system.

Article VIII. Walker River Basin

A. Allocations to Present Rights and Uses

1. Except as the rights of the Walker River Irrigation District may be limited by subsections 2 and 3 below, the provisions of the decree in the case of United States v. Walker River Irrigation District, et al., United States District Court for the District of Nevada, Equity No. C-125, filed April 15, 1936, as amended by the Order of the Honorable A. F. St. Sure, dated April 24, 1940, hereafter called Decree C-125 are hereby recognized and confirmed.

2. The rights of the Walker River Irrigation District to store water of the West Walker River in Topaz Reservoir with a storage capacity of 59,000 acre-feet, under Part VIII of Decree C-125 and under any other basis of right, and to use such water, are hereby recognized and confirmed, subject to the following:

(a) The maximum quantity of water which can be diverted annually to storage is 85,000 acre-feet. No more than 85,000 acre-feet of water less reservoir evaporation can be rediverted for use within the district annually. The 85,000 acre-feet amount so allowed to be diverted to storage and rediverted to use include water used under direct diversion rights in Decree C-125 acquired by said district prior to 1964. For the purpose of this provision 'annually' means the period from November 1 through October 31 of the following year.

(b) The maximum rate of diversion to such reservoir under such rights is 1,000 c.f.s.

(c) For the purpose of determining the availability of water to satisfy rights junior to the Topaz Reservoir storage rights of the Walker River Irrigation District, or for division between the states as unused water, water which has been stored, or is available for storage in and can be physically diverted to such reservoir under such reservoir rights but is released or is allowed to pass through the reservoir and is not rediverted to use in Nevada, shall be deemed to have been held in storage; provided, that until a new major storage project is constructed on the West Walker River, the foregoing shall not apply to the extent that said district with the concurrence of the watermaster determines, prior to the release or passing through of such water from Topaz Reservoir in any year, that it is necessary to release or pass through such water in order to provide storage space in Topaz Reservoir as a means of protecting lands in Nevada against flood damage later in the year.

3. The rights of the Walker River Irrigation District to store water of the East Walker River in Bridgeport Reservoir with a storage capacity of 42,000 acre-feet, under Part VIII of Decree C-125 and under any other basis of right, and to use such water, are hereby recognized and confirmed, subject to the following:

(a) The maximum quantity of water which can be diverted to storage in any year is 57,000 acre-feet. No more than 57,000 acre-feet of water less reservoir evaporation can be rediverted for use within the district in any year. The 57,000 acre-feet amounts so allowed to be diverted to storage and rediverted to use include water used under direct diversion rights in said decree acquired by said district prior to 1964 except for water used under such rights prior to 1964 on lands owned by said district in Bridgeport Valley. For the purpose of this provision 'year' means the period from November 1 of one calendar year to October 31 of the following calendar year.

(b) Water of the East Walker River and its tributaries may, adversely to the Bridgeport Reservoir storage rights herein-above recognized and confirmed, be stored upstream from said reservoir in any year, for later use after the spring flood of the year in which the water was so stored, under rights junior to said reservoir rights; provided, that when the Walker River system is put on priority under Decree C-125 after the annual spring flood,

or upon demand made prior to the spring flood for water necessary to satisfy early season demand, the watermaster shall make an accounting and water shall be released from said upstream storage in such amounts as determined by the watermaster to be necessary to satisfy said reservoir rights to the same extent as they would have been satisfied in the absence of said adverse upstream storage.

4. (a) There is allocated to each state respectively the amount of existing diversions and uses of water of the Walker River Basin diverted upstream from Weber Reservoir and not specifically covered in Decree C-125, provided, that this allocation shall not include water distributed under the historical administration of Decree C-125 in excess of the rights set forth in Decree C-125 to lands having rights thereunder. In making this allocation, it is recognized that the amounts of water allocated and the respective priorities are not presently known with certainty. The commission shall as soon as practicable after its effectuation provide for an investigation, either with its own staff or by other agencies or persons, to ascertain with certainty the amounts of water and priorities of such uses. As between the respective states, the priorities shall be determined as follows: In cases of use not under state-recognized rights, the priorities shall be the date of initiation of use; in cases of use under state-recognized rights, the priorities shall be as provided under the law of the state where the diversion is made. Upon approval by the commission, the results of the investigation shall be binding as to the allocation to each state hereunder.

(b) In addition to rights recognized in subsection A.1 of this article there is allocated to Nevada for use on the Walker River Indian Reservation a maximum of 13,000 acre-feet per year for storage in Weber Reservoir and later rediversion to use and in addition 9,450 acre-feet per year to be diverted from natural flow. Both allocations shall have a priority of 1933. The season for diversion of water to storage shall be from November 1 to October 31 of the following year. The season for diversion of water directly for use shall be from March 1 to October 31 and at a maximum rate of 60 cubic feet per second. For the purpose of determining the availability of water to satisfy rights junior to this allocation or for division between the states as unused water, water which has been stored, or which can be physically stored or diverted to use under this allocation but is released or is allowed to pass through Weber Reservoir and is not rediverted to use on the Walker River Indian Reservation, shall be deemed to have been held in storage or used; provided, that the foregoing shall not apply to the extent that the appropriate representative of said reservation with the concurrence of the watermaster determines prior to the release or passing through of such water from Weber Reservoir in any year, that it is necessary to release or pass through such water in order to provide storage space in Weber Reservoir as a means of protecting lands in Nevada against flood damage later in the year; provided further, that the foregoing shall not apply to passage of water of inferior quality to the extent that such passage may be necessary to maintain the water of suitable quality for irrigation on said reservation as determined by the commission.

Water of the Walker River and its tributaries may, adversely to the Weber Reservoir storage rights hereinabove recognized and confirmed, be stored upstream from said reservoir in any year, for later use after the spring flood of the year in which the water was so stored, under rights junior to said reservoir rights; provided, that when the Walker River system is put on priority under Decree C-125 after the annual spring flood, or upon demand made prior to the spring flood for water necessary to satisfy early season demand, the watermaster shall make an accounting and water shall be released from said upstream storage in such amounts as determined by the watermaster to be necessary to satisfy said reservoir rights to the same extent as they would have been satisfied in the absence of said adverse upstream storage.

5. In addition to rights recognized in subsections A.1 and A.4(a) above, there is allocated to California water of the West Walker River as follows:

(a) When all direct diversion rights under Decree C-125 are being satisfied and simultaneously water of the West Walker River is being diverted to storage pursuant to the Topaz Reservoir storage rights recognized and confirmed in subsection 2 of this Section A, but there is not flow in excess of that required to fully satisfy Topaz Reservoir storage rights, diversions in Antelope Valley in excess of the amounts to which Antelope Valley lands are entitled to water under Decree C-125 shall be permitted by the watermaster for such periods and in such amounts as, in the sound professional judgement of the watermaster, will not cause, on an overall irrigation season basis, any discernable net reduction in the amount of water available to satisfy said Topaz Reservoir storage rights.

(b) Such excess diversions may be used only on Antelope Valley lands entitled to water under Decree C-125 which can be served from the ditch systems existing as of the effective date of this compact.

(c) The allocation in this subsection 5 shall terminate after construction of a new major storage project on the West Walker River upstream from Antelope Valley.

B. Allocation of Unused Water

1. The term 'unused water' includes all waters of the Walker River and its tributaries in excess of the amounts allocated, or required for satisfaction of rights and uses recognized and confirmed, as provided under Section A of this Article VIII, except that there shall be excluded therefrom natural flow which is not physically available above the head of Mason Valley. There is allocated to the State of California 35 percent of such unused water, and there is allocated to the State of Nevada 65 percent of such unused water. The allocation to each state provided herein in this subsection B.1 shall be equal in priority.

(a) The reregulation by storage of waters allocated for storage shall not be considered as the development of 'unused water'.

2. Neither state shall be precluded from constructing works for the control, use and development of the water allocated pursuant to subsection B.1 of this article for optimum use of water.

3. While separate development may be undertaken by either state for surface storage of unused water of the West Walker River so allocated, the State Engineer of the State of Nevada and the Department of Water Resources of the State of California shall cooperate in a joint review of all potential developments of unused water of the West Walker River so allocated in subsection B.1 of this Article VIII and shall prepare and present a report of the benefits to be obtained, and other relevant data from each such development to the commission or if the commission has not yet become operative, to the joint commission which negotiated this compact, at a public hearing or hearings held at times and places within the Walker River Basin set by the commission or said joint commission.

(a) Should a separate surface storage project or projects be constructed in Nevada to develop Nevada's share of the unused water of the West Walker River, California may thereafter store and use said unused water allocated to Nevada adverse to such Nevada storage projects; provided, that, without charge to Nevada, California makes available for consumptive use in Nevada, water in the same amounts, at the same times, and in the same places as would have been available for use in Nevada from such Nevada storage projects had California not so stored and used said unused water allocated to Nevada; and provided further, that Nevada shall not be deprived of water required for: (1) maintenance of a minimum reservoir level for the preservation of fish life and (2) nonconsumptive uses which are found by the commission to be in the public interest of the Walker River Basin as a whole.

(b) From time to time after construction of each surface storage project upstream from Topaz Reservoir, for development of the unused water allocated herein, the commission shall determine the amounts of water which may be diverted and used in each state pursuant to its allocation as the result of the construction and operation of such project. In making such determination the commission shall compute any increase of yield of previously constructed reservoirs which may result from operation of such project constructed to develop unused water and shall include such increase in the amounts of water which may be diverted and used in each of the two states pursuant to its allocation of unused water.

4. Return flow to the Walker River or its tributaries from any source shall be deemed to be natural flow.

5. Unused water shall be used only:

(a) Within the Walker River Basin;

(b) Within the portion of Artesia Lake Basin south of the northern township line of Tier 12 North and west of a line one mile east of the eastern range line of Range 23 East, Mount Diablo Base Line and Meridian;

(c) Within the portion of Mason Valley and Adrian Valley south of the northern township line of Tier 15 North, Mount Diablo Base Line;

(d) Within the area tributary to Topaz Lake; or

(e) Any combination of the above areas.

C. Watermaster.

1. A single watermaster shall have the responsibility and power to administer: (a) all rights and uses of water of the Walker River Basin recognized in Section A of this Article VIII, including rights under Decree C-125, (b) the allocation between the states provided for in this compact of water of the Walker River Basin in excess of that necessary to satisfy such rights and uses, and (c) all rights acquired to use water so allocated.

2. The watermaster shall be nominated by the commission as soon as practicable after this compact goes into effect, but his appointment shall not become effective until approved and confirmed by the Federal District Court for the District of Nevada, it being the intent of this compact that only a person satisfactory to both the commission and said court be the watermaster under this compact and under Decree C-125. At any time either the commission or said court may terminate the appointment of the person serving as watermaster by adopting an appropriate resolution or order, and notifying the other and the watermaster thereof. When a vacancy occurs by such action or by the death or resignation of the person serving as watermaster, a successor shall be selected by the same procedures as provided for the original appointment.

3. Until appointment of the watermaster becomes effective by approval and confirmation of said court, either as to the original selection of the watermaster or subsequent selections to fill a vacancy, a person designated by the commission shall have interim responsibility and power to administer the allocation between the states referred to in subsection 1(b) above and all rights and uses other than the rights under Decree C-125, and the rights and uses under Decree C-125 shall be administered on an interim basis as may be provided by said court.

4. Actions and decisions of the watermaster as to the administration of the rights under Decree C-125 shall be subject to review and modification by said court. Actions and decisions of the watermaster as to the administration of the allocation between the states referred to in subsection 1(b) above and of all rights and uses other than rights under Decree C-125 shall be subject to review and modification by the commission.

5. Said court is requested to appoint a six-member advisory board composed on one person each representing: (1) the East Walker River Basin in California, (2) the West Walker River Basin in California, (3) the East Walker River Basin in Nevada, (4) the West Walker River Basin in Nevada, (5) the Main Walker River Basin in Nevada, and (6) the Walker River Indian Reservation. The watermaster shall prepare an annual budget of proposed expenditures for personnel, equipment, supplies, and other purposes deemed by him to be necessary to carry out his functions. In the

formulation of said budget the watermaster shall consult with said advisory board. In the event that said advisory board is not in agreement with the budget proposed by the watermaster, it shall so advise said court. Said budget shall require approval of both the commission and said court to become effective.

6. The expenditures attributable to administration of the rights under Decree C-125 shall be apportioned and collected in accordance with orders of said court. The expenditures attributable to administration of all other rights and uses of the water of the Walker River Basin under this compact shall be equitably apportioned among, and collected from, the users thereof by the watermaster under rules and regulations of the commission, and the commission shall have the power to enforce collection thereof by any reasonable means, including court action in any state or federal court of appropriate jurisdiction. The expenditures attributable to administering the allocation between the states referred to in subsection 1(b) above shall be borne by the commission as part of the expense under Article IV, subsection B.1 of this compact.

Appendix 2
SOURCES OF FURTHER INFORMATION

This appendix presents some suggestions for further reading on subjects covered in this atlas. Background material used to prepare the atlas came primarily from information collected by the Department of Water Resources as part of its work over the years on the interstate allocation issues. The following material is not a complete bibliography but is, instead, intended to provide the reader with a listing of some of the primary information sources (especially those still commonly available today) and some of the interesting general material.

Historical References

A History of the Comstock Mines; Mineral and Agricultural Resources of Silver Land. Dan DeQuille (William Wright). F. Boegle, Virginia City, Nevada. 1889.

California Historical Society Quarterly. *Early History of Mono County.* Maxine Chappell. Vol. XXVI, No. 3, September 1947.

California Historical Society Quarterly. *Bodie; the Last of the Old-Time Mining Camps.* Grant H. Smith. Vol. IV, No. 1, March 1925.

The Cattle King. Edward F. Treadwell. Western Tanager Press. Santa Cruz, California. 1981. (first printing, 1931).

General Information

Water and Related Land Resources, Central Lahontan Basin, Walker River Subbasin, Nevada/California. Report prepared by USDA Nevada River Basin Study Staff in cooperation with Nevada Department of Conservation and Natural Resources, Resources Agency of California, and United States Department of Agriculture. Carson City. June 1969.

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Alternative Plans for Water Resource Use, Walker River Basin, Area 1. Nevada Division of Water Resources. Carson City. 1973.

Truckee River Atlas. California Department of Water Resources. Sacramento. June 1991.

Carson River Atlas. California Department of Water Resources. Sacramento. December 1991.

Geology and Water Resources of Smith Valley, Lyon and Douglas Counties, Nevada. U.S. Geological Survey Water Supply Paper 1228. Washington, D.C. 1953.

Legal References — Statutes

California-Nevada Interstate Compact, California Water Code Sec. 5976 and Nevada Rev. Stat. Sec. 538.600. (As ratified and approved by the legislatures of both states, but not consented to by Congress.)

California Wild and Scenic Rivers Act, Calif. Stats. 1989, Ch. 215 §1.

Reclamation Act of 1902, 32 Stat. 388, 43 U.S.C. Sec. 371 et seq.

Small Reclamation Projects Act of 1956, 43 U.S.C.A. §422a.

Calif. Stats. 1961, Res. Ch. 203 (Assembly Concurrent Resolution 97).

Truckee-Carson-Pyramid Lake Water Rights Settlement Act, Title II of Public Law 101-618, 104 Stat. 3289.

Legal References — Judicial Actions

National Audobon Society v. Superior Court of Alpine County, 33 Cal. 3d 419, 189 Cal. Rptr. 346, 568 P. 2d 709 (1983). (Initial exposition of application of California's public trust doctrine to water rights.)

Pacific Live Stock Co. v. Antelope Valley Land and Cattle Co., U.S.D.C., D.Nev., No. 731 (entered March 22, 1919).

United States of America v. Walker River Irrigation District, U.S.D.C., D.Nev., In Equity No. C-125 (entered April 15, 1936; amended April 24, 1940).

Walker River Irrigation District v. California State Water Resources Control Board, U.S.D.C., D.Nev., In Equity No. C-125-A (designated as a subproceeding within No. C-125).

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