

IRRIGATION, SETTLEMENT, AND CHANGE ON THE CACHE LA POUDRE RIVER

By

Rose Laflin

A stylized graphic spanning the width of the page. It features a black silhouette of a mountain range on the left. To the right of the mountains, a thick black horizontal line runs across the page. Below this line, a wavy, horizontal band of bright cyan color represents a river. The river band has a black outline and a slightly irregular, flowing shape.

Colorado Water

Resources Research Institute

Special Report No. 15

**Colorado
State**
University

Irrigation, Settlement, and Change on the Cache la Poudre River

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Special Report Number 15
June, 2005

Colorado Water Resources Research Institute
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This special report is produced with funding from the National Park Service through a cooperative agreement with Colorado State University and printed by the Colorado Water Resources Research Institute and Colorado Water Center with funding from U.S. Department of Interior, Geological Survey and Colorado State University. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government, the State of Colorado, or Colorado State University.

Acknowledgements

Several people were invaluable in helping me see this project to fruition. First and foremost, I would like to thank Susan Boyle at the National Park Service for her unwavering support, advice, and encouragement. Additionally, Mark Fiege, professor of History at Colorado State University, guided me through the early stages of research and shared his knowledge of water and the American West with me.

I am grateful to all those who reviewed the document throughout its various stages including members of the Poudre Heritage Alliance. I am especially indebted to Richard Seaworth for sharing his knowledge of irrigation and the Cache la Poudre and Brian Werner, of the Northern Colorado Water Conservancy District, for opening his files to me while I was researching NCWCD. Robert Ward at the Colorado Water Resources Research Institute also graciously made CWRRI's research library accessible to me during the summer of 2003. The staff at Colorado State University's Water Resources Archive and at the City of Greeley Museums were also especially helpful in my multiple visits to their institutions.

Colorado State University professors emeritus Daniel Tyler and Jim Hansen took time out of their busy schedules to read the manuscript and give me detailed and thoughtful comments that I sincerely appreciate. Their own works of history have inspired me when I needed it.

Bob Stieben, a Cache la Poudre valley irrigator, along with George Varra and Shawn Hoff, current and former Cache la Poudre River Commissioners, allowed me to interview them and pick their brains for the details of irrigation along this river that only they know. I am truly grateful for their kindness, patience and candor.

This is such a special river and all those mentioned here helped allow its story to be told. Thank you.

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Introduction

This manuscript examines the water delivery system of Colorado's Cache la Poudre River - the small ditches, large canals, and reservoirs that divert and store the river's water, originally for agricultural purposes and later for municipal, industrial, and recreational use. The Poudre, as it is commonly called by northern Coloradoans, drains 1,890 square miles of land in the Mummy and Never Summer ranges in Colorado and Wyoming. It begins on the Continental Divide, flows through mountain canyons on the eastern side of the Rocky Mountains in Colorado and onto the plains, before joining the South Platte River. American settlers first diverted the Poudre's water into ditches and canals to facilitate irrigation on the plains in the early 1860s. It was among the first few rivers tapped for irrigation in Colorado.

Settlers to the Cache la Poudre valley imagined transforming the dry grasslands that abutted the river into productive farmland through irrigation. They labored over canals and reservoirs that conveyed water to the dry but fertile land and stored water for late summer months when the river's supply dwindled. In addition to building the water delivery system of canals and reservoirs, beginning in the 1870s and 1880s, they increased the Poudre's supply with water from other watersheds, worked out a way of exchanges that made water use more efficient, and helped create legislation to govern water use that differed immensely from water law in the eastern United States.

An agricultural boom in the first two decades of the twentieth century increased demand for irrigated acreage along the Poudre and made agriculture the largest contributing sector to Colorado's economy. This created a need for more water, especially by the drought-plagued 1930s. New technology that was developed on the banks of the Poudre that made water use more accurate and efficient was not enough to satisfy the demand for additional water in northern Colorado. Poudre water users lobbied for a Bureau of Reclamation project to enhance the Poudre and other Front Range rivers. The Colorado-Big Thompson project brought water from the Western Slope to the Front Range, supplemented the Poudre's supply, and facilitated prosperity and growth in northern Colorado in the latter half of the twentieth century.

The Cache la Poudre, augmented with Western Slope water from the Colorado-Big Thompson project, attracted new people and industries to northern Colorado. The economy diversified from extractive industries that took things out of the earth such as mining, logging,

and agriculture, to technology, tourist, and service-based industries. Cities and industries flourished and competed with the agricultural sector for the Poudre's water. Urban and suburban residents used and perceived of the Poudre in ways that competed and conflicted with irrigators who had consumed the majority of the river's water for generations. In the latter decades of the twentieth century, Poudre valley water users clashed over pollution in the river, the use of groundwater, new storage proposals, and issues of minimum stream flow for healthy forests and wildlife. Irrigators, cities, industries, recreators, and environmentalists hashed out agreements that resulted in new ways of using the Poudre's water – still essential to life and the economy in its vicinity – in ways that reflected the values of the changing population.

Diverting the Poudre's water into canals and reservoirs and applying the river's water to agricultural, municipal, industrial, environmental, and recreational uses altered the river, the landscape, and the population around it. This history of the Cache la Poudre's water delivery system explores how people changed the river and then adapted to the unintended consequences of their interference. Some of these consequences included evaporation, transpiration, alkalinity, overuse, floods, weeds, and pests.

The work of environmental historians influenced this manuscript. Environmental historians study the relationship between humans and nature and how particular environments shape human history. As the professor, naturalist, and environmental ethicist Aldo Leopold believed, culture is the result of the raw materials that humans have to work with. The types of foods people eat, the homes they build, the clothes they wear, their customs, laws, and economy reflect what their environment provides them. Environmental historians study the interaction between humans and nature and how this produces a hybrid landscape and society.

Environmental historian Donald Worster wrote:

As societies try to remake nature, they remake themselves, without ever really escaping natural influences. In this spiral of history the people are by no means like helpless passengers of a boat that is being tossed this way and that in a storm; there are options open to them at every point. But always they must respond to nature, then fit themselves to their response.

And Mark Fiege, professor of environmental history at Colorado State University, asserts that often “people only modify something in the biophysical environment that was already there. In turn, nature changes what humans build, often in unanticipated ways.” The reciprocal relationship between humans and nature creates a new environment and society.¹

The Cache la Poudre's history exposes the broader narrative of water's role in the American West. This river is not well known to those outside of northern Colorado; yet, it is essential to life in its vicinity. The Poudre's existence made settlement possible in what was an inhospitable but, ultimately, transformable environment. The formation of the river's water delivery system demonstrated nineteenth century attitudes towards nature and its malleability, along with human ingenuity, and the importance of agriculture. When conflict and cooperation erupted over how to use the Poudre's water in a dry land, new ways of using and monitoring the river resulted, just as similar scenarios took place throughout the West. Because water was so important but expensive to acquire and move, the federal government involved itself in large water projects to facilitate irrigation and settlement of the West and citizens in the Poudre valley desired and were given a federal project of their own. Economic and demographic changes in the Poudre valley in the twentieth century brought new perceptions of water and conflict materialized between those who wanted to use the river in traditional ways to benefit people and industry, and those who wanted to protect the water itself and the flora and fauna that depended on it.

This project is the first attempt to synthesize the history of the Cache la Poudre's water delivery system from the 1860s to the present day. As with any first attempt to fuse a large amount of historical information into a coherent history, not every detail was included. Undertaken at the request of the National Park Service as part of the research associated with the Cache la Poudre River National Heritage Area, the purpose of the project was to compile the existing public information from university libraries, local history archives, the Colorado State Archives, the Colorado State University Water Resources Archive, and the Denver Public Library's Western History Department, and to prepare as detailed a history as possible. We still know little about how the early system worked and other important aspects of the evolution of the water delivery system because this information is not currently available to researchers. Although this work needs to be put in context with all of Colorado agriculture and with irrigation systems on other rivers in the state, a rich story emerges about this small but influential river. Furthermore, new information about irrigation companies, water institutions, water users, and

researchers is slowly infiltrating the public domain and will help future projects on this and similar topics.

Questions that guided the research for this project include: how did the Poudre's water delivery system develop from the first simple ditch to the highly complicated system of today with large canals, storage reservoirs, transbasin diversions, water exchanges, interstate compacts, and local, state, and federal oversight? How did the Poudre's water delivery system impact the society, economy, laws, technology, hydrology, and the environment? What is unique about the Poudre's water delivery system? How does the Poudre's story shed light on broader western history? Also included is a brief synopsis of Colorado water law as it applies to the subjects covered in this work as well as the contributions of Poudre valley irrigators to state and western water law.

Conflict and cooperation are overarching themes throughout this work. The huge physical and fiscal toll of moving water in the West sparked plenty of disagreements but also demanded collaboration. Amidst the arguments and disagreements – big and small – that occurred over dividing the Poudre's waters, the instances of cooperation that I include will, I hope, encourage future generations to work together in sharing this resource in ways that benefit and respect all users.

CHAPTER ONE: Necessity and Imagination

John G. Coy was born on April 14, 1834 in Oswego, New York. Orphaned by the age of ten, he traveled among relatives through Illinois, St. Louis and New Orleans, absorbing the lessons of a country in the midst of momentous territorial, economic and cultural expansion. At the age of twenty-eight, Coy married an English immigrant named Emily Adams and convinced her to explore the American West with him - that mythical land of dreams where opportunity and prosperity awaited anyone willing to work hard and believe in luck, or so the hopeful told themselves. In 1862, the same year the United States government passed the Homestead Act and thousands of soldiers massed in the Tennessee countryside for the battle of Shiloh, John Coy and his bride packed their possessions and headed west. It was their honeymoon.

Railroad and steamboat routes terminated in western Missouri and eastern Kansas and Nebraska in the early 1860s at places like St. Joseph, Council Bluffs, Independence and Omaha. Travelers took horses, wagons, stagecoaches, and various other contraptions across overland routes into "the West" from these towns and cities. In Cuba, Missouri, the Coys purchased a wagon, three yoke of oxen and a horse and creaked and jolted onto the prairie sod. They traveled eight miles a day camping near creeks and waterholes that got smaller and fewer the further west they went.

The Coys were just two people among thousands in the 1860s who chopped down trees and brush in the river bottoms for fuel, grazed their livestock on native grasses, and carved deep wagon ruts into the soft soil as they moved across the middle section of the country. This migration changed the ecosystem of the Great Plains as well as the lives of the Indians inhabiting the region. But John and Emily did not consider any of this. They had balky oxen to deal with that were either too green or too wise to take a yoke willingly. They got stuck in the deep mud of at least one nameless creek, were rescued by U. S. soldiers, and mugged by bandits, or "bushwhackers" according to Mrs. Coy, before they even crossed the Missouri border into Kansas. At this point they reached what most Americans in the 1860s considered the "frontier" - an unexplored, unsettled area - despite the countless native peoples, Spanish, French, Russians, and others who lived in and knew the land west and south of the Mississippi and Missouri rivers.

The Coys traveled a northern route across the plains that followed the Platte River, hoping for but not quite achieving a trip without mishaps. In Kearney, Nebraska half of their

cattle disappeared during the night. They doubled back several miles on the lookout for their stock and lost ten travel days and any chance of reaching California, their ultimate destination, before bad weather set in. While recovering from these unexpected circumstances, the young couple encountered travelers headed for Colorado Territory. The group included a Mr. Andrew Ames who had filed on a homestead in Colorado and was returning to it with his mother and sisters, a single woman from Indiana just out of school and joining her family already settled in the territory, and two single brothers searching for opportunity in the mines above Denver or in the boom town itself. John and Emily joined this little group and decided to spend the winter of 1862-1863 in Colorado before heading to the West Coast.

The small party moved slowly. It was July, the weather was hot and the landscape was very dry. The travelers broke camp early each day and took long noontime breaks. The parched terrain, an environment still sometimes referred to as the Great American Desert, surely startled those familiar only with the green, humid East. When they reached Orchard, in eastern Colorado, the soil was so sandy they doubled up their teams of oxen and carried half a load at a time across the unstable ground. The women and children walked behind the sinking wagons where the sand burned the soles of their feet through their leather shoes. Finally, in August, the party neared the future site of Greeley, Colorado, in 1862 still a desolate plain at the confluence of the South Platte River and a smaller river with a funny French name – the Cache la Poudre.

The Coys followed the Cache la Poudre several miles upstream towards the foothills of the Rocky Mountains looking for a suitable winter camp. They chose a site close to the river, their lifeline in this dry, unfamiliar country. The moderate if unpredictable weather of the Front Range produced some warm, sunny days during which John and Emily investigated the surrounding country as they waited for spring. Occasionally they saw other inhabitants: scattered settlers there since the fur trading days of the 1840s and a few people farming small plots in the river's bottomlands. The U.S. government had recently moved the overland stage route down from the north to avoid restless Arapahoe, Cheyenne, Utes, and Sioux and arranged for a military installation on the Cache la Poudre to protect the route and settlers from violence. With the Army moving into the area, the Coys wondered how quickly the Indians would be relocated and the land parceled off and settled.

The couple believed the fertile land next to the river would soon attract homesteaders. Settlers and fortune seekers had poured into Colorado since the discovery of gold in 1858. Some

of these newcomers wandered down from the mining camps or bypassed the goldfields altogether and staked claims on the Front Range where they tried their luck at farming. Whether one mined or farmed, nothing was more essential to life in this semi-arid climate than a steady supply of water and, consequently, land along the region's rivers was steadily filing up. These thoughts and others occurred to John and Emily Coy as they camped next to the Poudre.

As spring approached, the brown grass and crumbly soil turned green before John Coy. He imagined a ditch pulling water from the river and flooding a sloping plot of land where he and Emily planted a garden and watered enough wild hay to feed their stock. Water flowed where he directed it, his household thrived, towns developed, and this dry, desolate land bloomed, literally and figuratively, in his imagination because of this little river and human ingenuity. On a warm, late winter day in 1863, John and Emily Coy watched the sun set over the Rocky Mountains and discussed the possibility of staying in this beautiful place next to such a providential river.²

Each spring in the 1860s a few hardy settlers, including John and Emily Coy, broke ground near the banks of the Cache la Poudre River. One of their most important groundbreakings was not for a house or a barn but for something far more essential: a ditch or, more accurately, a gash in the earth extending from the river through the muddy bottomlands to a patch of ground large and flat enough to support a few crops. Rocky Mountain rivers were essential to settlers like the Coys in the 1860s. Rivers provided drinking water, irrigated basic crops, sluiced gold from the earth, and moved timber from the mountains to the plains for shelter and fuel. Water was necessary, but so was human imagination and muscle. Hopeful newcomers from the humid sections of the United States and Europe, where at least twenty inches of annual rainfall forced crops out of the earth with little effort, found themselves in a land that received between twelve and fourteen inches of precipitation a year – in a good year. But the climate did not dissuade them. As late nineteenth century Americans moved to the Front Range of Colorado, to the banks of the Poudre and other rivers they imagined transforming this dry grassland into productive farmland. Since the Age of Jefferson and before, Americans thought of themselves as a republic of self-sufficient farmers. Homesteaders heading west after the Civil War still wanted to live this ideal. They turned their agricultural visions into reality with

imagination, physical stamina, cooperation and corporate money and along the way they changed the environment, and to some extent themselves, in order to achieve economic and social stability, neither of which were possible in the American West without water.

John Coy, G.R. Sanderson, Robert Boyd, Fred Whitney, and Benjamin Eaton were among the first to dig small ditches up and down the length of the Poudre; but these newcomers were not the only ones who recognized the value of the river. The Indians knew the river well and in the hot summers of 1863 and 1864 the new settlers were joined on the Poudre by hundreds of Arapaho under chiefs White Wolf and Friday, whose bands also occasionally stayed at Camp Collins when it was established in 1863. Chief Friday implored the U.S. government to set aside land for his people on the north bank of the Cache la Poudre, extending from the Box Elder Creek to the South Platte River and reaching as far north as Crow Creek. U.S. Indian Agent, Simeon Whitely advised against this, as it would have required relocating sixteen non-Indian families living along the river in the proposed area. As the government negotiated with the Indians, homesteaders were busy excavating ditches, building shelters, planting crops, and transforming the land.³

Irrigation ditches were absolutely essential to Poudre valley homesteaders who insisted on farming, but constructing them was hard work. First, farmers shoveled or plowed a preliminary trough from the river, constantly trying to make it smoother and straighter. The course of the ditch was turned toward higher ground if water flowed too rapidly in it or towards lower ground if flow was sluggish. The continuous movement of water in the channel leveled an imperfect grade but constant adjustments were still necessary. More than once, too much river water coursed through a ditch and completely eroded it or, alternately, the river's water level dropped abruptly because of a freeze at the higher elevations and water no longer reached a ditch's entrance. Settlers then waded into the river and stacked rocks and brush in the main channel below their ditch openings. This slowed the current and pooled the water until some of it funneled into the ditch. A change in river fluctuation wiped out these simple diversion dams on a regular basis and, like the ditches themselves, required vigilant maintenance.⁴

Despite the difficulties of early ditch construction, people along the Cache la Poudre managed to move water where they wanted it between 1860 and 1870. As they did so, homesteaders claimed land near the river and farming became increasingly important to the region's economy. Before 1870, it was estimated that 25,000 to 30,000 acres were irrigated in

the entire Colorado Territory and about 1,000 acres in the Cache la Poudre valley, between the mouth of the canyon and the river's convergence with the South Platte River about forty-four miles away.⁵

After 1870, irrigated acreage along the river increased exponentially. Groups of irrigators along with corporate canal companies built the Poudre's bigger canals in the 1870s and 1880s, the area's most extensive period of canal building. Constructing large canals in the nineteenth century was a difficult endeavor best approached with as much capital and manpower as possible. People who knew little about the challenges of aridity and irrigation but believed whole-heartedly in living sober, self-sufficient lives in the American West built the first big canals that diverted water from the Poudre. What these individuals lacked in practical knowledge, they made up for with fortitude.⁶

In 1859, Horace Greeley, editor-in-chief of the *New York Tribune*, traveled through Colorado and became convinced that the dry, desolate benchlands above the river bottoms could be cultivated with irrigation, thereby bringing much more land into production. Greeley was not the first to think of this but he reached a wide audience when he published his findings in his newspaper and encouraged the formation of an agricultural colony to take advantage of the available land. In a rapidly industrializing and expanding nation some Americans found comfort in communal colonies. Such groups had been popular in the United States since the 1840s and while the communal mood seemed to have waned in the U.S. by the 1850s, there was a revival of these beliefs after the Civil War and the American West, with its available land, was a desirable location for new colonies.⁷

Nathan Cook Meeker, the agricultural editor at the *New York Tribune* and a longtime member of communal societies, responded to Greeley's suggestion and founded a new agrarian colony. Meeker recruited temperate families of good character who paid a \$155 membership fee, part of which was appropriated by the colony's locating committee to purchase land in the less crowded and presumably less industrialized West. Eventually, enough sober and adventurous people rallied around Greeley and Meeker's idea and formed the Union Colony. It was said the new colonists came together as strangers, yet were "bound by kindred ties; each with a past checkered by sad experiences and glad mementoes, yet each looking forward to a future full of promise... at the foot of the Shining Mountains." The myth of the American West as a place of new beginnings and endless opportunities inspired them as it had countless others.⁸

On the 5th of April 1870, after exploring parts of Kansas, Nebraska, Arkansas, New Mexico, Wyoming, and Utah, the Union Colony purchased over 9,000 acres of land near the Cache la Poudre River. The *New York Tribune* bolstered the new colony with favorable articles lauding the possibilities of irrigation, agriculture, and life in general along the Poudre. One article gushed:

The Cache-a-la-Poudre comes down from the Rocky Mountains clear as crystal, and with little labor ice-cold water can be brought into the house of every family, for there is sufficient head to force it up the highest building. The cost of irrigation will be much less than anticipated.

In an 1870 editorial, Horace Greeley advised colony members to build dams, canals, windmills, wells and reservoirs to ensure their survival and success on the dry plains. They would need to.⁹

Throughout the spring and summer of 1870, Union Colony families built the town they called Greeley. The settlement was roughly fifty miles between Denver and Cheyenne situated on land purchased from and bisected by the Denver Pacific Railway. The surrounding land was still used as open range by cattle barons. In June, a *Rocky Mountain News* reporter traveled from Denver to inspect the newcomers. He counted 460 inhabitants with 70 houses and numerous tent shelters. Already three general stores, two bakeries, two butcher shops, a hotel, boarding house, bank, post office, and depot stood proudly on the plains. Despite such progress, the bleak surroundings and the shallowness of the Poudre in June compared to eastern rivers unnerved some of the new settlers. A few people returned to the East. One man left after an hour in the new town, “shaking the sand of the desert and the prickly pears from his feet.” Union Colony member, J.B. Flower, reported to the *Rocky Mountain News* a “general good feeling among the colonists with a few exceptions. These exceptions came here expecting too much, and unless they make up their minds to take frontier life as it is, and cease to breed dissatisfaction, it will be better for them to leave and cease being a disturbing element.” With the spring floods over, the Poudre’s water level declined day by day and the landscape baked before the colonist’s eyes. Those who remained in the Poudre valley in the summer of 1870 knew securing water for households and crops was their priority. The Union Colony set about diverting the Poudre’s water where it was needed: up out of the river bottoms and onto the dry benchlands.¹⁰

Original Union Colony articles drafted and adopted in New York contained a plan for four large irrigation canals. These were not mere ditches but elaborate structures meant to carry huge amounts of water over several miles and irrigate thousands of acres. Greeley No. 1 was to

divert water near Bellvue, a small settlement northwest of Fort Collins. Greeley No. 2 would take water out of the Cache la Poudre one mile south of what is now the town of Timnath and divert it to the plains north of town. Greeley No. 3, also taking water from the Poudre, was the “town ditch,” ten miles long, fifteen feet wide and two and a half feet deep. Greeley No. 4 was to take water from the Big Thompson River a few miles south of the Poudre. The Union Colony had no choice but to build such structures in order to cultivate crops in this land of little moisture, but much had changed since the Coys settled the area. There was labor for hire in addition to the manpower of the colonists themselves.¹¹

The Union Colony surveyed the Greeley No. 3 Canal, their “town ditch,” on April 23, 1870, just a few days after the first members arrived. A contractor excavated the canal as colonists built shelters. In addition to paid contractors, everyone of eligible age was eventually conscripted to work on the canals. Money for initial construction came from membership fees, while annual assessments levied on colonists raised money for maintenance, superintendence, and enlargements. Water first flowed into Greeley No. 3 in June 1870; however, hopeful irrigators watched in dismay as the newly opened, thirsty soil took its fill and more than a week passed before water reached the end of the ditch furthest from the river. In July, just three months after the colonist’s arrival, the No. 3 Canal irrigated 2,000 maple, elm, and walnut trees imported from the East. The trees grew, at least initially, but irrigated crops were another matter. The colonists spent over \$6,000 building the first version of No. 3, yet they irrigated just 200 acres of land. Even this small acreage received little water because of the canal’s crude construction and the absence of any kind of diversion dam in the river to shunt water into the structure.¹²

That same summer, the Union Colony surveyed its second canal, Greeley No. 2 and issued construction contracts. This canal was ten feet wide on its bottom, sixteen feet wide on its surface and over twenty-six miles long, longer than any existing canal in the Poudre valley. In 1871, the colony irrigated 2,000 acres with Greeley No. 2 water; unfortunately, the crops died. In addition to being a dry year, there was again no diversion dam on the river and the canal ran for over a mile along the edge of a slough where its lower bank soon settled and failed to contain the flowing water. Problems persisted on this canal as David Boyd, an early and influential Union Colony member, attested:

Canal No. 2 was given a grade of 3.2 feet to the mile, a depth of only 2 feet, and a width on the bottom of 12 feet at the head. The course was very crooked...no embankment was made on the upper side.... This was economical in construction, but wasteful in the long run.... The sharp bends were of necessity taken out, thus shortening the course and increasing the slope. The upper side had to be embanked where the water flowed far back, in order to prevent the action of waves on the lower bank and waste by evaporation.... the result of these changes was a great increase in velocity and resulting wear of the bed which has now to be checked whenever water is taken from it. Portions of the bed not influenced by these checks are being worn away, and hence are in a condition to permit great loss by percolation.¹³

Colony officers believed the four proposed ditches would irrigate 120,000 acres and cost a total of \$20,000. Instead, the first ditch, Greeley No. 3, failed to water more than 200 acres and expenses quickly ballooned to over three times the original outlay in the canal's first year. After three enlargements in 1871, 1872 and 1873, including a diversion dam, the amount of money spent on the canal soared to \$25,000. Likewise, the first version of Greeley No. 2 totaled \$27,000. After improvements and repairs between 1871 and 1877, No. 2's total was up to \$87,000. The Union Colony was so consumed financially and emotionally by these two canals that it never built No. 1 and No. 4.¹⁴

The colony's irrigation troubles were not uncommon – most Americans had little experience with large-scale irrigation in the nineteenth century. Few people knew how expensive canals were to construct or how much water was needed to irrigate an acre of land. Edwin Baker, a Union Colony member who moved to Greeley in 1871, recalled the process of building canals as a frustrating and less than professional exercise that Poudre valley farmers learned by trial and error. In a memoir written for the *Weld County News* Baker reminisced:

Most of the horses [to pull plows in ditch construction] were gotten from nearby herds, and looked large and beautiful on the range, but when put on the scales they did not demonstrate the avoirdupois they appeared to have... Frequently the scraper caught and the holder vaulted over it into the heels of the animals.... In the course of a week or so the force would get settled down to something like decorum.

Establishing an irrigated farm involved more than using clumsy horses to excavate canals. Farmers trekked into the mountains to cut down timber or quarried sandstone from the hogbacks west of Loveland and Fort Collins to build diversion dams and headgates - structures that open and close at the entrance to a canal and control the amount of water flowing in it. Once the

canal, headgate, and diversion dam were completed, irrigators determined the slope of their land and diverted water to its highest point. From there water funneled into smaller ditches and furrows that ran the length of fields. Luckily, most land in the Poudre valley required little leveling due to its natural slope away from the Rockies. Union colonist David Boyd claimed, “even when the surface is quite uneven, if there is considerable fall, a farmer can generally lead the water over the higher spots.” Soil in the valley was generally well drained with surface layers of sandy and clay loam and an underlying layer of sand or gravel.¹⁵

After a farm was prepared for irrigation and water was brought to the land, the tricky process of distributing and measuring water began. When farmers irrigated instead of relying on rainfall they first determined how much water was available to them and then how much was needed for each crop and soil type. Poudre valley irrigators estimated the duty of water when determining the quantity needed for crops. The duty of water referred to the amount of water needed for a particular area dependent upon the quantity of water, the type of soil and crop, the slope of ground, and skill of the irrigator. The phrase was maddeningly vague and caused much disagreement among irrigators. Basically, more water was used and the duty of the water was less on newly cultivated land. The more saturated land became through irrigation, the less water it needed and the duty of water increased. Another way of describing the duty of water is to equate the duty with efficiency; the duty is less, as in less efficient, on newly cultivated land because it typically absorbed more water than that which had been in production for a number of years.¹⁶

Measuring irrigation water was also a difficult but essential process when the amount of water was limited and divided among many users as it was on the Poudre. Edwin Baker believed the measurement of water was one of the most difficult problems Poudre irrigators faced and they consequently tried many new measuring methods and schemes. One of the first units of measurement used by Poudre irrigators was the “irrigating head,” roughly translated as the volume of water one man could handle when watering fields alone. The irrigating head varied according to individuals, although most likely it was in the area of three to four acre-feet of water, an acre-foot of water being enough to cover one acre with one foot of water, or, the equivalent of approximately 326,000 gallons.

A more precise method of measurement was necessary as more users claimed water from the Poudre. Weirs became common. These structures resembled dams with openings that

measured the rate of water's flow based on the size of the opening. Weirs were problematic because they were sometimes installed improperly and gave inaccurate measurements. A local invention, the Max Clark Box, developed by and named after a Union Colony member, slowed the velocity of water approaching a weir, making it smoother and easier to measure. But the search for more accurate measuring devices continued as demand for water outweighed supply and parceling it out correctly and efficiently became more important.¹⁷

The value of the Poudre's water increased over time. Writing in 1905, irrigation expert Elwood Mead noted that in the early days of western irrigation, "the idea of water itself having a property value was not considered. The prices charged for water rights in the first place were fixed by the cost of ditches and varied from \$2.50 to \$4 an acre." The higher than expected construction costs of Poudre canals resulted in a relatively high cost of water per irrigated acre. As the system of canals expanded and water was more assured, farmers in the Poudre valley planted lucrative, water-intensive crops - sugar beets, alfalfa, apples, peaches, cherries, wheat, corn, oats, potatoes, and onions - as opposed to hay and vegetables. The more farmers depended on these high-value crops and the profits they generated, the more value they placed on the water that made them possible and water's value soared as a result.¹⁸

Despite the rising value of water, irrigation remained a difficult and risky endeavor in the nineteenth century. Government officials writing about irrigation for the U.S. Department of Agriculture, warned after observing irrigators in the West that,

Unless he is fortified by an income outside of that obtained from his farm, the first few years [the irrigator] has a struggle for existence. That the pioneer is often overcome in this unequal fight is evidenced by many deserted homes and unfinished irrigation works.

Irrigators along the Poudre and other western streams dealt with the natural occurrences that plagued all farmers: drought, hail, frost, tornadoes, plant disease, insects and other pests, as well as problems specific to an irrigated farm.¹⁹

Irrigation produced some unintended outcomes as Poudre valley farmers changed their environment and forced their dry land into production. Vegetation of all sorts grew in ditches and canals almost as soon as water flowed into them. Volunteer weeds and trees thrived on earthen canal banks, slowing the current that propelled water through the waterways and onto fields and depriving crops of their full allotment. Farmers spent time and money each year

battling these invasive phreatophytes. The Taylor and Gill Ditch Company diverted water from the Poudre near the town of LaPorte, north and west of Fort Collins, beginning in 1866. Every year, the company hired men alone or with teams of horses to maintain the ditch. Maintenance included burning or manually clearing the weeds and trees with plows, shoring up embankments, installing checks to stop erosion caused by swift currents, and leveling troublesome grades.²⁰

Irrigation water itself caused problems. Water diverted into canals seeped underground and elevated the water table, evaporated into the dry air, and collected in low-lying areas. In 1894, the Colorado State Engineer recorded over 61,000 acres in the Poudre valley as “waste and pasture land,” the result of heavy applications of irrigation water that did not drain away into the subsoil. David Boyd confirmed in 1897, less than thirty years after irrigation began in earnest in the Poudre valley, that some land near the river was kept so wet by irrigation of the higher benchlands that it had changed into “cattail and rush-bearing swamps.” When irrigation water appeared in unexpected places, farmers dug new ditches, called drainage ditches, below the level of their saturated fields. Drainage problems occurred in towns as well as on agricultural land. By the mid-1870s, irrigation water rose inconveniently in Greeley cellars. Greeley and Fort Collins constructed expensive drainage systems that diverted the rising water away from resident's property.²¹

Irrigation changed the very flow of the Poudre. Water that seeped through the bottoms and sides of canals or was not absorbed by crops migrated via underground tributaries back to the river and was used by other irrigators who built new canals to divert this “seepage water,” water also referred to as “return flow.” U.S. Department of Agriculture irrigation engineer Robert Hemphill conducted an irrigation survey of northern Colorado fifty years after irrigation began on the Poudre and noticed considerable return flow to the river. By late summer the river was almost dry in places upstream where several canals diverted water. Further downstream, past irrigated fields, the river flowed again and supplied farmers with water. Hemphill estimated seepage water from fields and canals returning to the Poudre totaled 15,000 acre-feet annually and the amount of seepage water that was intercepted and used by other irrigators or stored in reservoirs was 12,000 acre-feet.²²

Irrigation water occasionally affected soil in adverse ways. Water applied to the high plains, which typically did not receive a lot of moisture, could damage rather than nourish the land. Soil contains salt; rain leaches salt out of soil over time in humid locales but in dry regions

irrigation accelerated the leaching process. Heavy applications of irrigation water in the Poudre valley brought salt to the surface quickly where it evaporated, sometimes poisoning topsoil for crops. On well-drained soil, salt was carried down into the groundwater alleviating the alkali, or salt, problem unless the water table rose to an extent that it reached the roots of crops that would not tolerate the groundwater's salinity. Drainage pits and new canals carried salty groundwater away from fields but meant added time and expense for farmers. Some land near Fort Collins was particularly prone to poor drainage and several drainage canals and seepage ditches were constructed in the late nineteenth and early twentieth centuries.²³

Perhaps the ultimate, potential problem associated with irrigation was the fact that irrigators depended on the amount of water available, meaning the quantity of rain and snow that fell on the mountains, which varied widely and was completely beyond human control. According to Robert Hemphill, in his bulletin entitled *Irrigation in Northern Colorado*, measurements taken of the Cache la Poudre at the canyon mouth showed the average flow in the 1880s was 320,000 acre-feet, but this varied from a minimum of 169,000 acre-feet in 1888 to a maximum of 689,000 acre-feet in 1884. Farmers adapted to these dramatic fluctuations as best they could. The federal government provided some guidance on crops and irrigation with tracts variously entitled, *Preparing Land for Irrigation*, *Methods of Applying Water to Crops* and *Practical Irrigation*; however, the early water delivery system - the ditches, canals, and reservoirs - of the Cache la Poudre valley developed more haphazardly and organically, with the exception of the Union Colony's original planned canals, as it was one of the first irrigated areas in Colorado and the West outside of California. Ditches such as John Coys' and even the larger Poudre canals were constructed, used, and enlarged or improved upon by the time government publications detailed the "proper" way to construct them.²⁴

Cooperation among irrigators was necessary partly due to the difficulty distributing Poudre water and dealing with the unintended consequences of moving it out of its natural environment. Small groups of farmers pooled resources and shared water in the 1860s but by the end of the decade moving and controlling water required the labor and investment of larger, wealthier parties, sometimes for mutual gain and sometimes for outright profit. Farmers cooperated with each other and diffused the labor and costs associated with canal construction among themselves. Cooperative companies constructed and maintained canals, purchased supplies, and marketed produce according to their means. The Little Cache la Poudre Ditch that

irrigated the Dry Creek valley, Lake Canal that irrigated a series of farms near Timnath and the Boxelder Ditch that irrigated land near Fort Collins, were examples of cooperative ditch companies, also called mutual irrigation companies. One Poudre valley cooperative group constructed the New Mercer Canal. A.A Edwards, an early pioneer to the Cache la Poudre valley, left Mercer, Pennsylvania with six others in the summer of 1869. The Mercer group arrived in the valley prior to Union Colony settlement when irrigation ditches were still limited to land near the river bottoms. In order to irrigate the higher lands they settled near Fort Collins, this group pooled their money, formed the Mercer Pole and Ditch Company and immediately constructed their ditch, which eventually rose out of the bottomlands after several enlargements.²⁵

Cooperative ownership of water allowed the Union Colony to build the largest canals on the Poudre in the early 1870s. The colony proved cooperative irrigation was a useful endeavor. Settlers who preceded the Union Colony and were once skeptical about the community's ability to support itself on the dry uplands wondered by 1873 where they would find markets large enough to sell the quantity of crops they grew. The Union Colony's success was due to its collective ownership of canals. In 1877 the Union Colony traded one form of cooperation for another when it sold the canals to local farmers who used the water. Colony leaders happily shifted the "obligations" of canal ownership when, after the third enlargement of Greeley No. 2 in 1877, the "bottom was too high in some places, banks not high enough in others, there were breaks, lack of checks, [and] measuring weirs." After farmers purchased the canal and formed the Cache la Poudre Irrigation Company, also called New Cache la Poudre Irrigation, they responded to complaints about damage from overflow, the need for checks in the canal to slow water flow and reduce erosion, crop loss and a general shortage of water. The new cooperative owners spent approximately \$25,000 over the next several years straightening the course of the canal, constructing a permanent dam and headgate, and installing checks.²⁶

New Cache la Poudre Irrigation Company's structure resembled that of other cooperative, or mutual, irrigation companies in the valley. Irrigators bought shares of stock in the company; each share represented a certain amount of water in the canal that they were entitled to based on their legal water rights. A Board of Trustees, composed of five stockholders elected yearly, performed the corporate duties. The trustees then appointed a general superintendent who oversaw the canal for the irrigation season and a water commissioner who parceled out water to

individual users according to their purchased shares. Annual assessments levied against company stock financed expenses and salaries.²⁷

Cooperation was an important social element in nineteenth century America and was often the reality of the irrigated American West. This was not the mythical Wild West dominated by rugged, independent cowboys. Cache la Poudre irrigators, like most western farmers, were transplanted easterners, usually of European descent, who wanted to own land and farm regardless of the dry climate they encountered. One cannot underestimate the importance of cooperation when marshalling water in the West. In his influential 1878 report to Congress on the arid lands of the United States, John Wesley Powell, the first known man to travel the length of the Colorado River in 1869 and later head of the U.S. Geographical and Geological Survey, noted that individuals could divert and use small waterways; however, utilizing water in larger streams required huge amounts of capital and cooperative labor. Powell remarked, “The diversion of a large stream from its channel into a system of canals demands a large outlay of labor and material.... It is manifest that a farmer depending upon his own labor cannot undertake this task.” Cooperation among Poudre valley irrigators contributed to the success of the region’s entire water delivery system and the social and economic success that followed its creation.²⁸

The success of cooperative canal companies in the Poudre valley meant more water was diverted from the river onto farms. New settlers discovered a region transformed: green fields, tidy farmhouses, and growing towns surrounded a river whose water made life not only possible but also comfortable. Railroads brought more settlers to Colorado, providing a convenient means of travel for the people of the Poudre valley as well as a way to ship goods to larger markets. State and regional boosters along with speculators from all over the country and abroad encouraged settlement in northern Colorado and boasted of the region’s water supply. Advertisements in newspapers and magazines praised the state’s irrigated farms. One advertisement in *Irrigation Age* magazine exclaimed, “Certainty of Crops! Much larger yields! Better quality of grain! Land does not wear out!” Thanks to Colorado’s irrigated agriculture. The *Rocky Mountain News* gushed:

One of the most beautiful rivers in this or any other territory is the Cache-La-Poudre.... The Poudre, as it is familiarly known all through Northern Colorado, is distinctively a mountain stream and loses none of its characteristics till it mingles its shining waters with the tawnier waves of the sluggish Platte.... The Poudre is always bright and glowing as a picture of youth, and its pebbly bed and banks of

living green are as charming after it leaves the mountains as where their rocky walls reflect themselves in its recesses.²⁹

William Pabor, an early and influential member of the Union Colony and a founder of the Agricultural Colony of Fort Collins declared: “water, won by skill and enterprise from its accustomed channel, runs over fields and farms, and becomes in the alchemy of nature as precious as were the words that dropped from the mouth of the princess in the fairy tale and changed, in the dropping, to pearls of price.” This was certainly hyperbole. Only hard work, determination, and, increasingly, cooperation made an irrigated farm successful along the Poudre. Still, the valley's agricultural sector did not depend on cooperative ventures alone. Entrepreneurs realized the opportunity in moving and selling water for profit rather than mutual gain.³⁰

Corporate canal financing occurred in the nineteenth century American West and the successful water delivery system on the Cache la Poudre attracted investors. One corporate venture involving the Poudre began when an Englishman, Francis L. Carter-Cotton, incorporated the North Poudre Land, Canal, and Reservoir Company in 1880 in order to irrigate 16,000 acres between the North Fork of the Poudre and Box Elder Creek along the north side of the river. The projected length of the North Poudre Land, Canal, and Reservoir Company's system was fifty-two miles, with an estimated price of \$175,000 to \$200,000 for the entire project. The Colorado Mortgage and Investment Company of London, a British company that invested in Colorado water projects, backed Carter-Cotton financially. This company, known locally as the “English Company,” invested in irrigation for profit and was not owned by farmers irrigating from the proposed canal.³¹

Carter-Cotton's engineers estimated that the canal, including the necessary flumes, tunnels, ditches and headgates, would cost \$35,000 and extend twenty miles. He received disappointing news when the first mile of work approached \$75,000. He secured additional financing from the Traveler's Insurance Company of Hartford, Connecticut but experienced several more years of disappointment until Traveler's took over operation of the company when Carter-Cotton fled Fort Collins and approximately \$150,000 in debt. After ten years, Travelers had turned a profit only once on the canal and sold it to yet another irrigation developer, F.C. Grable, of the National Land and Irrigation Company. The company, renamed the North Poudre Land and Canal Company, went into receivership and was then taken over by Philadelphia

investor Thomas Bradley. Finally, in 1901, a group of Greeley and Fort Collins investors bought the company for \$67,000 and reincorporated it as North Poudre Irrigation.³²

The confusion and financial losses associated with the North Poudre Ditch were not uncommon in the West during this period when speculators and boosters inflated expectations of profit and success. Many ditch companies, cooperative and corporate, failed in the nineteenth century due to a lack of planning, inadequate funding, poor management, or simply the difficulty of delivering water over long distances in a semi-arid climate subject to frequent drought cycles. Yet, corporate investors faced particular animosity at times.³³

Corporate and foreign investors concerned Poudre valley farmers by the late 1880s. The Colorado State Grange focused attention on corporate control of irrigation systems. In 1886 the Grange, in conjunction with the Farmers' Irrigation and Protective Association, successfully lobbied to prevent corporations from charging excessive fees for carrying water in their canals. In addition, the Colorado Legislature passed a law preventing land speculation by foreign companies, or "water grabbers," as they were often called. As farmers complained that corporate canal owners treated them unfairly they were further plagued by feelings that they had reached the limit of irrigation in the Cache la Poudre valley because of the finite amount of water in the Poudre. They spent the late nineteenth century exploring new ways to augment the river's supply.³⁴

CHAPTER TWO: Expansion

The ditches and reservoirs have created permanent wealth several times over their own estimated value. They have influenced not only the growth of the city and country but also the institutions and the character of the population. Information gained near here in the development and application of water has been scattered to the four corners of the globe, wherever modern irrigation on a large scale is being practiced.³⁵ -- Greeley Tribune

Water development - acquiring, diverting, and storing water - in the Poudre valley boomed in the latter decades of the nineteenth century. The Poudre's water made life and prosperity possible and large cooperative and corporate canals attracted new settlers and investors to the area. Unfortunately, the river could not support all who were drawn to northern Colorado's newer, greener environment. A mere twenty years after John Coy and others dug small trenches through bottomland fields, the Poudre's water supply was over-extended: too many people were using a finite amount of water. By 1882, fifty-three canals and ditches siphoned water away from the Poudre and irrigators wanted to expand the river's possibilities even further. They needed to increase the amount of water in the river and regulate its flow to provide water in late summer when the plains baked and farmers needed moisture most. In other words, Poudre valley irrigators could deliver water *where* they wanted it via their extensive system of ditches and canals; the next step was to deliver water *when* it was needed.³⁶

Beginning in the 1880s, irrigators and entrepreneurs in the Poudre valley built high elevation, transbasin ditches and tunnels that turned water away from natural streambeds into the Poudre. The Larimer County Ditch Company (LCDC) constructed the first of these so-called transbasin water diversions into the Cache la Poudre. Owners of this ditch company conceived of their first diversion while inspecting their Chambers Lake Reservoir, situated near the Continental Divide at Cameron Pass. Shivering in the cool, thin air at 10,000 feet the men realized that water trickling west and north from the Divide's remote snowfields could be redirected with some carefully placed turns of a shovel to flow into Chambers Lake and from there into mountain tributaries of the Poudre. That summer LCDC brought a small amount of water from the Laramie River basin via Lost Lake into Chambers Lake and from there into the Poudre. The company also diverted water from the Michigan River watershed through a ditch that ran north and east to Cameron Pass and deposited Michigan water into Joe Wright Creek, a

Poudre tributary. This Cameron Pass Ditch was so successful LCDC widened it from three feet to six feet and deepened it from one foot to two. This increased diversion incensed ranchers in North Park on the Western Slope where the Michigan's waters naturally flowed before the creation of the ditch. North Park ranchers regretted the loss of their excellent watershed:

The land which the ditch will drain is the best snowshed on the Michigan Creek. It is a mountain over which the snow from the park is blown during the winter months to a depth of 100 feet – a mountain whose enormous side is covered with the most dense of spruce timber – a mountain on the side of which the snow lies the year round.

After the outrage, came threats: "The question of legality will doubtless be investigated by the proper authorities." This did not deter LCDC and other irrigation companies from pursuing additional transbasin diversions into the Poudre; indeed, these initial, small diversions were harbingers of what was to come.³⁷

In the summer of 1891, LCDC tapped the Laramie River again, this time with a small ditch that brought water from the north slope of Mount Cameron to the eastern side of the mountain and ran it into Chambers Lake, a distance of about five miles. Work progressed slowly at first but by June of 1893, 150 men camped and labored near the Continental Divide; by August they numbered 300. The site was several days journey from the plains, up 5,000 feet on narrow trails and crude roads. Once the work crew reached the location they set up a base camp with bunkhouses, cook house, and storage buildings. The men stayed all summer, working as fast as they could before winter set in at that elevation. The task before them was difficult and unprecedented.

The ditch, known as Skyline, took shape as a long snaking gash eighteen feet wide at the top, twelve feet at the bottom, and five and a half feet deep, constructed at a forty-five degree angle near 10,000 feet. Work crews blasted a 110-foot tunnel from solid rock and built wooden flumes that resembled boxes or troughs raised on trestles, which carried water over gullies and muddy, unstable terrain unsuitable for an earthen ditch. Laborers shoveled dirt, removed timber, blasted through rock with dynamite, and stabilized ditch banks all the while fighting rain, wind, monotonous food, and mosquitoes seemingly the size of hummingbirds. When the men noticed that the swaying of the trees above the ditch loosened the soil and caused mudslides that refilled the excavated trench, they cleared the timber for another thirty feet and used the felled trees to

stabilize the lower bank. Maintenance proved almost as burdensome as construction. After Skyline Ditch was completed and fully utilized by 1895 it was frequently closed for repairs.³⁸

As construction crews struggled over Skyline Ditch, the Larimer County Ditch Company reincorporated as Water Supply and Storage Company and implemented plans it first explored in the 1880s to divert portions of the Grand River, later renamed the Colorado River, into the Poudre. In August 1894, a small amount of the Grand River's headwaters flowed through a segment of the proposed Grand Ditch, then called the Bennett Ditch. The Fort Collins newspaper rejoiced: "About four cubic feet of the waters of the Grand were last week diverted from their course to the Pacific Ocean and made to flow towards the Atlantic," flowing in the Poudre and irrigating countless fields along the way. This was the first major diversion of water from the Colorado River, destined to become one of the most diverted and divided rivers in the world. But the Grand River Ditch did not materialize as easily as earlier transbasin projects. The financial depression of the mid-1890s hampered funding of the project and construction languished until 1898. The South Side Ditch portion was completed in 1900 but other segments remained unfinished due to contracting and financial difficulties within the newly formed Water Supply and Storage Company. In 1910 the ditch reached Tank Creek and operated until 1914 with only routine maintenance; at this time, the ditch closed again for extensive repairs and World War I labor shortages delayed construction yet again.³⁹

Beyond construction and financial difficulties, the Grand River Ditch had another problem. The addition of Grand River water threatened to flood the Poudre canyon and irrigated land beyond during times of high flow. There was no place to store the extra water the ditch carried until the time when farmers on the plains needed it in late summer. Water Supply and Storage drafted plans for a mountain reservoir to capture and store Grand River Ditch water until it could be released in precise quantities when called for; however, they ran up against a formidable adversary over their intended reservoir location.

Rocky Mountain National Park was created in 1915 as construction of the Grand Ditch dragged on. In 1922, when Water Supply resurveyed its reservoir site for the ditch water they found, to their dismay, that the proposed site would now back water onto national park land, a problem since no part of a national park could be used for commercial purposes. After some political wrangling and another extensive delay, Fort Collins congressman Charles Timberlake introduced a bill transferring the reservoir land from the National Park Service to the U.S. Forest

Service and this federal agency issued a permit for it. With construction of Long Draw Reservoir finally under way in the late 1920s, work on the Grand River Ditch resumed again. It was finally completed in 1934, almost fifty years after Water Supply first formulated plans for it.⁴⁰

Diverting transbasin water was laborious and expensive but the increased demand for it on the plains and in the cities of Greeley and Fort Collins promised lucrative profits. Water Supply and Storage was in no way financially secure after its incorporation in the early 1890s. After the first deliveries of Skyline Ditch water the price per share of the company's stock increased significantly. By 1901 a share sold for \$1,200 to \$1,500. After a limited amount of Grand Ditch water was delivered in 1910, the stock price more than doubled to \$3,700 and, by the mid 1920s, one share sold for \$7,000. Water the company's users did not need was rented to other irrigators, generating revenue that financed additional transbasin projects.⁴¹

Water Supply's success encouraged others to develop transbasin diversions. In 1897 Rollin Tenney and Philip Wilson surveyed and built two new diversions. The Deadman Ditch carried water to the Poudre from Deadman Creek into Sand Creek, both tributaries of the Laramie River. The Sand Creek Ditch then transported this water to Sheep Creek, a tributary of the Poudre's North Fork. In 1906 William Rist and John McNabb, the engineer and foreman on the Grand River Ditch, completed the Michigan Ditch, further diverting water from the Michigan's watershed into the Poudre. Up to sixty-five men worked in the summer months on this ditch from 1902 to 1905. In the meantime, F.C. Grable of the National Land and Irrigation Company took over ownership of the North Poudre Canal from the defunct Francis Carter-Cotton and Travelers Group. Grable organized the Mountain Supply Ditch Company to deliver the newly tapped Michigan water to irrigators on the plains. Still, another group of Poudre valley investors built a transbasin tunnel that carried more Laramie River water into the Poudre where a ditch was impossible and set off a legal dispute that lasted decades.⁴²

One day in 1897, Wallis Link hunted near his ranch in Big Park, Colorado in western Larimer County. He wounded a deer and followed the animal until he found himself on top of a ridge separating the Laramie River from the Cache la Poudre. From this perch, the thought occurred to Link that a tunnel less than two miles long bored through the mountain he stood on could divert water from the Laramie to the Poudre, which conveniently lay hundreds of feet lower than the Wyoming-bound Laramie river. Four years after conceiving this plan, Link

moved to Fort Collins where he met Abraham Akin, his future partner in the transmountain tunnel.

Link envisioned a water delivery system that included three collection ditches shunting water away from the Laramie's tributaries to the tunnel. In the summer of 1902, Link and Akin went up the Poudre canyon together and surveyed the site. Because the two lacked capital they decided to construct a small portion of their system, the Upper Rawah Feeder Ditch, to attract potential investors. By 1903, Abraham Akin's brother Myron along with Wellington Hibbard and another investor joined the endeavor. The group soon realized they needed a distribution system to deliver water to irrigators on the plains once it moved through the ditches, tunnel and canyon. Three years and almost \$50,000 later, the men incorporated as the Laramie Reservoirs and Irrigation Company. They planned to transport the tunnel water through the existing Poudre Valley Canal with its headgate near the mouth of the Poudre canyon and extend this ditch eastward past Briggsdale, far out on the plains of Colorado over eighty miles from the tunnel. The water would flow to a new irrigation district on the plains consisting of 100,000 acres that could potentially support 7,000 to 10,000 people. It was an ambitious and complicated plan indicative of the fact that much of the easily developed diversion projects along the Poudre were already built. But population growth along the river was explosive after the turn of the century and the popularity of water intensive crops such as sugar beets convinced tunnel investors that the effort was necessary and the expense would be recouped.⁴³

With a plains distribution system planned on paper, laborers constructed the Upper Rawah Feeder Ditch in 1907. The Greeley-Poudre Irrigation District was organized and facilitated the on-going construction of the plains system, which was financed by bonds sold within the newly formed district. Irrigation districts were authorized in Colorado by the state Legislature in 1901. The law allowed irrigators to set boundaries, issue bonds, and derive revenue from assessments levied upon land within its boundaries in order to procure water at a time when it was increasingly expensive and difficult for individual irrigators to acquire it by themselves. A district was managed and operated by citizens within its boundaries but subject to state oversight.⁴⁴

As the plains system took shape, work crews in the canyon excavated the Laramie-Poudre Tunnel. There was no easy road up the Poudre Canyon at that time. All equipment and supplies were hauled on mules, horses and men's backs on a route that took two days from Fort

Collins. A dam built on the river above the Poudre Falls operated three water wheels that powered drills and supplied electricity. Workers on the east and west portals blasted, drilled, and picked their way into the mountain for two years, with work continuing in the winter months because the site was protected from the elements. The two work crews met inside the mountain in July 1911. The completed tunnel was over two miles long, seven feet high and nine feet wide. The governor and two state Supreme Court justices joined the laborers at the eastern portal and celebrated the engineering and physical achievement. The celebrations were short-lived.⁴⁵

The state of Wyoming filed a lawsuit on behalf of its Laramie River water users in 1911. This contributed to the bond market collapse of the Greeley-Poudre Irrigation District, deterring irrigators and citizens who financed the project. The lawsuit, *Wyoming v. Colorado*, postponed work on the Laramie-Poudre Tunnel plains distribution system for twenty years. Throughout most of the western United States water was a scarce and highly coveted resource. Rivers do not conform to state boundaries; water flows where it wants, yet states jealousy guard whatever water passes within their borders. Just as North Park ranchers were outraged when Poudre irrigators diverted the Michigan's water, Wyoming water users were angered by the diversion of the Laramie River. Poudre irrigators were hardly the only ones arguing over interstate waters. Seven major rivers began in Colorado, each flowing on to other states and all diverted, divided, and disputed.⁴⁶

In 1931, after much argument and speculation by both sides in *Wyoming v. Colorado*, the United States Supreme Court decided both states were entitled to portions of the Laramie River, meaning both Wyoming and Colorado received significantly less water than they had hoped for. This decision, along with the financial uncertainty associated with the depression of the 1930s, forced the Laramie-Poudre Irrigation Company out of business and the unfinished system was sold off in parts to various irrigation companies along the Poudre. Water Supply and Storage and the Windsor Reservoir and Canal Company formed the Tunnel Water Company, operating the tunnel and delivering water to its users through their existing canals and reservoirs.⁴⁷

Transbasin diversions brought an additional 35,000 acre-feet of water to the Poudre basin by the early twentieth century but a crucial component of the river's water delivery system was missing. As seen with the Grand River Ditch, the extra water shunted into the Poudre through the new diversions threatened to flood the river and damage farms and towns along its course. Poudre valley irrigators quickly realized they needed reservoirs to store this extra water until

later in the summer when irrigators needed it most and when the low flow of the Poudre shortened the irrigation season. By 1890, the Poudre's canals carried a full supply of water for only two months, usually the end of May to the end of July, when most of the snow had melted at the higher elevations. Crops withered in dusty fields despite the influx of transbasin water without reservoirs to regulate the water supply late into the growing season.⁴⁸

Irrigators in the Poudre valley created one of the earliest, extensive reservoir systems in Colorado. Most Poudre reservoir building occurred between the 1880s and early 1900s, coinciding with population growth and drought. Reservoirs were privately, mutually or corporately owned, on the plains or in the mountains, and stored water from multiple watersheds. Some smaller reservoirs trapped water that seeped from canals, irrigated land or other reservoirs. Others were filled by the run-off of a normally dry channel during heavy rains. Reservoirs stored water from May to June when snow melt from the high elevations was heavy enough to irrigate early crops and fill the storage units. At the end of June, all available river water bypassed reservoirs and was sent down the canals. Finally, when the Poudre's flow dwindled to the point that some irrigators were not receiving water, the reservoirs released their supply and supplemented the river.⁴⁹

Natural depressions in the landscape made ideal reservoirs. An embankment was constructed along the lowest edge and inlet and outlet canals brought water to and from the river. The first dams were made of earth ranging from ten to forty feet high; the exception was North Poudre Irrigation's Halligan Dam, a ninety-four foot, arched concrete structure built in 1909. Larimer County Ditch Company, North Poudre, and the Box Elder Ditch Company created several reservoirs in the 1880s. As time went on, these and other irrigation companies expanded existing reservoirs and constructed larger ones.⁵⁰

Despite general enthusiasm for reservoirs, a few farmers and citizens worried about the safety of the structures. Some remembered disasters such as the Chambers Lake dam collapse. On the morning of June 9, 1891, torrential summer rains forced water over the dam's wasteway, which was situated on a small hill and assumed to be partly rock but was later determined to be entirely soil. When water spilled over the wasteway, it cut away at the hill and descended 4,000

feet down the canyon past Fort Collins in about four hours – literally a wall of water. Six-foot square boulders bounced like pebbles along the canyon walls. This disaster forced the owners of the reservoir, Larimer County Ditch Company, to disband due to financial difficulties and reincorporate as Water Supply and Storage. A few citizens were leery of new reservoirs in the canyon and valley that could cause similar disasters, and it was true, reservoirs could be unpredictable. Water seeped out of them just as it did from earthen canals. Evaporation was also a problem, especially from shallow plains reservoirs with lots of surface area exposed to sun and wind as opposed to deeper mountain reservoirs kept cool by temperature and shade. In spite of these risks and problems, Poudre valley irrigators needed reservoirs and built an extensive network of them.⁵¹

In 1891, the Larimer and Weld Reservoir Company built Terry Lake Reservoir a few miles north of Fort Collins, considered by many at the time to be the first large, cooperatively built reservoir in the Cache la Poudre valley. Larimer and Weld turned the actual construction of Terry Lake over to a group of farmers using water in the company's existing canal. Technically, only those farmers who bought shares in the future reservoir could divert and use its water, but there seemed to be some confusion over this at first. E.E. Baker, the engineer in charge of the new storage structure no sooner opened the headgates allowing water from the reservoir into the Larimer and Weld Canal when he was forced to lower the gates again because irrigators who had not purchased water diverted it illegally from the canal anyway. A temporary restraining order from the county court stopped these interlopers and many quickly bought shares of Terry Lake's water, driving the price up from \$140 a share to \$500.⁵²

Other irrigation companies in the valley built reservoirs after witnessing the success of Terry Lake. Farmers using water from the Cache la Poudre Canal, formerly Greeley No. 2, surveyed sites for a reservoir in 1891. When they found a site for the Cache la Poudre Reservoir four miles above their canal, stockholders did not unanimously support the project. Some thought it too expensive and others worried there was not enough available water to fill it. Those irrigators who favored the reservoir cut their harvesting short in the late summer of 1892 and helped construct it by loading up their wagons with plows and scrapers and providing "dump wagons" that hauled away excavated material. In July 1893, the first water flowed from the new reservoir, but all was not immediately well. In October, J.W. Yancy went before the company demanding compensation for damage to his crops caused by overflow from the reservoir's outlet

canal. He was given \$40. In 1896, the Cache la Poudre Reservoir Company had accumulated significant attorney's fees because of its involvement in litigation with Water Supply and Storage and Windsor Reservoir Company. By the 1910s, things settled down and the company's annual reports showed a gradual reduction of debt and increased financial stability among stockholders.⁵³

Dozens of reservoirs dotted the plains and foothills of the Cache la Poudre valley by the turn of the century. The *Fort Collins Courier* reported:

Every year witnesses the construction and completion of some of these important adjuncts to successful farming, each adding in a greater or less degree to the extent of the cultivated lands and lessening the danger of loss from water shortage... when the work is done and the reservoir filled with water the farmers under that ditch can bid defiance to drouths [sic].”

By December 1900, Colorado had more reservoirs than any other western state and Hemphill noticed, “nearly all the cultivated land of the [Poudre] valley is supplied to some extent with stored water.” The first decade of the twentieth century featured further reservoir construction. New reservoirs were built and older ones enlarged. Several of the Poudre's tributaries – Coal, Park, Bristol, Indian, Elk Horn, North and South Pine, Zimmerman, Pennock, Fossil, Stonewall, and Sheep creeks – filled reservoirs. Edwin Baker, the engineer who hastily closed the gates to Terry Lake Reservoir on opening day, commented in 1917, “I see on the streets every day men who have become wealthy through the raising of potatoes, a lucrative crop in the valley in the late nineteenth century, wholly due to the water made available by reservoir construction.” Baker also noticed that some of the successful farmers who once opposed reservoirs eventually became wealthy because of them. Once the Poudre's water delivery system consisted of canals, transbasin diversions, and reservoirs, the essential infrastructure was complete; it was then time for irrigators to get creative about using that infrastructure.⁵⁴

Distributing water efficiently through the Poudre's increasingly complex system of canals and reservoirs required cooperation among users as well as innovative thinking. A system of water exchanges worked out among irrigation companies strengthened the success of the water delivery system by allowing a greater amount of water to be used. Water exchanges were a way

of moving water from one place to another and between one user and another without injuring one's water rights or requiring anyone to sell their rights. At the same time, exchanges fulfilled the rights of those involved and maximized the efficiency of the entire system. Exchanges occurred between canal companies, reservoir companies, water districts, and municipalities but all parties involved had to agree on the exchange. Some were negotiated every year and others were long-standing agreements. Water exchanges most likely existed between neighbors and cooperative ditch companies since the beginning of the river's irrigation system in the 1860s and on other Colorado rivers, but the Poudre's exchanges were the first of such a large and complex scale. An exchange could be as simple as one neighbor giving another his portion of ditch water when he did not need it and the neighbor returning the favor at another time. This was a very informal exchange but the concept was the same as that which guided those that took place between cooperative and corporate canal and reservoir companies.⁵⁵

Irrigation companies voluntarily exchanged water with each other through canals and reservoirs, transferring water around the system until all users got their proper share. This moved water in an efficient manner, minimized evaporative and seepage losses in canals when water was carried long distances, and made reservoir construction cheaper because companies utilized natural depressions in the land and saved costs, regardless of whether the reservoir was far away from the company's canals and water users. For example, North Poudre Irrigation Company had the most upstream, headgate on the North Fork of the Poudre but the most junior water rights, meaning water users on all other canals had claimed water first and could legally divert water from the river before North Poudre users. The New Cache la Poudre Irrigation Company, formerly Greeley No. 2, had one of the lowest, or most downstream, headgates but its users had very senior water rights. In order to efficiently use stored water in reservoirs between these companies' canals, a system of exchanges developed in which North Poudre diverted a portion of New Cache's water from the North Fork of the Poudre where North Poudre had a headgate but New Cache did not. North Poudre then released the specified amount of water to the Larimer County Canal, owned by Water Supply and Storage, located below North Poudre's canal and easily filled by North Poudre reservoirs.

Water Supply and Storage ran this water down its Larimer County Canal where it was used by that company's irrigators. The company then released the same amount of water from one of their reservoirs conveniently located near another irrigation company's canal, the Larimer

and Weld Canal. Larimer and Weld Canal Company diverted this water, technically and legally still New Cache's water, through its ditch for use by its irrigators and released the same amount from its Windsor Reservoir to the New Cache la Poudre Canal giving New Cache the same amount of water it was entitled to but which New Cache allowed North Poudre and others to divert and exchange. Why did New Cache and the others go to all this trouble? Because if the company insisted on using its right to the river water and bypassed all other canals and reservoirs, the water would travel down the river several miles to New Cache's headgate, losing water to seepage, vegetation, and evaporation along the way and preventing other ditch companies from using their canals and reservoirs to the fullest extent and being able to provide the maximum amount of water to all users. This allowed irrigators to efficiently use more of the Poudre's water. The exchange system especially let North Poudre Irrigation maximize water use. North Poudre's Fossil Creek Reservoir, built in 1902, was well south of its delivery area but ideally situated to exchange water with several ditch companies holding senior water rights such as New Cache, the Whitney Ditch, and the Ogilvy Ditch.⁵⁶

Exchanges were so important to the efficient use of water in the Poudre valley that legal disputes between irrigation companies did not interfere with them. For example, during the 1895 irrigation season, the New Cache la Poudre Canal experienced widely fluctuating amounts of direct flow from the river - 200 cubic feet per second (cubic feet per second, or c.f.s., is equal to the rate of water passing through a rectangular cross section, one foot wide by one foot deep, flowing at an average velocity of one foot per second) one day and 25 c.f.s. the next. New Cache could not distribute a fair amount of water to its canal users with this fluctuation. The company therefore asked the Larimer and Weld Reservoir Company, proprietor of Windsor Reservoir situated just above the New Cache Canal, to let New Cache water flow through the Larimer and Weld Canal into Windsor Reservoir where it could be drawn off by New Cache in more precise quantities when needed. This was allowed even though these companies were frequently engaged in litigation with each other over stored water rights.⁵⁷

The exchange system was an extraordinary and extralegal arrangement born of cooperation and ingenuity among Cache la Poudre irrigators. Irrigation expert and one time Colorado State Engineer, E.S. Nettleton, claimed the exchange system promoted a "spirit of cooperation" among water users. Robert Hemphill, in his survey of northern Colorado irrigation, remarked, "the exchange has brought about a better understanding between the canal men of the

[Poudre] valley and there is now a tendency to get together and talk over differences before resorting to the law.” The Cache la Poudre’s canals, reservoirs, transbasin diversions, and exchange system garnered national attention in the nineteenth century. It was noted that:

Colorado stands pre-eminent in the extent and high degree of development of agriculture by irrigation. Here what may be termed American methods and devices for diverting and applying water to the fields have grown up, and the success attained has stimulated attempts elsewhere throughout the Western third of the United States. The same relation that Colorado holds to the rest of the arid region is borne by the Cache la Poudre valley to the State of Colorado. It has for many years led in the construction and extension of irrigation systems, and its history may be said to epitomize the record of struggles and successes throughout the State.⁵⁸

The Cache la Poudre was at the forefront of western water development in the nineteenth century in part because of the people who lived near it, diverted water from it, researched it, and wrote about it. Settlers such as John Coy wrestled water away from the Poudre with muscle and perseverance and paved the way for the extensive system that followed. After John Coy claimed the land he showed Emily that winter day in 1863, he built a successful farm, twice served as Larimer County Commissioner, and was a candidate for state senator and for governor of Colorado. Families like the Coys incrementally built the Poudre’s water delivery system and stayed on the land attracting settlers and capital to the region.⁵⁹

Another early and influential Poudre valley resident was Benjamin Harrison Eaton who settled on the river in 1864. Eaton traveled from Iowa to Colorado Territory in 1859, hoping for gold. En route to the mines, he camped one night along the Cache la Poudre and returned to the river after mining and later tenant farming in New Mexico. He had learned a few things about irrigation during his travels and he quickly dug a ditch to water bottomland hay along the Poudre about twelve miles west of the future site of Greeley. From that point on, he spent his life developing irrigation and agriculture along the river and in the state. He helped construct the Union Colony’s Canal No. 2 and others, including Lake Canal and Larimer County No. 2 near Fort Collins, as well as the Larimer and Weld Canal that was eventually almost fifty miles long and capable of carrying the entire flow of the Poudre within its banks - essentially a river unto itself. The immense size of Eaton’s canal alarmed downstream water users and provoked Poudre irrigators, especially those in Greeley, to call for statewide water regulation. Eaton was a local leader who helped set up the Poudre valley’s first school in 1866, the same year he was appointed Justice of the Peace. He became a Weld County Commissioner two years later and

was elected by the residents of Larimer and Weld counties to represent them in the territorial Legislature in 1872. As a legislator he helped implement the state's first water laws. He was elected governor in 1884 and served one term before returning to his home near the Poudre.⁶⁰

The Union Colony's contribution to the development of irrigation in the Poudre valley and the West cannot be overlooked. Colonists built the first large, cooperative canals in the region and a few became influential water administrators in the state as a result of this early experience. B.S. La Grange helped construct Greeley No. 2, designed its first dam on the river, was the first water commissioner on the Cache la Poudre during the 1880s, and later became Colorado State Engineer. La Grange along with J. Max Clark, the Union Colony member who invented the "Max Clark Box," a water-measuring device used along the Poudre and in several western states, and David Boyd, irrigator and author of several histories of the Union Colony and Greeley, represented the Poudre valley in early efforts to establish a state system of water administration. Their opinions were widely respected because of the Union Colony's involvement with the Poudre's early and extensive irrigation system.⁶¹

The Colorado Agricultural College also attracted prominent water specialists, in spite of the fact that locating an agricultural college in the middle of northern Colorado's arid landscape struck some as ludicrous in the 1870s when Fort Collins was chosen as the site. The legislator responsible for casting the deciding vote for the college remarked, "I feel as if it was throwing the money away, for you can never make Colorado an agricultural state. It is only fit for a cow pasture and for mining." Another school official commented,

The affair was looked upon as something in the nature of a burlesque. A school for the promotion of agricultural science and the mechanical arts, located in the Great American Desert with nothing in sight more suggestive of enlightened civilization than dry prairies, dotted with cactus patches, bestrewn with bleaching bones of departed buffalo, and inhabited by prairie dogs, coyotes, and buzzards.

Cache la Poudre irrigators helped prove these critics wrong.⁶²

Elwood Mead introduced the first irrigation engineering program in the United States at the Colorado Agricultural College in Fort Collins in 1884 and went on to an illustrious career in water development in the West. He was assistant State Engineer in Colorado, went on to become Wyoming's State Engineer, headed the U.S. Department of Agriculture's Office of Irrigation Investigations, and finally headed the U.S. Bureau of Reclamation. Professor Louis G. Carpenter of the Colorado Agricultural College was a renowned irrigation authority. Carpenter researched

water throughout Colorado, Wyoming, New Mexico, Africa, France, India, and Italy and wrote extensively about his irrigation studies. He taught irrigation and civil engineering at the Agricultural College beginning in 1888 and went on to direct the Agricultural Experiment Station and establish the American Society of Irrigation Engineers.⁶³

The Agricultural College provided a place to formally study irrigation and complimented the hard work and resourcefulness of Poudre irrigators. From the 1880s onward, the college was a leading institution in the West for water-related matters. The river also served as a working laboratory for the college, a place where instructors and students tested hypotheses, researched, and spread knowledge among Poudre water users. In just one example from 1884, the college established an experiment station on the river at the mouth of Poudre Canyon that recorded flow measurements, the first such measurements taken on any western river. Those involved in irrigation research and development around the West valued these early measurements.⁶⁴

The river was also the site of the first return flow studies in the United States. The first Cache la Poudre water commissioner, B.S. La Grange, believed the water supply of the lower Poudre increased over time because of return flow from irrigated land along the river. To prove it, La Grange and State Engineer E.S. Nettleton measured and charted seepage return in the Poudre in October 1885. They closed all the headgates along the length of the river and stopped all diversions from it. The amount of water flowing at the mouth of the Poudre was recorded and compared to that flowing forty-seven miles away near Greeley. The river's capacity increased by eighty-six c.f.s. from the mouth of the canyon to the Greeley site, a change attributed to return flow from irrigation running over the surface of the land or seeping into the ground through porous soil and flowing subterraneously back to the river.⁶⁵

Certain innovations, such as water exchanges, cannot be associated with any one person but rather with the multitude of irrigators and water developers influenced by the unique happenings on the Cache la Poudre. It is important to remember the notable people who created the Poudre's water delivery system were joined by ordinary farmers and laborers: the men, women, and children who dug the ditches, excavated the tunnels, turned the water onto the fields, and made the whole system work.

Scores of canals and reservoirs snaked away from the river and dotted the plains and mountains of the Poudre basin by the early twentieth century. This system, financed by individuals, cooperative groups, and corporations, supported an economy and society never

before seen in the region. Between 1889 and 1899, irrigated acreage in Larimer County increased 63 percent and Weld County experienced a 102 percent increase. The two counties combined had nearly 400,000 acres of land under irrigation. Farmers in the Poudre valley dreamed of a time when these statistics would reach even larger proportions. A.E. Gipson of Greeley imagined a future in which “water will be conveyed by pipes and conduits or through enclosed channels, and made to do more than quadruple duty by under surface application” and “great flowing wells” would supply farms with endless water. These human visions would one day materialize in the Poudre valley as had so many other ideas involving irrigation; however, further expansion of the physical system required that water users work out a way to divide water on paper.⁶⁶

CHAPTER THREE: Water Law

“The right to appropriate the unappropriated waters of the natural streams of the state for beneficial use in order of priority shall never be denied.” -- Colorado Constitution, 1876

As the nineteenth century progressed, more Americans moved west and along the way encountered unfamiliar environments. Beyond the Mississippi and past the 100th meridian that roughly bisected Kansas, Nebraska, Oklahoma, Texas, and the Dakotas, settlers found grasslands, mountains, and deserts very different from the lush, green terrain of the eastern United States. In order to live and prosper in this dry region, the newcomers used the water supply differently than they had in humid sections of the country. They created elaborate canal and reservoir systems to convey and store water and miners, farmers, legislators, and district courts fashioned water policies out of legal decisions and legislative guidelines in order to distribute the resource to a large number of people.

Each western state crafted water policy that favored its own unique environment, geography, and economy. Westerners wanted to use water in a manner that benefited the most people. Miners in California and Colorado were the first in the West to use water according to a priority, or first come-first served system, rather than a riparian system. Under the riparian doctrine, all landowners along the banks of a river or stream had a right to use that water as long as one did not alter, deplete, or pollute it in a way that adversely affected other users. These rights were tied to land next to the riparian environment and the rights existed whether one used the water or not. This policy worked well in the water-abundant East, as it had in England; however, in the more arid West, riparianism was not practical. Miners sometimes worked at a distance from streams and rivers or required more water than was available from the nearest water source. They diverted water where they needed it and kept track as best they could of who diverted water first, second, and so forth. One historian described the situation:

After a lawless period, the miners, essentially law-abiding people from the eastern and mid-western states, organized ‘mining districts’ to create some semblance of order on the then ungoverned public domain. These de facto governments promulgated rules and adopted customs regulating mining claims, and of equal importance, the right to use water to wash the gold from the gravel in which it was found. They established essentially the same rule for ownership of mining claims and for the right to use water. The discoverer of a mine was protected

against all who tried to jump his claim. The first user of water was protected against later takers. This rule was known as prior appropriation – the law of the first taker.⁶⁷

Miners and the farmers who followed them into Colorado Territory realized that putting water in the hands of riparian landowners would severely limit settlement and economic development in the region. They reasoned that under a priority system more people used water over a larger geographic area for a variety of uses. Nor were the majority of them interested in adopting the more community based acequia system that prevailed in parts of southern Colorado and New Mexico. This communal way of distributing was based on Spanish colonial and Mexican precedents. Water was allocated based on need and equity among all users, rather than priority of use. All water users participated in decisions relating to the acequias, or system of ditches, and helped maintain them. Acequias remained in parts of southern Colorado well past statehood but were increasingly challenged as official state water policy, based on prior appropriation, coalesced.⁶⁸

Colorado was the first state to adopt the doctrine of prior appropriation in its constitution and entirely reject riparianism; consequently, in the late 1870s and 1880s prior appropriation was sometimes referred to as the “Colorado doctrine.” Colorado’s system of prior appropriation was based on the premise that “first in time is first in right.” In other words, the first person or group that diverted - or appropriated - water from a stream had the first “right” to that water, the second to do so had the second right, and so on. In Colorado, water was considered public property and no one *owned* the water flowing in the state’s streams and rivers; rather, when one diverted water and put it to beneficial use that person acquired the right to *use* the water, although these water users were often called water owners. Still, water rights under prior appropriation were a form of property not connected to any particular piece of land. Rights could be sold, traded, or given away provided the change did not adversely affect other users. No one person or government entity could take a water right from a water user without providing just compensation. Users also had to observe a crucial element of prior appropriation - beneficial use. A simple diversion of water from a stream did not result in an automatic water right unless one put the water to some beneficial use. One attorney described beneficial use as the diversion of water for “mining and manufacturing to propel machinery in mills and factories, to irrigate land for the production of crops, and to furnish water to the citizens of a municipality for drinking and other domestic and

useful purposes.” This was sometimes referred to as the “use it or lose it” principle. In theory, beneficial use prevented water users from wasting or hoarding water that would otherwise benefit others. Likewise, a water right could not be abandoned or left unused for an unreasonable amount of time, thus depriving would-be users of water.⁶⁹

Several legislative acts and legal decisions preceded Colorado’s constitutional embrace of prior appropriation. In 1872, a case before the territorial Supreme Court of Colorado entitled *Yunker v. Nichols*, confirmed that a person owning land adjacent to or near a stream had the right to divert water for irrigation over another’s land. In other words, an irrigator could divert water to land away from a stream and getting water to his or her land was considered such a necessity in the western climate that the right to do so preempted the right of private property. This legal ruling left no doubt about the importance of agriculture and irrigation to Colorado’s economy. The *Yunker v. Nichols* decision had precedents in early Colorado territorial statutes. An irrigation statute adopted by the first territorial Legislature in 1859, shortly after Colorado Territory was created from parts of Kansas and Utah, appeared to recognize rights based on priority of claim, including those “remote from streams.” Remote irrigators were permitted to “make the necessary dams, ditches, and other improvements” to secure water and could cross another’s land to do so. These provisions were upheld in an 1861 territorial law entitled “An Act to Protect and Regulate the Irrigation of Lands,” although some riparian rights were also recognized.⁷⁰

Irrigation legislation beginning in 1879 strengthened prior appropriation in Colorado by defining how water users were to go about claiming and using their water rights. An incident on the Cache la Poudre contributed to the need for such specific water legislation. In 1874, an environmental phenomenon – drought – obliged Poudre valley residents to reconsider prior appropriation. A few years before, certain Union Colony members had established the Agricultural Colony at the site of the abandoned military camp, Fort Collins. These settlers, along with others already nearby, constructed large irrigation canals upstream from the older Union Colony canals. The new Fort Collins canals, including the Larimer County Canal No. 2 built in 1872, and Lake Canal built in 1873, depleted the Poudre before it reached the Greeley canal intakes to such an extent that the downstream users received little or no water during times of drought, as was the case in July 1874. As their crops withered and the ditches ran dry, three members of the Union Colony Board of Trustees took a trip to Fort Collins to verify rumors that upstream users were diverting more than their share of water. The *Greeley Tribune* reported that

the trustees not only saw plenty of water running in the Fort Collins' canals, but the Larimer County Canal No. 2 was apparently wasting the precious liquid because only one hundred acres were watered from the ditch in spite of its heavy flow. Union Colony representatives believed they had been swindled.⁷¹

The Union Colony retained an attorney and threatened an injunction against upstream users when the two parties agreed to meet and try to settle the disagreement outside of court. Irrigators traveled the dusty roads of Larimer and Weld counties and converged at the Eaton schoolhouse, halfway between Greeley and Fort Collins. The interior of the small structure provided shade but no relief from the dry, shimmering heat of the plains. The mood was tense. "Hot and unseemly language" ensued as well as a call to arms before cooler heads prevailed. A suggestion was made to appoint a neutral person to divide the water among those who needed it the most, temporarily suspending prior appropriation. This was a stark challenge to the doctrine and a pivotal moment in the history of Colorado water law. In 1874, prior appropriation was widely practiced and strengthened by legal decisions such as *Yunker v. Nichols* but had not yet been declared the law of the land in the state constitution. Union Colony residents bolstered prior appropriation that July day by not agreeing to abandon the doctrine, however temporarily. Fort Collins water users promised to send water towards Greeley to irrigate valuable trees and shrubs in the town. Ironically, this water was not delivered and David Boyd asserted, "violence would have been resorted to but for a timely heavy rain." After this volatile summer, Union Colony residents were determined to enact legislation that not only recognized the legality of prior appropriation but also spelled out the means for distributing and administering their water. They were no longer content with local agreements and legal decisions with no administrative framework to make the system work.⁷²

Some Fort Collins residents initially opposed regulation of appropriative rights, at least until diversions were made on the Poudre that threatened their own water rights. In 1878, delegates from the Poudre valley joined their South Platte neighbors at an irrigation conference in Denver that addressed how to administer water in the state. In that same year, as Cache la Poudre irrigators discussed water policy in Denver, Benjamin Eaton was constructing his Larimer and Weld Canal, expected to be the biggest canal in the state – large enough to carry the Poudre's entire flow. This project was a strong incentive for Fort Collins irrigators to support a greater level of state control to protect their water rights. Convention delegates at the irrigation

conference nominated a committee of five men, including David Boyd of Greeley and John C. Abbott of Fort Collins, to draft legislation outlining how prior appropriation would function in the state and what individuals and institutions would administer the new policies. The group's proposals were incorporated into the Irrigation Acts of 1879 and 1881. Elwood Mead later contended that this innovative legislation resulted from the tension between Fort Collins irrigators and those downstream in Greeley during the drought of 1874. Certainly such disagreements demonstrated the need for guidelines.⁷³

According to the 1879 and 1881 irrigation legislation, water users were required to file their water rights, also called appropriations, with the clerk of the district court where the water was located. This prioritized appropriations from 1859 to 1881 on every river in the state. The courts adjudicated – or, considered the appropriations in formal court proceedings – appropriations made after 1881 on a first come-first served basis. In an adjudication proceeding water users submitted their appropriations to a court. The court then determined whether or not the appropriation was legal and fair in relation to the water available from the river or stream, its intended use, and the rights of other appropriators using the same water source. Courts could order some modifications to the appropriation or accept it as it was and grant it a decree, which made it legal, and assign it a priority number. Appropriations were also published in local newspapers and anyone who objected had two years from publication to ask the district court to review it. District courts investigated and approved the sale of appropriations; previously transfers or sales occurred without any legal oversight. Appropriators wishing to construct or enlarge canals had ninety days after beginning construction to file a map and statement giving the location of the headgate, the legal subdivision of land upon which it was located, the depth, width, and grade of a structure, as well as its carrying capacity with the county clerk and the state. Upon completion of these requirements, the date of appropriation was the date construction commenced on the diversion system, as opposed to the earlier practice of granting an appropriation date according to when water was first applied beneficially to the land. The new regulations differed distinctly from the practices of early appropriators who diverted water from a stream, used it for mining or irrigation purposes, and in this way had a water “right,” however tenuous. Prior to an established state record keeping system, determining the availability of water rights on a stream meant searching various county records and still not having the whole picture since no comprehensive list of claims or even canals existed. In

addition to giving the courts a pivotal role determining water rights, the irrigation acts of 1879 and 1881 made Colorado the first state to create water districts and the office of State Engineer.⁷⁴

The State Engineer measures and keeps records of the locations of all the state's rivers, streams, canals, and reservoirs, approves plans for and consults on the construction of reservoirs with a capacity of more than seventy-five million cubic feet, or with dams and embankments higher than ten feet, and oversees district water commissioners. Water commissioners supervise the distribution of water to users. Commissioners consult the state's list of priority numbers when determining who is eligible to receive water on a given day. When a river's flow is heavy, all users receive their share; when supply is low, only those with early priority numbers see water flow into their ditches and fields. When an irrigator on the Poudre believes another appropriator is diverting water out of turn, he or she notifies the water commissioner who checks records and remedies the situation by ordering the unauthorized appropriators to close their headgates. Commissioners monitor the daily flow of the state's streams and rivers and maintain records of all water diversions that take place on a river or section of river. Good water commissioners act in the best interests of all water users and encourage them to work together to allow the greatest number of them access to the maximum amount of water. If a junior appropriator's crops dry up, a commissioner might persuade senior users not in immediate need of water to relinquish it to those who need it more. A commissioner's impartiality encourages cooperation and benefits the entire system. The Poudre's water commissioner works closely with ditch companies and irrigators when facilitating water exchanges which do not strictly adhere to prior appropriation but are possible because of commissioners who diligently and neutrally monitor the complicated diversions. The practice of exchanging water also demonstrates a certain degree of flexibility in Colorado's water policy.⁷⁵

Colorado's constitution and the 1879 and 1881 irrigation legislation created greater organization and accuracy for those administering and using water, although water policy was in no way complete. Subsequent legislation created new layers of institutional control over the resource at the state and local levels. Legislation also addressed maintenance and conservation issues. Ditch owners were required to keep canals in good condition and prevent damage to surrounding property. Anyone polluting a ditch was subject to a fine. Headgates were mandated and made measuring water easier and use more efficient. Litigation clarified other issues. Six years after the state constitution declared prior appropriation the law of Colorado and significant

legislation governed water use, some still challenged the state's water policy in court. In a case entitled *Coffin v. Left Hand Ditch*, Mr. Coffin owned land adjacent to the St. Vrain River near Longmont and irrigated directly from that river. Owners of the Left Hand Ditch, meanwhile, diverted water from the St. Vrain to Left Hand Creek, before using the water. The Left Hand Ditch Company claimed appropriated rights and Coffin claimed riparian rights. In the dry year of 1879 there was not enough water for both claimants and drought again challenged the priority doctrine as it had in 1874 on the Poudre. The dry conditions drove Mr. Coffin to demolish Left Hand Ditch Company's diversion dam which shunted water into their ditch and invoke his riparian rights over the company's appropriated rights (Coffin claimed some appropriated rights but apparently none early enough to challenge the ditch company's). The Left Hand Ditch Company sued and the Colorado Supreme Court ruled in their favor in 1882, confirming prior appropriation as the foundation of Colorado water policy, and supporting the idea of transferring water out of its original basin. The court noted the practicality of prior appropriation and its contribution to agriculture and the state's economy:

Water [in the various streams of Colorado] acquires a value unknown in moister climates. Instead of being a mere incident to the soil, it rises, when appropriated, to the dignity of a distinct usufructuary estate, or right of property. It has always been the policy of the national as well as the territorial and state governments, to encourage the diversion and use of water in this country for agriculture; and vast expenditures of time and money have been made in reclaiming and fertilizing by irrigation portions of our unproductive territory.... Deny the doctrine of priority or superiority of right by priority of appropriation, and a great part of the value of all this property is destroyed.

The growing importance of agriculture and the influx of new irrigators dependent upon prior appropriation to guarantee them a water supply meant Coloradoans would not flirt with riparianism again.⁷⁶

Cache la Poudre irrigators helped shape Colorado water law through their involvement in legal disputes. According to David Boyd,

In the same way that Colorado has led in improvements in [western water] legislation have the citizens of Greeley and vicinity been the leaders in Colorado. First to experience the necessities, they have been at the front in urging needed reforms, and in these they have been notably successful.

A few of the Colorado court cases involving Cache la Poudre water users, some of which helped establish important legal precedents, include *Wyatt v. Larimer and Weld Irrigation Company*,

1892, and *New Cache la Poudre Irrigation Company v. Water Supply and Storage*, 1902. Both dealt with changing a canal's point of diversion from the river. In the latter case, the Colorado Supreme Court affirmed that changing a diversion point was valid as long as it did not injure the rights of other water users and that those users were notified of the potential change before it occurred. *Water Supply and Storage Company v. Larimer and Weld Irrigation, et al.* and *New Mercer Ditch Company v. Armstrong* addressed beneficial use and the abandonment of a water right. In 1895, the Colorado Supreme Court stated in the New Mercer case:

The policy of our law is to enforce an economical use of the waters of our natural streams. They are the property of the people, subject to appropriation, for beneficial use.... One may not, as against subsequent appropriators, divert, and indefinitely, or for an unreasonable length of time, hold water for purposes of mere speculation and make no beneficial use of it, while so holding; nor may he divert more than he needs for the purpose of which the diversion was made.⁷⁷

Legal conflict was not limited to canals. Cache la Poudre irrigators built the first extensive reservoir network in the state and were leaders in adapting water law to regulate reservoirs beginning in the 1880s. In some ways, reservoir law resembled canal policy. Those constructing reservoirs filed court records with basic information including the source of the reservoir's supply, the date construction began, and its capacity in cubic feet. Reservoir owners were also legally required to build safe structures. In 1891, John Zimmerman filed suit against the Larimer County Ditch Company (later Water Supply and Storage) after the collapse of that company's Chambers Lake dam. The Colorado Court of Appeals cited legislation enacted by the state that held reservoir owners responsible for damages to property owners resulting from leakage, overflow, or flooding from their structures. The court recognized that "The damming and retaining of large bodies of water at elevations sufficiently great to allow the water to be used for purposes of irrigation, is at all times a danger and continual menace to lower proprietors on the course of the stream through which the water would find its natural outlet." Owners were financially responsible in order to ensure that they built sound structures that did not threaten property or life.⁷⁸

Other cases involved competition between reservoir companies. In 1868, the Colorado Milling and Elevator Company built a ditch that diverted sixty cubic feet per second of water from the Poudre to power their mill. They discharged the same water, undiminished in quality or quantity, back into the river after it was used in the operation of the mill. In 1881, Water Supply

and Storage constructed a ditch upstream from the mill company's headgate for irrigation and storage. In 1892, the Cache la Poudre Reservoir Company built a ditch below the point where the milling company discharged its sixty c.f.s., took this water, and stored it in their reservoir. Then, in the winter of 1893, Water Supply and Storage decided to divert the sixty c.f.s. of mill water into their reservoir when the mill was closed and not using their share. This diversion deprived the downstream reservoir company of the water it used for storage after the milling company used it for power. The two companies each asserted they were the prior appropriator of the mill's water once the mill finished with it. Water Supply claimed that since its ditch existed since 1881, it was entitled to divert winter storage water to its reservoir when all senior appropriators on the river, including the mill, were receiving their full share of water or declined to use their share. Counsel for Water Supply argued "The moment that a claim of water ceases to be exercised, partially or totally, the water in the river from the source to its mouth is relieved to that extent of any legal right in the claimant, and it is, as to succeeding claimants, unappropriated water." Water Supply's mistake was in not being able to prove that it diverted and used the water before Cache la Poudre Reservoir Company built their ditch in 1892 and was legally decreed the sixty c.f.s. of water that was once used by the mill. The state Supreme Court found that the Cache la Poudre Reservoir Company was first to appropriate and use the sixty c.f.s. of water for winter storage. Chief Justice Campbell stated: "an appropriation can be made only by an actual diversion of water followed by an application thereof, within a reasonable time, to a beneficial use. The fact, therefore, that the defendant water company [Water Supply and Storage], from 1882 to 1892, and during the winter seasons of these years, neither diverted water nor beneficially applied it until after the plaintiff [Cache la Poudre Reservoir Company] made its diversion in 1892, makes the former the junior appropriator, and the later the senior."⁷⁹

In a case involving Terry Lake in the early 1890s, the farmers under contract with the reservoir company ran into trouble when the owner of the canal they had arranged to carry water from the reservoir to their land suddenly reneged. A judge determined that a canal is a public carrier and if a canal already existed and had "the capacity and proper location" to carry the water of those other than the owners of a canal," that canal must carry the water and "prevent burdening the real estate" with parallel structures.⁸⁰

In addition to helping pioneer water law for canals and reservoirs, Cache la Poudre irrigators participated in interstate water policy. Colorado was embroiled in several interstate

water disputes in the early twentieth century as several major rivers, including the Colorado, South Platte, Arkansas, and Rio Grande, originated in the state. Water flowing in the rivers of Colorado did not stay within the state's borders and downstream users sometimes took issue with Colorado's water policy. In *Kansas v. Colorado*,⁸¹ Colorado contended it was "justified...in consuming for beneficial purposes all the water within her boundaries; and that as the sources of the Arkansas River are in Colorado, she may absolutely and wholly deprive Kansas and its citizens of any use of or share in the waters of the river." Kansas, for its part, pushed forward with the suit and maintained the position of a prior appropriator since Kansas Territory was created in 1854 and had originally included what later became Colorado Territory. The United States Supreme Court intervened, as it does with interstate issues, and ruled in 1907 that "no state may claim the exclusive right to the use of all the waters within its boundaries; that there must be an equitable division or apportionment of the benefits of an interstate stream between the states affected." Colorado was not entitled to the entire flow of rivers just because they originated in her mountains.⁸¹

Cache la Poudre water users were involved in *Wyoming v. Colorado* in which the state of Wyoming filed suit against Colorado over the attempted diversion of Laramie River water via the Laramie-Poudre Tunnel. Wyoming water users claimed as theirs the water diverted from the Laramie River into the Cache la Poudre via the tunnel. Similar to the Kansas case, Colorado maintained the right to water forming within its boundaries, as the Laramie's headwaters did, in spite of downstream prior appropriators. The United States Supreme Court ruled in June 1922 that appropriative rights belonged to those who first claimed the water and put it to beneficial use, regardless of where that water originated. The court rejected Colorado's 1902 priority date for the tunnel and placed it at 1909 when construction commenced. This gave it a priority date behind several Wyoming water users. Colorado was allowed 15,500 acre-feet a year from the Laramie River based on what the court determined were its legitimate, appropriated rights. This was not nearly as much water as Poudre water users had anticipated, nor as much as the tunnel could accommodate.⁸²

Legal conflicts concerning water use, whether interstate or local, confirmed the difficulty of dividing water fairly and accurately and conforming it to man-made boundaries such as state lines. This problem was exacerbated by water scarcity, which was at the heart of the legal and legislative battles that took place over water in Colorado and elsewhere in the West. Prior

appropriation was a crucial element in western development that allowed miners, farmers, municipalities, and industries to use the limited water supply over a greater geographic area than was possible under a riparian system. But the doctrine was not foolproof. Problems were inevitable because prior appropriation was a regimented system applied to a fluctuating resource, incapable of complete regulation. In 1902 one observer of western law noted,

The laws regulating or attempting to regulate the water feature of the arid west are in a most degraded, chaotic state.... Lawsuits and family difficulties caused by loose laws on the subject are three times more than from theft, divorce, murder and the corruption of other property interests combined.

Part of the problem stemmed from the fact that water policies emerged on an as-needed basis. F.H. Newell, the first director of the Bureau of Reclamation, remarked: “The Colorado laws regarding irrigation have grown much as has the ditch system, by adding here and there, and as a result they are far from perfect, although better than those of many of the other irrigating states.” When guidelines were enacted they were not always effective. For example, although the State Engineer’s records listed the duty of one cubic foot of water per second as sufficient to irrigate between eighty and one hundred acres, one cubic foot of water per second might be decreed on as little as two acres. This amounted to an excess of nearly fifty times the water actually needed. Instead of ceding the extra water back to the state so others could use it, the decree holder could sell or lease the surplus water or enlarge his or her canal to accommodate it if the water could be used beneficially.⁸³

Such problems, in part, stemmed from a lack of knowledge about water in the nineteenth century. Lawyers, judges, and irrigators were hardly experts in hydrology, nor did they have the time or money to analyze stream flow data, determine how much water was needed to raise crops in different soils, or monitor how much water was actually used in contested areas. Courts relied on the testimony of irrigators and investors. Elwood Mead noted,

In many cases...litigation is the first experience of farmers with courts, and of attorneys and judges with irrigation. Practical and technical acquaintance with the subject has no assured influence, and often ignorance and inexperience have controlled.

Sometimes irrigators could not resist giving themselves the benefit of the doubt or exaggerating their circumstances when adjudicating rights.⁸⁴

Conflicts over water use, although ubiquitous, were not the only option. Despite the criticism and litigation that surrounded water policy in Colorado, cooperation transpired among those dealing with the erratic, illusive flow of the Cache la Poudre and other rivers. Prior appropriation was a popular policy and cooperative efforts made it work. Just as collective efforts were needed to build a successful water delivery system, cooperation was essential to administer and divide water according to the law. Cooperation, rather than the courts, sometimes alleviated conflict, as was the case at the 1874 Eaton schoolhouse meeting where locals worked out a compromise on their own, with some help from the weather. Four years later many of the same farmers attended the 1878 conference on irrigation and elected delegates from their ranks to draft legislation that led to the 1879 and 1881 irrigation acts.

One settler claimed the spirit of cooperation was in the very air of the arid region and it was what “every sentient person from the East feels immediately he strikes the West.” Some irrigators felt prior appropriation was a natural part of a democratic society and more egalitarian than riparianism because it abandoned “the aristocracy of privilege conferred by the common law on riparian proprietors.” In 1904, William Russell Thomas, professor of constitutional history and irrigation law at Colorado Agricultural College in Fort Collins, wrote that the existence of complicated irrigation systems such as the Poudre’s “may be cited as an illustration of the traditional capacity of the American people to work out fairly equitable methods, even in the face of defective, if not at times vicious, legislation.” Prior appropriation enables water users to transfer water to new uses – agricultural to industrial, industrial to recreational – as society’s needs changed. No one water user is favored over another as long as their water use is considered beneficial to the public.⁸⁵

Prior appropriation facilitated the wide spread use of water in the West and propelled agriculture to the forefront of many western economies, including the state of Colorado’s. As the West became more populated and demand for irrigation water intensified, politicians championed the procurement and management of new water sources in their states and brought the issue of irrigation before the nation. Irrigation advocate and attorney C.S. Kinney wrote after the turn of the century, “Instead of a narrow sectional question, irrigation is becoming more and more each year a broad national problem.” Changes in the nation’s political scene coincided with western appeals for federal aid to develop new water. Reform and conservation-oriented

politicians supported government intervention in various areas of American life, including water reclamation and administration.⁸⁶

CHAPTER FOUR: The Working Poudre

“Agriculture is the foundation upon which the superstructure of all other interests rests. It forms the very basis of society and gives it that stability which is the keystone of prosperity. Without agriculture as one of the principal industries of the commonwealth, its population must necessarily be fluctuating and unstable.”⁸⁷

-- Ansel Watrous, History of Larimer County, 1911

The Jeffersonian ideal of the small, independent farmer still resonated with the American public in the first half of the twentieth century. In response to the rapid industrialization that changed the society, economy, and landscape, some longed for a seemingly simple, agrarian existence. Americans moving west in pursuit of such a lifestyle encountered a region very different from the sparsely settled, sagebrush-covered expanse that John and Emily Coy discovered. Newcomers to the Poudre valley after 1900 found towns, farms, railroads, roads, and a well developed water delivery system along the river. Canals and reservoirs diverted and stored the Poudre's water; irrigation methods were established; transbasin water augmented the river's flow; the exchange system made water use more efficient; state water administrators studied the Poudre's flow and walked its banks to make sure the complicated system ran as smoothly as possible; and legal and legislative guidelines assured that those willing to expend their time, labor, and capital to establish farms would have access to legally decreed shares of water.

An agricultural boom in the first two decades of the twentieth century increased demand for irrigated acreage along the Poudre, made agriculture the largest contributing sector to Colorado's economy, and spurred the creation of new technology that made western water use more efficient and accurate. But, there was still a need for more water, especially by the drought-plagued 1930s. Poudre water users, motivated by this ecological disaster, now sought federal assistance. This took the form of a reclamation project that necessitated new legislation and special agencies to administer the additional water and integrate it with the existing Cache la Poudre system. The changes in this era were sweeping and demanded cooperation and vision from Poudre valley irrigators.⁸⁸

Unease over industrialization and the copious changes in American culture in the late nineteenth and early twentieth centuries coincided with historian Frederick Jackson Turner's theory that the "frontier," a definitive element of American life, had ended. Turner read a bulletin written by the Superintendent of the Census for 1890 which included this passage: "Up to and including 1880 the country had a frontier of settlement, but at present the unsettled area has been so broken into by isolated bodies of settlement that there can hardly be said to be a frontier line." In response Turner wrote,

This brief official statement marks the closing of a great historic movement. Up to our own day American history has been in a large degree the history of the colonization of the Great West. The existence of an area of free land, its continuous recession, and the advance of American settlement westward, explain American development.⁸⁹

Despite the simplicity and inaccuracies of Turner's observation, most glaringly that he failed to consider that the area he deemed an unsettled "frontier" was actually inhabited by numerous native peoples and he presented an east to west model of American development that discounted other areas of European exploration and settlement such as the Spanish in the southwest, he wrote at a time when the country reeled from the worst economic crisis in its history, immigrants poured into the country, labor strife erupted from coast to coast, and environmental destruction broke over the national consciousness like a wave. The western frontier, which Americans considered a land of new beginnings, was disappearing. Natural resources such as timber, coal, and water fuelled the country's industrialization and the destruction was writ large upon the landscape of the West and the polluted cities of the East. Within this context, Americans entered the twentieth century in a state of great anxiety. Conflicted over this new world, they wondered how to slow the changes or where to go to escape them. Some, calling themselves "progressives," sought to rectify political, social, economic, and ecological abuses. They opposed government and corporate corruption and pursued ways to halt the give away of public land and resources to business interests. As a result, railroad rate regulation, banking and industry laws, forest protection, and national irrigation projects were among the reforms progressives supported.⁹⁰

Preceding and overlapping the progressive movement was a conservation movement that developed before the Civil War and manifested itself in various ways in the latter half of the nineteenth century. In the 1850s, popular literature such as Thoreau's *Walden; or, Life in the Woods*, romanticized rural living and the preservation and enjoyment of nature. In 1858, Frederick Law Olmsted developed New York's Central Park, the first park in a large American city, as a refuge from urbanization. In 1864, Congress set aside the Yosemite valley as a public park for the state of California. By the 1890s, both conservationists and progressives were concerned about the nation's forests and water and saw the health of each related to the other. Westerners recognized the importance of forests in protecting watersheds from flooding and erosion. Colorado farmers implored the Legislature to enact laws maintaining healthy forests as a means of protecting irrigated agriculture as early as 1885. Ansel Watrous, Fort Collins resident and author of the *History of Larimer County* in 1911, criticized the destruction of forests and proclaimed: "No one act of the federal government is more largely in the interest of agriculture and irrigation than the establishment of forest reservations about the sources of great rivers." In 1897, the Forest Management Act established forest reserves (later National Forests) that protected large, forested tracts of land from private landowners but granted some access to mining, timber, and grazing industries.⁹¹

Despite the conservationists' accomplishments, some Americans were hostile to the movement. They believed efforts to protect parts of the western public domain and natural resources favored the federal government or eastern business interests at the expense of private citizens. There was a vocal anti-conservation movement in Colorado that propelled powerful politicians to Washington, such as congressmen John Shafroth, Edward Taylor and Senator Henry Teller. Nonetheless, development and utilization of natural resources continued in the West with a new emphasis on efficiency, management, and federal involvement to counter private, speculative investors; in other words, with progressive overtones. Irrigation was an endeavor well suited to progressive thinking. The scientific and measured application of irrigation water encouraged efficiency, an important tenet of progressivism and of practical importance in light of the population influx. Irrigation was an efficient way to farm when natural conditions were right. Dry soil allowed farmers to till the land better, controlled applications of water fostered deeper root growth and produced hardier plants, water was applied strategically

when the plants needed it most to produce the highest yields, and harvesting usually took place in favorable weather, reducing the possibility of damage to a crop.⁹²

The federal government was involved in the nation's water policy before the progressive era. In the mid-nineteenth century, Congress authorized the Army Corps of Engineers to protect the navigability of the nation's waters. By the beginning of the twentieth century, the Corps was in charge of bridges, wharves, piers, harbors, and channels as well as some water diversions. The United States enacted the Desert Land Act in 1877 giving western states the right to control water on public lands, recognized the right of prior appropriation on those lands, and appeared to sever water from the public domain. The Desert Land Act made it possible for settlers to purchase up to 640 acres of arid land from the federal government for twenty-five cents an acre if they reclaimed it through irrigation within three years. The act gave settlers the right to appropriate all available, non-navigable water on the public domain at no cost. Desert lands were declared to be "all lands exclusive of timber lands and mineral lands which will not, without irrigation, produce some agricultural crop." In 1894, the Carey Act gave western states the right to receive up to one million acres of "desert land," as defined by the Desert Land Act, from the public domain if the state irrigated and settled such land. These federal policies met with limited success but set a precedent for federal involvement in western water.⁹³

Coloradoans were aware of the increased federal involvement in water policy; some requested federal assistance as early as the 1860s. An editorial in the *Rocky Mountain News* in December 1864 called for "Congress to enact some law general in its provisions, to provide means for the irrigation of agricultural lands in the western states and territories." In the 1870s, Colorado Governor John Routt believed federal help was necessary to build canals and reservoirs that were of "too large a scale" and "too great to be undertaken by the state." Routt declared in a speech before the state Legislature: "Why should not we, with our vast, unproductive plains, ask the government to assist us?" In 1885, the *Rocky Mountain News* claimed:

Irrigation is the gospel of the West and it must be preached to Congress and the country until words of wisdom bear fruits in deeds of worth.... The plains must be watered, but the undertaking is too vast for private enterprise; it must be done by aggregated capital or not at all. Directly or indirectly, it must be done by the government.⁹⁴

Irrigation was so important to the western economy that even anti-conservationist western politicians lobbied for federal water programs for their states. In 1888, Colorado

Senators William Morris Stewart and Henry M. Teller proposed legislation, which Congress later approved, for a survey of available western water and potential storage sites. Westerners' relationship with the federal government was always complicated. Those who settled in the region often went looking for wealth and independence; however, from the early days, achieving success in the region depended upon government largess. The U.S. Army removed native peoples to reservations, the U.S. Geological Survey explored and mapped the area, and the General Land Office mapped and sold land. Eastern capital flowed into and developed the West, largely due to generous mining, timber, land, and railroad laws. Given this history, it was not unusual for westerners to ask for federal help acquiring, moving, and storing water when it was deemed too expensive for private investors to do so. Managed water systems were needed in the West, no matter who paid for them. Before federal intervention ramped up, Colorado briefly initiated state water projects. From 1888 to 1903, the state Legislature planned to build canals and reservoirs using convict labor. Only five reservoirs were built, however, before the state got out of the reclamation business, apparently facing the same financial and environmental problems that hindered early Poudre valley irrigators.⁹⁵

Western appeals for federal aid were partly born of progressive thinking, but also came with the realization that irrigation was the key to success and development of the region, and it was increasingly difficult for private entities to pay for irrigation structures once they had tapped the easy to reach water. In addition, droughts in the 1890s rattled westerners and made federal water development that much more appealing. William E. Smythe was a newspaper reporter in Nebraska who saw first-hand how quickly nature destroyed the dreams of settlers who staked claims during wet years. Smythe believed the federal government could help settlers overcome nature. In 1899 he wrote the popular book, *The Conquest of Arid America*, in which he encouraged westerners "under the leadership of the paternal Nation" to "grapple with the desert, translate its gray barrenness into green fields and gardens, banish its silence with the laughter of children." Smythe was convinced that more water storage facilities were needed in the West and that federal reclamation of arid land would achieve what private financing could not:

When Uncle Sam puts his hand to a task, we know it will be done. Not even the hysteria of hard times can frighten him away from the work. When he waves his hand toward the desert and says, 'Let there be water!' we know that the stream will obey his command.

According to Smythe and others, national irrigation policies would provide stability and security in the arid region. This was a romanticized view of life in the West and the federal government's ability to help; nonetheless, it struck a cord with Americans partly because of the social and economic upheavals of the period.⁹⁶

Successfully irrigated areas such as the Cache la Poudre River valley, transformed from tawny grasslands to fertile, productive farms over the course of a few generations, inspired settlers and politicians alike to seek more irrigation systems. A series of irrigation conferences began in the West in 1891. At the Irrigation Congress held in Denver in 1894, state delegates urged the "creation of a national commission to devise plans for the reclamation of arid lands." This proposal was refined in subsequent meetings throughout the 1890s. By 1900, the national Republican and Democratic parties advocated the reclamation of arid lands in their party platforms. In January 1901, Representative Francis G. Newlands of Nevada introduced a series of bills that coalesced into the "Newlands bill," which became the Newlands Irrigation Act and created the United States Reclamation Service on July 17, 1902 (changed to the Bureau of Reclamation in 1923). Theodore Roosevelt, owner of a cattle ranch in the Dakotas in the 1880s, signed the Newlands Act into law. Federal water policy in the West entered a new era.⁹⁷

Land speculators, railroads, and eastern corporations looking for new markets supported federal reclamation legislation. But, some congressmen worried the program was vulnerable to fraud and abuse and others still resented the intrusion of the government. In the end these doubters did not prevail in the face of those who, in the words of one historian, "With the heroic example of an expansionary past behind them and with a new century beckoning them on... [were] not ready just yet to stop filling up the West." Whatever the motives of those who championed it, enthusiasm for federal irrigation was catching.⁹⁸

The small, independent farmers the country held so dear believed the Bureau of Reclamation was created for them. One author in *Irrigation Age*, a magazine conceived and edited by William Smythe, declared:

The inauguration of national irrigation means that every family in the United States who wants a home upon the soil may have one.... It means the restoration of those automatic social conditions which in past generations relieved the pressure of population upon the old centers and constantly extended the frontiers of civilization toward the North, the South and the West.... We stand upon the threshold of another great colonization movement made possible by the glorious fact of national irrigation.

Progressives advocating reclamation envisioned families fleeing crowded tenements and broadening their horizons in the open spaces of the West. It was not uncommon for people to write poems and songs about irrigation and federal reclamation, or the lack of it. J. Laidlaw submitted a poem entitled “Inspiration” to *Irrigation Age*:

My fields of grain I drove across
To figure out my gain or loss –
But all around it seemed I heard,
Said to my soul this curious word – “Irrigate.”

I trod my dusty corn fields thro’
And picked the ears so small and few,
But every nubbin I let fly
Seemed in my dust-filled ear to cry – irrigate!

My half starved bairns so thinly clad,
My worn out wife so pale and sad,
My ragged clothes – my courage gone –
My shabby home, all seemed to moan – irrigate!⁹⁹

Despite the enthusiasm that greeted federal reclamation, Cache la Poudre irrigators did not immediately see a need for a Bureau of Reclamation project in their area. The first two decades of the twentieth century were remarkably wet years on the northern Front Range. Agricultural products commanded high prices as the nation’s population increased and the United States immersed itself in global markets, especially exporting to Europeans during World War I. Farmers all over the country profited from these events, but the Great Plains and the West truly benefited as agricultural success swelled the population and fueled the economy. Approximately one third of the plains, including land in Colorado, was mortgaged and plowed during this period. In Colorado between 1900 and 1910 reservoir and ditch construction continued and irrigated agriculture increased correspondingly. Thousands of acres of fertile and sub-marginal land were cultivated. Wheat and other cash crops replaced native grasses. Farmers on the plains who lacked an adequate water supply practiced “dry farming” methods. But, whether they irrigated or not, farmers planted as much as possible and took advantage of the good times.¹⁰⁰

In 1909, Professor H.M. Cottrell of the Colorado Agricultural College in Fort Collins announced the need for more farmers in Colorado to produce agricultural products locally. Cottrell called for 30,000 new farms. In 1900, the U.S. Census reported 24,700 farms in Colorado, by 1910 there were 46,170 farms and in 1920 there were almost 60,000. Cities, industries, and speculators enticed settlers with visions of opportunity, independence, and success. A 1911 promotional booklet for the Cache la Poudre valley proclaimed:

Here irrigated land is obtainable in a new and coming empire. Forty to eighty acres of irrigated land is sufficient for a farm. These lands are within easy access of markets and centers of population. They are but an addition to the Poudre Valley, where irrigation upon a large scale in the arid west had its inception, where it has reached the acme of its perfection, and where the abundance of its harvest has earned the world's renown. Opportunity knocks but once at every gate. Now is the time and this is the place for energy and ambition to lay the foundations of a home and fortune.

F.C. Grable, another booster and landowner in Larimer County, rejoiced: "The king on his throne lives in poverty of riches compared to the king of the soil on his little farm in the far famed valley of the Cache la Poudre." Those who responded to these tempting solicitations to settle and farm in the valley were not immediately disappointed.¹⁰¹

The climate in Colorado and on the plains during this period favored irrigated agriculture. Droughts receded into memory, rivers ran full and swift, and water rights were fulfilled. Some of those eager to cash in on the wealth of water developed sloppy farming practices. An agriculturalist for the U.S. Bureau of Plant Industry writing about western irrigation in 1910 remarked,

There are altogether too few irrigated regions in this country at the present time where any attempt is made toward the use of crop rotations with a view to keeping up the productive capacity of the soil. There appears to be a widespread impression that the fertility of irrigated lands is inexhaustible.

There was also a tendency towards "intensive and specialized crop production," usually for higher profit, which exhausted the soil and encouraged pests and plant disease. But few paid attention to these warnings as agriculture fuelled local economies.¹⁰²

In 1899 Colorado exceeded California as the state with the largest area of irrigated land and it held that distinction until 1919 when California again claimed the title. In the Cache la

Poudre valley, irrigated agriculture made Greeley a prosperous and confident city. The Greeley-Poudre Irrigation District reported:

Weld County without irrigation can do but little in agriculture; with it she produces from her present territory over \$5 million worth of potatoes annually... and its three sugar factories put out each year as much beet sugar as any county in the United States.

A *Greeley Tribune* editorial contended the system of ditches and reservoirs not only contributed to Greeley and Weld County's growth and prestige, "but also the institutions and the character of the population. [Additionally,] information gained near here on the development and application of water has been scattered to the four corners of the globe." By the early twentieth century the potential of a river like the Cache la Poudre was remarkable because of the efficient water delivery system that enabled a plethora of farmers to live and prosper in its vicinity. A participant at the Irrigation Congress in 1911 described the Cache la Poudre in the following way:

An observing passenger riding from Denver to Cheyenne on the Denver Pacific railroad would notice about one mile north of the city of Greeley, an insignificant looking little stream scarcely entitled to be dignified by the name of a river, approximately 100 feet wide from bank to bank...and carrying eleven months in the year something like twenty five cubic feet of water per second.... If the said observing passenger was informed that this modest little mountain stream... supplies the water which makes possible the growing of crops annually which support a population of 50,000, the observing passenger would think it a Colorado yarn.¹⁰³

Favorable weather, a booming population, and an established water delivery system advanced irrigated agriculture along the Poudre. The sugar beet became one of the most important crops irrigated with Poudre water in this period and beet production enhanced the area's economy. Beets were first grown in Colorado in the 1860s. In northern Colorado, the state Agricultural College grew experimental sugar beet crops beginning with the opening of the school in 1879 and the Colorado Agricultural Experiment Station began experimenting with sugar beets in 1888. The soil and sunny climate near the Cache la Poudre were favorable to the beets and produced a high sugar content. Beet by-products also supported other agricultural industries in the Poudre valley such as lamb and cattle fattening and dairy farming. The sugar beet industry was such a success that by 1926 A.T. Steinel, author of the influential report, *The History of Agriculture in Colorado*, commented, "All the gold and silver that has ever been taken

from the mountains of Colorado, or that still may be waiting the touch of the pick and drill, cannot compare in value to the wealth already produced in twenty-five years by the beet crop.”¹⁰⁴

Between 1899 and 1907 sixteen sugar beet factories were constructed in Colorado, including locations in Windsor, Eaton, Greeley, and Fort Collins, all eventually owned by the Great Western Sugar Company. By 1909, a decade after construction of the first plant in Grand Junction, sugar beets production in Colorado was valued at over \$6 million. Colorado farmers grew nearly sixty percent of the irrigated acreage of beets in the United States - four times more acreage than the next closest beet producing state. More than seventy percent of the beets were grown along the South Platte and its tributaries, including the Poudre, with Weld County leading the state in beet production. A Greeley irrigator explained why sugar beets were crucial to Weld County’s economy: “Sugar was not as volatile as potatoes [another profitable crop]. It was a stable commodity and that made stable credit. With potatoes, one year you would get good prices and the next year you might not, it was tougher for a bank to finance.” The sugar beet was a valuable economic commodity for Poudre irrigators but it also generated social change.¹⁰⁵

Harvesting sugar beets required intensive hand labor throughout the summer and early fall, primarily because the beet produced multiple seeds, which developed into shoots. All but the hardiest of shoots were removed by hand, which allowed the strongest, single plant to grow with sufficient space. Various ethnic groups harvested beets in the Poudre valley, including German-Russians, Hispanics, and Japanese. Germans from Russia were knowledgeable laborers because of their prior experience cultivating beets in Russia and on the Great Plains. Hispanics from southern Colorado, New Mexico, and Mexico overlapped and replaced this group as German-Russians eventually bought land and farmed for themselves. Sugar beet factories sometimes recruited Hispanics by offering transportation to the northern fields and housing for the growing season. During labor shortages caused by World War I, the Bureau of Immigration negotiated with Hispanics to work in Colorado beet fields under government contracts. Seasonal harvesting of beets in the Cache la Poudre valley also depended on the myriad transient workers who traveled the West and included all ethnic groups. In the late 1930s, the Writers’ Program of the Works Projects Administration in Colorado noted that on the streets of Greeley,

Farmers and their hired hands, descendents of English, Scottish and Irish settlers, together with many German-Russians and Spanish-Americans, gather along the broad streets and talk in a common lingo of the run of irrigation water, the growth of sugar beets and potatoes, and the progress of lamb feeding.

The expanding agricultural economy that flourished because of Poudre River water and the region's particular soil and climate diversified the area's society.¹⁰⁶

In addition to hand labor, sugar beets had physical needs that changed the Poudre valley landscape. Because the beets did not survive long after harvesting, processing factories and railroads were built nearby. Sugar beet factories encouraged farm owners to build adequate housing for beet workers to ensure a stable labor force. Factory workers lived in Fort Collins and Greeley and carved out working class areas with small, plain houses. Some housing in enclaves such as the Buckingham, Alta Vista, and Andersonville neighborhoods near Fort Collins were built expressly for sugar beet workers and used adobe as a building material. By the 1950s new mechanical harvesters and thinners, a hybrid, single-seeded beet that reduced the need for hand thinning, and a decline in the sugar beet industry reduced the need for hand labor in the fields. But the Poudre River community was forever changed by the introduction of sugar beets.¹⁰⁷

Prosperous boom periods never last in the American West and after World War I the agricultural boom that had done so much to change the environment and life along the Poudre came to an end. Drought, along with the contraction of world markets and over-extended credit, caught up with many farmers. Between 1920 and 1930, the net farm increase in Colorado was a mere twenty-two farms. And yet, the decline in agricultural output did not dampen the emphasis on scientific research intended to improve irrigated farming methods. If anything, the agricultural slump made new technology more necessary than ever; irrigators wanted to make the Poudre work for them as much as possible.¹⁰⁸

Time, energy, and money made the Poudre more efficient and productive in this era. Federal, state, and local agencies disseminated information on improved canal and dam construction, the proper cultivation of crops, and new methods of measuring water. The state Agricultural College was a Morrill Act school mandated by Congress to promote "scientific inquiry" and disseminate "agricultural information to the general public." The college spread knowledge through farmers' institutes, boys' and girls' clubs, demonstration trains, agricultural

experiment stations, and cooperative extension agencies. In addition, farmers working on their own land contributed knowledge to the college's agricultural experts. The Colorado Agricultural Experiment Station (CAES) was established in 1888 with departments devoted to the study of agriculture, horticulture, botany, chemistry, meteorology, irrigation engineering, and veterinary studies. By the time CAES was established, many of the irrigation ditches in the Cache la Poudre valley already existed; consequently, CAES advised on surveying and designing reservoirs and dams, and designing and constructing efficient headgates, flumes and other structural elements of the Poudre's water delivery system. CAES administrators, such as irrigation expert L.G. Carpenter, studied and kept records of the Poudre's flow, the amount of seepage lost in canals and reservoirs, and experimented with the measurement of water. Research and technology in the early twentieth century was such that *Fort Collins Courier* editor Ansel Watrous claimed farmers had mastered nature.¹⁰⁹

The search for efficiency on the Poudre River brought fame to a Colorado Agricultural College professor and CAES researcher named Ralph Parshall. Parshall was a native Coloradoan, who graduated from the Agricultural College in 1904 and joined the faculty of the civil and irrigation engineering department in 1907. Between 1907 and 1913, Parshall and Victor Cone, the director of the irrigation investigation office of the U.S. Department of Agriculture, which had an office on campus, built a hydraulic laboratory at the college. Parshall and others conducted valuable irrigation research for the USDA on campus. In the early 1920s, in order to test the research projects coming out of the campus lab, Parshall built a field laboratory on the banks of the Cache la Poudre. The Bellvue Irrigation Hydraulic Laboratory in Bellvue, Colorado was situated on the river near the Jackson Ditch in Larimer County. There, among the willows and mosquitoes on the Poudre's muddy banks, Parshall perfected a measuring flume that improved irrigation on the Poudre and around the world.¹¹⁰

Parshall's measuring device more accurately measured water among users. Until Parshall perfected his flume, measuring water was a constant problem. Irrigators commonly measured water with the Venturi flume, weirs, and various other devices. But many collected sediment and debris, altered measurements, and were costly and frustrating to use. Parshall's new flume, originally called the "Improved Venturi Flume," had an upstream converging section, a throat, and downstream diverging section with a shape similar to an hourglass when viewed from above. Parshall changed the convergence and divergence angle of the Venturi flume, increased the

throat length and sloped the throat floor downwards. This design shunted water into the throat with increased velocity and through a narrowed channel, clearing sediment and debris that collected at the base of other flumes. Measuring gauges, sometimes called throat gauges, were set into the inside face of the flume or, if the flow was too swift and deep and passed roughly through the flume, the gauges were placed in “stilling wells” - compartments made of sewer tiles shot through with a 45-caliber bullet in order to pass a tube from it to the flume. The ditch rider or river commissioner dipped a measuring stick into the stilling well to take a measurement or set up a recording device over the stilling well.¹¹¹

Parshall flumes were fitted into canals of all sizes and on the laterals that diverted water from canals to farmers’ fields. Farmers preferred Parshall’s flume because it had no moving parts and was easy to operate and maintain. It could be made of wood, sheet metal, or concrete. Some were portable and those made of sheet metal and concrete resisted fire from weed and trash burning along ditches, a part of springtime maintenance. The flume’s dimensions were also difficult to alter and, therefore, “cause willfully unfair measurement of the discharge.” In fact, Parshall warned that when his device was first installed a river commissioner should expect complaints because, compared to their previous measurements, some irrigators “will find themselves served with a much smaller head of water than formerly.... In such case it is probable that the farmer heretofore was using a portion of his neighbor’s water because of improper measurement of the flow into his own lateral.” Farmers got used to measuring properly and Parshall’s flume improved the efficiency of the entire water delivery system, as well as of prior appropriation, and turned the Poudre into a laboratory for efficient irrigation. In 1930 the American Society of Civil Engineers recommended that this flume be called the “Parshall Measuring Flume.” It is used throughout the world and is considered to this day one of the most accurate and convenient ways to measure water in canals and laterals.¹¹²

Little of the research conducted by state and federal agencies or the technology that came out of places like the Colorado Agricultural College prepared the West for the economic and environmental disasters of the 1930s. The Depression aggravated the hard times farmers already experienced in the preceding decade. Rural unemployment rates climbed steadily and by the 1930s many western families received federal or state relief. Getting relief in rural areas did not necessarily mean one was unemployed, as it usually did in urban areas. According to one Works Progress Administration report, three-fifths of relief families living on farms in Colorado were

“employed” in working the farm, even if that farm was not making any money. Americans coped with the Depression in various ways in addition to, or instead of, receiving relief payments. People moved to cities and towns, relied on kinship networks, practiced subsistence lifestyles, and relied on humor and faith. Businesses made sacrifices too. Employees of the New Cache la Poudre Irrigation Company took a fifteen percent pay cut in 1931. In 1932, the company’s assessment fees were reduced from \$3 to \$2.50. Delinquent assessments were a problem in 1933 but the board was lenient and did not close the headgates of those who were behind in their payments.¹¹³

Compounding the Depression was an environmental disaster on the plains, including portions of eastern Colorado, brought on by extended drought and overgrazing. Drought was a common occurrence in the region, reappearing every few years and tormenting inhabitants. A drought is a shortage of water that is both a natural and social phenomenon – drought is caused by lack of precipitation, but is exacerbated when human demand for water outpaces supply. A community’s water consumption and amount of storage capacity impact the effects of drought. Compounding a lack of precipitation, high temperatures, strong winds, low humidity, and minimal cloud cover increase evaporation and transpiration, reduce groundwater recharge, streamflow and reservoir storage, and worsen the effects of drought. The most common droughts in Colorado last six months or less. So-called single season droughts, lasting one to three months, occur almost annually in the state, meaning some portion of Colorado is always experiencing, or is close to experiencing, a drought.¹¹⁴

Droughts generate human responses. The dry summer of 1874 brought residents of Greeley and Fort Collins near violence, but resulted in legislative guidelines for water administration and distribution. Drought along the Poudre in the 1890s initiated transmountain diversions and the construction of reservoirs. Drought coupled with financial catastrophe in the 1930s convinced many that the only hope for more water development in the West was help from the federal government.¹¹⁵

Even before the 1930s the demand for water was so high in the Poudre valley, especially with the cultivation of thirsty sugar beets, that very often there was not enough water to grow profitable crops year round. A longtime Greeley irrigator remembered that there was often not enough water to sufficiently irrigate an entire farm. Irrigators planted half their land with alfalfa

or another crop that took less water and grew potatoes, sugar beets, and water intensive crops on the other half.¹¹⁶

The 1930s drought was particularly devastating because so many westerners and mid-westerners made a living from agriculture. The physical transformation farmers wrought on the landscape in the early decades of the twentieth century, namely plowing up prairie grasses, deeply tilling the soil, fallowing barren fields, and intensively growing one crop, such as wheat, compounded the dry conditions. When drought hit the plains fewer native grass roots held the soil. Dirt that kicked up on a flat patch of a farmer's field in eastern Colorado formed into monstrous clouds of dust that grew as they swept across the plains of Kansas, Texas, New Mexico, and Oklahoma. A.A. Edwards, former president of Water Supply and Storage Company remarked in the Fort Collins' newspaper that he had never seen so severe a drought in the Cache la Poudre valley as that of the mid-1930s. He also expressed a common axiom of the 1930s, that the plains were a "next year country," reflecting an optimism that had seen many westerners through previous dry spells. Edwards claimed he had "never seen the time when the region was not basically prosperous" and he had "confidence in its ability to 'come back.'" Still, nature seemed to have conspired against the humans living next to the Poudre River.¹¹⁷

In October 1929, while figurative storm clouds gathered over the nation's economy, literal clouds brewed over the Poudre. On October 25th, eight inches of snow fell on the teams and wagons of Poudre valley irrigators in their second week of harvesting sugar beets. Farmers, laborers, spouses, and children struggled to dig the beets from the frozen soil. Eighty percent of the crop froze before the cold, weary workers gave up and went home. A few days later the stock market crashed. W.D. Farr, long-time Greeley irrigator and businessman, remembered hard times in the valley that winter:

Everybody was broke. The stock market crashed and the beets froze in the ground. Grocery stores financed the farmers. Then there were a lot of farmers who bought a car or a truck on credit and also owed money to clothing stores, and they couldn't pay.

The extension of credit was particularly damaging in these times. Farr explained:

The farmer went to the bank and borrowed money, which had to be paid back in full with the earnings from his crops. Farmers went to the grocery store and bought groceries on credit and went to the clothing store and bought clothing on credit. All with the agreement that 'I'll pay you this fall when the crop is up.'

The farmer's inability to make payments affected local merchants who then could not pay suppliers. From 1930 to 1937 the Poudre watershed experienced a 540,000-acre-foot water deficit. One third of farms were put up for sale in Larimer County alone. The price of northern Colorado's lucrative crop, the sugar beet, dropped significantly in market price and state revenue plunged correspondingly.¹¹⁸

Poudre valley residents decided, along with many others in Colorado, that the answer to the devastating drought was to secure more water storage. The Depression and drought were catalysts for what became known as the Colorado-Big Thomson project (CBT). Multi-purpose water and power ventures were part of core New Deal policies that employed thousands of Americans, provided cheap water and power, and spurred growth. Arizona, Wyoming, and Washington had received major projects and northern Coloradoans felt the time was right to seek a federal project of their own.¹¹⁹

The New Deal gave new life to the Bureau of Reclamation, which had fallen on hard times. By the 1920s the Reclamation Service had failed to irrigate significant acreage in the West. Settlers using reclamation water were often inexperienced irrigators who did not know how to prepare land and plant crops for irrigation. Reclamation projects were often located on marginal land with poor soil that required expensive drainage systems. In 1923, thirty percent of reclamation farmers barely broke even and fifty-four percent lost money. The agricultural depression that followed World War I was partly to blame, but the problem also stemmed from the Bureau launching too many projects without enough resources, not evaluating project feasibility thoroughly enough before construction, failing to investigate market options for new farmers, and approving some projects for political reasons.¹²⁰

In 1923, a fact finding commission was appointed to determine why so many reclamation farmers had defaulted on their payments to the federal government or abandoned their irrigated farms altogether. Extensive interviews were held with Reclamation Service personnel, members of Congress, western governors, lawyers, and at least 175 delegates representing farmers. The delegates presented recommendations to the commission and many of their suggestions were incorporated into the Fact Finders Act of 1924. New reclamation legislation was enacted that

required a thorough investigation of a project's possibilities before authorization, allowed water users to operate and manage their projects after construction, and lengthened irrigator's repayment period from ten to forty years – significant changes that affected the Poudre valley. A reclamation project under a revamped Bureau appealed to many Poudre valley irrigators in the 1930s.¹²¹

Irrigators along the South Platte and its tributaries, the St. Vrain, Big Thompson, and Cache la Poudre rivers, could not afford to capture additional storage water or divert more transbasin water on their own. The turbine pump had not revolutionized irrigation wells and the wells that existed on the northern Front Range ran on centrifugal pumps that could not lift water more than twenty feet. One of the best options for more water in the 1930s that did not involve interstate negotiations appeared to be on the Western Slope. Poudre irrigators wanted to divert more Colorado River water to their basin, adding to the transbasin water already diverted from the Grand, Skyline, Cameron Pass, Sand Creek, and Michigan ditches and the Laramie-Poudre Tunnel diversions.¹²²

W.D. Farr explained the mood along the Cache la Poudre when irrigators first discussed plans for a new water diversion and storage project: “You have to imagine that conditions were awfully tough in northern Colorado. The drought had started, we were in the midst of the Depression, everybody was pretty blue, prices were low, the crops were poor.” Members of the Greeley Chamber of Commerce formed a committee in 1933 and explored ways to alleviate the impact of this and future droughts. They determined that the best way to acquire more water in northern Colorado was to go across the Continental Divide and appropriate Western Slope water. At the time, however, no one really knew if it was possible to bring large amounts of water through the mountains and to the Front Range in a reasonable amount of time. Farr recalled:

The Greeley Chamber of Commerce got a grant for some people to do raw surveying to see whether a large-scale water diversion project from the Western Slope was even possible.... But they came in with a report that, yes, it was feasible that water could be brought from a place like Grand Lake to this side.... And so the Bureau [of Reclamation] really started to become interested in the proposal and they began to develop and plan the project that was actually built.

In 1935, the Bureau of Reclamation allocated \$150,000 to survey and prepare cost estimates to bring Colorado River water over the divide to northeastern Colorado.¹²³

Successfully negotiating the political shoals of a Bureau of Reclamation project in the midst of the Depression demanded strong leadership and the cooperation of irrigators. A water conservancy district was formed to consult with the United States over the CBT project and, eventually, operate and manage it at the local level. Water users put the project up for a public vote since a mill levy tax was necessary to support operation and maintenance. Proponents of CBT drove from town to town explaining the project to citizens in public meetings. They felt that without more storage northern Colorado would remain “a second-rate farming community.” A majority of the public favored CBT and the creation of the conservancy district to manage the new water.¹²⁴

Ralph Parshall, at the time a senior irrigation engineer for the USDA, prepared an economic report for the CBT project, so named because it diverted water from the Colorado River to the Big Thompson River and from there to Front Range reservoirs and river basins, including the Poudre. Parshall’s justification for the project reflected the mood of the Depression. He asserted the Colorado River diversion would:

Safeguard the agricultural development of one of the largest irrigated sections in the semi-arid third of the United States.... It will definitely provide social security for the existing population of this section of the state and the opportunity for normal population growth. It is not a colonization scheme. Its success does not depend upon stimulated migration from other parts of the country. It is an earnest plea from 175,000 hardy, self-reliant American farmers and townspeople for aid in constructing these needed supplemental irrigation facilities to stabilize the present economic achievement and make secure the possibilities of future progress.

Parshall maintained that those using junior water rights were in constant danger of losing crops due to lack of water. He also predicted that the amount of families needing federal relief in northern Colorado would decrease if the project were built.¹²⁵

There was considerable political wrangling over the CBT project, both to get the details of the physical construction and layout worked out and to get Congress to pay for it. Former Colorado Agricultural College instructor and irrigation expert Elwood Mead lent his support to CBT and influenced his friends in the Roosevelt Administration. Dan Tyler, author of *The Last Water Hole in the West*, a history of the CBT project, explained that Mead “weakened the opposition of eastern politicians who held that more water for Colorado crops controverted administration goals of conserving the land and reducing agricultural production.” Many Front

Range irrigators spent time in Washington coaxing the project through the appropriation process. An attempt was made to get Congress to appropriate money for construction of CBT in 1936; however, Congressional representatives from the Western Slope, notably Ed Taylor, a rancher from Grand Junction, blocked this move in an effort to recover part of the water the region stood to lose under the diversion. As a result of extensive negotiations between parties on the East and West Slopes, Green Mountain Reservoir was added to the CBT project for Western Slope water users. This concession paved the way for an accord in Colorado that resulted in a \$900,000 appropriation from Congress in 1937 to begin construction. The estimated cost of the entire project was \$44 million.¹²⁶

Construction began on the CBT in 1938, but was disrupted periodically because of U.S. involvement in World War II. The project also underwent tough questioning in Washington during the delay. Dan Tyler explained:

The CBT design was complex enough to require constant explanation in Washington.... With a deteriorating world situation and nagging domestic problems, proponents of CBT were eventually placed in the position of defending the Project as part of a national defense program.

This was especially true because of its hydroelectric power. In 1942, Congress enacted the Food for Defense Program and CBT proponents highlighted the project's irrigation potential as a way to meet agricultural quotas. When the Korean War broke out in 1950, the project was still incomplete and the hydroelectric possibilities were again played up for national security reasons. Thus, CBT was not only a New Deal project; it was also, at least nominally, part of the broad military defense build-up in the West during and after World War II.¹²⁷

Perhaps, ultimately, many northern Coloradoans were afraid of remaining a "second rate farming community," in the words of W.D. Farr, without the diversion project. There were other indications that the area would suffer economically without an influx of water to support agriculture, municipalities, and industries. A sociologist for the state Agricultural Experiment Station wrote in 1940,

There is evidence to indicate that Colorado is approaching its population saturation point under its present economic and social structure.... Agriculture cannot provide jobs for any significant probable future increase in Colorado's population unless it is possible to increase the amount of water available for irrigation purposes and change the present agricultural practices to more intensive farming.

Northern Coloradoans wanted supplemental water to irrigate their farms, mitigate the effects of future droughts that could ruin them financially, and boost the agricultural sector of the state's economy that had suffered since the 1920s. Little thought was given to conserving water or diversifying the economy away from irrigated agriculture. Poudre valley irrigators were relieved when, on June 23, 1940, another drought year, men dynamited away parts of the mountains forming the Continental Divide and began work on the "world's largest tunnel for irrigation," a significant portion of the CBT project.¹²⁸

Work on the tunnel was delayed repeatedly due to labor and supply shortages during the war. But slowly, charges of dynamite ate away at some of the most formidable mountains in the continental United States. Tons of rock and rubble were hauled out, day after day. Dust and dirt pervaded the dark tunnel during construction and nervous engineers calibrated distances, direction, and grade within the oppressive space. When this key element of the project was completed, it was quite a sight. In 1947, about fifty CBT supporters milled outside the eastern portal of the concrete-lined Alva Adams Tunnel, waiting for the first surge of water to arrive from the Western Slope. W.D. Farr recalled the nervous excitement of the men waiting in suits and hats on a warm June day, listening for the sound of rushing water but hearing only their own voices in the still, thin air:

Here's just the tunnel and its blank and nothing, very quiet.... We stood around and fidgeted and talked. Then all of a sudden we heard a roaring noise, not like water or anything, it sounded like a train coming. We couldn't quite figure that out and then the biggest cloud of dust I ever saw came out of that tunnel ahead of the water. You can imagine that – thirteen miles long! It just covered us with dust, we were just filthy – our hats, our clothes. That dust hit us and we couldn't see anything. Then here was the water rushing out and we knew it was going to work and we knew the water was there and I have never seen men as happy in my life and don't expect to. These were grown men, I was the youngest of the group, but they hugged each other, they kissed each other, they threw their hats up in the air. They did this for several minutes because finally you had the water and you knew it was going to change northern Colorado. You had no idea how, but that was the answer.

Another ten years of construction followed the completion of this milestone; although to men at the base of the tunnel in 1947, it was already obvious a new era had arrived.¹²⁹

Water from the north fork of the Colorado River and several of its tributaries was stored in Lake Granby and Shadow Mountain reservoirs on the Western Slope. A channel connected

Shadow Mountain Reservoir to Grand Lake, from which Colorado River water flowed into the Adams Tunnel, under the Continental Divide, to Estes Park. The work was expensive, complicated, and arduous due to elevation and inclement weather. The water's descent from the east portal of the tunnel to the plains was captured by five hydroelectric power plants. It then moved through a series of canals and conduits into three Front Range reservoirs, one of which, Horsetooth Reservoir, stored 156,000 acre-feet of water and supplied water to the Cache la Poudre basin. This reservoir filled a valley six miles long in the foothills west of Fort Collins and required four dams. Work on it began in 1946, and the first CBT water poured into it five years later.¹³⁰

CBT was the largest transmountain diversion in Colorado. It eventually grew to include 12 reservoirs, 35 miles of tunnels, 95 miles of canals, an irrigated area stretching 150 miles east to west, and 65 miles north to south, encompassing 600,000 acres. The change in the landscape was marked; dams, dikes, pumping stations, canals, concrete, siphons, pipes, tunnels, and new roads now existed along the Front Range. When CBT was finished in 1956 it was the largest Bureau of Reclamation project ever completed as well as the largest diverter of Western Slope water. It was also a unique venture because the water delivery system on the Poudre and other Front Range rivers already existed. Prior to this, no Bureau project supplied an area where an irrigated community already existed. CBT water supplemented the water supply of ditch companies. However, incorporating CBT water into the Poudre's existing water supply and complicated delivery system was a challenge that necessitated new cooperation and legislation.¹³¹

In 1937, when Poudre valley and Front Range irrigators negotiated with the Bureau of Recreation to manage CBT, they formed an organization like an irrigation district, which were authorized by the state in the early 1900s to pool capital for irrigation projects, but on a larger scale. The new entity, comprised of eighty irrigation companies in six counties, formed the Northern Colorado Water Users Association. They pushed the Colorado Legislature to pass the Water Conservancy Act authorizing the creation of conservancy districts capable of raising more money and building and managing larger projects than irrigation districts. Water conservancy districts were another layer of institutional control over water below the state level but encompassing various localities. These districts could,

Acquire and sell; lease or otherwise dispose of water, waterworks, and water rights; construct and operate facilities; exercise eminent domain powers to condemn private property for public use; contract with the federal government for construction, operation, and maintenance of project facilities; fix water rates for non-project water users, make special assessments, levy taxes on all property within the district, and issue bonds.

The Northern Colorado Water Conservancy District was created because the federal government needed a reliable organization with which to contract with that would deliver the federal water to the state's water users. It was Colorado's first water conservancy district and it pioneered the administration and distribution of federal water within an established, privately owned, and decentralized irrigation system. By taxing all the population within their borders, not just irrigators, water conservancy districts distributed the costs of construction, operation, and maintenance among all residents on the theory that all would benefit from the additional water. Districts were considered "quasi-municipal" or "quasi-governmental" primarily because they had the authority to tax district landowners, similar to a municipality.¹³²

When the first CBT water flowed into the Poudre River in 1957, the area was in the midst of yet another drought. The river commissioner and ditch companies worried about the distribution of the new water. It was several years before irrigators grew accustomed to receiving CBT water and were assured that they were getting their proper share of water and were not jeopardizing their Poudre River rights. It also took time to convince local irrigation companies and water users they were not losing their sovereignty because of this additional water administered by a powerful water organization. Private irrigation companies along the Poudre did not lose their autonomy because the Northern Colorado Water Conservancy District only distributed CBT water, although the district was a major new player in the Cache la Poudre valley whose presence became ubiquitous in the latter half of the twentieth century.¹³³

CBT was a high profile federal project that increased the amount of water available to Front Range farmers by over 200,000 acre-feet annually. The project also changed the landscape and strengthened the bureaucratic control of water in northern Colorado. Once again, Poudre valley irrigators were key figures in expanding and changing their water delivery system in ways that had not been tried before. The addition of new dams, reservoirs, canals, and additional water turned more fields green, helped cities grow, industries prosper, and recreators enjoy. Irrigated agriculture augmented by CBT water drew more people to northern Colorado,

concentrated farms in small areas close to the water supply, and made roads, utilities and commercial development more affordable. An interesting report by the Bureau of Reclamation in 1952 compared irrigated Weld County to similar but non-irrigated counties elsewhere along the Front Range. According to the report, in 1950, Weld County supported 33 people per 1,000 acres on farms instead of the 3.9 people non-irrigated counties supported. Irrigation bolstered the county's economy, produced a higher standard of living for residents, and contributed millions of dollars to the gross national product. Nearly seventy percent of Weld County residents had telephones compared to forty-one percent in non-irrigated counties, ninety percent had electricity compared to sixty-two percent, and commercial centers were an average of nine miles away compared to over sixteen miles in non-irrigated areas. Poudre valley irrigators built on their past experience of cooperating and experimenting with their water delivery system by expanding and changing their system in ways they felt would carry them through the twentieth century as political, economic, and demographic changes increased competition for water and changed attitudes towards it.¹³⁴

CHAPTER FIVE: Competition

“Water Flows Uphill to Money” -- anonymous

The American West experienced dramatic growth and change during and after World War II. Military-industrial complexes, interstate highways, and massive reclamation and hydroelectric projects materialized on the landscape and the West boomed again. Millions of people flocked to the region, not for gold, furs, or irrigated land this time, but for jobs and ranch houses in newly platted subdivisions. The population of Colorado nearly doubled between 1940 and 1970. The overwhelming majority of these citizens lived in cities and suburbs along the Front Range from Colorado Springs to Fort Collins.¹³⁵

The dry climate, open spaces, and rugged mountains that once hampered the western economy now attracted people and industries. The economy diversified from extractive industries that took things out of the earth such as mining, logging, and agriculture, to high-tech, tourist, and service-based industries. Martin Marietta, IBM, Honeywell, Ball Aerospace, Beech Aircraft, Kodak, and Hewlett Packard relocated to Colorado. Government installations in the state included the National Bureau of Standards, the National Center for Atmospheric Research, the Denver Federal Center, the North American Air Defense Command, the National Seed Storage Laboratory, the Center for Disease Control, the National Park Service, and the Bureau of Reclamation.¹³⁶

The Cache la Poudre valley's population and economy changed and grew during this time. Strip malls and subdivisions appeared on land once farmed by Benjamin Eaton and John G. Coy. Cities and industries grew and competed with the agricultural sector for the Poudre's limited water supply. As agricultural water rights flowed to homes and businesses, farms disappeared; similar this trend was occurring all over the irrigated West. Cities and industries, along with urban and suburban residents, used and perceived of the Poudre in ways that competed and conflicted with irrigators who had used the majority of the river's water for generations. Many urban and suburban westerners relaxed and recreated near the Poudre and wanted to protect its beauty and ecological integrity. Irrigators who used the river for their livelihood and had done so since the first ditches were dug resented new uses of Poudre water

and new regulations imposed by environmentalists, in conjunction with state and federal governments.

In the past, conflict concerning the Poudre centered on *how* to expand its use; in the post-war era, conflict erupted over *whether* to expand its use. As with past episodes of change on the Poudre, the latter half of the twentieth century was a period of conflict, contention, and compromise on the river. Poudre valley water users clashed over pollution in the river, the use of groundwater in addition to surface water, new storage proposals, and minimum stream flow. Irrigators, cities, industries, recreators, and environmentalists hashed out agreements that resulted in new ways of using the Poudre's water – still essential to life and the economy in its vicinity – in ways that reflected the values of the changing population.

Colorado's economy evolved after World War II from one that was predominantly rural and resource-based centered on mining and agriculture to a diversified economy that attracted new citizens to its growing cities and suburbs. These economic changes were hard on the agricultural sector that depended upon the West's scanty water supply. Immediately following World War II, agriculture was Colorado's leading industry and its biggest water user, as it had been since the late nineteenth century. The Cache la Poudre basin was well above state and national averages in the percentage of its labor force participating in agriculture – nineteen percent in 1960 – and Weld County produced hundreds of millions of dollars worth of agricultural goods, amounting to twenty-five percent of the state's output. Farmers cultivated water-intensive crops such as sugar beets and corn with the help of electric pumps, sprinklers, fertilizer, pesticides, and hybrid seeds. By the 1960s and 1970s, Colorado mirrored national trends with fewer farms but increasing farm size. But good times for agriculture did not last. Historian Richard White observed that until the 1970s, "many rural westerners believed they would prosper alongside the metropolitan regions. Not until the 1980s, when the rural economy collapsed into an all too familiar shambles as bust followed boom, did the optimism dwindle." Inflation, grain embargos, global competition, an oil crisis, and highly mechanized and energy-intensive farming practices frustrated many farmers in the late 1970s and 1980s. The

agricultural slump overwhelmed Colorado because the energy, steel, technology, and tourist industries also declined.¹³⁷

Still, the agricultural sector continued to be the largest consumer of water in the Cache la Poudre basin and Weld County was among the top ten agricultural producing counties in the United States. In 1990, over 600,000 acres of agricultural land in northern Colorado produced \$331 million worth of crops, a significant part of the state's economy. The Cache la Poudre River, flowing year after year, season after season, past expanding cities and quiet fields, in many of the same canals and reservoirs that made up the original water delivery system, supported agriculture through its economic upheavals. But, municipalities, industries, and recreators increasingly needed the river.¹³⁸

Mutual irrigation companies still existed and controlled the majority of the river's water. The four largest companies - North Poudre Irrigation, Water Supply and Storage, the Larimer and Weld Irrigation, and New Cache la Poudre Irrigation, all of which originated in the late nineteenth century - held rights in the name of their shareholders to most of the Poudre's water. City representatives, rather than farmers, increasingly filled open board positions at the irrigation companies as municipalities acquired agricultural water rights. The board members of the irrigation companies along with the Cache la Poudre Water Users Association, made up of ditch company representatives and the company's attorneys, made the major decisions about water and the Poudre.¹³⁹

During this time, Poudre water users wanted their traditional exchanges recognized and protected by the court. In 1975, the Cache la Poudre Water Users Association, the four major ditch and reservoir companies, smaller irrigation companies, and the cities of Greeley and Fort Collins petitioned the Division One water court to recognize and adjudicate their water exchanges. Great Western Sugar initially objected to the formal recognition of ditch and reservoir exchanges but soon withdrew their opposition. Judge Donald Carpenter signed the adjudication decree in 1978.¹⁴⁰

The Poudre's irrigation ditches running through Fort Collins and Greeley, formerly the pride of an agricultural region, were sometimes considered nuisances as cities grew and the population urbanized. Water seeped out of canals and into basements; the canals themselves were receptacles for trash; they attracted insects, and posed a danger to small children. As early as 1929, the *Fort Collins Courier* declared the Arthur Canal, the former Fort Collins "town

ditch,” a “constant menace to life and property.” Hundreds of citizens signed petitions to fill in the canal, and it was slowly diverted into pipes and enclosed by Works Progress Administration workers in the 1930s. The interment was not without humor, as Judge Fred W. Stover commented, “If the Town Ditch is placed in conduit, openings with covers should be placed at regular distances so that property owners may continue to dump their garbage in the ditch.” Most of the canals remained open, but coursed through transformed environments. Canals and ditches that took significant planning, cooperation, and difficult manual labor to construct and were essential elements of social and economic success in this semi-arid region were now marginalized, obscured from view, and forgotten by urban residents.¹⁴¹

Few new ditches and reservoirs were built within the Poudre system in this era. Notable exceptions include Milton Seaman Reservoir built by the City of Greeley with a grant from the Works Progress Administration and completed in 1945; Horsetooth Reservoir, part of the Colorado-Big Thompson project (CBT), completed in 1957; Park Creek Reservoir built by North Poudre Irrigation in the early 1970s; and some flood control systems like the Box Elder Creek flood control projects constructed by North Poudre Irrigation, the Soil Conservation Service, and Larimer County, which act like temporary reservoirs in the event of a flood. Because nature provided few new accessible and affordable reservoir sites, existing storage units underwent enlargements and repairs in the late twentieth century.¹⁴²

The biggest change to the Poudre’s water supply was the addition of Colorado-Big Thompson water. CBT water attracted new people and industries to the Poudre valley and supported diverse water demands. CBT supplemented almost all of the ditches in the Poudre basin and the completion of Horsetooth Reservoir acted like a vast shared reservoir for Poudre farmers. By the 1980s, only seven or eight ditches received strictly Poudre water, without any CBT supplementation. These tended to be smaller ditches with older decrees that did not need additional water, such as the Taylor and Gill and Boxelder ditches, the latter of which reportedly ran CBT water from Horsetooth Reservoir for two hours in 1977 and never again. Other ditch companies immediately felt the impact of CBT water, especially the North Poudre Irrigation Company. As noted earlier, the unreliable Englishman, F.L. Carter-Cotton, who hopped the first train out of Fort Collins when he realized his canal venture was costing him significantly more money than he estimated, formed the company that became North Poudre Irrigation in the 1880s. A series of investors bought Carter-Cotton’s company and local irrigators finally reincorporated

it as North Poudre Irrigation in 1902. Prior to the completion of the CBT project, North Poudre's main canal was called "the dry ditch" by Poudre irrigators, despite improvements to its system over the years. It was commonly said there were three types of farmers using the system: "one-a-coming, one-a-going and few-a-staying." But in 1957, when the first rush of CBT water surged through the company's main canal, Ed Munroe, a longtime company board member, exclaimed, "You can't call this the dry ditch anymore!" One Cache la Poudre irrigator under the North Poudre system noted: "nobody knew what [CBT] was going to bring, some thought it was pretty good and others thought it wouldn't amount to anything.... I thought it would help but didn't think it would be as good as it is."¹⁴³

CBT water, originally intended to supplement agriculture, was increasingly sold to municipalities. In 1957, when CBT first became fully operational, fifteen percent of its water was sold to cities and industries; by 2004, this number was over sixty percent. Agriculture's use of CBT and Poudre River water decreased as cities and industries grew, partly because of the agricultural slump, but also because cities and industries paid farmers for their water. For example, the City of Fort Collins obtained its first water right in 1889 when it purchased four cubic feet per second (c.f.s.) from Thomas Gilkinson for rights in the John R. Brown Ditch. In 1904, the city purchased nearly three c.f.s. from the Yeager Ditch, which had the first priority right on the river, and continued buying agricultural water rights as time went on.¹⁴⁴

When Greeley and Fort Collins purchased water rights from farmers, they officially changed the use of those rights from agricultural to municipal use in court. This could involve changing points of diversion from a headgate near a farmer's field to a municipal pipeline or other diversion points more convenient to the city. Changing the use of water rights involved all Poudre water users because one change disrupted the flow of water in the river and could cause hardships for others. When a city bought agricultural water and used it differently, it had to satisfy the historic uses of that water and consider who used the return flow. Notifying water users who may be affected by the changes and allowing them to voice their concerns in court was a crucial part of changing the use of water. Officially changing a water right from agricultural to municipal use could be as cumbersome as physically filling in and diverting ditches.¹⁴⁵

Engineers determined the amount of water that belonged to an agricultural water right after evaporation and transpiration, after water evaporated out of the ditch or seeped through the

bottom, and informed a court of their findings. The remaining water that irrigated the field was called the “beneficial historic consumptive use” and the rest belonged with the stream system where others used the return flow. If a court granted a change of use, the water right retained its original seniority and was transferred from agricultural to municipal use. Because cities purchased agricultural water rights, new municipal development did not mean that more of the Poudre’s water was being used than before. Ward Fischer, a water attorney and member of the Fort Collins Water Board, confirmed, “if we need the water for new industry ... or new developments ... or something, they are basically planted where it used to be irrigated land. So you take the water that used to irrigate those tracts and use it for making beer or [for] household uses.” One group of water users gave way to another because of the limited supply of Poudre water.¹⁴⁶

Transferring water to municipal and industrial uses transformed the landscape around the Cache la Poudre. Land painstakingly leveled, furrowed, and irrigated by generations of irrigators was paved over as Greeley and Fort Collins bought agricultural water and transferred it to their residents and businesses. Houses, traffic, urban pollution, flushing toilets, and storm drains replaced farms. This happened more frequently in Larimer County than in Weld, and irrigators reacted differently to the changes. Harlan Seaworth, former board member and president of North Poudre Irrigation Company, farmed for years around Fort Collins and Wellington and witnessed the conversion of agricultural land in the area. It did not bother him to see farmland turned over to municipalities along the Front Range because, in his words, “there is plenty of land out east to farm.” Another former North Poudre irrigator remarked,

You hear discussion about if you build over all this farm ground what are we going to eat? Well, what we grow here along the Front Range just doesn’t amount to that much in the whole scheme of things. I think the thing that I dislike most about it is that this is a great life and a great place to raise your family but you have to be able to make money doing it or it’s not going to fly. So, we’re to the point where the water is worth more than the land and water flows uphill to money.

But many in Weld County who believed agriculture would still be viable well into the twenty-first century were not so enthusiastic about the loss of irrigated acreage. Longtime Weld County irrigator W.D. Farr believed the most fertile, irrigated land in the county would remain in production and farmers would switch to high priced specialty crops, while alfalfa and cheaper

crops move further east. Farr predicted: “agriculture will stay because there are just very few places where agriculture is as good as it is here.... Weld County will always be a big agricultural county.” Yet, the suburbs of Greeley and Fort Collins continue to grow. Fort Collins and Greeley, concerned about the water supply of the Poudre region now that their cities and industries consumed such a large share of it, created water boards to manage existing supply and pursue storage and diversion projects, a job irrigators had once taken upon themselves. The state of Colorado also formed new water bureaucracies to manage water. The Colorado Water Conservation Board was a state water agency created in the 1930s to develop and protect the state’s water and the Colorado Water Resources and Power Development Authority was created in 1981 and charged with developing new water resources in Colorado.¹⁴⁷

In addition to competing with agriculture, cities also competed among themselves for water. In the 1980s, the City of Thornton, a northeast suburb of Denver, looked north to the Cache la Poudre basin to satisfy its future water needs. At the time, due to the agricultural slump, one longtime resident of the Poudre valley described the area as “a depressed community,” noting that “there were a lot of farmers who were on the brink of foreclosure and so there was considerable excitement for many of them to find somebody that would buy their water or their farms – and Thornton would buy either one.” In this climate, Thornton anonymously acquired options on 12,000 acres of Poudre valley farmland and 283 out of 600 shares of the Water Supply and Storage Company of Fort Collins. Thornton intended to pipe the water from northern Colorado to their residents as part of a multi-million dollar water project. In his history of the Water Supply and Storage Company, Colorado State University professor James Hansen observed, “Under the best circumstances this move would have been controversial, but cloaked as it was in secrecy, its discovery unleashed an outraged reaction – not only within the company, but throughout the Poudre Valley region.” Taking Poudre water out of its basin of origin was an emotional issue for northern Coloradoans and something they had not experienced, although they had favored transmountain diversions, including the CBT project, that had moved water into their basin for over one hundred years.¹⁴⁸

The City of Fort Collins was a shareholder in Water Supply and Storage by the 1980s and Thornton’s acquisition of the controlling share of stock in the irrigation company threatened Fort Collins’s water supply as well as that of irrigators receiving water from Water Supply and Storage. To keep Water Supply and Storage in local hands, the company and the city of Fort

Collins made an agreement in which Fort Collins turned over shares of stock it owned in Water Supply to the company in exchange for additional shares issued by Water Supply. The company issued 300 additional shares of stock in the deal, and this diluted Thornton's portion to 283 out of 900 instead of 600 shares. Thornton was no longer majority shareholder but they owned a sizable portion of Poudre River water rights. Eventually, representatives from Thornton, Fort Collins, and Water Supply and Storage sat down and worked out an agreement with each other in which Thornton representatives constituted four of the nine directors of Water Supply and Storage and the remaining five directors represented the Poudre basin. Municipal growth and competition between municipalities over water demonstrated the social and economic changes happening in the Poudre's vicinity in the late twentieth century, changes that not only resulted in new competition for the river but in new perceptions of it as well.¹⁴⁹

Urban and suburban residents who populated Front Range cities and compelled them to seek out additional water viewed rivers and reservoirs differently than irrigators. These residents wanted to enjoy the river and protect it from over use and pollution. Many did not realize this clashed with the traditional way the Poudre was used by irrigators since the 1860s. For generations, irrigators diverted and heavily used the Poudre's water as they supported the region economically and socially. As time went on, farmers adopted water conservation techniques. Many used irrigation tubes that funneled water directly into furrows between rows of plants rather than flooding whole fields. Center pivot sprinklers with hoses that dropped close to the ground to reduce evaporation also became more popular. Still, irrigators used vast quantities of the river's water and caused pesticides and fertilizers to enter it with return flow. As the twentieth century wore on, some saw this use as wasteful and detrimental to the river and its ecosystems. Conflict broke out over protecting and polluting the river's water, expanding its use through groundwater pumping, building more storage, and allocating water for aquatic and other life.¹⁵⁰

To many city dwellers and non-irrigators, the Poudre was not a "working river" that ensured a family's income and contributed to the state's economy as it had for generations; rather, the river was a source of recreation and beauty. Urban dwellers wanted to enjoy the

Poudre closer to their own backyards, or use it as a backyard in some cases. They wanted to walk, jog, and bike along the river's banks, float down it on rafts and tubes, and wade in it on hot summer days. In the late 1960s, Fort Collins built trails along the river and planned, along with Colorado State University, an environmental learning center along a six-mile stretch of Poudre floodplain between that city and Interstate 25. In the 1990s, residents of Greeley built a trail system along the river with money from corporate contributors including Kodak, Monfort Feedlots, and Hewlett-Packard. Many urban and suburban residents did not equate the Poudre with the water flowing in their taps or as the source for irrigating picturesque farms on the outskirts of their cities. They challenged the historical treatment of the river they now considered a unique natural area in an urban environment. Farmers feared this new attitude would put them out of business.¹⁵¹

Urbanization and changing attitudes towards the Cache la Poudre River resulted in two federal designations for the watercourse. In 1986, the upper seventy-five miles of the Poudre was designated a Wild and Scenic River. The Wild and Scenic Rivers Act of 1968 was considered an expansion of the Wilderness Act of 1964. The Wilderness Act was landmark environmental legislation that emphasized preserving land for public enjoyment and protection rather than privatizing it. The designation curtailed development along the upper Poudre and prevented the construction of new reservoirs. It was the result of a sometimes contentious battle between those who wanted to curb development and those, including the cities of Fort Collins and Greeley and the Northern Colorado Water Conservancy District, that worried about the future water supply of northern Colorado and wanted to keep their options open for new mountain reservoirs. Congressman Hank Brown struggled to bring both sides to a compromise. Eventually he convinced the water developers and environmentalist to accept a Wild and Scenic designation for seventy-three of the canyon Poudre's eighty-five miles, leaving open eight miles of the river for possible development as well as a site on the south fork of the river known as the Rockwell site for Fort Collins and Greeley. The United States Forest Service managed the Wild and Scenic designated portions of the river and was forced to limit the number of rafters and carefully manage campers who converged along the Poudre, the first Wild and Scenic River in Colorado.¹⁵²

After the canyon portion of the Poudre was designated Wild and Scenic, some locals pursued a designation for the lower plains portion of the river as well. In October 1996, the

lower Poudre was designated a National Water Heritage Area emphasizing the themes of water development and westward migration in the United States. Federal heritage areas emphasize interpretation and education. The House of Representatives bill that established the Cache la Poudre River National Water Heritage Area acknowledged the river's basin was a "nationally significant historical, recreational, scenic, cultural, natural, economic, and scientific resource." The designation covered nearly forty-four miles of the Poudre and its floodplain from the mouth of the canyon to its confluence with the South Platte River. With these two federal designations, nearly the entire length of the Poudre River was either protected from development or recognized as a unique and valuable watercourse that supported the society and economy around it. Only eight miles of the lower canyon river were not included in the Wild and Scenic or the Heritage Area designation. The federal designations reflected the new perceptions of the Poudre. It was a river that irrigated agricultural fields, allowed cities and industries to expand, and was a valued resource for its own sake. The river was protected and honored, but also in great demand.¹⁵³

The Poudre supported and mirrored the society that lived along it. The complex and changing social and economic situation surrounding the Poudre that resulted in different perceptions and new designations for the river was reflected in battles over pollution as well, especially as the environmental movement gained momentum. The twentieth century environmental movement took hold in the late 1950s in reaction to atomic testing in the Great Basin and western deserts. The movement mirrored changing values among Americans who came to appreciate ecological integrity, the beauty of nature, and open space. Long-established environmental groups such as the Sierra Club and the Wilderness Society gained supporters during this time. Grassroots groups of citizens focused the nation's attention on the depletion and degradation of natural resources.

Some of the nation's newly enacted environmental policies impacted the Poudre, causing further tension between urban and agricultural water users. The 1970 National Environmental Policy Act (NEPA) required that all federal agencies file an environmental impact statement prior to any federal building projects or actions that could damage the environment. Under NEPA, all large water projects underwent environmental impact studies. Citizens were allowed to study and comment on the results of the impact studies and, through this process, regained public control over resources and decisions that had long been bureaucratized in federal agencies. Congress enacted the Endangered Species Conservation Act instructing the Secretary

of the Interior to “carry out a program in the United States of conserving, protecting, restoring, and propagating selected species of native fish and wildlife that are threatened with extinction” because of habitat destruction. This legislation was expanded in 1973 and is referred to as the Endangered Species Act. This act along with the Fish and Wildlife Coordination Act of 1970 required that the federal government consider wildlife conservation when planning water development projects. Other federal regulations impacting the Poudre’s water supply included the Federal Water Pollution Control Act, the Safe Drinking Water Act, and the Clean Water Act. States followed the federal government in enacting environmental laws to protect land, water, and wildlife. Environmental groups such as the Nature Conservancy, Trout Unlimited, the Environmental Working Group, American Rivers, Colorado Environmental Coalition, Colorado Public Interest Research Group, Friends of the Poudre, and the Poudre River Trust monitored the Poudre. The intention of these environmental mandates and groups was to protect the Poudre, along with its animal and human neighbors, from pollution and over use.¹⁵⁴

Studies of the Poudre’s water revealed an ailing river. A 1965 U.S. Health Department report found:

The organic and bacteriological quality of the Cache la Poudre River at the edge of the mountains is generally good.... At Fort Collins there is deterioration in quality due to the discharge of inadequately treated municipal and industrial waste waters in the Fort Collins area. Below Fort Collins there are diversions from the river for direct irrigation or storage. These diversions often divert much of the waste water from the river resulting in an improvement in quality for a section of the river below the diversion. Below Greeley the river is polluted throughout the year. There are extensive sludge deposits and the river has a gray, septic appearance.

In 1966, in response to the newly enacted Federal Water Quality Act, Colorado enacted the Water Pollution Control Act to curb pollution entering the state’s waterways. This created the Water Quality Control Commission, which established and enforced water quality standards, issued permits for pollution discharges into streams, and evaluated proposals for wastewater treatment plants. Despite the new commission and regulations, the Poudre’s water quality still caused concern in the 1970s. In 1972, the EPA conducted a water quality report based on four months of stream surveys along the Cache la Poudre. The results were dismal:

The Cache la Poudre River was virtually an open sewer downstream from the Greeley discharge. The murky water smelled of sewage, and rich organic sludge beds blanketed most of the stream bottom. Such sludge beds constitute a

violation of... Basic Water Quality Standards. Sludge worms were profuse in number because of the available food and the lack of competition in their sludge bed habitat. Fish populations near the mouth of the Cache la Poudre consisted of forage species: no game fish were found.

The pollution was so great in the Poudre that it contaminated portions of the South Platte near Kersey, Colorado, where the two rivers meet.¹⁵⁵

The Poudre continued to be a troubled stream in the 1990s. According to a report published by the Environmental Working Group in 1996, the Cache la Poudre was the most polluted river in Colorado. The Poudre received 356,000 pounds of toxic chemicals between 1990 and 1994. The next closest watercourse in terms of pollution, Clear Creek, absorbed 211,000 pounds of toxins. The report was based on information on pollutants legally dumped into the river and reported by industries. The two corporations dumping the most pollution into the Poudre were among the top five polluters in the state - the Kodak plant in Windsor was the number one polluter and the Great Western Sugar Company in Greeley was number five. Together they dumped ammonia, glycol ethers, ethylene glycol, methanol, silver, and manganese compounds into the river. Some environmental groups such as Colorado Public Interest Research Group believe loopholes in federal pollution laws allowed the proliferation of chemicals in Colorado's streams. Others worried about the health implications of pollution for both humans and wildlife, regardless of whether or not the discharges were legal. In 2000, the district officer for the Colorado Division of Wildlife in Greeley's north district remarked, "When systems become compromised, we lose special kinds of fish, and only the general species survive.... Now the lower Poudre is a carp and sucker stream and those fish have lesions and pimples all over them." In 2001, over 2,000 frogs and fish in a one-mile stretch of the river died from an unknown spill of organic material, possibly animal feces, which depleted the river of oxygen. This working river was a long way from the clear stream that trickled to life in Rocky Mountain National Park.¹⁵⁶

Agriculture and municipalities contributed to the Poudre's pollution. Fertilizers and pesticides ran off fields or sank into groundwater and made its way to the river. Great Western Sugar violated Colorado's waste abatement requirements and exceeded sugar beet industry effluent limits. W.D. Farr, a director of Great Western Sugar from 1965 to 1970, explained how the sugar factories pumped waste directly from the mills to the Poudre and other Colorado rivers:

“In the fall the rivers were just terrible from beet processing. Wet pulp, everything went into the rivers and they were just a stinking mess,” Farr recalled. Municipalities polluted the Poudre with fertilizers, herbicides, pesticides, pet waste, motor oil, and illegal dumping of paints and chemicals down storm drains. The *Greeley Tribune* reported,

Agricultural pollution from feedlots and fertilizers used to be the biggest threats [to the river], but City water officials are discovering that the habits of city residents are just as dangerous. And it could be even worse because, while agriculture is hardly booming, the population of Colorado is exploding.

Pollution levels fluctuated with the amount of water in the Poudre. The same percentage of pollution was legally allowed in the river during times of high flow and low flow with drastic consequences for wildlife and humans who ventured into the diminished river at the end of summer.¹⁵⁷

Protection and pollution were not the only issues that pitted irrigators and environmentally concerned citizens against each other. Expanding the use of the Poudre through groundwater pumping incited further controversy. This issue was complicated by the fact that groundwater use escalated in dry years and wells spread throughout the valley just as water users were developing an understanding of how groundwater functioned in relation to surface water, and before there was an established body of groundwater law.

Poudre irrigators, taking advantage of post-war technology, drilled wells and pumped groundwater in unprecedented amounts in the latter half of the twentieth century. Pumping groundwater on one’s own property was much more convenient than relying on the old ditch system: farmers turned electric pumps on and off themselves when they needed to. Longtime Poudre valley irrigator Bob Stieben explained:

The appeal of a well is that it is there on command. If I decide at ten o’clock in the morning that I’d better start irrigating [from the ditch] I would go out and punch the button and I would start irrigating. Whereas if I decided at ten o’clock in the morning I wanted to irrigate why I would go in and call the ditch company and order water for the next day. So you have the flexibility if something should go wrong like if you have a ten-inch rainstorm in the afternoon you just go in and shut your well off. If you have ditch water ordered in it won’t get shut off until the next morning more than likely. Well water is also available early whereas ditches often don’t run until there is enough demand.

A one time investment in a well and a pump was often cheaper in the long run than purchasing reservoir water after ditch water ran low in late summer.¹⁵⁸

Irrigation wells were first used in the Cache la Poudre valley in the nineteenth century. According to a U.S. Geological Survey report on groundwater in the basin, the first irrigation well was dug east of the town of Eaton in 1885 and the practice of pumping groundwater via wells gradually escalated in the early twentieth century. L.G. Carpenter, irrigation engineer at the Colorado Agricultural College, noted in 1902, “the thought of many has been turned toward irrigation by pumping, and many trials have been made both by inventors and by farmers of devices which will serve to raise water economically.” Early pumps were centrifugal pumps powered by steam or gasoline engines that pulled water from twenty feet below the surface. Much of the Poudre’s groundwater was below twenty feet and not accessed until the turbine pump came to the valley. In the fall of 1928, a farm owned by W.D. Farr’s father accumulated standing water in a low spot. Apparently, the water had seeped from the nearby Larimer and Weld Canal after it was cleaned of weeds and a silt lining that had protected it from seepage. With the lining gone, water leaked out of the sides and bottom of the large canal and turned up in Mr. Farr’s fields. Farr asked irrigation expert Ralph Parshall for help removing the water from his soggy land. Parshall suggested a turbine pump, then used almost exclusively in California. These electric powered pumps proved very popular in the Poudre valley in the subsequent decades.¹⁵⁹

Drought compounded the use of groundwater. When the river’s surface flow was scarce, the newly tapped groundwater filled the void. 1940 was a year of severe drought that came on the heels of the dry 1930s. The amount of water pumped for irrigation in 1940 totaled 220,000 acre-feet, with an additional 9,000 acre-feet for municipal use and 4,000 acre-feet for sugar factories and railroads. The total pumped for the year - 233,000 acre-feet - was, according to W.E. Code, irrigation engineer at the Colorado Agricultural Experiment Station, “equivalent to more than two-thirds the average annual flow of the Cache la Poudre River, or more than three-fourths the proposed capacity of the Colorado-Big Thompson diversion tunnel.” The U.S. Geological Survey reported that the number of wells jumped in the mid 1950s in response to another drought.¹⁶⁰

By the 1960s and 1970s, pumps and wells were ubiquitous on the Poudre landscape. Thoughts turned to using groundwater in ways that satisfied everyone’s water rights and did not injure other users or the overall water supply. Irrigators grappled with questions about the nature of groundwater. Did the groundwater underneath a field belong to the landowner? Did it belong

to the nearest watercourse and, if so, should it be divided among surface water users who held legal rights? If it was pumped to depletion, did this hurt other water users? Questions concerning groundwater brought up issues of hydrology - the study of the flow and distribution of water over the earth's surface, its subsurface, and the atmosphere. Hydrologists observe how water moves, sinks into the soil, evaporates, and falls back to the earth as precipitation, otherwise known as the hydrologic cycle.

Researchers at the Colorado Agricultural College and many Poudre irrigators realized groundwater was connected to nearby streams and that using one source affected another. As early as 1937, Ralph Parshall wrote,

This practice of the depletion of the ground-water storage will ultimately deprive some other appropriator farther down stream of his ditch water, which in some cases is wholly derived from the return flow of this ground water back into the stream.

He went on: "Pumping is not a cure. The constant draft on the underflow has, it is believed, been largely responsible for the depletion of the return flow in the South Platte River valley."¹⁶¹

Pumping groundwater depleted underground reservoirs, also called aquifers. According to an engineering study conducted in the 1980s, the major aquifers in the Cache la Poudre valley were the Cache la Poudre River valley fill and terrace deposits, Boxelder Creek, Lone Tree Creek, Spring Creek, and Crow Creek valley fill deposits, and the Harmony Terrace pediment and fan deposits. These aquifers are shallow and hydraulically interconnected. The Lone Tree, Spring, and Crow Creek aquifers are outside the Cache la Poudre basin but are hydrologically linked, because their principal recharge source is irrigation water from the river. The depth to water in the aquifers ranges from zero to forty feet. The quality of the groundwater varies depending upon the amount of times it was pumped to the surface and used before resuming its subterranean journey back to the Poudre or its tributaries. Surface water applied to crops passes through soil and recharges, or replenishes, groundwater but along the way picks up minerals and deposits them in the aquifers. Samples taken after the 1950s drought revealed the Poudre's groundwater contained "dissolved solids in amounts prohibitive to irrigation under normal conditions." The use of fertilizers and pesticides further degrades groundwater quality.¹⁶²

As irrigators accelerated their use of groundwater, the Colorado Legislature developed guidelines to oversee it, much as they had in the late nineteenth century to manage surface water use. In 1951, the Colorado Supreme Court ruled in one early groundwater case, *Safranek v.*

Town of Limon, that all ground water that makes its way to a stream is considered tributary to that stream and subject to appropriation as part of the waters of that stream. The Colorado Legislature created groundwater regulations in 1957 that required groundwater users to file statements with the State Engineer by July of 1960 indicating the “nature, extent, location, and quantity of their withdrawals and use.” Well users had to obtain a permit from the State Engineer before drilling new or deeper wells. The Legislature exerted further control over groundwater in 1965 with the enactment of the Colorado Ground Water Management Act. This legislation empowered the State Engineer to shut down well owners if their actions injured other water users. It also classified groundwater as either tributary, meaning it was hydrologically connected to a stream, or non-tributary, meaning it was not connected to an identifiable watercourse. Legally, water was presumed tributary until proven otherwise. Anyone wanting to legally appropriate groundwater applied for a permit with the state’s Groundwater Commission, identified the basin from which water would be taken, described the anticipated beneficial use, the location of the well, the annual amount of water applied to the land, and the maximum pumping rate of the well so the commission could form an idea of where and how much water was used throughout a river basin. A permit for groundwater use issued by the Ground Water Commission referred to a particular piece of land and the water could not be used elsewhere without authorization.¹⁶³

Another round of state legislation produced the 1969 Water Rights Determination and Administration Act, which established priorities between surface water users and groundwater users as well as priority rights among groundwater users. This act declared:

It is the policy of this state to integrate the appropriation, use, and administration of underground water tributary to a stream with the use of surface water in such a way as to maximize the beneficial use of all the waters of this state.

According to the 1969 act, water users seeking to change their water rights from surface flow to groundwater had to obtain judicial approval from newly created water courts. Water courts published a monthly list of “resumes,” or applications for changes of water rights from surface water to groundwater, and all users who may be affected by such changes could file their opposition with the court. A change in use was allowed if it did not “injuriously affect” others with legal rights to the river.¹⁶⁴

The 1969 Water Rights Determination and Administration Act also authorized the use of augmentation plans for irrigation wells. With an augmentation plan, a well owner used water out of priority, whenever they wanted to, as long as they replaced the water used out of priority so senior appropriators had their full share. Replacement, or augmentation water, was acquired in various ways. Drying up previously irrigated acreage and crediting the unused water back to the stream was one way, diverting water from another watershed, or using non-tributary groundwater were other ways to augment the river's supply and satisfy senior appropriators. In 1969, in response to this legislation, irrigators, local leaders, attorneys, and the Cache la Poudre Water Users Association (CLPWUA) sat down and developed an augmentation plan for Poudre groundwater users. Under the "Poudre Plan," participating well users turned over their unused water rights to the CLPWUA. Well users then used these decrees at their wells rather than at the river's various ditches and reservoirs. The same amount of water was used from the Poudre system as if surface users exercised senior decrees and well users with junior rights had their decrees shut off. It was essentially another exchange system.¹⁶⁵

Bringing groundwater into the priority system, regulating its use, and requiring augmentation plans helped prevent the additional consumption of Poudre water. Groundwater legislation was developed in the 1960s in the context of the environmental movement with its emphasis on preserving natural resources. Holding water consumption at a steady rate concerned Poudre valley residents debating another controversial issue on the Poudre - new storage projects.

Cache la Poudre irrigators discussed plans for new reservoirs shortly after the Colorado-Big Thompson project was completed in 1957. In the 1960s, a coalition of Poudre valley water users and Northern Colorado Water Conservancy District board members developed an ambitious plan for Cache la Poudre storage that included multiple dams on the Poudre's main stem and tributaries. Those favoring new reservoirs in the second half of the twentieth century were as enthusiastic as those fighting for CBT in the 1930s, but attitudes among some citizens were changing towards large reclamation projects.¹⁶⁶

The 1940s, 1950s, and 1960s were the glory days of the Bureau of Reclamation when the Bureau built "cash register" dams along some of the West's largest and most beautiful rivers – the Columbia, the Missouri, and the Colorado to name just a few. Huge dams generated hydroelectric power and financed other Bureau projects, thus, acting like cash registers. But the

flurry of building took its toll on the physical landscape of the West and portions of the public lost their tolerance for these large, expensive projects. Growing numbers of Americans questioned the necessity, expense, and damage to the natural environment large dams caused. With the rise of the environmental movement in the 1960s and disasters such as the collapse of the Bureau of Reclamation's Teton Dam in southeastern Idaho in 1976, opposition to dams and reservoirs grew. Still, Poudre valley water users, especially the Northern Colorado Water Conservancy District, explored the river's canyon, employed engineers and experts, bought out landowners, and tried to convince residents they needed new reservoirs.¹⁶⁷

Initially, there appeared to be Bureau of Reclamation support for a Poudre storage project. In 1963, the Bureau proposed the construction of Idylwilde Reservoir in the Poudre Canyon and a second reservoir at Grey Mountain, near the mouth of the canyon, with a power system between the two storage sites, as well as diversion dams, conduits, transmission lines, and substations. Idylwilde Reservoir, as proposed in the 1960s, would have backed water up the river for seven miles and meant relocating portions of Colorado Highway 14. The reservoir was to be located within the Roosevelt National Forest and required purchasing over 3,000 acres of federal, state, and private land. The Bureau of Reclamation raised questions about the feasibility of selling the electric power from this proposed project and the need for additional irrigation water in the Poudre valley. It concluded in 1966, "the total irrigated acreage in the Cache la Poudre basin had facilities and water supplies ample to meet an average of 95 percent of their theoretical requirements." The Bureau believed Fort Collins and Greeley would not need the additional water provided by the Idylwilde Reservoir until forty years in the future and the estimated five percent shortage irrigators faced with the existing supply could be recouped with improved water management practices. The Bureau also noted that North Poudre Irrigation Company, with help from a Bureau of Reclamation Small Reclamation Project Loan, was constructing Park Creek Reservoir. It was thought that this small reservoir could alleviate the shortages in the water delivery system and permit more efficient use of available water.¹⁶⁸

Interest in the second reservoir proposed by the Bureau of Reclamation, Grey Mountain Reservoir, emerged in the late 1970s in response to drought. The Larimer-Weld Regional Council of Governments Drought Council requested another Bureau of Reclamation feasibility study for a Poudre storage project and the Cache la Poudre Water User's Association, Northern Colorado Water Conservancy District, and the Fort Collins and Greeley water boards supported

this. However, the environmental movement was in full swing in the 1970s and the drought did not last long.¹⁶⁹

State agencies took a greater role in proposing storage projects as the federal government eased out of the practice. In the early 1980s, the Northern Colorado Water Conservancy District asked the Colorado Water Resources and Power Development Authority to study the Poudre basin and determine what type of water and hydroelectric power project could be built without federal assistance. The Colorado Water Conservation Board also conducted feasibility studies for Poudre storage on behalf of the state Legislature. This time, as feasibility studies proceeded, it was not the Bureau of Reclamation that objected to the plan but a group of angry local residents. Opponents of Poudre storage projects tended to be urban, suburban, and middle class and many of the organized opposition groups were based in Fort Collins rather than the more rural Weld County. These citizens loathed destroying the river's canyon for more storage and voiced concern about the cost of new dams and reservoirs and the lack of a market for hydroelectric power, which was to generate revenue to partially pay for the project. Dam opponents advocated alternatives including enlarging and dredging existing reservoirs, storing water in underground aquifers, buying additional CBT water, and emphasizing water conservation. Opposition grew when local newspapers and the *Denver Post* reported in 1981 that approximately 200 houses would be flooded by the proposed reservoirs. Dam construction and the re-routing of Highway 14 would affect other homes. Thousands of acres of deer, elk, and bighorn sheep habitat would be lost as well as the state fish hatchery and the 80,000 pounds of rainbow trout produced annually in the canyon.¹⁷⁰

Environmental groups and sympathetic citizens criticized the reservoir proposals for the environmental destruction they claimed the new dams would cause. Dams prevent spring floods on rivers and alter natural flows that fish adapt to over time. Natural river flows generally peak in spring with snowmelt and decline the rest of the year in the Rocky Mountain West. But, to generate hydroelectric power, water levels behind dams are forced to peak in summer and winter when electricity demand is highest. This causes water to fluctuate, which impedes the formation of insulating ice in winter, which warms fish. Additionally, because water released from modern dams has to be free of debris to prevent damage to the machinery that regulates flow, water is released from the calmer, deeper parts of reservoirs. This water is often warmer or colder than the temperature of the river and the shock can kill native fish unaccustomed to sudden

temperature fluctuations. Dams also restrict natural flood flows that remove trees with shallow root systems along riverbanks. Invasive trees such as tamarisk and Russian olive flourish with restricted flood flows. This changes riverbank habitat and aides predators' access to fish. Rivers without dams carry sediment, which forms sandbars, backwaters, and pools where fish feed and young fish grow away from swifter currents. Finally, dams impede spawning and migration of some fish and produce new environments, primarily lake habitat, sometimes unsuitable for the fish and wildlife that adapted to the riparian environment.¹⁷¹

In addition to ecological concerns, the proposed Poudre reservoirs threatened to deluge cultural artifacts and stunning topography. After surveying over 6,000 acres where Grey Mountain Reservoir was to exist, archaeologists found twenty historic and nine prehistoric archaeological sites that included remnants of bridges, road grades, canals, mines, dugouts, cellar holes, masonry foundations, and standing structures. These sites were associated with a variety of themes including homesteading, ranching, farming, early tourism, and Depression era public works projects. Six sites were believed eligible for the National Park Service's National Register of Historic Places, authorized under the National Historic Preservation Act of 1966. All significant sites were located in "direct impact areas" and would be partially submerged in the beginning phases of construction. Furthermore, archaeologists maintained that "Inundation would be tantamount to destruction at all six [potential National Register] localities and avoidance/protection are not feasible management actions unless project designs are seriously altered or abandoned." The report concluded with a warning that the survey was incomplete and "The absence of known archaeological sites within large portions of the study area therefore should not be interpreted as necessarily indicating a true dearth of sites." The potential environmental and cultural losses upset some Poudre valley citizens.¹⁷²

There was also opposition to the Northern Colorado Water Conservancy District's role in acquiring land and paying for the proposed Poudre reservoirs. Five local residents who opposed the reservoir proposals founded the group Friends of the Poudre (FOP) in 1986. By 1989, FOP had several hundred members and the support of thousands of local citizens. The group opposed the \$3 billion Poudre Power Project that included a 416-foot tall dam at Grey Mountain, four miles west of the canyon mouth. This reservoir was designed to back water several miles up the river to just below the community of Poudre Park and inundate five miles of the Poudre's North Fork. FOP warned members in its newsletters "there will be no public vote on whether to build a

dam on the Poudre River. No new legislation will have to pass. Any agency can apply for and receive a license to build a dam project for private benefit, subject to approval from various state and federal agencies.” FOP’s objections went beyond Poudre storage projects to the organization driving the project itself - the Northern Colorado Water Conservancy District. In April of 1989, FOP staged a “tea party,” the Boston type, at Horsetooth Reservoir. Approximately forty demonstrators in three rafts tossed Kentucky bluegrass clippings (their “tea”) into the reservoir, carried signs and rallied against the conservancy district’s “taxation without representation” policy. Participants felt that if water conservancy districts taxed the property of all residents in a district, the residents should be able to elect its board members. Rather, under water conservancy district legislation, board members were appointed by court judges and were not subject to term limits. The Northern Colorado Water Conservancy District countered that voters approved the taxation policies and the appointment of board members by judges when conservancy districts were created in the 1930s; this downplayed the demographic changes that occurred on the Front Range since then. Additionally, the counties served by the Northern Colorado Water Conservancy District welcomed new residents and taxpayers until the district eventually collected more money than they repaid to the Bureau of Reclamation for construction costs of the CBT project. Repaying the construction loan was the reason the conservancy district originally received the power to tax. In 1986, the Sierra Club and Friends of the Poudre had accused Northern Colorado Water Conservancy District of secretly buying land for the Poudre dam projects with excess money collected from taxpayers. Concerned citizens believed the mission of the Northern Colorado Water Conservancy District had changed from a water distributor to a water development agency and they intended to have a voice in those decisions.¹⁷³

According to the Northern Colorado Water Conservancy District, the Poudre storage projects were not built in the 1980s because the plans lacked funding and public support. The district was reluctant to ask residents living within its boundaries to pay for the entire project and sought funding for the dams from utility companies, some of which expressed interest but could not provide enough capital. Plans for new Poudre storage projects are still discussed and future generations will debate the issue. The Wild and Scenic River and the National Heritage Corridor legislation left eight miles of the lower canyon portion of the Poudre River undesignated and, therefore, open to development. This was intentional and was considered a compromise between

environmentalists and citizens who wanted as much of the Poudre protected as possible and others who were concerned about the water supply of the region. W.D. Farr predicts a drought will eventually be the impetus for building more reservoirs on the Poudre. He commented in 1999, “If we try [to build reservoirs] in plentiful years, environmental opposition is too strong.... People haven’t seen it like I have! It is awfully hard to get them to understand how a drought slowly chokes things.” Bob Berling, Bureau of Reclamation Project Manager from 1973 to 1984 for CBT observed in 1987, “the days of building the CBT and other projects are over.... We really don’t have a federal water program any more. If the Poudre Project is developed, and I think it should be, it will have to be done by the District or the state.” Former river commissioner John Neutze, believes the Grey Mountain reservoir will eventually be constructed although it may take twenty to thirty years. As he puts it, “You can’t keep growing people without the need for more water.”¹⁷⁴

Strident protests against storage proposals in the late 1980s and 1990s may have been influenced by the abundant precipitation during that time and a corresponding feeling that the Poudre valley was water rich. According to the Colorado Climate Center, since 1982, Colorado experienced the longest period of reliable moisture since the 1905 to 1929 period, when settlers flocked to the West and plowed up the prairies. In the past, as seen time and again on the Poudre, humans reacted to natural occurrences and only time will tell how a prolonged drought will affect the Poudre and its population with its current level of storage.¹⁷⁵

Another issue that Poudre water users wrestled over in this era that reflected new values over the river’s use was minimum stream flow. Minimum stream flow referred to the practice of allowing water to bypass storage facilities and diversion structures and flow into a watercourse for the environment and the preservation of aquatic life. Using water for minimum stream flow to improve fish habitat was not part of early definitions of beneficial use in Colorado. The state constitution did not specifically define beneficial use but did mention domestic, agricultural, and industrial uses. In later years, the Colorado Legislature expanded the definition of beneficial use to include using water for fighting fires, sprinkling streets, recreation programs, and minimum stream flow. A report by the U.S. Department of Health found that minimum stream flow was particularly important to the Poudre because so much of its water was diverted that little remained for fish and wildlife. Much of the “surplus” water in the river, after diversions, derived

from irrigation return flow and municipal and industrial runoff from storm drains. This water entered the lower reaches of the river and did little for aquatic life in the rest of the stream.¹⁷⁶

In the 1990s the U.S. Forest Service (USFS) became embroiled in the minimum stream flow issue in an effort to protect wildlife in and near the Poudre and the wilderness areas that drew water from the river and its tributaries. Healthy forests protected rivers by accumulating snow that melted at rates that the stream could carry without building up sediment in the watercourse. At this time, the USFS reconsidered the permitting process authorizing Fort Collins, Greeley, and Water Supply and Storage to store water in their reservoirs located on Forest Service land in the Poudre canyon. Permits were previously given to the cities and the ditch company for twenty-year periods, but when the permits came up for renewal in 1991, the USFS was revising its policies to incorporate minimum stream flow regulations. The USFS issued permits for one year while the agency implemented new proposals in favor of more river flow to protect forests, stream channels, and habitat. The USFS wanted the cities and Water Supply and Storage to release water from their high mountain reservoirs in fall, winter, and spring months so the Poudre would flow at a more “natural” rate during these seasons, as if the reservoirs were not there.¹⁷⁷

The cities, ditch company, and United States Senators Hank Brown and Ben Nighthorse Campbell appealed to the Secretary of Agriculture, the department that oversees the U.S. Forest Service, to block the minimum stream flow mandate. They objected on the grounds that such requirements would cause a loss of water yield and an increase in operating expenses because of the difficulty accessing the mountain reservoirs in the winter to release water. The USFS, for its part, cited an amendment to the 1969 Water Rights Determination and Administration Act that authorized the Colorado Water Conservation Board to acquire water for minimum stream flow in Colorado. Water rights purchased for minimum stream flow were part of the priority system, meaning the Conservation Board, like all appropriators, commanded water only when its rights were in priority. This did not guarantee minimum flow at all times.¹⁷⁸

In the dispute between the USFS and the Poudre water users, Judge Robert Behrman of Greeley Water Court ruled against the USFS and in favor of Poudre water users. The USFS appealed to the Colorado Supreme Court but not long afterwards Greeley, Fort Collins, Water Supply and Storage, and the USFS made an agreement outside of court that satisfied the USFS’s minimum stream flow requirements without the cities and ditch company formally

acknowledging the policy. Under the agreement, Fort Collins, Greeley, and Water Supply and Storage signed a “Joint Operations Plan” in which they exchanged water among themselves and released a total of ten cubic feet per second into the Poudre. This increased winter flow in such a way that minimized each group’s individual loss of water and let local entities retain control over the process rather than submit to federal regulations. Other conflicts erupted on the Poudre during this time over providing water for fish and wildlife. One involved a ditch company, an environmental group, a scenic valley, and a few fish. Like the USFS minimum stream flow issue, this too had a local solution.¹⁷⁹

The Poudre’s North Fork was dammed in the first half of the twentieth century to create Halligan and Seaman Reservoirs, but the river still flows freely in Phantom Canyon on the North Fork, in part, because of an agreement between the Nature Conservancy and the North Poudre Irrigation Company. The Nature Conservancy maintains the 1,700-acre Phantom Canyon Preserve along the North Fork. The preserve contains black bears, mountain lions, bobcats, mule deer, pronghorn antelope, big horn sheep, bald eagles, golden eagles, great horned owls, brown and rainbow trout, and over 200 plant species including the Larimer aletes, a rare type of parsley listed under the Endangered Species Act. In 1843, John C. Fremont wrote of the Poudre’s North Fork canyon:

It was a mountain valley of the narrowest kind – almost a chasm, and the scenery very wild and beautiful. Towering mountains rose about, their sides sometimes dark with forests of pine and sometimes with lofty precipices washed by the river. Below the green river bottom was a wilderness of flowers, their tall spikes sometimes rising about our heads as we rode among them.¹⁸⁰

The Nature Conservancy purchased the preserve in the mid-1980s to “protect one of the last remaining roadless canyons along Colorado’s Front Range” and operates the area as a wildlife and fish sanctuary. Just north of the preserve, North Poudre Irrigation operated Halligan Dam, filling it between November and March, and allowing little, if any, water to flow beyond the dam and into the North Fork during these months, as is their legal right. In 1987, the Nature Conservancy negotiated with North Poudre to release a small amount of water from Halligan Reservoir during the winter months to connect pools together in the river and allow fish a better chance of surviving the season. The irrigation company agreed to release 2.5 c.f.s., which was estimated to be five acre-feet per day for the stream or about 600 acre-feet for the months of November to February to improve fish habitat. The Nature Conservancy agreed to reimburse the

irrigation company if Halligan Reservoir was not completely filled by July 1st. In 1988, North Poudre Irrigation further agreed to the Nature Conservancy's request to stop shutting Halligan's gates suddenly at the end of the irrigation season and, instead, incrementally step-down flow over the course of a few days and step-up flow in February or March to more closely simulate natural stream patterns in spring and fall.¹⁸¹

The agreement between the Nature Conservancy and North Poudre Irrigation does not work perfectly every year. Droughts heighten tensions and many farmers in the valley are skeptical of the entire deal. The relationship was tested in 1996 when North Poudre released water from Halligan Reservoir so the State Engineer could perform a safety check on the dam's gates. 7,500 cubic yards of sediment from the bottom of the reservoir flooded the Poudre's North Fork, killing fish and insects and destroying miles of fish habitat. In some places the sediment was more than ten feet deep. North Poudre and the Nature Conservancy met with the State Engineer's Office, the Division of Wildlife, the Water Quality Control Division, and the Colorado Department of Natural Resources in an attempt to increase communication and prevent another incident like this from taking place. Yet, this is another example of a local solution to a problem that state and federal agencies are grappling with. Such an agreement can serve as a model for future relations between Poudre water users, environmentally concerned citizens, and environmental organizations struggling over how to share a limited, essential resource.¹⁸²

As seen time and again, water – powerful, ever-changing, and ephemeral – affected the institutions set up to control it and the society and economy that depended on it. The Cache la Poudre is diverted, measured, monitored, coveted, jealously guarded, respected, and enjoyed. It is the most polluted river in Colorado and the first designated Wild and Scenic River and the only National Heritage River in the state. The river supports agriculture, cities, industry, and recreators who compete, sometimes contentiously, over the river. The Poudre's human neighbors also occasionally compromise with each other in order to share the river's water as happened several times at the local level on the river. The Cache la Poudre is an active shaper of human history along its banks, a force that both serves humans and keeps them on their toes.

CHAPTER SIX: The Twenty-First Century Poudre

“The ditch is a moody creature, unpredictable, irritable, irritating, unreliable.”
-- Stanley Crawford, *Mayordomo: Chronicle of an Acequia in Northern New Mexico*¹⁸³

George Varra grows hay on 160 acres of land north of Fort Collins. He wakes at 5:15 a.m. every day, like most farmers. But, rather than walk out to his fields and set irrigation pipes, Varra sits down at his computer, dials up the Canyon Gauging Station located where the Cache la Poudre tumbles out of its canyon and onto the plains, and downloads the most current reading of the river. He checks the current height of the water and the flow in cubic feet per second. He refers to this information several times a day to make sure the river is moving as he thinks it should. He then plots the Poudre’s flow on a continuous, rolled up sheet of graph paper that he updates everyday, all summer long. George Varra is the Cache la Poudre river commissioner and each spring he gets a telephone call that prompts him to put away the charts and records that occupy him all winter and begin actively managing the Poudre’s system of canals and reservoirs.¹⁸⁴

In his fourteen years as deputy and full-fledged commissioner, George Varra has seen a lot of changes on and around the Poudre. He has seen physical changes to the river’s shape, droughts and floods that affect its flow, weeds and pests that invade the water delivery system, the appearance of a major municipal pipeline, gravel pits, and powerful water entities that control increasing amounts of the Poudre’s water. These occurrences demonstrate how humans battle the Poudre and the environment around it as they change it to suit their needs, while thoroughly using its water. For George Varra, every day managing the Cache la Poudre River could bring something new.

During the irrigation season, New Cache La Poudre Irrigation Company is the first to call commissioner Varra at 5:45 a.m., to see how much water would be available that day. At 6:00 a.m., Larimer and Weld Irrigation Company calls, followed by Water Supply and Storage at 6:15 a.m. and finally, at 6:30 a.m., North Poudre Irrigation. Individual irrigators let the irrigation companies know by telephone or email how much water they needed and the companies convey this information to Varra.¹⁸⁵

In addition to fielding the morning phone calls and plotting the flow of the river, Varra and his deputy commissioner routinely check the Poudre's canals and chart houses where instruments record the amount of water diverted from the river each day. That is why, on a hot, June morning in 2003, George Varra swung his pickup truck to the east side of Highway 14, about six miles up the Poudre canyon, and unlocked a chain link fence using a key chain the size of a man's fist. He descended crude, stone steps to a dirt ledge ten feet below the highway. Cars and campers roared by overhead, oblivious to the meticulous water monitoring Varra was conducting just feet below the road. This was the North Poudre Diversion Structure, the first major diversion off the Poudre. Headgates draw water away from the main channel of the river and send it rushing into a tunnel built by the Bureau of Reclamation in 1952 as part of the Colorado-Big Thompson system. This water is shunted under the foothills and under the Poudre itself before carrying water to the Wellington area.¹⁸⁶

Inside the small, white chart house under the highway, Varra checked the original 1950s equipment that records the river's flow and the amount of water entering the canal twenty four hours a day during the irrigation season. He sent an electric tape drop, basically a tape measure that gives off an electric charge when its tip hits water, down into the stilling well where water enters from the roiling canal and calms enough to permit an accurate reading. When the tape hit the water, Varra recorded the depth and examined the chart recordings on an instrument that resembles a miniature seismic machine. A piece of graphite recorded fluctuations on graph paper wrapped around a metal cylinder. Some water districts, such as the St. Vrain, invested in electronic data loggers that commissioners simply hooked their laptop computers to and downloaded the flow information. But, on the Poudre, the old equipment worked just fine and the commissioner was used to it. From the squiggly lines he determined when a cold spell hit the mountains and slowed the river's current, when a ditch company had trouble regulating the spill on its reservoir, and when a ditch rider shut off his or her headgates. After reading the chart at the North Poudre Diversion, George Varra moved on downstream.¹⁸⁷

The next stop was near the canyon mouth where the Poudre met the plains. The Poudre Valley Canal siphoned water from the river on the south side of Highway 14 with concrete and steel headgates and, further down the ditch, sandgates returned sand and gravel back to the river. The canal was empty but its moist, sandy bottom and flattened grass indicated that water recently flowed there, a good sign for Poudre valley irrigators since this canal did not run water at all

during the 2002 drought year. The Poudre Valley Canal fills reservoirs in Larimer and Weld Irrigation Company's reservoir system, namely Cobb Lake and Douglas Reservoir No. 8. Beyond its chart house, an access road passes over the canal and tire tracks lead through tall weeds to the Poudre River Canyon Gauging Station, where Varra receives information each morning. There are two gauging stations on the river, this one just west of the canyon mouth and another near the Poudre's confluence with the South Platte. These stations make extremely accurate measurements of the Poudre's flow and transmit this information via satellite to the Colorado Department of Water Resources, where citizens and officials, such as George Varra, access them with a computer and a modem. The Poudre's Canyon Gauging Station was the first gauging station in the state and has been used continuously since 1883. It has a nondescript, concrete chart house, assorted governmental communication and meteorological devices protrude from the building, and a cable that state hydrologists take manual river measurements from hangs over the main channel.¹⁸⁸

The river was wide and swift at the gauging station that June day but this was not always the case. In 1983, the Poudre experienced a lengthy flood flow caused by heavy snowmelt. The water moved so much sand and rock along the riverbed that an island formed just downstream from the gauging station. It accumulated over time as the river pushed more sand and rock against this barrier and willows and other vegetation grew contentedly on it. The river commissioner and State Engineer's office considered the island a nuisance. The Poudre's flow slowed before the island and the river split into two forks to move around it, backing water up into the main channel and interfering with the gauging station measurements. In 2001, the island was removed with the help of a bulldozer at low flow; the river's human neighbors had won the battle, however temporarily.¹⁸⁹

George Varra collected his chart from the Poudre's gauging station and headed off to the next canal, paralleling sandstone hogbacks where, high up on the rocks, the Poudre Valley Canal creates a barely visible line as it travels south and east to fill its prairie reservoirs. Varra passed a fresh cutting of alfalfa drying in the sun and green ears of new corn in a distant field. Only an irrigator with a very old and secure water right could plant corn, a crop that requires a tremendous amount of water, despite the past three years of searing drought and the record low flow of the river.¹⁹⁰

The Poudre's canals and reservoirs have eased some of the effects of droughts and floods through the years but, ultimately, the climate and the river's water supply are out of human control. Droughts and floods, even the mere thought of them, affect decisions and emotions on the river. The most severe droughts to hit the Poudre valley in the late nineteenth and twentieth centuries occurred in the late 1880s and 1890s, between 1930 and 1937, in 1940, between 1953 and 1956, 1975 to 1977, and 2000 to 2002. Human responses to drought varied. Reservoirs were built during and after the 1890s and 1930s droughts and groundwater was tapped in the 1950s. In the early 1980s, Colorado developed its first Drought Response Plan. No new governmental agency was established, but the plan coordinated the activities of local governments, universities, and other public and private entities already involved in drought research and monitoring. Snowpack, streamflow, and reservoir levels are measured daily in hundreds of locations across Colorado to assess and prepare for drought. During the drought that began in 2000, Fort Collins and Greeley initiated water restrictions and rate hikes, farmers held prayer services for rain, and discussion again turned to storage proposals. Farmers stopped planting sugar beets and switched to more drought-resistant crops. The Western Sugar Cooperative, which took over sugar beet processing from Great Western Sugar and is owned by farmers in Colorado, Nebraska, Wyoming, and Montana, closed its Greeley factory in 2003 because of the drought. All other beet-processing factories on the Front Range were closed in the late twentieth century. For the first time in 100 years, sugar beets were not processed in the Poudre valley.¹⁹¹

Droughts amplify tension among water users. Despite the instances of cooperation on important issues such as the exchange system and augmentation plans on the Poudre, squabbles among water users are commonplace. In a semi-arid climate, where water is scarce and jealously guarded, people often argue over getting their proper share and making sure others don't take more than they should. When water is scarcer than normal, emotions are heightened. Glen Johnson, a Poudre valley irrigator who farmed near Harmony Road in Fort Collins and was also the president of the Larimer County Canal No. 2 Irrigation Company, remembered:

When the water was tight, you couldn't get enough of it to go around, that's when you had the arguing I can remember my dad getting in some awful arguments with some of them old-timers down the way. In fact, I can remember one telling my dad one day - he caught him up at the headgate of the ditch - and he said, 'you're not supposed to be here, the superintendent's supposed to take care of that.' And dad says, 'well, I was up to check to see if the headgate had any weeds

or anything in it, you know, slowing down the flow of water.’ And I can remember this neighbor saying ... ‘if I catch you one more time up at this headgate I’m going to shoot you.’ And he was serious, too!¹⁹²

Droughts reveal a region’s limits. There is some concern in the West today that drought is more than a fleeting occurrence. The seven western states that share Colorado River water – Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming – face dwindling supplies from that river due to prolonged drought at the same time demand is increasing along the Front Range and in cities like San Diego and Las Vegas. The *New York Times* reported in 2004:

Those who worry most about the future of the West – politicians, scientists, business leaders, city planners and environmentalists – are increasingly realizing that a world of eternally blue skies and meager mountain snowpacks may not be a passing phenomenon but rather the return of a harsh climatic norm.

Droughts elicit calls for additional storage and conservation and serve as reminders that growth in the West is finite. Floods, on the other hand, cause a different type of damage.¹⁹³

The Colorado Front Range experiences three types of floods. Springtime snowmelt floods are usually welcome and initiate little, if any, damage when the extra water is channeled through the Poudre’s ditches and stored in reservoirs. Occasionally rain accelerates snowmelt and the resulting spring flood may be heavier than usual, causing some damage. In 1983, heavy flows from excessive snowmelt intensified the flood flow in the Poudre, eroded the river’s banks, and downed enormous cottonwoods and willows that had grown on the edges for decades. The third type of flood happens along the Front Range in June, July, and August and is triggered by convective thunderstorms that produce intense rain over short periods of time. Flash flooding and swift currents cause severe erosion, property damage, and, sometimes, death. Witnesses often report a “virtual wall of water” during such floods. This was the case on the night of July 31, 1976 when strong easterly winds propelled a moist, unstable air mass upslope against the northern Front Range mountains. Atmospheric conditions held the clouds nearly stationary over the area for several hours. Flash floods swept through the canyons of Larimer County causing 139 deaths and over \$35 million in damage. Rainfall over the Poudre basin was ten inches, but the worst of the damage was over the canyon of the Big Thompson River, to the south of the Poudre.¹⁹⁴

The Poudre escaped the worst of the damage in 1976 but had seen its share of floods before that. In June of 1859, a flood caused one early settler named Provost to lose a ferry he kept tied up on the river. A flood in May of 1864 inundated the valley where the original Camp Collins was located near present-day LaPorte. According to early Fort Collins' resident, Ansel Watrous, the flood halted more than 200 immigrant wagons on the bluffs south of LaPorte as travelers waited for the waters to recede. Camp Collins relocated further down the river to a higher piece of land. Other floods occurred in 1874, 1888, and 1891, the latter when the Chambers Lake Dam collapsed. A flood occurred on the North Fork of the Poudre in May 1904 and covered the towns of LaPorte and Bellvue with two feet of water. Railroad tracks, bridges, fences, and culverts were damaged in Wellington and, one observer commented, "the Boxelder valley was afloat from bluff to bluff." After the floodwaters receded, the Boxelder Creek coursed in an old bed a half-mile from its previous location. A lengthy account in the Fort Collins newspaper described,

Nearly all day Friday while no rain fell in Fort Collins, dark masses of clouds hung on the horizon west and north. The rainfall in the watershed of the North Fork of the Poudre and on that of the Boxelder must have been enormous. The river Friday afternoon about four o'clock was flowing about 900 cubic feet per second. In two hours the flow had risen to not less than 30,000 cfs and Water Commissioner Armstrong thinks it was more, perhaps 40,000 feet. The effect cannot be described. The whole river bottom was overflowed, not with stagnant water but with a rushing torrent. The damage was what might have been expected from a stream swollen to nearly a mile wide.¹⁹⁵

Blackie Mason's dance hall floated downstream until it crashed into a railroad bridge. All bridges between LaPorte and Greeley were damaged and an iron bridge at LaPorte reportedly "careered down stream like a steam boat." Ditches overflowed their embankments and headgates were damaged. The Poudre Valley Canal washed out and the overflow destroyed the headgate of the Larimer County Canal and eroded its banks. The Pleasant Valley and Lake Canal headgate was destroyed and two miles of its length filled with sand. North Poudre Irrigation Company lost thirty headgates and laterals and all the ditches crossed by Boxelder Creek reported some degree of damage. The Buckingham area near Fort Collins, home to many of the recently arrived German-Russian sugar beet laborers, was inundated when the river, apparently following an old streambed, coursed right through it. Many of the German-Russian's small frame houses were found "decorating" the farm of John G. Coy the morning after the

flood. Mr. Coy, for his part, was one of the few Poudre valley residents who remembered both the 1864 and 1904 floods. He believed the flood of 1864 that washed out Camp Collins was worse than the 1904 flood. Still, the damage in 1904, when there were more homes, farms, and businesses to be destroyed, was estimated at over \$200,000. The City of Fort Collins later assessed this flood's peak flow at 21,000 c.f.s., similar to what it was in the 1864 and 1891 floods. In comparison, the normal spring "flood" of the Poudre is approximately 4,000 c.f.s. The *Greeley Tribune* reported flooding in June 1947 when the Poudre was running near or at flood stage and a dike on 9th Street was breached during the night. Water spread over the river bottoms, flooded Island Grove Park, and forced the evacuation of 100 homes between 11th Avenue and 8th Street. Because of frequent flood damage, Greeley and Fort Collins spent considerable time and money altering land and watercourses for flood prevention. The cities also installed expensive flood warning systems to protect citizens.¹⁹⁶

Other Poudre basin floods were frequent but not as severe. The Box Elder Creek flooded eleven times between 1904 and 1969 until the Soil Conservation Service installed flood control dams near the town of Wellington, north of Fort Collins. In some instances, irrigation canals caused flooding. The West Vine Basin in Fort Collins flooded in 1980, 1997, and 1999, partly because of spills from irrigation canals coursing through that vicinity. Canals helped other flood-prone areas. The area around Dry Creek has had no serious flooding since 1950 because irrigation canals intercepted some of its flow. In spite of these canals and state and city flood plans, the land around the Poudre and its tributaries is still not immune to flooding, as evidenced by the Spring Creek flood in 1997 that killed five people and destroyed over 2,000 homes and businesses. Other flooding occurred on the Poudre and in its surrounding cities, usually caused by flash floods caused by thunderstorms of the type that flooded the Poudre and Big Thompson River in 1976 but they were either on tributaries of the Poudre (for example, Dry Creek in 1951 and Spring Creek in 1938 and 1997) or were not as dramatic on the Poudre River itself, having more to do with flooding in the streets due to excessive rainfall or in adequate storm drains, as in 1902 and 1992.¹⁹⁷

In summer 2003, floods were far from commissioner Varra's mind. After checking the Canyon Gauging Station, he followed a frontage road to Water Supply and Storage's Larimer County Canal. From its beginning near the small town of Bellvue, this canal travels sixty miles onto the plains and helps fill twelve reservoirs. It was built in 1881 but acquired earlier water

rights including priorities from the old Pioneer Ditch built in 1862. Below the clapboard chart house, this canal has a concrete weir rather than the more typical Parshall Flume. Varra did not mind that it was not the Parshall, he only asked for an accurate measuring apparatus on each ditch. It was up to the ditch company to install the device and keep it in working order. While some might find measuring water a daunting task, the commissioner's experience and the help of conversion charts made it easy, although he was careful to say he did not get involved with how ditch companies measured water once it was past their headgate from the river. There is a stilling well in the Larimer County Canal's chart house but no electric tape drop so Varra stepped out onto flimsy planks masquerading as a bridge across the fast moving canal and read the weir's outside staff, which resembles a giant ruler.¹⁹⁸

The water ran smoothly in the Larimer County Canal, partly because dense vegetation in the canal slowed the current. Willows, shrubs, brome grass, and the pale yellow sprigs of the dreaded leafy spurge thrived on the ditch water and grew thicker and heavier with each passing cubic foot. Ditch companies in the valley sprayed the weeds with herbicides and weed districts sent out notices to ditch companies and irrigators admonishing them to keep control of the invaders, but every year they appeared on the ditches. Weeds and pests were evidence that the Poudre's human neighbors had not truly mastered the river or its water delivery system. Irrigation systems, and water in general, seldom performed exactly as boosters, engineers, politicians, and settlers in the West expected them to. An army of people diverted water into canals, shored up the earthen walls after the water surged through them, pulled, scraped, and poisoned the weeds and moss that grew in the shallow canals, replaced rusted headgates, dredged silted reservoirs, rebuilt dams that leaked and settled, and filled sinkholes that appeared out of nowhere. As soon as early Poudre settlers excavated their canals and sent Poudre water surging on a new course, nature reacted, as it always did.¹⁹⁹

Non-indigenous weeds - Russian, spotted, and diffuse knapweed, Canada and musk thistle, leafy spurge, perennial pepperweed, hoary cress, downy brome, and Dalmatian toadflax - grow in irrigated fields and ditches along the Poudre. Two of the most noxious weeds in Colorado that thrived around irrigated agriculture are the thistles and leafy spurge. Canadian thistle is a creeping perennial that reproduces from seeds and has a dense underground root system. It prevails in Colorado's cultivated fields, pastures, rangeland, forests, riparian areas, lawns, and gardens. Leafy spurge can extend its roots thirty feet into the ground and tends to

overtake all other vegetation in pastures, rangeland, and riparian areas. Irrigators pulled, hacked, burned, and poisoned these weeds and eventually banded together in cooperative groups to combat them. Larimer County started an organized weed control district in 1959 with two pilot programs in Fort Collins and Loveland. The North Fork Weed Coop on the North Fork of the Poudre holds monthly meetings, formulates weed management plans, and gives workshops and weed tours. In Weld County, the Public Works Department controls noxious weeds on county property and works with landowners to combat weeds and comply with the Colorado Weed Management Act that lists and seeks to eradicate noxious weeds in the state. The top ten offenders are all located within Larimer County and many within Weld County. Ditches are prime incubators for weed growth as ditch water transports weed seeds to irrigator's fields.²⁰⁰

Weeds are not the only nuisances Poudre irrigators encounter. Caterpillars, alfalfa weevil, grasshoppers, spotted alfalfa aphid, corn borers, and the Colorado potato bug occasionally feast on cultivated crops in the Poudre valley. In 1889, the Poudre valley experienced a severe outbreak of the potato bug. Irrigators in Greeley and Eaton alone used 14,000 pounds of Paris Green, a copper and arsenic compound, to attack this parasite. David Boyd estimated the average farmer spent over \$8,000 in labor and chemicals fighting the pest. The Beet Leafhopper, an insect three millimeters long, visited the Poudre off and on. The Leafhopper carries organisms that trigger the "curly top" disease in sugar beets which causes the leaves of the beet to curl up, turn yellow and die, killing the plant. Between 1930 and 1937, Poudre valley farmers confronted an infestation of grasshoppers and webworm in sugar beets. As quickly as Poudre valley irrigators converted dry grassland into irrigated fields and created miniature riparian environments along canals, plants and animals changed as well. By the twenty-first century, irrigators and other water users on the Poudre were fairly used to the weeds and pests associated with the water delivery system, but they were still aggravating and expensive to stamp out.²⁰¹

After Varra checked the Larimer County Canal, with its abundant weeds, he headed to the Greeley Water Treatment Plant at Bellvue. This treatment facility diverts and stores raw water from the Poudre in holding ponds lined with plastic that prevents seepage. Colorado-Big Thompson water from Horsetooth Reservoir is added to the Poudre River water and treatment begins. It is easier to treat the water from these two different sources after it is mixed because the composition of each fluctuates and requires different chemicals. Skirting this facility is the

Pleasant Valley and Lake Canal, the reason for Varra's visit. This small ditch had an old six foot Parshall Flume in disrepair near the chart house. Two trees pushed against it and tilted it towards the water, most likely interfering with accurate water measurements. This canal cut through a swath of powdery, red soil that crumbled away along the bank. The hoof prints of cattle filled slowly with water and melted in the soft edges. The Pleasant Valley and Lake Canal follows the natural topography of what looks like an old draw. Its meandering path and stray trees give it the appearance of a creek, shimmering and alive with insects. This natural looking area is a reminder that although irrigation systems are man-made, they are not always artificial looking, especially the Poudre's older canals that wander around hills, ridges, and depressions in the land, much like creeks.²⁰²

The flotsam of the latest drought – tree limbs, tennis balls, soda cans, leaves - pushed against the headgates of the Pleasant Valley and Lake Canal. Sometimes whole trees forced their way into a canal. The high flow of the Poudre in 2003 after several years of low flow brought on by drought caused the river to pick up debris that languished on its dry edges for several seasons. Occasionally ditch riders, who oversee individual ditches, float old telephone poles in the water just in front of the headgates to prevent debris from being sucked against the gates with the momentum of the diverted water. The larger canals have trash gates for the same purpose. Sometimes headgates are closed to relieve the pressure of the water while ditch riders remove trash with hooks, backhoes, or trucks with winches attached.²⁰³

Trash is not the only thing invading Poudre valley canals. Water in the desert attracts all kinds of life. When it flows over the warm soil of a canal in summer it brings life with it and invites it to its banks. Raccoons, possums, muskrats, deer, birds, small fish, insects, and humans gather on canal banks for various reasons. Varra and others see muskrat holes in canals, although they rarely glimpse the creatures themselves. One spring, a ditch rider on the Jackson Ditch discovered a family of beavers had moved in over the winter. Occasionally children swim in the canals and every four to five years a few people die swimming in the Larimer and Weld Canal. Sometimes the life that is drawn to the water is threatened by its very condition. In 1991, retired CSU biology professors, Howard Ensign Evans and Mary Alice Evans, listed the river otter, pygmy shrew, peregrine falcon, bald eagle, boreal owl, wood frog, boreal toad, northern leopard frog, greenback cutthroat trout, johnny darter, and Iowa darter as “tottering on the verge of local or of total extinction” in the Poudre basin.²⁰⁴

As Varra climbed back to solid ground from the bottom of the Pleasant Valley and Lake Canal he avoided the prickly pear cactus dotting the banks, a reminder that the desert waited patiently at the edge of this moist environment. Beyond the headgate and this quiet ditch, the Poudre roared past on its way to the cities of Fort Collins and Greeley. As the commissioner drove just east of Bellvue to the Dry Creek Ditch, more commonly called the “Jackson Ditch,” he passed the remnants of an old experiment station between the ditch and the river, a reminder of the river’s appeal as a laboratory. Beside the headgate of the Jackson Ditch in the 1920s, Ralph Parshall diverted water into the Colorado Agricultural College Hydraulic Laboratory’s experimental flume. In 2003, the wooden shell of Parshall’s flume was rotting, the bottom was boggy and overgrown with weeds, and the clapboard building where the researchers worked was covered in grime. Parshall’s headgate no longer diverted water and the Jackson Ditch had new concrete on its headgate. Ironically, the six foot Parshall Flume at the Jackson Ditch did not work properly, instead of sloping down to flush out sand and debris, the throat had almost leveled out. The river commissioner and ditch riders changed their calculations to correct for the slowed flow and the resulting inaccurate measurements.²⁰⁵

From the Jackson Ditch, Varra traveled south and east through rolling hills past Claymore Lake, filled by the Pleasant Valley and Lake Canal. On a dirt track that skirted the bottom of Bingham Hill, the cemetery on top bristling with cactus, Varra stopped his pickup and unlocked a series of cattle gates leading to the Larimer County No. 2 Canal. This canal and the New Mercer Canal next to it take their water from the same diversion dam on the river and parallel each other for most of their runs southeast through Fort Collins. This is the only double diversion dam on the Poudre. These two canals extend from the south side and the Little Cache la Poudre Canal diverts from the north side. The Larimer County No. 2 and the New Mercer, along with the Poudre Valley and Lake and the Arthur canals are owned by the City of Fort Collins. The canals have large trees growing on their banks; the city fears angering landowners by destroying this shady, riparian environment despite the water such phreatophytes consume. The spit of land between the river and the canals was just wide enough for Varra’s truck. The south bank of the river eroded here in 1983 from the same floods that gave birth to the island near the Canyon Gauging Station. The riverbank below is shored up with concrete, boulders, and riprap by the New Mercer Ditch Company to prevent further erosion and possible

destruction of the ditch. The river's urge to constantly rearrange its bed is not conducive to the irrigation system.²⁰⁶

Cotton from the cottonwood trees blew in the bottomlands between the Larimer County No. 2 and the New Mercer Canal. It clotted in the waist high grasses that George Varra waded through to reach the chart house of the New Mercer Canal. The New Mercer was first constructed in 1869 by a group of people from Mercer, Pennsylvania interested in forming an agricultural community in the West. The canal this group constructed has been enlarged several times and has water rights dating back to 1869, 1871, 1872, and 1880. Canadian thistle stands five feet tall in this secluded place, crowned by purple buds ready to burst open. Sunlight filters through the cottonwoods and willows and shines down through the water to the sandy bottom of the old ditch. The undergrowth surrounding the canal is so thick and lush that it is easy to think for a moment that one is in some humid locale. It takes effort to remember that the water churning below the concrete flume is there through human intervention and that the green landscape around it is contrived.²⁰⁷

From this pastoral place, the river commissioner headed south on Taft Hill Road, over a new bridge built high and wide because of the Poudre's repeated flooding near this section of road. Just below Taft Hill itself was a boggy field, a common occurrence when Larimer County No. 2, just a few yards south, was running water. Landowners complained regularly to Varra about seepage water that surfaced, most inconveniently, on their land. The commissioner predicted that as demographics continued to change in the valley and urban environments replaced farms, ditch companies would have to more actively combat the seepage problem.²⁰⁸

From Taft Hill Road, Varra approached the chart house for the Arthur Ditch, formerly known as the Fort Collins Irrigation Canal, or "town ditch." There were no trees on that part of the Arthur and the descent to the chart house featured slippery sand that covered the tops of Varra's shoes. The barren landscape and the searing heat reminds observers that the ditch is fighting a battle against a more arid environment; at the Arthur chart house, compared to the jungly New Mercer Canal, it appears the desert was winning.

Arthur is one of the older ditches on the river. Constructed in 1869, it provides water for domestic use within the city of Fort Collins and for farms along its eight-mile length. The canal was diverted into conduits in the early twentieth century and runs under the older section of Fort Collins. It passes through the Colorado State University campus, crosses Spring Creek between

College and Shields avenues, and fills Williams Lake and Nelson Reservoir. A few yards north of the chart house the diversion dam off the Poudre is large and noisy, the opposite of the sluggish ditch that waters one farm in east Fort Collins, a parcel of land very close to being swallowed up by housing developments. When this farmer sells, the Arthur Ditch will solely irrigate parks, schools, and greenbelts for the city.²⁰⁹

On the north and east side of the Arthur Canal, former gravel pits were filled with water and surrounded by trees. Commissioner Varra believed that along with continued municipal growth, the biggest change that could affect the Cache la Poudre River and surrounding areas in the near future was the expansion of gravel pit mining. Gravel pits are expected to proliferate north of Highway 287 in Fort Collins and east of Interstate 25 near the cities of Windsor and Greeley. When gravel pits are dug, groundwater seeps into the pit and evaporates off the surface resulting in a net loss of water to the Poudre basin. A state law requires gravel pit owners to pay for evaporative losses in pits dug after 1980 or else augment the evaporative groundwater losses by keeping the pits full of legally appropriated water. This water slowly seeps into and replenishes the groundwater. If a pit owner adds a clay or slurry lining to the pit after gravel mining operations are over, it can then be filled with water if the company obtains decreed water rights. The pit then acts as a storage reservoir. Some old gravel pits near the Colorado State University Environmental Learning Center in east Fort Collins were converted to natural areas.²¹⁰

Another change in the Poudre's water delivery system was the Pleasant Valley Pipeline – the first significant pipeline transporting Poudre River water. The Northern Colorado Water Conservancy District, in conjunction with the cities of Greeley and Fort Collins, the East Larimer County Water District, Fort Collins-Loveland Water District, and the North Weld County Water District, constructed the pipeline in the spring and summer of 2003. The 8.5 mile conduit took water from the North Poudre Irrigation's Munroe Canal just north and west of Ted's Place on Highway 287 and traveled under the Poudre River to three water treatment plants owned by the cities and water districts. By jointly building this pipeline, these groups hoped to transport water more efficiently to their respective treatment facilities and delivery areas and avoid duplicate projects. Construction of the Poudre Valley Pipeline is emblematic of the growth of municipalities that can afford to finance such projects. It also probably means the eventual demise of open canals in the Poudre valley as cities acquire the money and technology to build

these new water delivery systems that are impervious to evaporation and seepage, weeds, and pests.²¹¹

Beyond the Arthur Canal, looms the wide Larimer and Weld Canal with its thirty-foot Parshall Flume. The water surges towards the flume with a steady, powerful current and the structure creates a powerful backlash once water is shunted down its throat and released. Water hits the bottom of the canal, rolls up in a startlingly large wave, crashes into the sides of the canal and back into itself, causing wakes on the surface before it settles down again and rolls away on its forty-five mile journey to the eastern plains. This is a powerful canal that runs 700 c.f.s. of water. Near its headgates, the concrete-lined sides resemble the sterile canals of the Central Valley Project in California or the Central Arizona Project. No trees grow along its banks, although leafy spurge is visible growing right to the concrete edge, drawing water from the canal through its long tap root.

The Larimer and Weld Canal is an extension of the Larimer County Canal No. 10, originally constructed in 1864. Benjamin Eaton helped enlarge the No. 10 Canal in 1875 and became convinced that a much larger canal was needed in the vicinity. He began building an extension to the No. 10 in 1878 but quickly ran out of money. He convinced the Denver Pacific Railway and the Colorado Mortgage and Investment Company, also known as the “English Company,” to partner with him and the ditch was completed in 1881. This large canal is big enough to carry the entire flow of the Poudre River, although it does not have the water rights to do so.²¹²

In contrast to this large canal is the old Coy Ditch, dug by John G. Coy and his wife Emily in the early 1860s. The ditch’s diversion dam on the river, once made of rock and brush, is now concrete punctuated in the middle for a canoe shoot and at the side to create a fish ladder. Interestingly, the City of Fort Collins went to water court and obtained a water right, albeit very junior, to run water through this canoe shoot for recreational purposes. This was an unusual step but one that emphasized the importance of the river for recreation and the revenue it generates for the area. The Coy Ditch runs unobtrusively along the west side of Linden Street. It was never enlarged and is still only approximately one and a half miles long and carries less than two cubic feet per second, miniscule compared to the Larimer and Weld Canal, but a source of pride to John G. Coy and the difference between success and failure in 1865. It now waters a golf

course in Fort Collins and may someday provide water to the *WalMart SuperCenter* located where the Coy farm used to be.²¹³

Varra's deputy river commissioner checked the southern half of the Poudre's canals. He began his weekly chart check where George Varra ended his, at the Box Elder Ditch near River Bend Ponds in east Fort Collins. Like Varra, he worked his way downstream. The deputy commissioner's route quickly took him east to the New Cache la Poudre Canal, commonly referred to as "No. 2." Weeds and Russian olive trees grow along the canal's banks and dip down into the water. The Rocky Mountains loom in the western distance, brown and purple in the early morning light, snow still visible on the highest peaks. The Greeley No. 2 diverts water two miles south of the town of Timnath and terminates twenty-six miles to the east. It is thirty feet wide, similar to the Larimer and Weld, and the water bubbles as it surges off the sloped bottom of the twenty-five foot Parshall Flume. The graphite line on its chart showed wide fluctuation because this canal carries the diurnal runoff from the river. The river commissioner kept the Poudre flowing at seventy c.f.s. past this canal, but as snowmelt intensified on warm days and slowed at night, the river's flow rose and fell. The daily, or diurnal, flow fluctuated and the Greeley No. 2 got the excess above seventy c.f.s.²¹⁴

This is a land of cottonwoods, small farms, and two-lane roads. Agriculture is the third most profitable industry in Colorado and Weld county ranks fifth in the nation in money generated from agriculture. Statewide, agriculture uses over 85 percent of the available water in the state. Some fault the prior appropriation doctrine that awards water on a first come, first served basis and encourages water users to use or lose their water. Such a system protects individual rights rather than encouraging basin, state, or regional water plans that could distribute water in a more equitable, efficient manner. Historian Donald Pisani asserted in his book, *Water, Land, and Law in the West: The Limits of Public Policy, 1850-1920*:

Prior appropriation creates absolute rights and provides little incentive to conserve water. Indeed, users are encouraged to consume more water than they need so they can maintain a claim to the largest supply possible. This misuse, in turn, leads to waterlogged fields, the buildup of alkali and salts from excessive irrigation, abandoned farms, the pollution of surface and groundwater from pesticide runoff, damage to fish and wildlife from excessive diversion, an increased use of underground water, inadequate land use planning, and the neglect of the water needs of Native American communities. Even though the right to use water was given away for nothing by the federal government to states, prior appropriation does not recognize a 'public interest' in how water will be used.

At the present time, no one has successfully challenged the prior appropriation doctrine in Colorado, but changes in the way water is allocated may be ahead just as change creeps steadily closer to the old agricultural areas in Larimer and Weld counties. Fields of alfalfa are platted to receive thousands of new homes in the near future, which will dramatically alter this pastoral landscape.²¹⁵

The Poudre's deputy river commissioner had a long, hot morning ahead of him. He pulled his government truck onto a dirt track and checked on the Jo Dee gravel pit. This pit belongs to the Central Colorado Water Conservancy District, a district that mainly buys water rights to augment well use along the South Platte River. Checking these augmentation pits adds to the workloads of the commissioner and his deputy. Additional bodies of water using Poudre water rights must be monitored. These storage pits are lined with clay and filled with water from upstream ditches. The Joe Dee Pit is filled with water from the Box Elder Ditch after it flows through the Ptarmigan Golf Course near the town of Windsor. This change of water use threatens to dry up downstream ditches such as the Ogilvy, which has a junior water right, but, being the last on the river, previously had plenty of water from irrigation return flow. In some instances, augmentation ponds intercept the return flow, or, it is sent down the Poudre to the South Platte, past downstream ditch riders who wonder why the water bypassing their headgates is not for them anymore. Central is the newest entity on the Poudre and its influence is seen and felt all along the river's lower reaches.²¹⁶

Off of County Line Road near Windsor, through a cattle gate marked private property, the deputy river commissioner guided his truck towards the B.H. Eaton Ditch. The headgates are on the south side of the Poudre. Water courses through the ditch for four miles before it rejoins the river. This was Benjamin Eaton's original ditch, built in 1864, which irrigated his farm about one mile east of it. Eaton's original water right was number nine in priority on the Poudre. Past a dirt road, weeds, and sullen cattle, a corrugated metal shack stands next to this narrow ditch. Hunting was once allowed in these bottomlands and the metal hut protected the ditch rider and river commissioner from stray bullets, at least while they were inside of it. The mountains are no longer visible, lost to distance and mid-morning haze. The water here is murky and sluggish, revealing its distance from the snowfields where it originates. In the bottomlands near Ben Eaton's ditch, one glimpses the challenges that awaited early settlers in the hot Colorado

summers. A housing development creeps over the low hills to the west, a reminder that the state increasingly grows people instead of crops.²¹⁷

Heading east again past the Kodak plant near Windsor, the Poudre is visible by the line of trees in the increasingly arid landscape. The next stop was Greeley No. 3, the first canal built by the Union Colony for household use within the new town and the first large, cooperatively built canal in the Poudre valley. Now, the city of Greeley and the Greeley Irrigation Company jointly manage the canal. The dirt track along the canal parallels the Poudre River Trail, and the deputy commissioner often encountered people walking along the ditch thinking it was the river. This is not surprising since the Greeley No. 3 usually carries more water than the Poudre at this point. At the canal's headgate, only a splash of water trickles over the diversion dam and the Poudre below the dam is a series of shallow, green pools in between sandbars. Driftwood, trash, and old tires litter the bottom; mosquitoes hover and birds clamor. The river gains water further downstream from runoff and seepage. Still, it is startling to see the ditch take almost all of the river's water. The canal, in contrast, runs briskly with grass and trees alternating along its banks - orchard grass, Canadian thistle, leafy spurge, mustard weed, and one gigantic willow that must have grown along those banks for over a hundred years. Bridges span Greeley No. 3, leading to new homes that back right up to the ditch.

The last canal diverting water from the Cache la Poudre is the Ogilvy Ditch. This ditch was constructed relatively late on the Poudre, in 1881, by Lyulph Gilchrist Stanley Ogilvy, son of the Earl of Airlie from Great Britain. The Earl arrived in the United States in 1879, intrigued by the irrigation canals financed by the Colorado Mortgage and Investment Company. He purchased the Crow Creek Ranch for his son Lyulph who ran cattle on the land from 1881 to 1888. In 2003, the deputy commissioner drove his truck through the dirt parking lot of a truck washing station to the Ogilvy's concrete and wood diversion dam. A telephone pole acted as a trash block before the headgate and the mummified carcass of an unidentifiable animal floated along with the trash, the week before the animal had been bloated and evil smelling, but similarly beyond recognition. The water in the river was brown and slow, the channel narrow and lined with rushes and weeds. There were more sandbars than shade trees. What little water was left in the river trickled under, rather than over, the wood and concrete diversion dam and flowed past a mossy, mucky expanse before settling into small pools. The Ogilvy takes most of what was left of the Poudre, water that returns to the river after Greeley No. 3's diversion and from the city of

Greeley's water treatment plant. The water quality is severely diminished and, looking at the littered, muddy bottom of the emptied channel, it is apparent what a "working river" is. The Poudre staggers the remaining few miles to the South Platte while the Ogilvy Ditch, in contrast, gushes swift and muddy between grassy banks.²¹⁸

Standing above the Cache la Poudre after the Ogilvy Ditch's diversion, one understands that this river, literally, gives its all to the community that surrounds it. Its waters were first tapped for irrigation and domestic use in the 1860s. The system of canals and reservoirs that followed turned the landscape green, attracted more people, and supported a vigorous agricultural economy. Over time, green fields of alfalfa, sugar beets, and corn gave way to homes and industries. Urban water users came to depend on the Poudre as much as irrigators. Today, agriculture, municipalities, industries, and recreators argue over and share the Poudre's waters. This river is so essential to those who live around it that it is depleted, polluted, and left to stagger towards its traditional merging place with the South Platte River, on its way to the Missouri River, the Mississippi, and the Gulf of Mexico.

Endnotes

Introduction

¹ Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), 188. Worster quote see Donald Worster, *Rivers of Empire: Water, Aridity and the Growth of the American West* (New York: Oxford University Press, 1985), 27. Fiege quote see Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999), 9.

Chapter One: Necessity and Imagination

² Note, footnotes are located at the end of paragraphs rather than at the end of sentences; this makes for fewer but longer footnotes. Within each note, every source is identified and the point or quote to which it correlates is explained if necessary. The John Coy introduction is based on a letter written by Emily Coy for the annual banquet of the Pioneer Association in Larimer County. Reproduced in Ansel Watrous, *History of Larimer County, Colorado* (Fort Collins: MM Publications, 1911), 34-36, 471. Note, in Russell N. Bradt, "Foreign Water in the Cache la Poudre Valley" (Master of Arts Thesis, Colorado State College of Education, 1948), a John M. Coy is mentioned as a disgruntled miner who returned from the California gold fields and settled on the north bank of the Poudre. Watrous's account, however, contains the letter from Emily Coy and several other accounts of the John G. Coys whose family still lived in Fort Collins at the time Watrous published his book. Possibly John M. and John G. Coy are the same person and the "disgruntled miner" description refers to John G. Coy's days as a miner and itinerant worker in California in the 1850s, which Mrs. Coy mentions in her letter. For information on homesteading in Colorado in the 1860s see Carl Ubbelohde, Maxine Benson, Duane A. Smith, *A Colorado History*, 8th ed. (Boulder: Pruett Publishing, 2001), 186. For information on Camp Collins, Indian, and early settler activities see Robert O. Rupp, *The Fort Collins Military Reservation* (Fort Collins: privately printed, 1967), available at Colorado State University Archives. For general history on some of the Native Americans in Colorado, the fur trade, and gold rush see Carl Abbott, Stephen J. Leonard, and David McComb, *Colorado: A History of the Centennial State* (Niwot: University of Colorado Press, 1994); Ubbelohde, Benson, and Smith, *A Colorado History*, 1-18, 175-183. Also note, geographically, the "American West" is the area west of the one hundredth meridian that bisects North Dakota, South Dakota, Nebraska, Kansas, and Texas. It is, generally, an arid to semi-arid environment. Most areas receive less than ten or between twelve and fifteen inches of precipitation a year. Within the region there are areas with moist, humid climates such as the Pacific Northwest and high elevations of the Rocky Mountains. References to the arid and semi-arid West, here incorporate those areas in which irrigation is necessary for agriculture.

³ For information on early settlers in the Cache la Poudre valley see Jane E. and Lee G. Norris, *Written in Water: The Life of Benjamin Harrison Eaton* (Athens: Swallow Press, 1990). Ditch information in Jay Trask, *Irrigation and Water-Related Structures in the Cache La Poudre River Corridor* (Fort Collins: National Park Service, 2002), 13, 16, 64, 75, 77. Note, since John Coy's water appropriation date is April 1865, he either waited until 1865 to build a ditch or an initial ditch built in 1863 was wiped out in the 1864 flood. For details on Camp Collins as well as Indian and some settler activity in the Cache la Poudre valley see Rupp, *The Fort Collins Military Reservation*. Rupp researched the military records of Camp Collins and compiled many of them in his book. Camp Collins existed since the summer of 1863 when it was moved from its original location near LaPorte to present day Fort Collins after the flood of 1864. It was closed upon recommendation of William Tecumseh Sherman, Ulysses S. Grant, and others in 1867. A few settlers who lived near or on the military reservation from the 1860s remained after the soldiers left. The land was officially offered for homesteading in 1872, after some debate about whether Camp Collins was ever officially declared a military fort. Also see, Evadene Burris Swanson, *Fort Collins Yesterdays* (Fort Collins: George and Hildegarde Morgan, 1975), 6-10.

⁴ Department of Agriculture, Yearbook 1900: *Practical Irrigation*, by C.T. Johnston, C.E. and J.D. Stannard (Washington, D.C.: Government Printing Office, 1901), 492-496; "Development of Weld County and Greeley Tightly Bound Up with Irrigation Progress," *Greeley Tribune*, 10 October 1930.

⁵ For farming between 1860 and 1870 see Frank Fossett, *Colorado: Its Gold and Silver Mines, Farms and Stock Ranges and Health and Pleasure Resorts. Tourist's Guide to the Rocky Mountains*, (New York: C.G. Crawford, 1880), 165, available at the Colorado State University Archives. For farming statistics in the Poudre valley see Edwin E. Baker, "The Development of Irrigation," *The Weld County News*, 4 July 1917; Department of the Interior, U.S. Geological Survey, Water Supply and Irrigation Papers, *Irrigation Near Greeley, Colorado*, by

David Boyd (Washington, D.C.: Government Printing Office, 1897). Note, irrigated farming occurred in southern counties of Colorado from at least the 1850s. When water rights were legally recognized by the courts in order of priority the first appropriated water right in Colorado was granted to the San Luis People's Ditch in the San Luis Valley. Its priority date is April 10, 1852. See Ubbelohde, Benson, and Smith, *A Colorado History*, 187-188 and for more on early Colorado decrees see Alvin T. Steinel, *History of Agriculture in Colorado, 1858-1926* (Fort Collins: Colorado State Agricultural College, 1926), 177-178; Victor A. Elliott, *Decree in the Matter of Priorities of Water Rights in Water District No. 3, Entered by the Hon. Victor A. Elliott, Judge of the Second Judicial District, April 11, 1882* (Fort Collins: Evening Courier Printing House, 1882); C.C. Hezmalhalch, *Tabulation of Water Right Decrees for the State of Colorado, Irrigation Division No. 1, Water District Numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 23, 46, 47, 48, 64 and 65. Compiled from Certified Copies of Court Decrees by C. C. Hezmalhalch of the State Engineer's Office* (Denver: Smith-Brooks Printing Company, 1920).

⁶ For general information on early irrigators in Colorado, including corporate and foreign investors in irrigation projects, see Ubbelohde, Benson, and Smith, *A Colorado History*, 186-194.

⁷ David Boyd, *A History: Greeley and the Union Colony of Colorado* (Greeley: Greeley Tribune Press, 1890), vi-vii, 11-14, 30; Fossett, *Colorado: Its Gold and Silver Mines, Farms and Stock Ranges and Health and Pleasure Resorts*, 165; Dean F. Krakel, *South Platte Country: A History of Old Weld County, Colorado, 1739-1900* (Laramie: Powder River Publishers, 1954), 217-225; Worster, *Rivers of Empire*, 85; Ubbelohde, Benson and Smith, *A Colorado History*, 123-132. Note, other agricultural colonies in northern Colorado included the Agricultural Colony at Fort Collins, the Chicago-Colorado Colony at Longmont, the St. Louis-Western Colony at Evans, and the Unique Platteville Colony in Platteville. For more, see Boyd, *A History*, 13-14; Krakel, *South Platte Country*, 217-223; and Ubbelohde, Benson and Smith, *A Colorado History*, 123-132.

⁸ For information on Union Colony recruitment, ideals, and membership see Department of the Interior/Boyd, *Irrigation Near Greeley*, 210-213, and *First Annual Report of the Union Colony of Greeley Including a History of the Town of Greeley from Its Date of Settlement to the Present Time, with Descriptive Chapters on Agriculture, Irrigation, Climate, Mountain Scenery, Flora, Churches, Schools, Societies, etc.* (New York: George W. Southwick, 1871), 4-7. The quote in this paragraph is from *First Annual Report of the Union Colony of Greeley*, 7.

⁹ The *New York Tribune* quote is from Howard Ensign Evans and Mary Alice Evans, *Cache la Poudre: The Natural History of a Rocky Mountain River* (Niwot: University of Colorado Press, 1991), 220. The authors cite an April 12, 1870 *New York Tribune* editorial. Also see Steinel, *History of Agriculture in Colorado*, 191-192; and *First Annual Report of the Union Colony of Greeley*, 7-11.

¹⁰ See *First Annual Report of the Union Colony of Greeley*; Boyd, *A History*; Ubbelohde, Benson and Smith, *A Colorado History*, 126-128; "Union Colony: Its Location, the Country, Scenery, Resources, Capacity, Manufactures, Climate, Markets, Wages, Native Animals, etc.," *Rocky Mountain News*, 11 April 1870, 1; "From Greeley: An Interesting Letter from the New Town," *Rocky Mountain News*, 1 June 1870; Flower quote is from *Rocky Mountain News*, 23 May 1870, 4.

¹¹ Department of the Interior/Boyd, *Irrigation Near Greeley*, 29; William R. Kelly, "The New Cache la Poudre Irrigating Company; The Cache la Poudre Reservoir Company: Some History for the Past 88 Years" (Greeley, Colorado: 1958), 6, available at the City of Greeley Museums; Steinel, *History of Agriculture in Colorado*, 197. Note, Greeley's canals were originally called Union Colony Canal No. 1, 2, etc. and later changed to Greeley No. 2 and 3. The terms were used interchangeably in early documents.

¹² *Rocky Mountain News*, 23 April 1870; Boyd, *A History*, 61-62; "Greeley: A Glance at Some Important Improvements," *Rocky Mountain News*, 7 July 1870; Department of the Interior/Boyd, *Irrigation Near Greeley*, 27-29; David Boyd, "Greeley's Irrigation Methods," *Irrigation Age* 2 (1892); *First Annual Report of the Union Colony of Greeley*, 12, 32.

¹³ Boyd, *A History*, 59; Trask, *Irrigation and Water-Related Structures in the Cache La Poudre River Corridor*; Elliott, *Decree in the Matter of Priorities of Water Rights in Water District No. 3*. For construction contracts issued for Greeley ditch construction see Cache la Poudre Irrigation Manuscript Collection (MSS 1232), Colorado Historical Society, Box 15; Department of the Interior/Boyd, *Irrigation Near Greeley*, 27-28. Quote is from *Irrigation Near Greeley*, 67-8.

¹⁴ Department of the Interior/Boyd, *Irrigation Near Greeley*, 29-30; David Boyd, "Greeley's Irrigation Methods," *Irrigation Age* 2 (1892). Note, Greeley Canals No. 1 and 4 were not built by the Union Colony but canals based on those plans were later built by other entities; see David Boyd, "Greeley's Irrigation Methods," *Irrigation Age* 2 (1892).

¹⁵ See Baker, "The Development of Irrigation" for first quote and information. For more about preparing land for irrigation see Department of Agriculture, Yearbook: *Preparing Land for Irrigation*, by R.P Teele (Washington, D.C.: Government Printing Office, 1904); Department of Agriculture, Yearbook: *Methods of Applying Water to Crops*, by Samuel Fortier (Washington, D.C.: Government Printing Office, 1910), 298, 303-305; and Department of the Interior/Boyd, *Irrigation Near Greeley*, 73-74. For information on area soils see Department of Agriculture, Soil Conservation Service in Cooperation with the U.S. Forest Service and Colorado Agricultural Experiment Station, *Soil Survey of Larimer County Area, Colorado* (Washington, D.C.: Government Printing Office, December, 1980), 6-8. Quote is from Department of the Interior/Boyd, *Irrigation Near Greeley*, 74.

¹⁶ See Department of Agriculture, Yearbook: *Irrigation on the Great Plains*, by F.H. Newell (Washington, D.C.: Government Printing Office, 1897) generally, and for duty of water see pages 193-195; Department of Agriculture/Johnston and Stannard, *Practical Irrigation*, 507; U.S. Department of Commerce, Bureau of the Census, *Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census: 1890*, by F.H. Newell (Washington, D.C.: Government Printing Office, 1894), 818.

¹⁷ For irrigating head and weirs see Baker, "The Development of Irrigation"; Boyd, *A History*, 110-111; Department of Agriculture, Bulletin No. 1026: *Irrigation in Northern Colorado*, by Robert G. Hemphill (Washington, D.C.: Government Printing Office, 1923), 29. For the Max Clark box see Department of the Interior/Boyd, *Irrigation Near Greeley*, 70; Boyd, *A History*, 111-112; and Baker, "The Development of Irrigation."

¹⁸ Quote is from Department of Agriculture, Office of Experiment Stations, Bulletin No. 157: *Water Rights on Interstate Streams: The Platte River and Tributaries (Water Rights Within the States)*, by Elwood Mead (Washington, D.C.: Government Printing Office, 1905) 98.

¹⁹ Department of Agriculture/Newell: *Irrigation on the Great Plains*, 192-193; Department of Agriculture, Yearbook 1909: *The Problems of an Irrigation Farmer*, by Carl S. Scofield (Washington, D.C.: Government Printing Office, 1910), 200. Quote is from Department of Agriculture/Johnston and Stannard, *Practical Irrigation*, 491.

²⁰ Minute books of Taylor and Gill Ditch Company, entry dates 20 February 1892, 16 August 1892, 13 February 1894, 23 March 1905, courtesy of Susan Boyle, Fort Collins, National Park Service. Note: an entry dated 25 February 1899 indicated stockholders could pay off assessments by maintaining the ditch. See also Trask, *Irrigation and Water-Related Structures in the Cache La Poudre River Corridor*, 61.

²¹ For drainage problems in Greeley see Department of the Interior/Boyd, *Irrigation Near Greeley*, 80; quote is from page 52. For drainage problems in other areas of the West associated with irrigation see Mark Fiege, *Irrigated Eden*, 31.

²² For return flow and seepage in the Poudre valley and elsewhere see Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 11-12; Steinel, *History of Agriculture in Colorado*, 225-226; Department of Agriculture/Scofield, *The Problems of an Irrigation Farmer*, 203; Boyd, *A History*, 150-151. See also Department of Agriculture, Bulletin No. 218: *Irrigation in Colorado*, by C.W. Beach and P.J. Preston (Washington, D.C.: Government Printing Office, 1910), 21-22.

²³ Boyd, *A History*, 150-151, 187; Department of Agriculture/Scofield, *The Problems of an Irrigation Farmer*, 203-204; Department of Agriculture, Farmer's Bulletin No. 103, Experiment Station Work XI: *Excessive Irrigation* (Washington, D.C.: Government Printing Office, 1899); several maps in the Larimer County District Court Map Collection, Water Resources Archive, Colorado State University, show drainage ditches near Fort Collins. For a definition of salt in relation to irrigation see Worster, *Rivers of Empire*, 319. Worster writes: "Salt is a generic term covering not only the familiar sodium chloride in the kitchen shaker but also a range of chemical compounds that are reactions between bases and acids. These include calcium carbonate (chalk), zinc sulfate, barium chloride, sodium bicarbonate, various phosphates, nitrates, and hydrates. Typically they have a whitish or grayish color, and their structures are crystalline. They readily dissolve in water, making it 'hard,' or alkaline."

²⁴ Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 6. For further reading on problems associated with irrigation see Department of Agriculture/Scofield, *The Problems of an Irrigation Farmer*; Department of the Interior, U.S. Geological Survey, Water Supply and Irrigation Paper: *Conveyance of Water in Irrigation Canals, Flumes and Pipes*, by Samuel Fortier (Washington, D.C.: Government Printing Office, 1901); Department of Agriculture/Fortier, *Methods of Applying Water to Crops*; Department of Agriculture/Johnston and Stannard, *Practical Irrigation*; Department of Agriculture/Newell, *Irrigation on the Great Plains*; Department of Agriculture/Teele, *Preparing Land for Irrigation*.

²⁵ A.A. Edwards, "The History of Poudre River Irrigation," *Fort Collins Express Courier*, 20 September 1931; Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 47; Alfred Augustus Edwards, "Autobiography of A.A. Edwards, 1928," available at Colorado State University Archives. For

cooperation among irrigators generally see Department of Agriculture/Scofield, *The Problems of an Irrigation Farmer*, 205-206.

²⁶ For skepticism of Union Colonists see Baker, "The Development of Irrigation." For information on the sale of Union Colony canals and information on New Cache la Poudre Irrigation Company see *Articles of Incorporation and Bylaws of Cache la Poudre Irrigation Company Prospectus*, City of Greeley Museums, vertical file entitled "Water and Irrigation – Laws Regarding the Distribution of Water – Misc."; Department of the Interior/Boyd, *Irrigation Near Greeley*, 31; Kelly, "The New Cache La Poudre Irrigating Company," 11-14; quote is from Kelly, page 11.

²⁷ For mutual irrigation companies see Radosevich, *Evolution and Administration of Colorado Water Law*, 174-183; North Poudre Irrigation Company, *Annual Report* (Wellington, Colorado, 1980); Department of Agriculture, Technical Bulletin 82: *Mutual Irrigation Companies*, by Wells A. Hutchins (Washington, D.C.: Government Printing Office, 1929).

²⁸ For more on cooperation in the nineteenth century see Samuel P. Hays, *The Response to Industrialism: 1885-1914* (Chicago: University of Chicago Press, 1957) and William E. Smythe, *The Conquest of Arid America* (New York: MacMillan Company, 1905). Quote is from John Wesley Powell, "Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah," 45th Congress, 2nd Sess. House Executive Documents, No. 73, serial 1805 (Washington, D.C.: Government Printing Office, 1878), 11. Powell suggested that due to the West's aridity, the region should be divided according to watershed basins rather than the grid system to avoid interstate water litigation. For more on Powell see Wallace Stegner, *Beyond the Hundredth Meridian* (Boston: Houghton Mifflin, 1953); Charles F. Wilkinson, *Crossing the Next Meridian: Land, Water and the Future of the West* (Washington, D.C.: Island Press, 1992), 236-238.

²⁹ For growth in Colorado and railroad information see *The Rocky Mountain Directory and Colorado Gazetteer for 1871* (Denver: S.S. Wallihan and Company, 1871), 115-119; *First Annual Report of the Union Colony of Greeley*, 36; Krakel, *South Platte Country*, 76-80. *Rocky Mountain News* quote is from "The Cache La Poudre: Some Notes of a Neglected but Romantic Mountain Stream," *Rocky Mountain News*, 25 July 1875, 4. *Irrigation Age* quote from *Irrigation Age* 2, No. 5, 15 December 1891.

³⁰ Pabor quote is from Ann Hilfinger, "Origins of the North Poudre Irrigation Company" (Fort Collins: private files of Professor James Hansen, Colorado State University, 1993), 7-8. Hilfinger quotes William Edgar Pabor, *Farmer's Guide to Northern Colorado: A Manual for Intending Settlers* (Denver: Farmer Print, 1882), 3. For more on Pabor see David Boyd, *A History*.

³¹ Hilfinger, "Origins of the North Poudre Irrigation Company," 1,3; Victor A. Elliott, *Decree in the Matter of Priorities of Water Rights in Water District No. 3*, 62-63; K.M. Gambrill, *Historic Inventory: Larimer and Weld Canal/Eaton Ditch* (Colorado: Colorado Department of Highways, 1980). For more on corporate canals see Ubbelohde, Benson, and Smith, *A Colorado History*, 186-194.

³² Hilfinger, "Origins of the North Poudre Irrigation Company," 1,3-4, 9-13; Watrous, *History of Larimer County*, 209-210; Richard Seaworth, interview by author, Wellington, 15 April 2003, handwritten notes, National Park Service, Fort Collins, Colorado. According to Richard Seaworth, who is a farmer under the North Poudre system, the remnants of the original ditch from the North Fork of the Poudre to the Box Elder Creek remain and portions of it now form an intake canal for the Park Creek Reservoir.

³³ Those who irrigated with North Poudre water often suffered from the financial insecurities of its original corporate owners. Until the 1950s the North Poudre Irrigation Company's system was referred to as the "dry ditch," rarely supplying enough water to its users. Harlan Seaworth, interview by Colorado State University graduate students Wayne Latham and Anne Hilfinger, Wellington, 9 October 1992, tape recording, courtesy of Richard Seaworth.

Chapter Two: Expansion

³⁵ "Development of Weld County and Greeley Tightly Bound up with Irrigation Progress," *Greeley Tribune*, 10 October 1930.

³⁶ For canals in 1882 see Elliott, *Decree in the Matter of Priorities of Water Rights in Water District No. 3*. Note, throughout this manuscript, the phrase "water development," refers to the acquisition, diversion, storage, and use of water. For the purposes of this book, developed waters are those that are manipulated in these ways by humans.

³⁷ Watrous, *History of Larimer County*, 156-158; Edwards, "Autobiography of A.A. Edwards, 1928." Note, Edwards was a member of the Water Supply and Storage Company (formerly Larimer County Ditch

Company) Board of Directors from its founding in 1891 to 1910. See also Bradt, "Foreign Water in the Cache la Poudre Valley," 18-26, 60-61. Note, Shortly after the Larimer County Reservoir Company formed, it merged with the Larimer County Ditch Company and they remained united until their reincorporation as Water Supply and Storage Company in 1892. Bradt had access to many of Water Supply and Storage's files. Quote is from "North Park Irrigation," *Denver Times*, 9 November 1899.

³⁸ For information on flumes see Department of the Interior/Fortier, *Conveyance of Water in Irrigation Canals, Flumes and Pipes*. For information on Skyline Ditch see Bradt, "Foreign Water in the Cache la Poudre Valley," 30-35; Watrous, *History of Larimer County*, 156-158; A. Ahlbrandt and K. Stieben, eds. *The History of Larimer County, Colorado*, vol. 2 (Dallas: Curtis Media Group, 1987), 64; Edwards, "Autobiography of A.A. Edwards, 1928."

³⁹ Edwards, "Autobiography of A.A. Edwards, 1928." For information on the Grand River Ditch's construction and the quote in the *Fort Collins Courier* see Bradt, "Foreign Water in the Cache la Poudre Valley," 43-53; also see Don McMillen, "Grand River Ditch Labeled Historic Place," *Triangle Review*, 10 November 1976. For more on the Colorado River see Philip L. Fradkin, *A River No More: The Colorado River and the West* (Tucson: University of Arizona Press, 1981).

⁴⁰ Bradt, "Foreign Water in the Cache la Poudre Valley," 53-60; Krakel, *South Platte Country*, 259-261; for a bit more on the Grand river ditch also see www.nps.gov/romo/resources/environment/hydrologic.html.

⁴¹ Bradt, "Foreign Water in the Cache la Poudre Valley," 64-65. Note, Bradt cites the autobiography of A.A. Edwards, board member of Water Supply and Storage.

⁴² Department of Agriculture, Office of Experiment Stations, Bulletin No. 134: *Storage of Water on Cache la Poudre and Big Thompson Rivers*, by C.E. Tait (Washington, D.C.: Government Printing Office, 1903), 27-28; Bradt, "Foreign Water in the Cache la Poudre Valley," 66-72, 78-88. Note, Wyoming and Colorado water users reached an agreement over this diversion in which they split the amount of water and agreed to joint administration by the two states. The Sand Creek Ditch system was completed in 1902 for a cost of \$150,000. An interesting side note, in 1898 Wilson sold his stake in the Sand Creek Ditch project to early Poudre valley irrigator and investor in irrigation projects, Benjamin Eaton. See Norris and Norris, *Written in Water: The Life of Benjamin Harrison Eaton*, 216-217.

⁴³ Bradt, "Foreign Water in the Cache la Poudre Valley," 89-96; "Will Reclaim 75,000 Acres of Arid Land," *Fort Collins Weekly Courier*, 27 March 1907.

⁴⁴ Department of Agriculture, Technical Bulletin No. 254: *Irrigation Districts: Their Organization, Operation and Financing*, by Wells A. Hutchins (Washington, D.C.: Government Printing Office, 1931); J. Warner Mills, *Mills' Annotated Statutes of the State of Colorado: (Revised Supplement) Vol. 3* (Denver: Mills Publishing Company, 1904), 655; Ubbelohde, Benson, and Smith, *A Colorado History*, 252. For the Irrigation District Law of 1905, as opposed to 1901, see Radosevich, *Evolution and Administration of Colorado Water Law*, 162-163.

⁴⁵ *State of Wyoming v. State of Colorado, et. al*, Supreme Court of the United States, 259 U.S. 419 (1922). See also *State of Wyoming v. State of Colorado*, 286 U.S. 494 (1932); Bradt, "Foreign Water in the Cache Le Poudre Valley," 89-119; Edwards, "Autobiography of A.A. Edwards, 1928," 11-12.

⁴⁶ Bradt, "Foreign Water in the Cache Le Poudre Valley," 89-119; Edwards, "Autobiography of A.A. Edwards, 1928," 11-12.

⁴⁷ *State of Wyoming v. State of Colorado, et. al*, Supreme Court of the United States, 259 U.S. 419 (1922) and *State of Wyoming v. State of Colorado*, 286 U.S. 494 (1932). For general information on *Wyoming v. Colorado* see Ubbelohde, Benson and Smith, *A Colorado History*, 254-255. For more on the background of the case see Bradt, "Foreign Water in the Cache la Poudre Valley," 89-119; Hansen, "The Water Supply and Storage Company," 20; Edwards, "Autobiography of A.A. Edwards, 1928," 11-12; Edwards, "The History of Poudre River Irrigation." Note, Edwards was a board member of Water Supply and Storage from its beginning and manager of the Laramie-Poudre Reservoir and Irrigation Company from 1910-1911. Evans, *The Cache la Poudre*, 63-64.

⁴⁸ For statistics on transbasin water to the Poudre valley see Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 24. For testimony on the shortened irrigation season see Boyd, *A History*, 115.

⁴⁹ Note, some sources indicate that the Poudre's reservoir system was the first in Colorado but more extensive studies of other river basins should be conducted and compared to the Poudre's in order to say for sure. See *Larimer County Map 1933*, Larimer County District Court Map Collection, Water Resources Archive, Colorado State University. Despite several accounts that reservoir building in the Poudre area began in the 1890s, the county map referred to here shows 1 reservoir built in the 1870s, 20 in the 1880s, 15 in the 1890s, 33 in the 1900s, 7 in the 1910s and 2 in the 1920s. See also, Hezmalhalch, *Tabulation of Water Right Decrees for the State of Colorado, Irrigation Division No. 1, Water District Numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 23, 46, 47, 48, 64 and 6; Bulletin*

Containing a Tabulated Statement of Water Right Decrees in Irrigation Divisions Numbers 1 and 2, Compiled under the Direction of the State Engineer from Certified Copies of Decrees of District Courts Issuing Such Decrees (Denver: Published by Authority of the State Engineer, Smith-Brooks Press, 1906); Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 69; Department of Agriculture, Office of Experiment Stations, Bulletin No. 92: *The Reservoir System of the Cache la Poudre Valley*, by E.S. Nettleton (Washington, D.C.: Government Printing Office, 1901); Department of Agriculture/Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*, 16.

⁵⁰ Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 69-70; Department of Agriculture/Nettleton, *The Reservoir System of the Cache la Poudre Valley*, 15-17; Department of Agriculture/Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*, 22-28.

⁵¹ For Chambers Lake Dam collapse see Bradt, "Foreign Water in the Cache la Poudre Valley," 27-28; Edwards, "Autobiography of A.A. Edwards, 1928," 5-6. For evaporation see Department of Agriculture, Bureau of Agricultural Engineering in Cooperation with the Colorado Agricultural Experiment Station, *Evaporation from Free Water Surfaces*, by Carl Rohwer (Washington, D.C.: Government Printing Office, December 1931) 2-3; Boyd, *A History*, 148. For evaporation and groundwater loss from reservoirs, generally, see Fiege, *Irrigated Eden*, 7, 25, 98-99.

⁵² Baker, "The Development of Irrigation"; L. G. Carpenter, "The Story of Irrigation," *The Greeley Tribune*, 14 August 1902, courtesy of the City of Greeley Museums; Steinel, *History of Agriculture in Colorado*, 228. Note, per Shawn Hoff, former Cache la Poudre River Commissioner, the area that became Terry Lake was originally a farm that was prone to water accumulation.

⁵³ For Cache la Poudre Reservoir construction see Department of the Interior/Boyd, *Irrigation Near Greeley*, 29-35; Department of Agriculture/Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*. For problems presented to the company's board see Kelly, "The New Cache la Poudre Irrigating Company," 109-147. The Colorado Historical Society has original documents related to Cache la Poudre Reservoir Company lawsuits in the Cache la Poudre Irrigation Company Manuscript Collection (MSS #1232), Box 15.

⁵⁴ Quote is from "A Big Reservoir," *Fort Collins Courier*, 22 April 1891. Hemphill quote is from Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 69, see also 80-81; Baker, "The Development of Irrigation"; Elwood Mead, *Irrigation Institutions* (New York: MacMillan, 1903), 169; *List of Reservoir Decrees, Water District No. 3* from the State Engineer's Office, copy courtesy of Brian Werner, Northern Colorado Water Conservancy District.

⁵⁵ Special thanks to former and current Cache la Poudre River Commissioners Shawn Hoff and George Varra for helping me understand the exchange process and put it into words. For more information on exchanges see John Wilkins-Wells, David M. Freeman, Annie Epperson, Shawn Hoff, Raymond L. Anderson, and Andrew Griguhn, "Water Exchanges and Agricultural Production in Northeast Colorado: Opportunities and Constraints for the Future" (Fort Collins: Colorado State University Agricultural Experiment Station, 2002); Department of Agriculture/Nettleton, *The Reservoir System of the Cache la Poudre Valley*, 37. Note, Nettleton was the Union Colony's engineer, see *First Annual Report of the Union Colony of Greeley*.

⁵⁶ Wilkins-Wells, "Water Exchanges and Agricultural Production in Northeast Colorado," 22; Department of Agriculture/Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*, 22-28; Colorado Water Conservation Board, *A Hundred Years of Irrigation in Colorado: 100 Years of Organized and Continuous Irrigation, 1852-1952* (Denver: Colorado Water Conservation Board, 1952), 39. For North Poudre Irrigation Company and Fossil Creek Reservoir see Hilfinger, "Origins of the North Poudre Irrigation Company."

⁵⁷ Department of the Interior/Boyd, *Irrigation Near Greeley, Colorado*, 60; Department of Agriculture/Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*, 26. According to Tait, Benjamin Eaton owned Larimer and Weld Reservoir Company and Windsor Reservoir until 1902 when Windsor Reservoir was reincorporated as Windsor Reservoir and Canal Company. Also see Department of Agriculture/Nettleton, *The Reservoir System of the Cache la Poudre Valley*.

⁵⁸ Department of Agriculture/Nettleton, *The Reservoir System of the Cache la Poudre Valley*, 45; Hemphill, *Irrigation in Northern Colorado*, 80-81. Quote on Colorado as preeminent is from Department of the Interior/Boyd, *Irrigation Near Greeley, Colorado*, 9.

⁵⁹ Watrous, *History of Larimer County*, 471. According to Larimer County Assessor Records from 1928, Coy's farm still spanned both sides of the Cache la Poudre River, bordered by the railroad tracks on Riverside Avenue, the Buckingham neighborhood on the north and roughly paralleled the area between Laurel Avenue and Laporte Avenue further to the west.

⁶⁰ For more information on Eaton see Norris and Norris, *Written in Water: The Life of Benjamin Harrison Eaton*; Watrous, *History of Larimer County*, 283. For additional information on Eaton's Larimer and Weld Canal see Trask, *Irrigation and Water-Related Structures in the Cache La Poudre River Corridor*, 36-37; Department of the Interior/Boyd, *Irrigation Near Greeley, Colorado*, 35-36.

⁶¹ Boyd, *A History*, 111, 398-399. See also Department of the Interior/Boyd, *Irrigation Near Greeley*; William R. Kelly, "A Compilation and Comment on Fifty Years, 1870-1920: I. Engineers and Ditch Men Developed on the Cache La Poudre, 1870-1920" (Fort Collins: 1967), available at the Colorado State University Archives.

⁶² For quotes on Colorado Agricultural College see John Lawrence McKinley, "The Influence of the Platte River Upon the History of the Valley" (Ph.D. dissertation, University of Nebraska, 1938), 83.

⁶³ For Mead see "Elwood Mead," *Irrigation Age* 17, No. 8 (August, 1902); James E. Hansen, *Democracy's College in the Centennial State: A History of Colorado State University* (Fort Collins: Colorado State University, 1977), 65-72; Kelly, "A Compilation," 8, 9, 16, available at the Colorado State University Archives. For Carpenter see Hansen, *Democracy's College*, 72-3, 88, 165-169, 171-172, 174-177; Kelly, "A Compilation," 5; Watrous, *History of Larimer County*, 342-343. For a few of Carpenter's own works see "A Summer in Europe," *Irrigation Age* 3, No. 5 (1892); Colorado Agriculture Experiment Station, Bulletin No. 23: *Preliminary Report on the Duty of Water*, by L.G. Carpenter (Fort Collins: Colorado State Agricultural College, 1893); Colorado Agricultural Experiment Station, Bulletin No. 123: *Rainfall on the Plains*, by L.G. Carpenter (Fort Collins: Colorado State Agricultural College, 1908).

⁶⁴ For experiments on the river and information on irrigation engineering at the Colorado Agricultural College (now Colorado State University) see Hansen, *Democracy's College*, 67-73, 226-227, 314-317. See also A.T. Corey, *Engineering for Agriculture at Colorado State University* (Fort Collins: Colorado State University, circa 1990); Department of Commerce/Newell, *Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census: 1890*, 95.

⁶⁵ R.L. Parshall, "The Importance of Return Flow to Colorado Irrigators," Colorado Irrigation Centennial Celebration, ed. (Denver: April, 1952).

⁶⁶ *Larimer County 1933 Map*, Larimer County District Court Map Collection, Water Resources Archive, Colorado State University. Note, despite several accounts that reservoir building in the Poudre area began in the 1890s, the county map referred to here shows 1 reservoir built in the 1870s, 20 in the 1880s, and 15 in the 1890s, for a total of 36 reservoirs. According to *The Cache la Poudre Reservoir Company v. The Water Supply and Storage Company, et al.*, No. 3638, Supreme Court of Colorado 25 Colo. 161; 53 p. 331; 1898, sixty ditches diverted water from the Poudre. For irrigated acreage statistics see Department of Commerce, Bureau of the Census, *Twelfth Census of the United States: Agriculture; Part Two: Crops and Irrigation*, 832. Gipson quote is from A.E. Gipson, "Water for the Soil," *Irrigation Age* 2, No. 4 (1891).

Chapter Three: Water Law

⁶⁷ See Radosevich, *Evolution and Administration of Colorado Water Law*, generally, and 16-20 specifically; Donald Pisani, *Water, Land and Law in the West: The Limits of Public Policy, 1850-1920* (Lawrence: University Press of Kansas, 1996), 1; Ubbelohde, Benson, and Smith, *A Colorado History*, 190-191; Worster, *Rivers of Empire*, 90; Gordon Morris Bakken, "The Influence of the West on the Development of Law," *Journal of the West* 24, No. 1 (1985): 67. Quote is from *Tradition, Innovation and Conflict: Perspectives on Colorado Water Law*, ed. Lawrence J. MacDannell, "The Historical Development of Colorado Water Law," by Raphael J. Moses (Boulder: Natural Resources Law Center, University of Colorado School of Law, 1986), 25-26. Moses quotes Frank Trelease, *Water Law Cases and Materials*.

⁶⁸ Note, riparianism was changing in the East as industrialization placed greater demands on the region's water supply. See Pisani, *Water, Land, and Law in the West*. For information on water use in different areas of the West that was community based and did not adhere to strict prior appropriation see Stanley Crawford, *Mayordomo: Chronicle of an Acequia in Northern New Mexico* (Albuquerque: University of New Mexico Press, 1988); Michael C. Meyer, *Water in the Hispanic Southwest, A Social and Legal History, 1550-1850* (Tucson: University of Arizona Press, 1984); Pisani, *To Reclaim a Divided West: Water, Law and Public Policy, 1848-1902* (Albuquerque: University of New Mexico Press, 1993). According to Donald Pisani, some counties in southern Colorado retained community ditches granted rights by the 1861 territorial Legislature until the 1950s. See Pisani, *To Reclaim a Divided West*, 44. Pisani cites Raphael J. Moses, "Irrigation Corporations," *Rocky Mountain Law Review*, 32 (1959-60): 528. For acequias see Crawford, *Mayordomo*; Meyer, *Water in the Hispanic Southwest*; Gregory A. Hicks and Devon G. Pena, "Community Acequias in Colorado's Rio Culebra Watershed: A Customary Commons in the

Domain of Prior Appropriation,” *Colorado Law Review* 74 (2003), 387-486. For general information on early miners in Colorado see Ubbelohde, Benson, and Smith, *A Colorado History*, 68-78, 89-96.

⁶⁹ Radosevich, *Evolution and Administration of Colorado Water Law*, 20-24, 56-60; S.W. Carpenter, *Law of Irrigation in Colorado* (Denver: W.H. Lawrence and Company, 1886), 13-15, 56; Mills, *Mills' Annotated Statutes*, 57, quote is from Mills, 65; Ward H. Fischer, *A Guide to Colorado Water Law* (Fort Collins: Colorado Water Resources Research Institute, 1978); Gregory J. Hobbs, Jr. “Colorado Water Law: An Historical Overview” *Water Law Review* 1, No. 1 (1997): 8. For the “Colorado doctrine” see Mills, *Mills' Irrigation Manual for Lawyers*, 26-30; Elwood Mead, *Irrigation Institutions*, 143. For information on the piecemeal development of Colorado water law see Mills, *Mills' Irrigation Manual for Lawyers*, 30-35; Moses, “The Historical Development of Colorado Water Law,” in *Tradition, Innovation and Conflict: Perspectives on Colorado Water Law*, 27-30. For the development of appropriation versus riparianism, generally, see Wells A. Hutchins, “History of the Conflict Between Riparian and Appropriative Rights in the Western States,” in *Water Law Conference on Riparian and Appropriative Rights, Austin, Texas, 1954* (Austin: Conference on Riparian and Appropriative Rights, 1954).

⁷⁰ Radosevich, *Evolution and Administration of Colorado Water Law*, 24-25; Mills, *Mills' Annotated Statutes*, 30-33; Moses, “The Historical Development of Colorado Water Law,” in *Tradition, Innovation and Conflict: Perspectives on Colorado Water Law*, 28; Pisani, *To Reclaim a Divided West*, 50; Hobbs “Colorado Water Law: An Historical Overview,” 5; *Law in the Western United States*, ed. Gordon Morris Bakken, “Making the West Safe for the Prior Appropriation Doctrine,” by Dale D. Goble (Norman: University of Oklahoma Press, n.d.). The author cites 1861 Colorado Session Laws 67, sec. 1 and 1862 Colorado Session Laws 44, 48, sec. 13. In 1861, the territorial Legislature originally endorsed riparianism when it declared: “all persons who claim, own or hold a possessory right...to any land...when those claims are on the bank, margin or neighborhood of any stream of water, creek or river, shall be entitled to the use of water...for the purposes of irrigation.” When water was scarce, the Legislature called for three commissioners to be appointed by the nearest Justice of the Peace who would apportion the available water among users. In 1862, the Legislature declared: “Nor shall the water of any stream be directed from its original channel to the detriment of any miner, millman or others along the line of said stream, and there shall be at all times left sufficient water in said stream for the use of miners and farmers along said stream.” For general information on the rules and legal practices of early miners see Ubbelohde, Benson and Smith, *A Colorado History*, 89-96.

⁷¹ Fischer, *A Guide to Colorado Water Law*; Gregory J. Hobbs, Jr. “Colorado's 1969 Adjudication and Administration Act: Settling In,” *University of Denver Water Law Review* 3, No. 1 (1999). For the Poudre conflict see Department of the Interior/Boyd, *Irrigation Near Greeley*, 61; “The Water Question,” *Greeley Tribune*, 15 July 1874, courtesy of the City of Greeley Museums; Colorado Water Conservation Board, *A Hundred Years of Irrigation in Colorado*, 34-40.

⁷² “The Water Question,” *Greeley Tribune*, 15 July 1874. Quote is from Department of the Interior/Boyd, *Irrigation Near Greeley*, 61.

⁷³ Department of the Interior/Boyd, *Irrigation Near Greeley*, 61-62; Colorado Water Conservation Board, *A Hundred Years of Irrigation in Colorado*, 35; Trask, *Irrigation and Water-Related Structures in the Cache La Poudre River Corridor*, 36-37; “Development of Weld County and Greeley Tightly Bound Up With Irrigation Progress,” *Greeley Tribune*, 10 October 1930. A precedent for state officials to oversee water administration can be found in the 1861 act passed by the territorial Legislature mentioned previously in this chapter (see endnote 70). This called for the appointment of three commissioners to apportion water in an equitable way that respected legal rights of those involved during times of drought. See Pisani, *To Reclaim A Divided West*, 50; “History of Water Rights in Colorado,” Colorado Department of Water Resources, www.water.state.co.us; Mead, *Irrigation Institutions*, 145-146.

⁷⁴ Moses, “The Historical Development of Colorado Water Law,” in *Tradition, Innovation and Conflict: Perspectives on Colorado Water Law*, 31-33; Hobbs, “Colorado's 1969 Adjudication and Administration Act: Settling In,” 5-6; Fischer, *A Guide to Colorado Water Law*, 10-22; Radosevich, *Evolution and Administration of Colorado Water Law*, 27-76; Mead, *Irrigation Institutions*; Department of Agriculture/Beach and Preston, *Irrigation in Colorado*, 34-35. For information on practices prior to the 1879 and 1881 legislation see Steinel, *History of Agriculture in Colorado*, 221. Steinel quotes a manuscript written by William Russell Thomas, professor of constitutional history at Colorado Agricultural College; see also “History of Water Rights in Colorado,” Colorado Department of Water Resources, available from www.water.state.co.us.

⁷⁵ Carpenter, *Laws of Irrigation in Colorado*, 90-91, 94-95 (See General Statute 1758); Colorado Agricultural Experiment Station, Bulletin No. 67: *The Distribution of Water: Powers and Duties of Irrigation Officials in Colorado*, by H.N. Haynes, (Fort Collins: Colorado Agricultural Experiment Station, December, 1901);

Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 81; Fischer, *A Guide to Colorado Water Law*. See also “History of Water Rights in Colorado,” Colorado Department of Water Resources, www.water.state.co.us.

⁷⁶ Carpenter, *Laws of Irrigation in Colorado*, 65, 71, 74-75 (See General Statutes 882, 1734, 1736); Radosevich, *Evolution and Administration of Colorado Water Law*, 25. Quote is from Mills, *Irrigation Manual for Lawyers*, 35-36; see also, page 37.

⁷⁷ Boyd quote is from Department of the Interior/Boyd, *Irrigation Near Greeley*, 10. Additionally see *David C. Wyatt et al. v. The Larimer and Weld Irrigation Company, et al.*, 1 Colo. App. 480; 29; 1892 Colo. App.; *The New Cache la Poudre Irrigation company v. The Water Supply and Storage Company*, No. 4216, 29 Colo. 469; 68 p. 781; 1902 Colo.; *Water Supply and Storage Company v. Larimer and Weld Irrigation Company, et al.*, No. 3519, 24 Colo. 322; 51 p. 496; 1897 Colo.; *The New Mercer Ditch Company v. Armstrong*, 21 Colo. 357; 40 p. 989; 1895 Colo. Also Fischer, *A Guide to Colorado Water Law*, 23-26, for a succinct definition of abandonment.

⁷⁸ *The Larimer County Ditch Company v. Zimmerman*, 4 Colo. App. 78; 34 p. 1111; 1893 Colo. App. This case sought to determine who was the actual owner of the Chambers Lake Reservoir: Larimer County Ditch Company, who leased the reservoir from Larimer County Reservoir Company, or Larimer County Reservoir Company. The court determined the ditch company was responsible, even though it was the lessee, because it appeared to have completed construction of the dam and reservoir and was, therefore, responsible for its soundness. See Baker, “The Development of Irrigation,” for other instances of concern about reservoir safety in the Poudre valley.

⁷⁹ *The Cache la Poudre Reservoir Company v. The Water Supply and Storage Company, et al.*, No. 3638, 25 Colo. 161; 53 p. 331; 1898 Colo. Also see *The Cache la Poudre Reservoir Company v. The Water Supply and Storage Company, et al.*, No. 4043, 27 Colo. 532, 62 p. 420, 1900 Colo.

⁸⁰ *Eaton et al. v. The Larimer and Weld Reservoir Company*, 3 Colo. App. 366; 33 p. 278; 1893 Colo. App. Quote is from Department of the Interior/Boyd, *Irrigation Near Greeley*, 38. See also “The Water Question,” *Greeley Tribune*, 15 July 1874. These sources differ as to when the reservoir company won the right to run water through the existing Larimer and Weld Canal, but both agree this was the final outcome.

⁸¹ Quotes are from *Kansas v. Colorado*, see Mills, *Mills’ Annotated Statutes*, 171-182. Also see Radosevich, *Evolution and Administration of Colorado Water Law*, 223-224; Colorado Water Conservation Board, *Interstate Compacts Volume I: Compilation of Articles from Various Sources*, “Adjusting Water Rights Between States,” by, Clifford H. Stone (Denver: Colorado Water Conservation Board, 1946), 50; Hobbs, “Colorado Water Law: An Historical Overview” *Water Law Review* 1, No. 1 (1997): 17. For general information on *Kansas v. Colorado* see Ubbelohde, Benson and Smith, *A Colorado History*, 253-254. Note, some people proposed alternative ways of using, dividing, and allocating water and land in the West precisely to avoid problems such as interstate issues. John Wesley Powell advocated the creation of water districts based on natural drainage basins rather than state boundaries. He endorsed neither riparianism nor prior appropriation. Powell suggested that irrigators in each district create laws tailored to their specific environment. See John Wesley Powell “Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah,” 45th Cong., 2nd Sess. House Executive Documents, No. 73, serial 1805 (Washington, D.C.: Government Printing Office, 1878).

⁸² *State of Wyoming v. State of Colorado*, et. al, Supreme Court of the United States, 259 U.S. 419 (1922) and *State of Wyoming v. State of Colorado*, 286 U.S. 494 (1932). For general information on *Wyoming v. Colorado* see Ubbelohde, Benson and Smith, *A Colorado History*, 254-255. See also Radosevich, *Evolution and Administration of Colorado Water Law*, 224-225; Kelly, “A Compilation,” 27; Steinel, *History of Agriculture in Colorado*, 219-220. Steinel noted that under the 1922 decision, 18,000 acre-feet of water per year was also allowed through Skyline Ditch from the Laramie River. See also Colorado Water Conservation Board, *Interstate Compacts Vol. I: Compilation of Articles from Various Sources*, “Interstate Water Problems: Final Report of the Committee of the Irrigation Division of Interstate Water Rights,” American Society of Engineer’s Paper No. 2055 (Denver: Colorado Water Conservation Board, 1946), 94.

⁸³ 1902 quote is from B.W. Rice, “Views on Government Control,” *Irrigation Age* 17, No. 3 (March 1902). Newell quote is from Department of Commerce/Newell, *Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census: 1890*, 94. For problems and challenges associated with prior appropriation see Steinel, *History of Agriculture in Colorado*, 222; Mead, *Irrigation Institutions*, 147-148, 152-155; Donald Pisani, “Enterprise and Equity: A Critique of Western Water Law in the Nineteenth Century,” *Western Historical Quarterly* 18, No. 1 (January 1987); Robert G. Dunbar, “The Adaptability of Water Law to the Aridity of the West,” *Journal of the West* 24 (1985): 61.

⁸⁴ Pisani, *Water, Land and Law in the West*, 14. Quote is from Mead, *Irrigation Institutions*, 148. Also see Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 16.

⁸⁵ Quote on cooperation is from George Wharton James, *Reclaiming the Arid West* (New York: Dodd, Mead and Company, 1917), 27-28. Quote on aristocracy is from Mead, *Irrigation Institutions*, 319. William Russell Thomas quote is from Steinel, *History of Agriculture in Colorado*, 221. For adaptability of prior appropriation see Hobbs, "Colorado Water Law," 2, 24-25.

⁸⁶ Quote is from C.S. Kinney, *A Treatise on the Law of Irrigation and Water Rights* (San Francisco: Bender Moss, 1912), 435.

Chapter Four: The Working Poudre

⁸⁷ Watrous, *History of Larimer County*, 70.

⁸⁸ Ubbelohde, Benson and Smith, *A Colorado History*, 250-282.

⁸⁹ Frederick J. Turner, "The Significance of the Frontier in American History," in *Annual Report of the American Historical Society* (Washington, D.C.: American Historical Society, 1894), 199. Also see William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton and Company, 1991), 31, 46-54; Jeremy Adelman and Stephen Aron, "From Borderlands to Borders: Empire, Nation-States and the Peoples in Between in North American History," *American Historical Review* (June 1999), for a current critique of the American "frontier" theory and Turner.

⁹⁰ Ubbelohde, Benson and Smith, *A Colorado History*, 262-273.

⁹¹ "Legislative Proceedings," *Rocky Mountain News*, 14 January 1885. See George Perkins Marsh, *Man and Nature; or, Physical Geography as Modified by Human Action* (New York: C. Scribner's Sons, 1864), for more on early conservation. Marsh was one of the first to warn that natural resources were exhaustible and that ecological balance was important. See also Pisani, *Water, Land and Law in the West*, 134; Ubbelohde, Benson and Smith, *A Colorado History*, 274-283. One can also explore the writings of Theodore Roosevelt and Gifford Pinchot, the first head of the U.S. Forest Service, and an advocate of multiple use and scientific management of forests. Watrous quote is from Watrous, *History of Larimer County*, 70.

⁹² For the anti-conservation movement in Colorado see Abbott, Leonard and McComb, *Colorado: A History of the Centennial State*, 128-129.

⁹³ For federal involvement in water policy see Department of Agriculture, Economic Research Service, *A History of Federal Water Resources Programs: 1800-1960* (Washington, D.C.: Government Printing Office, 1972), 4. For Desert Land Act see Mills, *Irrigation Manual for Lawyers*, 287-289; Norman K. Johnson, *The Doctrine of Prior Appropriation and the Changing West* (Western States Water Council, 1987), 7,29; Pisani, *Water, Law and Land in the West*, 44-49. For the Carey Act see James N. Corbridge and Teresa A. Rice, *Vranesh's Colorado Water Law*, rev. ed. (Niwot: University Press of Colorado, 1999), 283.

⁹⁴ For 1864 *Rocky Mountain News* editorial and comments by Governor Routt see Steinel, *History of Agriculture in Colorado*, 190, 194. The 1885 *Rocky Mountain News* quote is from "The Gospel of the West," *Rocky Mountain News*, 15 January 1885.

⁹⁵ For anti-conservationist's calls for federal intervention in water policy see Pisani, *To Reclaim a Divided West*, 139-142. Pisani researched the number of bills put before Congress to authorize surveys for federal assistance in irrigation works. He states, "virtually all westerners, particularly investors, favored some kind of federal assistance – such as soil, stream, reservoir, artesian well, or canal surveys – to tame the desert." For Colorado reclamation projects see Donald A. MacKendrick, "Before the Newlands Act: State-Sponsored Reclamation Projects in Colorado, 1888-1903," *Colorado Magazine* 52, No. 1 (1975); Pisani, *To Reclaim a Divided West*, 169-174, 214-222; *Tenth General Assembly Report of the Special Committee of Senators Appointed by the Ninth General Assembly on State Canal No. 1 and Other Matters Relating to Proposed State Irrigation Questions* (Denver: Smith-Brooks Printing Company, 1895); *Irrigation Laws and Instructions to Superintendents and Water Commissioners [of] Colorado* (Denver: Smith-Brooks Printing Company, 1893).

⁹⁶ For more on national irrigation providing security and stability see Pisani, *To Reclaim a Divided West*, 139-142. To be sure, not all westerners in the progressive era were in favor of a large federal presence; some vocal critics favored state and local control. Still, progressive sentiment was popular at this time and its influence in Colorado and in federal water policies cannot be ignored. For an example of a state's rights advocate associated with the Cache la Poudre see Daniel Tyler, *Silver Fox of the Rockies: Delphus E. Carpenter and Western Water Compacts* (Norman: University of Oklahoma Press, 2003). For Smythe quotes see William E. Smythe, *The*

Conquest of Arid America (New York: The MacMillan Company, 1905), xiii, xxv. For an analysis of Smythe, see Worster, *Rivers of Empire*, 118-125.

⁹⁷ For irrigation conferences see Smythe, *The Conquest of Arid America*, 268-270; Pisani, *To Reclaim a Divided West*, 239. Pisani asserts the irrigation conferences were “rigged” because they were heavily promoted and attended by business interests and western politicians. For Democrat and Republican party platforms see Smythe, *The Conquest of Arid America*, 272-274; “The Bureau of Reclamation: A Brief History” (accessed 28 May 2003), available at www.usbr.gov/history/borhist.html. For Newlands bill see Smythe, *The Conquest of Arid America*, 276, 281 and www.usbr.gov/history/borhist.html. Note, the 1902 Reclamation Act established a Reclamation Fund with money from the sale of public lands in the sixteen participating western states. Water users were to repay the Reclamation Fund the estimated costs of construction for the irrigation project in ten annual installments with no interest. The revenue from the land sales financed federal portions of the projects. The original act limited the right to use reclamation water to areas settled under homestead laws or to private lands not exceeding 160 acres and occupied by the landowner. Texas did not become a reclamation state until 1906, as it did not have any public lands. In that year, Congress passed a special act to include it in the Reclamation Act. The Reclamation Service was originally under the U.S. Geological Society but transferred to the Department of Interior in 1907 where it remains today. See www.usbr.gov/history/borhist.html; Smythe, *The Conquest of Arid America*, 344-345; Hobbs, “Colorado Water Law,” 13; Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (New York: Viking Penguin, 1986), 110-120.

⁹⁸ Quote is from Worster, *Rivers of Empire*, 165.

⁹⁹ *Irrigation Age* quotes about social conditions and progressive support of families and irrigation are from Thomas F. Walsh, “The Humanitarian Aspect of National Irrigation,” *Irrigation Age* (October, 1902): 365-366. J. Laidlaw quote is from “Inspiration,” *Irrigation Age*, (January 1896).

¹⁰⁰ Daniel Tyler, *The Last Water Hole in the West: The Colorado-Big Thompson Project and the Northern Colorado Water Conservancy District* (Niwot: University Press of Colorado, 1992), 14. For more on farming and dry land farming in Colorado see Steinel, *History of Agriculture in Colorado*; Department of Agriculture, Yearbook: 1907: *Dryland Farming in the Great Plains Area*, by E.C. Chilcott (Washington, D.C.: Government Printing Office, 1908).

¹⁰¹ Cottrell information is from Steinel, *History of Agriculture in Colorado*, 312-315. Census information is from Department of Commerce, Bureau of the Census, *U.S. Census of Agriculture, Part 3, Western States: Reports for States with Statistics for Counties and a Summary for the United States* (Washington, D.C.: Government Printing Office, 1927), 204-205. For quote on “coming empire” see *The New Addition to the Cache la Poudre Valley: Irrigation is King* (Greeley: Greeley-Poudre Irrigation District, ca. 1911), 10, available at Colorado State University Archives. F.C. Grable quote is from *Fort Collins: A Synopsis*, H.A. Bromley, Clark E. Daniels, Jesse R. Wood, eds., (Fort Collins: Fort Collins Chamber of Commerce, ca. 1910), also available at the Colorado State University Archives.

¹⁰² Quotes are from Department of Agriculture/Scofield, *The Problems of an Irrigation Farmer*, 201, 206.

¹⁰³ For Colorado exceeding California for area of irrigated land see Steinel, *History of Agriculture in Colorado*, 233. Greeley-Poudre Irrigation District quote see *The New Addition to the Cache la Poudre Valley: Irrigation is King*, 3. For *Greeley Tribune* quote see Associated Press, “Development of Weld County and Greeley Tightly Bound Up With Irrigation Progress,” *Greeley Tribune*, 10 October 1930. For 1911 Irrigation Congress quote see McKinley, “The Influence of the Platte River Upon the History of the Valley,” 82-83.

¹⁰⁴ Steinel, *History of Agriculture in Colorado*, 281-308, quote is from page 308.

¹⁰⁵ Department of Commerce, Bureau of the Census, *Thirteenth Census of the United States, Vol. 5, Agriculture, 1909-1910: General Report and Analysis* (Washington, D.C.: Government Printing Office, 1913), 862. For sugar beet production in Larimer County see *Fort Collins: A Synopsis*. Quote is from William Daven Farr, interview by Sally Mier, 21 December 1999, interview 1, page 7, transcript, City of Greeley. For general information on sugar beets in Colorado see Ubbelohde, Benson, and Smith, *A Colorado History*, 258-261.

¹⁰⁶ For sugar beet cultivation, generally, see Fiege, *Irrigated Eden*, 135-140. For additional information on beets and the Poudre valley including various ethnic groups see “Prefer the Japs,” *Fort Collins Express Courier*, 11 May 1904; James E. Hansen, *Beyond the Ivory Tower: A History of Colorado State University Cooperative Extension* (Fort Collins: Colorado State University, 1990), 58; Standish, “Beet Borderland: Hispanic Workers, the Sugar Beet and the Making of a Northern Colorado Landscape,” 23, 26, 37; Steinel, *History of Agriculture in Colorado*, 407-408. For more on Germans from Russia see the Sidney Heitman Germans From Russia Collection at the Colorado State University Archives. In 1927, there were 8,280 “white” farmers and 9, or .1 percent, “colored,” farmers in Larimer County and 2.8 percent “colored” in Weld County; it was not clear if “colored” referred to

African Americans, Native American, Hispanic, Japanese, other ethnic groups or all of the above. See Department of Commerce, Bureau of the Census, *U.S. Census of Agriculture, Part Three: Western States*, 243-245. Quote is from Writers' Program of the Works Progress Administration in the State of Colorado, *Colorado: A Guide to the Highest State*, ed. Colorado State Planning Commission (New York: Hastings House, 1941), 162. Note, regarding the two most prevalent ethnic groups in this history, the term "Euroamerican" is used to identify Americans of European descent, and "Hispanic" refers to Spanish-speaking peoples who may identify geographically with Mexico, South America, Spain, or the southwestern United States. People in the United States today identify themselves as African-American, Black, Asian, Native American, Irish-American, German-Russian, East Indian, Mexican, Hispanic, and Chicano, to name just a few examples. Perhaps no single or hyphenated name adequately represents one's unique background. Although the terms selected may seem unwieldy and problematic, they are used in this book with the best of intentions.

¹⁰⁷ Fiege, *Irrigated Eden*, 140-142; Standish, "Beet Borderland: Hispanic Workers, the Sugar Beet and the Making of a Northern Colorado Landscape," 30, 34, 43. For housing styles see Fort Collins Neighborhood History Project, "Buckingham, Alta Vista and Andersonville Neighborhoods," (Boulder: Community Services Collaborative, 1983); and Standish, "Beet Borderland," 79-86, 97-99.

¹⁰⁸ Department of Commerce, Bureau of the Census, *U.S. Census of Agriculture, Volume 3: Irrigation of Agricultural Lands* (Washington, D.C.: Government Printing Office, 1952). Note, between 1930 and 1935, Colorado gained 3,688 farms, but lost 12,208 farms between 1935 and 1940. Farms declined by nearly 11 percent between 1940 and 1950.

¹⁰⁹ For information on improved irrigation techniques see Department of the Interior/Fortier, *Conveyance of Water in Irrigation Canals, Flumes and Pipes*; Department of Agriculture/Fortier, *Methods of Applying Water to Crops*; Department of Agriculture/Johnston and Stannard, *Practical Irrigation*; Department of Agriculture/Newell, *Irrigation on the Great Plains*; Department of Agriculture/Teele, *Preparing Land for Irrigation*, to name just a few. For Colorado Agricultural College and Agricultural Experiment Station information see Hansen, *Beyond the Ivory Tower*, 7-24; Hansen, *Democracy's College*, 85; Steinel, *History of Agriculture in Colorado*, 541-544, 572-574. Watrous comment in Watrous, *History of Larimer County*, 71.

¹¹⁰ Corey, *Engineering for Agriculture*; Hansen, *Democracy's College*, 226-227; Trask, *Irrigation and Water-Related Structures in the Cache la Poudre Corridor*, 51-56.

¹¹¹ R.L. Parshall, "The Parshall Measuring Flume," *Reclamation Era* (May 1948): 97. Note, the Venturi flume was based on the experiments of an eighteenth century Italian engineer who experimented with flowing water through tapering tubes. See also Colorado Agricultural Experiment Station Bulletin No. 423: *The Parshall Measuring Flume*, by R.L. Parshall (Fort Collins, Colorado Agricultural Experiment Station, 1936), 48-49; Department of Agriculture, Soil Conservation Service and Colorado Agricultural Experiment Station, *Improving the Distribution of Water to Farmers by Use of the Parshall Measuring Flume*, by Ralph L. Parshall (Fort Collins: Colorado Agricultural Experiment Station, 1945).

¹¹² Quote on flume dimensions in Colorado Agricultural Experiment Station/Parshall, *The Parshall Measuring Flume*, 56. Quote on irrigator's complaints in Department of Agriculture/Colorado Agricultural Experiment Station/Parshall, *Improving the Distribution of Water to Farmers by Use of the Parshall Measuring Flume*, 4. For ASCE recommendation see "Parshall Measuring Flume," *New Reclamation Era* (March 1930), 42. Note, A.T. Corey, former Colorado State University engineering professor, remarked, "Although Parshall and his colleagues made many other contributions, the flume that bears his name resulted in more favorable attention to the irrigation program at the College than any other single research development." See Corey, *Engineering for Agriculture*, 10.

¹¹³ For WPA report see Colorado State College and Colorado Agricultural Experiment Station in cooperation with the Rural Section, Division of Social Research, Works Progress Administration, *Rural Households and Dependency*, by Olaf F. Larson (Fort Collins: Colorado Agricultural Experiment Station, May 1938). Note, this study was patterned after the National Relief Census taken by the Federal Emergency Relief Administration. Families receiving relief tended to have heads of household under 35 or over 54 years of age. A larger proportion of farm tenants and laborers were on relief than farm owners in 1933. The male head of household for families on relief had "less education for every comparable age and occupational group than those not on relief, averaging 6.5 grades of school compared with about 8 for the non-relief heads." Relief families had also moved more frequently since 1914 and had less steady employment than non-relief families. For New Cache la Poudre Irrigation Company see Kelly, "The New Cache la Poudre Irrigating Company," 79-80.

¹¹⁴ For more on droughts in Colorado see Thomas B. McKee, Nolan J. Doesken, John Kleist, Catherine J. Shrier, and William P. Stanton, "A History of Drought in Colorado: Lessons Learned and What Lies Ahead" (Fort

Collins: Colorado Climate Center, Colorado Water Resources Research Institute in collaboration with the Colorado Water Conservation Board, 2000): 4-6, 11, 14, 18.

¹¹⁵ Note, various large reservoirs were built in the 1890s including Terry Lake and Windsor reservoirs. The Grand River Ditch was started in 1894 and the tunnel was conceived by Link in 1897. See also Larimer County District Court Map Collection, Water Resources Archive, Colorado State University; Reisner, *Cadillac Desert*, 107-109.

¹¹⁶ William Daven Farr, interview by Sally Mier, 21 December 1999, interview 1, page 9, transcript, City of Greeley.

¹¹⁷ For a more detailed look at the Dust Bowl see Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York; Oxford: Oxford University Press, 1979). For A.A. Edwards quote see "Pioneer Recalls First Diversion for Irrigation," *Fort Collins Express-Courier*, 28 April 1935.

¹¹⁸ For October of 1929 see William Daven Farr, interview by Sally Mier, 21 December 1999, interview 1, page 23, transcript, City of Greeley; William Daven Farr, interview by Greg Silkensen, 4 August 1997, interview 1, page 17, transcript, City of Greeley. Note, in addition to being an irrigator and owner of Farr Farms Feedlots in Greeley, Farr served on the boards of the Colorado Water Conservation Board, Colorado Water and Power Authority, and the Northern Colorado Water Conservancy District. For farmers and credit see William Daven Farr, interview by Greg Silkensen, 24 October 1997, interview 4, page 59,63, transcript, City of Greeley. For Poudre water deficit, farm sales, and sugar beet price decline see Tyler, *Last Water Hole*, 15.

¹¹⁹ Department of Agriculture, *History of Federal Water Resources Programs*, 16-17. Note, in 1939, Congress passed the Reclamation Project Act and authorized the Secretary of the Interior to "plan and construct projects for multiple purposes in addition to irrigation" such as projects to improve navigation and flood control and develop hydroelectric power and water for municipal use. See Tyler, *Last Water Hole*, 28. Note, the City of Greeley had applied for and received help from the WPA to build the 5,000 acre-foot Milton Seaman Reservoir on the North Fork of the Poudre in the 1930s; for more information see William Daven Farr, interview by Greg Silkensen, 24 October 1997, interview 4, page 59,63, transcript, City of Greeley.

¹²⁰ Brian Q. Cannon, "We Are Entering a New Era: Federal Reclamation and the Fact Finding Commission on 1923-1924," *Pacific Historical Review* 66 (May 1997): 200-204.

¹²¹ For more on the Fact Finding Commission see Cannon, "We Are Entering a New Era"; "The Bureau of Reclamation: A Brief History" (accessed 28 May 2003); available at www.usbr.gov/history/borhist.html; Pisani, *To Reclaim a Divided West*, 169-188. For Bureau of Reclamation projects in the 1930s through the 1960s see Reisner, *Cadillac Desert*; Donald Pisani, "Federal Reclamation and the American West in the Twentieth Century," *Agricultural History* 77 (Summer 2003).

¹²² William Daven Farr, interview by Sally Mier, 28 December 1999, interview 2, page 78, transcript, City of Greeley; William Daven Farr, interview by Sally Mier, 13 January 2000, interview 4, page 15, transcript, City of Greeley; Department of Agriculture/Hemphill, *Irrigation in Northern Colorado*, 9; Tyler, *Last Water Hole*, 16-25. Note, Tyler points out that northern Coloradoans had hoped to make a deal with Wyoming and Nebraska for North Platte water but interstate disputes grew too prolonged and they turned their sights to the Colorado River.

¹²³ Farr quotes from William Daven Farr, interview by Greg Silkensen, 28 August 1997, interview 2, transcript, City of Greeley; *Reflections on the Colorado-Big Thompson Project: A Conversation with W.D. Farr*, produced and interviewed by Sally Mier (Boulder: The Storytellers Project, All Video Productions Inc., 2001), videocassette. For 1935 Bureau allocation see Department of the Interior, Bureau of Reclamation, *Synopsis of Report: Colorado Big Thompson Project, Plan of Development and Cost Estimate*, by Porter J. Preston (Washington, D.C.: Government Printing Office, 1937), 13, 30.

¹²⁴ Tyler, *Last Water Hole*; *Reflections on the Colorado-Big Thompson Project: A Conversation with W.D. Farr*, produced and interviewed by Sally Mier (Boulder: The Storytellers Project, All Video Productions Inc., 2001), videocassette.

¹²⁵ Department of Agriculture, Bureau of Agricultural Engineering, Colorado Agricultural Experiment Station: *Agricultural Economic Summary Relating to the Colorado-Big Thompson Project*, by R.L. Parshall (Fort Collins: Colorado Agricultural Experiment Station, 1937), 1-2, 4, quote is from pages 1-2.

¹²⁶ Tyler quote from Tyler, *Last Water Hole*, 41, also see pages 84-85; *Reflections on the Colorado-Big Thompson Project: A Conversation with W.D. Farr*, produced and interviewed by Sally Mier (Boulder: The Storytellers Project, All Video Productions Inc., 2001), videocassette; "U.S. Gave State \$14,000,000 for Irrigation," *Rocky Mountain News*, 18 May 1938. Note, reducing the flow of the Colorado River and controlling flooding through this diversion project was a prominent issue on the Colorado two years after Hoover Dam was completed. The diminished flow, according to Parshall and others, was favorable to bridges, roads, irrigation works and other

man-made structures along the river. For more information see Department of Agriculture/Colorado Agricultural Experiment Station/Parshall, *Agricultural Economic Summary Relating to the Colorado-Big Thompson Project*, 44.

¹²⁷ Tyler quote from Tyler, *Last Water Hole*, 99. See also E. Herbert Dyer and Robert Barkley, *Agricultural Production in Northern Colorado Water Conservancy District as Related to National Defense* (Denver: Colorado Water Conservation Board, 1941). For CBT and agricultural quotas see Tyler, *Last Water Hole*, 128. For CBT and national security see Tyler, *Last Water Hole*, 181-182.

¹²⁸ CAES sociologist's quote from Colorado Agricultural Experiment Station, Bulletin No. 462: *Population Trends in Colorado*, by R.W. Roskelley (Fort Collins: Colorado Agricultural Experiment Station, 1940), 2. Also see Tyler, *Last Water Hole*, 122, 156.

¹²⁹ William Daven Farr, interview by Greg Silkensen, 28 August 1997, interview 2, page 22, transcript, City of Greeley. Quote is from *Reflections on the Colorado-Big Thompson Project: A Conversation with W.D. Farr*, produced and interviewed by Sally Mier (Boulder: The Storytellers Project, All Video Productions Inc., 2001), videocassette. See also Tyler, *Last Water Hole*, 156-157.

¹³⁰ Department of the Interior/Preston, *Synopsis of Report: Colorado Big Thompson Project, Plan of Development and Cost Estimate*, 31-36. Tyler, *Last Water Hole*, 218, 229. Note, the CBT West Slope Collection System consists of five reservoirs and two pumping plants: Lake Granby, Farr Pumping Plant and Granby Canal, Willow Creek Reservoir and Pumping Plant, Shadow Mountain Reservoir, Green Mountain Reservoir and Grand Lake. Grand Lake is the largest natural lake in Colorado.

¹³¹ NCWCD website, www.ncwcd.org (accessed February 2003); Tyler, *Last Water Hole*, 4, 176; Jill Saito, "Adams Tunnel Marks Its Fiftieth Anniversary," *Fort Collins Coloradoan*, 23 June 1997; "Contributions of Big T Project Outlined by Regional Head of Reclamation Bureau," *Greeley Tribune*, ca. 1964, courtesy of City of Greeley Museums. Note, according to the Repayment Contract of 1938 the NCWCD agreed to pay back a maximum of \$25 million over forty years; because the CBT project was to benefit all agricultural, municipal and recreational water users, the cost was to be absorbed by the general public. Northern Colorado Water Users Association member and Colorado Agricultural College president Charles Lory predicted "all within the district will benefit from the supplemental water supply – water users directly, who pay a definite sum for each acre-foot used; others indirectly who pay on the basis of their property valuation." See Charles A. Lory, "Study of Grand Lake Diversion," *Fort Collins Express Courier*, 26 September 1937; and "Chronology," *Northern Colorado Water Conservancy District News*, No. 5 (September 1987): 22.

¹³² Note, there are conflicting dates for the beginning of the Northern Colorado Water Users Association, per Brian Werner at NCWCD, 1935 is the "official" date. See Tyler, *Last Water Hole*, 53, 60-61; "Chronology," *Northern Colorado Water Conservancy District News*, No. 5 (September 1987): 12; Hansen, "The Water Supply and Storage Company," 19; Evans and Evans, *Cache la Poudre*, 226-227. For irrigation districts in Colorado see Department of Agriculture/Hutchins, *Irrigation Districts: Their Organization, Operation and Financing*. For Irrigation District Law of 1905 see Mills, *Mills' Annotated Statutes of the State of Colorado*, 655; Radosevich, *Evolution and Administration of Colorado Water Law*, 162-163. Quote on water conservancy districts is from Radosevich, 162. For theory that all within a district would benefit and should, therefore, pay taxes see Lory, "Study of Grand Lake Diversion," *Fort Collins Express Courier*, 26 September 1937. Note, Lory was a member of the NCWCD.

¹³³ William Daven Farr, interview by Greg Silkensen, 28 August 1997, interview 2, page 34, transcript, City of Greeley.

¹³⁴ Tyler, *Last Water Hole*. Also see the Northern Colorado Water Conservancy District's website at http://www.ncwcd.org/project&features/cbt_main.asp; Department of the Interior, Bureau of Reclamation, *Accomplishments of Irrigation: Weld County, Colorado*, by Mark S. Bentson and Robert E. Struthers (Denver: Bureau of Reclamation Region Seven, 1952), 20-35.

Chapter Five: Competition

¹³⁵ Abbott, Leonard and McComb, *Colorado: A History of the Centennial State*, 279-280.

¹³⁶ For general information on post-war Colorado society and economy see Ubbelohde, Benson and Smith, *A Colorado History*, 321-391; and Abbott, Leonard and McComb, *Colorado: A History of the Centennial State*, 279-283. See also United States Department of Health, Education and Welfare, Public Health Service, Division of Water Supply and Pollution Control: *Water Quality Control Study and Public Health Aspects of the Cache la Poudre Project, Colorado* (Denver: U.S. Department of Public Health, Education and Welfare, 1965), 32; and Hansen, "Water Supply and Storage Company," 23-24.

¹³⁷ For agriculture as leading industry and biggest water user in post-war era and the cultivation of water-intensive crops see Tyler, *Last Water Hole*, 343-346; and Hansen, *Beyond the Ivory Tower*, 64, 67. For more on post-war agriculture in Colorado see Ubbelohde, Benson and Smith, *A Colorado History*, 322-323, 330-332, 350-352. For agricultural labor and output percentages in Colorado and Weld County and fewer farms but increasing farm size see United States Department of Health, *Water Quality Control Study*, 27-28; and Tyler, *Last Water Hole*, 347. Quote is from Richard White, *It's Your Misfortune and None of My Own: A New History of the American West* (Norman: University of Oklahoma Press, 1991), 558. See also Tyler, *Last Water Hole*, 347.

¹³⁸ For Colorado's agricultural and economic slump see Hansen, *Beyond the Ivory Tower*, 87-88. For agriculture as largest water consumer in Colorado see Harza Engineering Company, *Cache la Poudre Basin Study Final Report, Volume One, for Colorado Water Resources and Power Development Authority* (Denver: Harza Engineering Company, 1987), 1-2, from the Ival Goslin Collection, Water Resources Archive, Colorado State University; Julio Ochoa, "Agriculture Soaks Up 85 to 90 Percent of Water in the State," *Greeley Tribune*, 30 December 2002; Colorado Division of Water Resources, *Mountains to Plains: The Story of Colorado* (Denver: Colorado Division of Water Resources, circa 2004); Colorado Division of Water Resources, *Cumulative Yearly Statistics of the Colorado Division of Water Resources* (Denver: Colorado Division of Water Resources, 2003). Note, in 2003, according to State Engineer's reports, agriculture consumed almost sixty percent of water deliveries for the state and ten times as much water as municipalities, not including stored water. For 1990 agriculture statistics see Tyler, *Last Water Hole*, 461. The acreage Tyler refers to is within the boundaries of the NCWCD. His source is the NCWCD meeting minutes from 11 February 1983.

¹³⁹ Duane Hill, Phillip O. Foss, Roy L. Meek, "Project Completion Report for Organizational Adaptation to Changes in Public Objectives for Management of Cache la Poudre River System" (Fort Collins: Colorado State University, 1969), 5, 7; also, John Neutze, "Transcription of Presentation Before a Meeting of the South Platte Water Coalition," (1984), courtesy of Brian Werner, Public Information Officer, Northern Colorado Water Conservancy District. There were some small ditch, lateral, and reservoir companies as well as a few individuals who dealt directly with the river commissioner, in addition to the four major irrigation companies. John Neutze, Cache la Poudre River Commissioner 1969-1985, conversation with author, Fort Collins, 13 February 2003, handwritten notes, National Park Service, Fort Collins, Colorado. Note, in referencing the four major ditch companies that originated in the nineteenth century, it is meant they were created in some form in the nineteenth century. For example, North Poudre Irrigation was started by F.L. Carter-Cotton in the 1880s and finally reincorporated as NPIC in 1902. The other three companies were formed in the nineteenth century but underwent significant changes as well. See chapters 1 and 2 here.

¹⁴⁰ *In the matter of the application of the Cache la Poudre Water Users Association, Ogilvy Land and Irrigation Company; Arthur Irrigation Company; New Cache la Poudre Irrigating Company; North Poudre Irrigation Company; New Mercer Ditch Company; Greeley Irrigation Company; Jackson Ditch Company; Boxelder Ditch Company; Larimer County Canal No. 2 Irrigating Company; Cache la Poudre Ditch Company; Lake Canal Company; Taylor and Gill Ditch Company; Water supply and Storage Company; B.H. Eaton ditch Company; Whitney Irrigation Company; Pleasant Valley and Lake Canal Company; City of Fort Collins, City of Greeley, Lake Canal Reservoir Company; Cache la Poudre Reservoir Company; Windsor Reservoir and Canal Company; Larimer and Weld Reservoir Company; Divide Canal and Reservoir Company; Warren Lake Reservoir Company; Larimer and Weld Irrigation Company, W-8086-75* (District Court, Water Division One, State of Colorado, 1978).

¹⁴¹ Quote is from "Nearly 700 Property Owners Ask for Removal of Waters From the Town Ditch Here," *Fort Collins Courier*, 9 August 1929. For more on the urbanization of Fort Collins' canals see Molly Nortier and Michael Smith, *From Bucket to Basin: 100 Years of Water Service* (Fort Collins: City of Fort Collins, 1983), 15-16, 42; and City of Fort Collins website www.fcgov.com/water/more-sources.php.

¹⁴² The Box Elder Creek reservoir-type structures were built to accommodate sporadic floodwaters that North Poudre Irrigation Company could then divert into their canals and reservoirs. Richard Seaworth, interview by author, Wellington, 15 April 2003, handwritten notes, National Park Service, Fort Collins, Colorado; Gordon Proctor, "Creek Dams Dedicated," *Fort Collins Coloradoan*, 1 October 1982; Bob Stieben, former board member, president and manager of North Poudre Irrigation Company, interview by author, 1 May 2003, tape recordings/notes, National Park Service, Fort Collins, Colorado. Stieben remarked that Park Creek Reservoir was technically not a Bureau of Reclamation project. The Bureau originally funded it and the loan was later transferred to the Colorado Water Conservation Board and paid off. See also Harlan Seaworth, interview by Colorado State University graduate students Wayne Latham and Anne Hilfinger, Wellington, 9 October 1992, tape recording, courtesy of Richard Seaworth. Note, the Charles Hansen Supply Canal was a new addition to the Poudre's water delivery system, built between 1950 and 1952, but was a CBT-related structure bringing water north to Horsetooth

Reservoir. See Tyler, *Last Water Hole*, 229-236. For enlargements and repairs instead of new reservoirs see John Neutze, Cache la Poudre River Commissioner 1969-1985, conversation with author, Fort Collins, 13 February 2003, handwritten notes, National Park Service, Fort Collins, Colorado.

¹⁴³ For small ditches not receiving CBT water see Neutze, "Transcription of Presentation." For quotes and information regarding North Poudre Irrigation and the impact of CBT see Harlan Seaworth, interview by Colorado State University graduate students Wayne Latham and Anne Hilfinger, Wellington, 9 October 1992, tape recording, courtesy of Richard Seaworth.

¹⁴⁴ For CBT water sold to cities see William Daven Farr, interview by Greg Silkensen, 22 September 1997, interview 3, page 45, transcript, City of Greeley. Farr was a board member of the Northern Colorado Water Conservancy District from the 1950s to the 1990s. For 1957 and 2004 statistics on CBT water sold to cities and industries see "C-BT Operational Procedures Under Review," *Northern Colorado Water Conservancy District Water News* 23 (March 2004): 13. For more on municipalities purchasing agricultural water rights see Julie Piotraschke, "Builders Say Water Available for Homes, Despite Drought," *Greeley Tribune*, 20 September 2002; Kit Miniclier, "Arkansas River: A Tradition under Siege," *Denver Post*, 4 October 1998; Kit Miniclier, "Rocky Ford Melon Farmers Not Dying on the Vine," *Denver Post*, 24 April 2000; Erin Emery, "Selling a Way of Life," *Denver Post*, 16 December 1999; "C-BT Operational Procedures under Review," *Northern Colorado Water Conservancy District Water News* 23 (March 2004). For City of Fort Collins water rights see Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*. According to Trask, the John R. Brown Ditch no longer exists but it was constructed in 1865 and had several early priority decrees that were transferred to the City of Fort Collins.

¹⁴⁵ For more on municipalities acquiring agricultural water rights and changing the use see Hobbs, "Colorado Water Law." Hobbs cites *Strickler v. City of Colorado Springs*, Supreme Court of Colorado, 16 Colo. 61, 26 p. 313, 1891 Colo. and *New Cache la Poudre Irrigation Company v. Arthur Irrigation Company*, 87, p. 799, 800, 1906 Colo., when discussing cities acquiring agricultural water and changing use.

¹⁴⁶ For historic consumptive use see Radosevich, *Evolution and Administration of Colorado Water Law*, 62, 71-74, 108-110. For quote see Ward Fischer, attorney for Water Supply and Storage Company and Cache la Poudre Water Users Association, interview by Karen Waddell for the Fort Collins Public Library, Fort Collins 2 February 1989, courtesy of Fort Collins Public Library.

¹⁴⁷ Seaworth quote from Harlan Seaworth, interview by Colorado State University graduate students Wayne Latham and Anne Hilfinger, Wellington, 9 October 1992, tape recording, courtesy of Richard Seaworth. North Poudre Irrigation quote "You hear discussion ..." from Bob Stieben, former board member, president and manager of North Poudre Irrigation Company, interview by author, Fort Collins, 1 May 2003, tape recordings/notes, National Park Service, Fort Collins, Colorado. Farr quote from William Daven Farr, interview by Sally Mier, 21 December 1999, interview 1, page 34-35, transcript, City of Greeley. For Fort Collins water board see <http://fcgov.com/cityclerk/water.php>; Ward Fischer, attorney for Water Supply and Storage Company and Cache la Poudre Water Users Association, interview by Karen Waddell for the Fort Collins Public Library, Fort Collins 2 February 1989, courtesy of Fort Collins Public Library. For Greeley's water board see William Daven Farr, interview by Greg Silkensen, 24 October 1997, interview 4, page 65, transcript, City of Greeley. For Colorado Water Conservation Board see <http://cwcb.state.co.us/>; for Colorado Water Resources and Power Development Authority see <http://www.cwrpda.com/> and Tyler, *Last Water Hole*, 423.

¹⁴⁸ "Depressed community" quote from Ward Fischer, attorney for Water Supply and Storage Company and Cache la Poudre Water Users Association, interview by Karen Waddell for the Fort Collins Public Library, Fort Collins 2 February 1989, courtesy of Fort Collins Public Library. Hansen quote from Hansen, "Water Supply and Storage Company," 28-29. See also Jan Hulse, "Debt-Ridden Farmers Stand to Benefit from Thornton Land Deal," *Rocky Mountain News*, 1986, courtesy of Fort Collins Local History Archive, Vertical File entitled "FC - Water - Ditch Companies and Canals"; Ubbelohde, Benson, and Smith, *A Colorado History*, 370.

¹⁴⁹ Ward Fischer, "History of Fort Collins Water," (1988), available at Fort Collins Library Local History Archive website; Hansen, "Water Supply and Storage Company," 29; Tyler, *Last Water Hole*, 447-451; Bill Jackson, "Deal Prevents City Purchase of More Water," *Greeley Tribune*, 16 April 1996; "Thornton Sues Water Company," *Greeley Tribune*, 12 July 1986; Bill Jackson, "Thornton Offers Water Plan," *Greeley Tribune*, 2 April 1990. For details on NCWCD's efforts to deny Thornton use of CBT water see Bill Jackson, "Thornton Wins Water Fight," *Greeley Tribune*, 16 October 1996; Bob Kretschman, "Thornton Gets Approval to Use Piped-In Water," *Greeley Tribune*, 17 August 1993; Tyler, *Last Water Hole*, 447-451. As of 2005, Thornton has not yet built a pipeline to transfer the Poudre's water south to its citizens.

¹⁵⁰ Jesse Fanciulli, "End of an Era: Farmer Bids Farewell to Life of Working Hard," *Greeley Tribune*, 1 February 2003; Bill Jackson "Farmer Says Goodbye to Way of Life," *Greeley Tribune*, circa 2003. For drip irrigation see Bill Jackson, "Ways to Save," *Greeley Tribune*, 2 January 2003.

¹⁵¹ Poudre Trail information from City of Greeley Museums, vertical file entitled "Water-Irrigation-Cache la Poudre River-CLP Trail-Newsletters"; "Poudre River Trail Corridor, 2000-2001 Map and Information," courtesy of City of Greeley Museums. For more on proponents, opponents and changing values associated with the environmental movement see Samuel P. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987).

¹⁵² Wild and Scenic Rivers Act, 1968, 16 U.S.C., 1271; 82 Stat. 906; also available at www.nps.gov/rivers/wsract.html. For more information on the issue and the compromise worked out by Hank Brown see Tyler, *Last Water Hole*, 440-443; Kevin McMullen, "Fans Hope to Keep River Wild and Scenic," *Rocky Mountain News*, 4 July 1994. For water developers opposition to the designation see William Daven Farr, interview by Sally Mier, 28 December 1999, interview 2, page 89, transcript, City of Greeley.

¹⁵³ Department of Agriculture, United States Forest Service, Rocky Mountain Region, Arapaho and Roosevelt National Forests, Estes-Poudre Ranger District: *Cache la Poudre Wild and Scenic River Draft Management Plan, Larimer County, Colorado* (Fort Collins: Department of Agriculture/U.S. Forest Service, 1989). McMullen, "Fans Hope to Keep River Wild and Scenic." Note, part of the Wild and Scenic designation for the Poudre authorized \$75,000 to study designating the downstream portions of the river as a National Recreation Area. During the two years of the study, landowners near the river reportedly feared problems such as loss of privacy, vandalism, and cost associated with the designation. See Steve Porter, "Task Force Recommends Plan for Part of Poudre River," *Fort Collins Coloradoan*, 14 March 1990. For the Poudre's Heritage Area designation see "To Establish the Cache la Poudre River National Water Heritage Area in the State of Colorado," in U. S. House of Representatives, 104th Congress (1995); Fredreka Schouten, "Cache la Poudre Area Bill Passes," *Fort Collins Coloradoan*, 5 October 1996; Mike Zapler, "Senator Brown Touts River land Swamp," *Denver Post*, 25 November 1996. Note, the CLP River National Heritage Area Plan has not been fully implemented as of this date due to various problems between local, state, and federal officials. For the undesignated eight miles of the river see Harza, *Cache la Poudre Basin Study Final Report, Volume One*, 1-2; Steve Kanigher, "Poudre River Use Compromise Plan Meets Opposition," *Greeley Tribune*, 15 June 1984.

¹⁵⁴ NEPA and Fish and Wildlife Act see George Vranesh, *Colorado Citizen's Water law Handbook: Colorado Water: The Next One Hundred Years*, ed. Kathleen Cain (Denver: Front Range Community College, 1989), 39, 41. Endangered Species Act see Lawrence J. MacDonnell, *The Endangered Species Act and Water Development Within the South Platte Basin* (Fort Collins: Colorado Water Resources Research Institute, 1985), 9. For additional environmental regulations impacting the Poudre see Tyler, *Last Water Hole*, 375, 435.

¹⁵⁵ Health Department quote is from United States Department of Health, *Water Quality Control Study*, 13. For the Colorado Water Quality Control Commission see Radosevich, *Evolution and Administration of Colorado Water Law*, 191-193; Hobbs, "Colorado's 1969 Adjudication and Administration Act: Settling In," 21; Vranesh, *Colorado Citizen's Water law Handbook*, 2, 36. For further information on the classification of waters and the development of water quality regulations see Radosevich, *Evolution and Administration of Colorado Water Law*. For EPA quote see Environmental Protection Agency, Office of Enforcement, *Effects of Waste Discharges on Water Quality of the Cache la Poudre and South Platte Rivers* (Greeley: Environmental Protection Agency, 1972), 19-20, courtesy of Colorado Water Resources Research Institute.

¹⁵⁶ Jacqueline D. Savitz, Christopher Campbell, Richard Wiles and Carolyn Hartmann, *Dishonorable Discharge: Toxic Pollution in Colorado's Waters* (Washington, D.C.: Environmental Working Group, September 1996). See also Jared Fiel, "Polluted – But Legally," *Greeley Tribune*, 2 October 1996; Jared Fiel, "Poudre River Most Polluted in Colorado," *Greeley Tribune*, 11 September 1998. Quote by the Division of Wildlife officer is from Dan England, "Pollution Runs Through It," *Greeley Tribune*, 3 February 2000. For fish kill see Coleman Cornelius, "2,000 Fish Die in Spill," *Denver Post*, 7 September 2001.

¹⁵⁷ "Proceedings of National Conference: Irrigation Return Flow Quality Management," in *National Conference on Irrigation Return Flow Quality Management*, eds. James P. Law, Robert S. Kerr, Gaylord V. Skogerboe (Fort Collins: Colorado State University Office of University Publications, 1977), 81. For Great Western Sugar pollution see Environmental Protection Agency, *Effects of Waste*, 2; Farr quote is from William Daven Farr, interview by Greg Silkensen, 7 November 1997, interview 5, page 96, transcript, City of Greeley. For *Greeley Tribune* quote see Dan England, "Runoff Could Harm Water," *Greeley Tribune*, 14 May 2000. See also Colorado Department of Health, Water Quality Control Commission, *City of Fort Collins Request for "C" Classification: Hearing Officer's Recommended Findings of Fact and Conclusions of Law* (Denver: Colorado Department of

Health, Water Quality Control Commission, Circa 1977), from Records of the Colorado Water Resources Research Institute, Water Resources Archive, Colorado State University, see file "GAS: WQCC: RD: Poudre Classification"; Jessica Frazier, "Poudre River Changes Form Classification in Meanderings," *Greeley Tribune*, 23 July 1971.

¹⁵⁸ Quote is from Bob Stieben, former board member, president and manager of North Poudre Irrigation Company, interview by author, Fort Collins, 1 May 2003, tape recordings/notes, National Park Service, Fort Collins, Colorado. For more on the convenience of pumps see Department of Agriculture/Preston and Beach, *Irrigation in Colorado*, 31-32.

¹⁵⁹ Department of the Interior, U.S. Geological Survey, Water Supply Paper 1669-X: *Ground Water Investigations in the Lower Cache la Poudre River Basin, Colorado*, by Lloyd A. Hershey and Paul A. Schneider, Jr. (Washington, D.C.: Government Printing Office, 1964), 15. Carpenter quote is from Carpenter, "The Story of Irrigation," *Greeley Tribune*, 14 August 1902. For pumps see Colorado Agriculture Experiment Station Bulletin No. 483: *Use of Ground Water for Irrigation in the South Platte Valley of Colorado*, by W.E. Code (Fort Collins: Colorado Agricultural Experiment Station, 1943), 5. Farr's story about turbine pumps in the Poudre valley see William Daven Farr, interview by Greg Silksens, 4 August 1997, interview 1, page 10-12, transcript, City of Greeley.

¹⁶⁰ Code quote and information is from Colorado Agricultural Experiment Station/Code, *Use of Ground Water*, 21. For U.S.G.S. report on wells in 1950s see Department of the Interior/Hershey and Schneider, *Ground Water Investigations*, 18. Also see William Daven Farr, interview by Sally Mier, 28 December 1999, interview 2, page 78, transcript, City of Greeley.

¹⁶¹ Parshall quotes are in Department of Agriculture/Colorado Agricultural Experiment Station/Parshall, *Agricultural Economic Summary Relating to the Colorado-Big Thompson Project*, 5-6, 19-20.

¹⁶² For Poudre aquifers see Harza, *Cache la Poudre Basin Study Final Report, Volume One*. See also Department of the Interior/Hershey and Schneider, *Ground Water Investigations*, 20-21, quote is from page 21.

¹⁶³ For the 1951 Supreme Court case see Hobbs, "Colorado's 1969 Adjudication and Administration Act: Settling In" and Hobbs, "Colorado Water Law," 20. For 1957 groundwater regulations see Radosevich, *Evolution and Administration of Colorado Water Law*, 115. For the 1965 groundwater act see Tyler, *Last Water Hole*, 271-272; also Hobbs, "Colorado Water Law," 21. Note, some groundwater is considered partially tributary or not non-tributary "if connected to surface streams in a marginal manner," meaning depletions of this water may change the rate or direction of flow of a surface stream but total depletions to the surface stream do not equal what was withdrawn from a well. See Vranesh, *Colorado Citizen's Water Law Handbook*, 24, 48-49. For more on legally appropriating groundwater through the Colorado Groundwater Commission see Radosevich, *Evolution and Administration of Colorado Water Law*, 116-121.

¹⁶⁴ Quote is from Radosevich, *Evolution and Administration of Colorado Water Law*, 121-122. Note, the Water Rights and Determination and Administration Act replaced Colorado's seventy water districts with seven water divisions organized around the seven major watersheds in the state with a water court and engineer in each division. See Hobbs, "Colorado's 1969 Adjudication and Administration Act: Settling In," 3, 12 and Hobbs, "Colorado Water Law," 20-22.

¹⁶⁵ For augmentation see Vranesh, *Colorado Citizen's Water Law Handbook*, 20-21; Hobbs, "Colorado Water Law," 21; Fischer, *A Guide to Colorado Water Law*, 45-65. For the Poudre's augmentation plan see Bob Stieben, former board member, president and manager of North Poudre Irrigation Company, interview by author, Fort Collins, 1 May 2003, tape recordings/notes, National Park Service, Fort Collins, Colorado; Robert L. Stieben, "History of the Cache la Poudre Water Users Plan for Augmentation," (Fort Collins: 1998), courtesy of Bob Stieben. Note, not all Colorado irrigators created acceptable augmentation plans. Groundwater Appropriators of the South Platte, known as GASP, operate wells from Denver to Julesburg and had operated under an augmentation plan approved by the State Engineer following the 1969 Water Rights and Determination Act. In December 2000, the Colorado Supreme Court ruled the State Engineer does not have the authority to approve well operations and GASP farmers must go to court and have an augmentation plan approved. See *Empire Lodge Homeowner's Association v. Anne Moyer and Russell Moyer*. Until this is done, the wells may be shut down. The case is currently being appealed. See Bill Jackson, "Future of Water Wells Uncertain after Ruling," *Greeley Tribune*, 4 March 2002; James Pritchett and Stephan Weiler, *Estimated Economic Impact of Well Depletions by the Groundwater Appropriators of the South Platte* (Fort Collins: Colorado State University Cooperative Extension, Department of Agriculture and Resource Economics, January 2003). Note, the issue of wells, groundwater use, and augmentation has not been fully settled and the future may bring changes for the state.

¹⁶⁶ Tyler, *Last Water Hole*, 283; Department of the Interior, Bureau of Reclamation, Cache la Poudre Unit, *Colorado, Missouri River Basin Project: Concluding Report* (Denver: Bureau of Reclamation, 1966).

¹⁶⁷ Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002), 243-245; Worster, *Rivers of Empire*, 272-275, 308-309; Reisner, *Cadillac Desert*.

¹⁶⁸ Tyler, *Last Water Hole*, 284. Bureau of Reclamation quotes and information are from Department of the Interior/Reclamation, Colorado, *Missouri River Basin Project: Concluding Report*, 1-3, 18.

¹⁶⁹ Tyler, *Last Water Hole*, 424.

¹⁷⁰ For Colorado Water Resources and Power Development Authority see Tyler, *Last Water Hole*, 424. For Colorado Water Conservation Board feasibility studies see Colorado Water Conservation Board Project Studies: Cache la Poudre, *Cache la Poudre No. 1-4 Archive 1982-1983* (Denver: Colorado Water Conservation Board, 1982), available at the Colorado State University Archives. For 1981 opposition to new reservoirs see Jack Cox, "Currents of Argument Swirl over Poudre River," *Denver Post*, 24 May 1981; Tyler, *Last Water Hole*, 424-426, 440-441.

¹⁷¹ Fiege, *Irrigated Eden*, 42-47; Todd Hartman, "Fish Story, 2/3," *Rocky Mountain News*, 4 December 2000, 4x-5x; Ellen Wohl, *Virtual Rivers: Lessons From the Mountain Rivers of the Colorado Front Range* (New Haven: Yale University Press, 2001), 120.

¹⁷² Quotes and information from Marcus P. Grant, Christian J. Zier and Robert G. Rosenberg, *Supplemental Report: Cultural Resources Investigations in Stage One Areas of the Basin Study Extension, CLP Hydroelectric Project, Larimer County, Colorado* (Fort Collins: Centennial Archaeology, Inc., 1988), 238-239, part of the Ival Goslin Collection, Water Resources Archive, Colorado State University. See Tyler, *Last Water Hole*, 395-397 for information on similar archaeological finds on the Windy Gap Project.

¹⁷³ Quote is from *Friends of the Poudre General Information Bulletin* (May 1989). See also "Horsetooth Tea Party Makes Front Page News," *Friends of the Poudre Newsletter* (Fort Collins: Friends of the Poudre, 1989); Tom McKenna, "Your Water District: Taxation Without Representation," *Friends of the Poudre Spring Newsletter* (Fort Collins: Friends of the Poudre, 1989); Ed Quillen, "Can Democracy Win in Colorado?" *Greeley Tribune*, 6 February 1990, courtesy of City of Greeley Museums. See also Coleman Cornelius, "Conservation Group Awarded Grant," *Denver Post*, 14 August 1999. For more objections to the Poudre storage projects see Tyler, *Last Water Hole*, 424-426. Note, FOP was originally called Preserve our Poudre and reorganized as FOP in 1986. See Tyler, *Last Water Hole*, 568, footnote number 33. FOP continues to be influential along the Cache la Poudre. In 1999, the group received a grant from River Network to study the Poudre watershed, including a comprehensive water quality assessment. The group was instrumental in creating Gateway Park, a popular recreation spot near the mouth of the Poudre. For NCWCD's 1986 purchase of land see Associated Press, *Daily Camera*, 14 November 1986 and Tyler, *Last Water Hole*, 441. Note, according to the *Daily Camera*, NCWCD purchased 1,600 acres near the proposed Glade Reservoir site for \$1.6 million. Tyler acknowledges the district bought land but does not provide acreage or a prices. He cites NCWCD meeting minutes from 12 October 1984. For additional information related to Poudre reservoir proposals see Tyler, *Last Water Hole*, 424-426, 440-442.

¹⁷⁴ For NCWCD's position on not building the Poudre reservoir projects see David Lock, "Funding Woes Slow Poudre Project," *Greeley Tribune* 29 July 1987; Tyler, *Last Water Hole*, 424-426, 440-442. For the eight miles of the Poudre that are not designated Wild and Scenic or a National Heritage Area see Tyler, *Last Water Hole*, 426, 441-442. Farr quote is from William Daven Farr, interview by Sally Mier, 28 December 1999, interview 2, page 43, transcript, City of Greeley. See also William Daven Farr, interview by Sally Mier, 15 February 2000, interview 6, page 11, transcript, City of Greeley. Berling quote in "The District and the Bureau: Thoughts on a Partnership," *Northern Colorado Water Conservancy District Water News* 5 (September 1987). Neutze quote is from John Neutze, Cache la Poudre River Commissioner 1969-1985, conversation with author, Fort Collins, 13 February 2003, handwritten notes, National Park Service, Fort Collins, Colorado.

¹⁷⁵ McKee, Doesken, Kleist, Shrier and Stanton, *A History of Drought in Colorado*, 4, 15.

¹⁷⁶ For an explanation of minimum stream flow and expanded definitions of beneficial use see Fischer, *A Guide to Colorado Water Law*, 9-11; Hobbs, "Colorado Water Law," 22-23. U.S. Department of Health report is in United States Department of Health, *Water Quality Control Study*, 44.

¹⁷⁷ The City of Fort Collins owns Joe Wright Reservoir, Greeley owns Barnes Meadow Reservoir and WSSC owns Chambers Lake and Long Draw. For more information on this issue see Annie Epperson, "Wildlife Habitat and Agricultural Commodities: Organizing a Common Property Resource in Northern Colorado's Phantom Canyon" (Master of Arts Thesis, Department of Sociology, Colorado State University, 2001), 69.

¹⁷⁸ J. Lewandowski, "We're Not Trying to Own Water," *Fort Collins Coloradoan*, 8 April 1993; Bob Saile, "On the Rocks: Shut Off Dams Give Poudre's Trout Little Breathing Room," *Denver Post*, 20 April 1994. Note, the minimum stream flow issue was at one level an issue of state versus federal control of water. In 1897, the Forest Reserve Act passed in response to a conservation-minded public; however, to appease nervous westerners skeptical

of the increased federal control and loss of public domain, the 1897 act pledged that, “state water law would continue to apply to water rights on the national forests.” For the USFS’s claim that the 1969 Water Rights and Determination Act authorized the CWCB to comply with minimum stream flow see Hobbs, “Colorado’s 1969 Adjudication and Administration Act: Settling In,” 16. For more on instream flow issues and the public interest in Colorado see Norman K. Johnson, “The Doctrine of Prior Appropriation and the Changing West” (Western States Water Council, 1987), 14-15.

¹⁷⁹ Bill Hornby, “Greeley Case Could Alter West’s Growth,” *Greeley Tribune*, 6 February 1990; Bill Jackson, “Appeals Filed for National Water Rights,” *Greeley Tribune*, 17 September 1993; both courtesy of the City of Greeley Museums; Annie Epperson and David M. Freeman, “Law as Catalyst: A New Agenda for a Traditional Water Resource Appropriator at Phantom Canyon, Colorado,” *University of Denver Water Law Review* 6 (Fall 2002). For a more thorough discussion of these events see Epperson, “Wildlife Habitat and Agricultural Commodities”; Bob Kretschman, “Assessing Water Deal May Take Years,” *Greeley Tribune*, 20 June 1995; Tyler, *Last Water Hole*, 446-447.

¹⁸⁰ Epperson, “Wildlife Habitat and Agricultural Commodities,” 59. Fremont quote is from *Nature Conservancy Phantom Canyon Preserve Brochure*. Note, the accord between the Nature Conservancy and North Poudre Irrigation came about in the context of the USFS lawsuit with Greeley, Fort Collins, and Water Supply and Storage regarding minimum stream flow.

¹⁸¹ *Nature Conservancy Phantom Canyon Preserve Brochure*; Epperson and Freeman, “Law as Catalyst.” Note, 2002 was the first year in Phantom Canyon director’s memory that the Nature Conservancy chose not to buy water rights to reimburse NPIC for increased flow due to the drought, which limited supply and raised water prices. See also Epperson, “Wildlife Habitat and Agricultural Commodities” for more about this issue. Epperson interviewed various members of NPIC, the Nature Conservancy, and other individual water agencies in these two citations.

¹⁸² Epperson, “Wildlife Habitat and Agricultural Commodities,” 82-83, also see 76-79, 92-94, 97; Mark Obmascik, “Drain Off Kills 4,200 Trout,” *Denver Post*, 11 October 1996. Note, adjustments are made to the original agreement between NPIC and the Nature Conservancy over the years as the contract is renegotiated.

Chapter Six: The Twenty-First Century Poudre

¹⁸³ Quote is from Crawford, *Mayordomo*, 74.

¹⁸⁴ Varra information from George Varra, Cache la Poudre River Commissioner, 2000-present, conversation with author, Fort Collins, June 2003, handwritten notes, National Park Service, Fort Collins, Colorado. For Canyon Gauging Station information see www.dwr.state.co.us. The U.S.G.S. gauging station Varra consults is entitled “Cache la Poudre at Fort Collins Site.” According to former Poudre River Commissioner, Jack Neutze, Colorado has four different grades of River Commissioners for different rivers depending on how difficult they are to manage. The River Commissioner on the Poudre is called a Principle Commissioner and indicates the river is one of the most complex to manage. All Commissioners on the Poudre to date have been male. John Neutze, Cache la Poudre River Commissioner 1969-1985, conversation with author, Fort Collins, 13 February 2003, handwritten notes, National Park Service, Fort Collins, Colorado.

¹⁸⁵ George Varra, conversation with author, June 2003.

¹⁸⁶ George Varra, conversation with author, June 2003. Per Varra, there is one small diversion about forty miles north of the North Poudre Diversion structure in the canyon. This water user diverts water to irrigate the grounds of a small recreational facility. The water used is insignificant compared to diversions from the lower canyon and plains portion of the Poudre. The North Poudre Diversion Structure carries Northern Colorado Water Conservancy District’s CBT water to North Poudre Irrigation Company’s Munroe Canal for delivery to various areas along the Poudre.

¹⁸⁷ George Varra, conversation with author, June 2003.

¹⁸⁸ George Varra, conversation with author, June 2003. For the establishment of the gauging station see Department of the Interior/Boyd, *Irrigation Near Greeley*, 16-17.

¹⁸⁹ George Varra, conversation with author, June 2003.

¹⁹⁰ George Varra, conversation with author, June 2003.

¹⁹¹ In addition to previous chapters and endnotes in this volume about drought and human responses in the Poudre valley see “Drought History of the Poudre River,” available at <http://fcgov.com/water/drought-history.php>; McKee, Doesken, Kleist, Shrier and Stanton. *A History of Drought in Colorado*; Fischer, “History of Fort Collins Water”; Nortier and Smith, *From Bucket to Basin*, 50-54. For 2000-2002 drought see Jesse Fanciulli, “Great Storm

... Not Enough: Greeley Water Officials Continue Drought Measures,” *Greeley Tribune*, 20 March 2003; Anne Cumming, “Farmer: Rain, Snow, An Answer to a Prayer,” *Greeley Tribune*, 30 March 2003; Bill Jackson, “Drought Hits Ag Business,” *Greeley Tribune*, 2 February 2003; “Farmers May Dry Up Due to Drought,” *Greeley Tribune*, 5 February 2003; Mary Benanti, “Colorado’s Dry Spell: Short Term or Long Haul?” *Fort Collins Coloradoan*, 3 September 2000. See also Bill Jackson, “Time Will Tell About Dry Spell: Farmers Gather to Talk About Drought Options,” *Greeley Tribune*, 20 February 2003; Bill Jackson, “Company Idles Sugar Factory,” *Greeley Tribune*, 11 February 2003.

¹⁹² “Glen Johnson, interview by Scott Headley, Cache La Poudre Oral History Project, Fort Collins, 19 March 2004, photocopy, National Park Service, Fort Collins, Colorado.

¹⁹³ *New York Times* quote is from Kirk Johnson and Dean E. Murphy, “Drought Settles in, Lake Shrinks and West’s Worries Grow,” *New York Times*, 2 May 2004, A1, A24.

¹⁹⁴ Jerald F. McCain, Lee R. Hoxit, Robert A. Maddox, Charles F. Chappell and Fernando Caracena, *Storm and Flood of July 31-August 1, 1976, In the Big Thompson and Cache la Poudre River Basins, Larimer and Weld Counties, Colorado: Part A – Meteorology and Hydrology in Big Thompson River and Cache la Poudre River Basins* (Washington, D.C., 1979), 1, 5. For more on the Big Thompson Flood see George Gudauskas, “Larimer County Declared Disaster Area by President,” *Rocky Mountain News*, 3 August 1976, 26; Mike Chapman, “I Never Expected to See the River Do That,” *Fort Collins Coloradoan*, 2 August 1976, 11; Jack Olsen, Jr. “56 Known Dead in Flood; Hundreds Trapped,” *Rocky Mountain News*, 2 August 1976, 5, 15; Jack Olsen, Jr. “Death Toll Reaches 80,” *Rocky Mountain News*, 3 August 1976, 1, 23; Jack Olsen, Jr. “Many Ignored Warnings Sheriff Said,” *Rocky Mountain News*, 3 August 1976, 6.

¹⁹⁵ Ahlbrandt and Stieben eds., *History of Larimer County, Colorado, Vol. 2*, 211-212. Fort Collins newspaper quote is from “Poudre Valley Deluged,” *Fort Collins Express*, 25 May 1904.

¹⁹⁶ 1864 and 1904 floods see Ahlbrandt and Stieben eds., *History of Larimer County, Colorado, Vol. 2*, 66-67; “Poudre Valley Deluged,” *Fort Collins Express*, 25 May 1904; *Flooding in Fort Collins* Brochure, courtesy of Fort Collins Utilities. 1947 flood see “Scores Moved Out and Fed by Red Cross,” *Greeley Tribune*, 24 June 1947. For Fort Collins and Greeley flood prevention measures see *Flooding in Fort Collins* Brochure, courtesy of Fort Collins Utilities.

¹⁹⁷ *Flooding in Fort Collins* Brochure, courtesy of Fort Collins Utilities. 1947 flood see “Scores Moved Out and Fed by Red Cross,” *Greeley Tribune*, 24 June 1947. For floods not necessarily on the Poudre or not as dramatic on the Poudre as floods mentioned in detail here see Wayne A. Charlie, Colorado State University, Department of Civil Engineering Geotech Report No. 1998-100: “History of Flooding at Colorado State University (1902, 1938, 1951, 1992 and 1997),” (Fort Collins: Colorado State University, Department of Civil Engineering, September 1998).

¹⁹⁸ George Varra, conversation with author, June 2003. Information on Larimer County Canal from Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*; Department of the Interior/Boyd, *Irrigation Near Greeley*, 41.

¹⁹⁹ For one example of maintenance issues encountered by irrigation companies see North Poudre Irrigation, *Annual Report*; Harlan Seaworth, former board member and president of North Poudre Irrigation Company, interview by CSU graduate students Wayne Latham and Anne Hilfinger, Wellington, 10-9-1992, courtesy of Richard Seaworth. For an example of municipalities along the Poudre expending money, time, and labor maintaining irrigation ditches see Jeremy Shaver, “No. 3 Ditch Cleaned Up, Banks Repaired,” *Greeley Tribune*, 5 March 1998.

²⁰⁰ North Fork Weed Coop, Weed Management: An Integrated and Adapted Approach” (accessed 13 June 2003); available at <http://www.northforkweedcoop.org/weedmgt.html>; “History of the Larimer County Weed Control District,” (accessed 13 June 2003); available at <http://www.co.larimer.us/publicworks/eweeds/history.html>; Colorado Weed Management Association, “Noxious Weeds and Non-Native Plants,” (accessed 13 June 2003); available at <http://www.cwma.org>; Weld County Weed and Pest Division, (accessed 16 June 2003); available at http://www.co.weld.co.us/departments/weed_pest/index.html.

²⁰¹ For 1889 potato bug infestation see Boyd, *A History*, 153-154. For 1930s sugar beet problems see “Better Beet Crop Than 1935,” *Fort Collins Express*, 30 June 1936.

²⁰² Information on Bellvue Water Treatment Plant from George Varra, conversation with author, June 2003.

²⁰³ George Varra, conversation with author, June 2003.

²⁰⁴ George Varra, conversation with author, June 2003; Evans and Evans, *Cache la Poudre*, 234.

²⁰⁵ George Varra, conversation with author, June 2003.

²⁰⁶ George Varra, conversation with author, June 2003.

²⁰⁷ George Varra, conversation with author, June 2003. Canal information from Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 47-48.

²⁰⁸ George Varra, conversation with author, June 2003.

²⁰⁹ Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 11-12; George Varra, conversation with author, June 2003.

²¹⁰ George Varra, conversation with author, June 2003. For gravel mining see “History of Water Rights in Colorado” in www.water.state.co.us.

²¹¹ George Varra, conversation with author, June 2003. Note, the Tri- districts previously had only CBT water but they have acquired Poudre River water rights and they will send this water through the new pipeline. The structure will enable Greeley to run CBT water in the winter when the Northern Colorado Water Conservancy District does not use its canals to transport CBT water out to that city. Fort Collins had to build new pipelines to replace old, raw water pipelines from the river. As for other pipelines in the area, the NCWCD has two large pipelines that deliver water from Carter Lake to Broomfield and to Fort Morgan but these were built relatively recently.

²¹² For Larimer and Weld Canal see Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 36-37; Department of the Interior/Boyd, *Irrigation Near Greeley*, 35.

²¹³ George Varra, conversation with author, June 2003.

²¹⁴ George Varra, conversation with author, June 2003.

²¹⁵ For agricultural water use in Colorado see Julio Ochoa, “Agriculture Soaks Up 85 to 90 Percent of Water in the State,” *Greeley Tribune*, 30 December 2002; Colorado Division of Water Resources, *Mountains to Plains*; Colorado Division of Water Resources, *Cumulative Yearly Statistics of the Colorado Division of Water Resources*. For Pisani quote and a critique of prior appropriation see Pisani, *Water, Land and Law in the West*, 2.

²¹⁶ George Varra, conversation with author, June 2003.

²¹⁷ For B.H. Eaton Ditch see Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 18-19; Norris and Norris, *Written in Water*.

²¹⁸ For Ogilvy Ditch information and background see Trask, *Irrigation and Water-Related Structures in the Cache la Poudre River Corridor*, 49-50.

Glossary

Abandonment

The loss of a water right based on the intent not to use the right and the actual nonuse of that water right. Both must exist before a water right is considered abandoned.

Absolute Water Right

A water right that has been perfected and placed to beneficial use.

Acre-Foot

The volume of water covering one acre of land to a depth of one foot. It equals 325,850 gallons or 1,233.5 cubic meters of water. An acre-foot is a land area equal to 43,560 square feet. It is also considered enough water to supply a family of four for about one year.

Adjudication

The judicial process by which a water right is confirmed by a court decree. The resulting judicial decree officially dates a water right under the prior appropriation system.

Adverse Use

The use of decreed water by someone other than the decreed appropriator. Adverse use for a continuous period of eighteen years may result in loss of ownership by the decreed owner and allow subsequent usage by the another user.

Appropriation

The diversion of a certain portion of the waters of the state and the application of those waters to a beneficial use. Under certain conditions, an appropriation for minimum stream flow or minimum lake level maintenance may be accomplished without the act of diversion and application to beneficial use.

Appropriation Doctrine

The system of water law dominant in the western United States under which the right to water is acquired by diverting water and applying it to a beneficial use, and a right to water is superior to a right acquired later in time.

Appropriator

The person or persons who have diverted water for beneficial use. A senior appropriator is a person whose water right on a stream predates the water rights of others on the stream. A junior appropriator is a person whose water right on a stream was granted later in time.

Aquifer

An underground bed of saturated sand, gravel, or porous rock through which water moves by gravity, and which is usually surrounded by impervious materials.

Augmentation: The act of increasing the supply of water available for beneficial use by developing new or alternate means or points of diversion. Pooling water resources, water exchange projects, providing substitute water supplies, and developing new sources of water are all methods of augmentation. Augmentation allows junior appropriators to divert water ahead of senior priorities downstream, provided they replace the water they divert so that the downstream rights remain unaffected.

Augmentation Plan: A detailed program to increase the supply of water available for beneficial use by developing new or alternate means or points of diversion. This may be done by pooling water resources; water exchange projects, providing substitute supplies of water; developing new sources of water, or other appropriate means.

Beneficial Use: The amount of water that is reasonable and appropriate, under reasonably efficient practices, to accomplish, without waste, the purpose of which the appropriation is lawfully made. Recognized beneficial uses include domestic, agricultural, industrial, municipal, and recreational uses, as well as minimum stream flows filed by the state.

California Doctrine: The legal doctrine that retains aspects of both riparian rights and the principles of prior appropriation.

Call: A request by an appropriator for water that they are entitled to under a decree. A call forces a user with a junior decree to cease or diminish their diversion and pass the requested amount of water to the downstream senior appropriator making the call.

Chart House: A small building that contains measuring and recording devices to monitor the amount of water flowing through a ditch. The chart house is usually located near a weir or flume.

Colorado Doctrine: This doctrine regulates water usage by priority of appropriation as opposed to riparian rights.

Compact: An agreement between states, apportioning the waters of a river basin to each of the signatory states, as approved by Congress.

Compensatory Storage: Storage that makes water available for those in a water basin of origin in association with an out-of-basin diversion.

Conditional Water Right: An unperfected water right coupled with the right to perfect it with reasonable due diligence.

Conservancy District: Made possible by the Water Conservancy District Act of 1937 in Colorado. A district can obtain rights-of-way for water projects; contract with the United States or otherwise provide for the construction of water storage and related facilities; assume contractual or bonded indebtedness; administer, operate, and maintain physical works; conserve, control, allocate, and distribute water supplies, have contracting and limited taxing authority to raise revenues necessary to accomplish its purposes.

Conservation District: Established by statute to oversee the conservation, use, and development of water in large geographical areas in the state.

Consumptive Use

The portion of water consumed during use that does not become return flow available for other uses.

Cubic Feet Per Second

Sometimes referred to as “second feet” or “c.f.s.,” this is the basic measurement of flowing water. A cubic foot per second is approximately 7.48 gallons per second, which is 646,317 gallons per day, or almost 2 acre feet.

Decree

An official document issued by the court defining the priority, amount, use, and location of a water right or plan of augmentation. The decree is a mandate to the State Engineer to administer the water rights involved according to the decree.

Designated Groundwater

Groundwater that, in its natural course, would not be available to and required for the fulfillment of decreed surface rights in areas not adjacent to a continuously flowing natural stream, wherein groundwater withdrawals have constituted the principle water usage for at least fifteen years preceding the date of the first hearing on the proposed designation of the basin.

Designated Groundwater Basin

An area of groundwater established by the Colorado Groundwater Commission. Once a groundwater basin is designated, an appropriation from it can only be made by application to the commission.

Developed Water

Water that is diverted into a water system through the efforts of mankind, and would not have entered the system of its own accord.

Diversion

The removal of water from its natural course or location by means of a ditch, canal, flume, reservoir, pipeline, conduit, well, pump, or other structure or device.

Diversion Record

The record of the daily flow, or cubic feet per second, for a ditch or other diversion structure. The district water commissioner, ditch rider, or other water official compiles the diversion record. Diversion records are on file and available for review at the state engineer’s office.

Division Engineer

Subordinate officers of the State Engineer who perform the functions of the State Engineer for each water division in the state.

Due Diligence

The effort necessary to bring an intent to appropriate into fruition by actually applying the water to the beneficial use intended. Due diligence does not require unusual effort or expenditures, but only such constancy in the pursuit of the undertaking as is usual with those in like enterprises. In other words, the appropriator’s actions must demonstrate his good faith intention to complete the undertaking within a reasonable amount of time.

Duty of Water

This was estimated when determining the quantity of water reasonably needed for crops in the nineteenth century before more accurate measuring terms and devices were used. The duty of water referred to the amount of water needed for a particular area, dependent upon the quantity of water, the type of soil and crop, the slope of ground, and skill of the irrigator.

Effluent Discharge

The disposal of water into a watercourse that was previously used for municipal and household purposes (i.e., sewage discharge).

Enlargement

A subsequent water right awarded to a canal or structure that enlarges the amount granted originally. More than one enlargement may be awarded over time and each enlargement will have a priority number related to the date it was appropriated to beneficial use. Enlargements may be absolute or conditional (see “absolute decree” and “conditional decree”).

Evaporation

The physical process by which a liquid is transformed to the gaseous state, which, in irrigation usually is restricted to the change of water from liquid to gas.

Evapotranspiration

The combined process by which water is transferred from the earth’s surface to the atmosphere; it is the evaporation of liquid, plus the transpiration from plants.

Federal Reserved Water Right

A claim by the federal government that argues for a federal water right on federal lands in a quantity sufficient to maintain the purpose for which the reservation was established. See *Winters v. United States*, United States Supreme Court, 1908.

Feeder Canal

A canal that feeds water into a reservoir.

Floodplain

The land area adjacent to a stream or other watercourse that is subject to flooding.

Flume

An inclined channel used to convey and or measure water.

Forfeiture

The loss of a water right based on its nonuse for a statutorily provided period of time.

Futile Call

A situation in which a junior priority will be permitted to continue to divert water in spite of demands by a senior appropriator in the same watershed. The senior appropriator’s call for water is futile in instances when curtailing the junior appropriator’s diversion would not effectively produce enough water to serve the beneficial use of the senior appropriator.

Gauge

For water and water measurement, a gauge may be defined as: an instrument used to measure magnitude or position, such as the elevation of water surface, the velocity of flowing water, the pressure of water, the amount of intensity of precipitation, the depth of snowfall, etc.

Gauge Height

The height of the water surface above the gauge datum.

Gauging Station

A particular site on a stream, canal, lake, or reservoir where systematic observations of gauge height or discharge are made.

Groundwater

Water in an aquifer. Colorado water law considers water in an aquifer that is tributary to a river as surface water. Nontributary groundwater is generally considered to be confined to a sealed aquifer that has not connection or outlet to flowing surface water.

Growing Season

That portion of the year, usually May through October in Colorado, when plants actively consume water and nutrients.

Headgate

A physical structure on a stream through which water is diverted into a canal. Headgates control the volume of flow by being opened to greater or lesser degrees.

Headworks

The structures that, together, divert water from a stream to a ditch. Headworks include the headgate, sandgate, and their foundations and mounting structures. Generally, headworks also include the diversion structure or dam.

Historic Use

The documented diversion and use of water by a water right holder in a ditch over a period of years.

Infiltration

The process by which water moves from a surface supply, such as precipitation or irrigation, into the ground. The rate, or speed, of infiltration will vary depending upon local soil, rock, vegetation, climate, and other physical conditions.

Instream Flow Right

A water right used to maintain water in a stream to preserve the environment for fish, wildlife, and aesthetic purposes. In Colorado, only the Colorado Water Conservation Board may appropriate such a right. See also minimum streamflow.

Instream Use

The term used to describe any use of water that does not require the water to be diverted from its watercourse.

Intent to Appropriate

That condition in which a person has formed a definite plan to divert or store water, created the means to do so, and applied such water to beneficial use.

Irrigation

The distribution of water on the land to establish a crop or to increase crop yield where the natural precipitation is inadequate.

Irrigation District

A legal entity created by statute for the purpose of developing large irrigation projects.

Irrigation Efficiency

The ratio of the volume of water consumed by a specific beneficial use compared to the volume of water delivered.

Irrigation Return Flow

Water that was applied to plants but not consumptively used that returns to a surface water or groundwater supply.

Irrigation Year

A one year period starting on November 1st of one year and ending on October 31st of the next year.

Lateral

A minor ditch leading away from a main ditch and used to direct water onto land. A ditch may have many laterals, depending on the amount of acreage irrigated, the slope of the land, and the rate of seepage loss.

Loss

The difference between the amount of water that is actually placed on the land and the amount of water that was physically diverted to the headgate. Losses usually are due to seepage, evaporation, and conveyance loss.

Miner's Inch

An antiquated water measurement still used by some irrigation companies that is roughly equivalent to cubic inches per second. The original miner's inch was the size and volume of a man's thumb – about one inch in diameter and four inches long. To translate it to acre feet, divide the number of miner's inches by 38.4, then divide that result by two to arrive at the number of acre feet of flow over a twenty-four hour period.

Minimum Stream Flow Requirement

A water right decreed to the Colorado Water Conservation Board that requires a set amount of water be maintained in a watercourse for the purpose of reasonably maintaining the environment. It is also known as "instream flow."

Mutual Ditch Companies

Owner-operated and financed irrigation companies that distribute water according to the ownership of shares in the company. Shareholders hold in common an ownership in the water rights and the water facilities of the company.

Natural Flow

The amount of water that would exist in a watercourse if there were no diversions from it. It is calculated by adding back all diversions to the recorded stream gauges, leaving no diversions "in the gauge."

Non-Consumptive Use

A use that does not reduce the water supply, such as hunting, fishing, boating, water skiing, and swimming.

Non-Point Source Solution

Pollution whose source cannot be specifically identified.

Original Right

The first right awarded to a ditch or storage structure.

Paper Right

A document purporting to be legal proof of a water right, but which has lost its legal validity because of abandonment or lack of due diligence in perfecting the right.

Parshall Flume

The Parshall Flume is named for its principle developer, Ralph L. Parshall. It is a structure designed to provide a simple and effective method of water measurement. It is the device most commonly used worldwide to measure the flow of water in irrigation channels. The flume has converging, vertical entrance walls leading to a throat, which has a downward sloping floor. The body of the flume is of a precise uniform width until it reaches the outlet section where the walls diverge and the floor of the flume inclines upward.

Perfection of a Water Right

The process of meeting all the legal requirements for establishing a legal right to the use of water. Once perfected, a conditional water right becomes an absolute water right.

Point of Diversion

The specific location of a headgate or water diversion structure for capturing, possessing, and controlling water.

Point Source Pollution

Pollution that can be traced to a specific source.

Prior Appropriation

A term describing a general process by which water rights are distributed among several claimants. It provides that the first person to use the water beneficially gets the water right, whether or not that person owns the land next to the river or lake from which the water is diverted. It is common in the western United States but virtually unknown in the East.

Priority

Refers to the seniority date of a water right. The priority of a water right determines its ability to divert in relation to other rights in periods of limited supply.

Quasi-Municipal

Government entities that provide certain services to the public that maintain some aspects of a municipality, such as taxing authority, yet remain separate from them.

Reclamation Act 1902

Originally called the Newlands Act, this established the U.S. Reclamation Service (renamed in 1923 the U.S. Bureau of Reclamation), which built water projects in the western United States. Money was initially provided through the sale of public lands and later by general fund appropriations.

Referee

A person selected by a water court judge to carry out certain judicial functions of the court.

Reservoir

A natural or man-made pond, lake, impoundment, or basin used for storage, regulation, and control of water.

Respiration

The process by which the chemical energy of organic molecules is released. It involves the consumption of oxygen and the liberation of carbon dioxide and water. It complements the process of transpiration, which consumes carbon dioxide and releases oxygen.

Return Flow

The unconsumed water that returns to its source, or some other body of water, after its diversion from a watercourse or its extraction from the ground.

Riparian Doctrine

A legal concept wherein owners of lands along the banks of a stream or body of water have the right to reasonable use of the waters and the right to protect those waters against unreasonable use by others that substantially diminishes the quantity or quality of water. This system is used primarily in the eastern United States to determine who has rights to water. Riparian rights do not consider prior use and are attached to the land. Colorado does not recognize the riparian doctrine or riparian rights.

Runoff

Precipitation that flows to, and in, surface streams.

Rural Water Districts

Water supply entities created in the 1950s and 1960s to meet the domestic water supply needs of residents living outside of city water service areas.

Salvaged Water

Water that is saved to a natural stream by human modifications or natural conditions.

Sand Gate

A headgate-type structure designed to prevent the build up of sand and silt in a canal. Opening the sand gate allows the water flow to clean sand and debris from the canal. It can also be used to help regulate the flow of a canal and allow for the return of water to the river.

Seepage

The slow movement of water out of a body of surface or subsurface water; the loss of water by infiltration into the soil from a canal, reservoir, or other body of water; or, from a field.

Senior Decree

A decree that is filled before others when the available water supply is not sufficient to fill all water rights in a water system.

Staff Gauge

A graduated scale used to indicate the height of the water surface in a stream channel, canal, reservoir, lake, or other water body.

State Engineer

The officer in the executive department of Colorado's state government who administers water rights. He or she is responsible for the supervision and administration of water, and the enforcement of decreed priorities and legislative enactments. The State Engineer also discharges the obligations imposed on the state of Colorado by compact or judicial orders and coordinates the work of the division of water resources with other departments of the state government. The engineer has rule-making obligations and supervisory control over measurements, record keeping, and distribution of the public waters of the state.

Storage Right

A right defined in terms of the volume of the water that is diverted from a stream and stored in a reservoir or lake, to be released and used at a later time.

Total Consumptive Use

The amount of water, regardless of its source, that is physically removed from the stream's system and is not available for other users on the stream. The best example of this is the amount of water used by crops during a growing season.

Transbasin Diversion

The removal of water from one natural stream basin into the natural basin of another stream.

Transfer

The process of moving a water right originally decreed to one ditch, to another ditch or point of diversion, by court decree. A transferred water right generally retains its priority in the stream system and may or may not retain its right to divert its entire decreed amount.

Transpiration

The process of gas exchange by plants. Plants transpire (exhale) water vapor, oxygen, and other by-products of photosynthesis through leaf structures called stomata. See also the definition of respiration, which is a process that complements the process of transpiration.

Tributary

A surface water drainage system that is interconnected with a river system.

Volume

A specific quantity of water generally expressed in acre feet.

Water Commissioner

Water commissioners operate under the direction of the division engineers of the Colorado State Engineer's office. They perform the daily administration duties of each water division.

Watercourse

A place on the earth's surface where water flows, regularly or intermittently, in a defined channel.

Water Court

In Colorado, water courts are specific divisions of district courts that have the exclusive jurisdiction to hear and adjudicate water matters. A district judge, called the water judge, presides over them.

Water Development

The process of building a diversion, storage, pumping, or conveyance facility for the purpose of applying water to beneficial use.

Water District

A subdivision of one of Colorado's seven water divisions.

Water Division

A major watershed division in Colorado. The state has seven water divisions with headquarters in Greeley, Pueblo, Alamosa, Montrose, Glenwood Springs, Steamboat Springs, and Durango.

Water Judge

In Colorado, a water judge is a district court judge who presides over a district water court to adjudicate matters pertaining to water.

Water Right

A right to use, in accordance with a priority established by appropriation, a certain portion of the waters of the state for beneficial purposes. Like other property rights, a water right can be bought, sold, leased, exchanged, or traded, provided such action does not injure other water users on a watercourse.

Watershed

An area from which water drains to a single point

Water Year

The period starting on October 1st of one year and ending on September 30th of the following year.

Weir

An overflow structure built across an open channel, usually to measure the rate of flow of water. Essentially, a weir is a dam with a fixed opening of a known size. The size of the weir opening and the surface elevation of the pool impounded behind the weir are the main determinants of a weir's discharge volume.

Yield

Regarding water in Colorado, yield may be defined as the quantity of water that can be collected for a given use or uses from surface or groundwater sources on a given watershed; total runoff; or, the streamflow in a given interval of time derived from a unit area of watershed.

Yield (Average Annual)

Average annual yield is the average annual supply of water produced by a given stream or water development project.

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“Looking at the Valley of the Cache la Poudre from the Hog Backs”

A drawing by a member of the Hayden Expedition, 1871.

Picture courtesy of the National Park Service



MR. AND MRS. JOHN G. COY

John and Emily Coy, early settlers and irrigators in the Cache la Poudre valley

Photo from Ansel Watrous, *History of Larimer County, Colorado*.



Construction of an irrigation ditch in Fort Collins

Photo courtesy of Fort Collins Public Library



Constructing an irrigation ditch, circa 1910

Photo courtesy of Colorado State University, Photography and Digital Imaging Department



Men repairing irrigation ditches near Fort Collins

Photo courtesy of Fort Collins Public Library



Laborers near a partially excavated, high elevation irrigation ditch, circa 1880s

Photo courtesy of Colorado State University, Photography and Digital Imaging Department

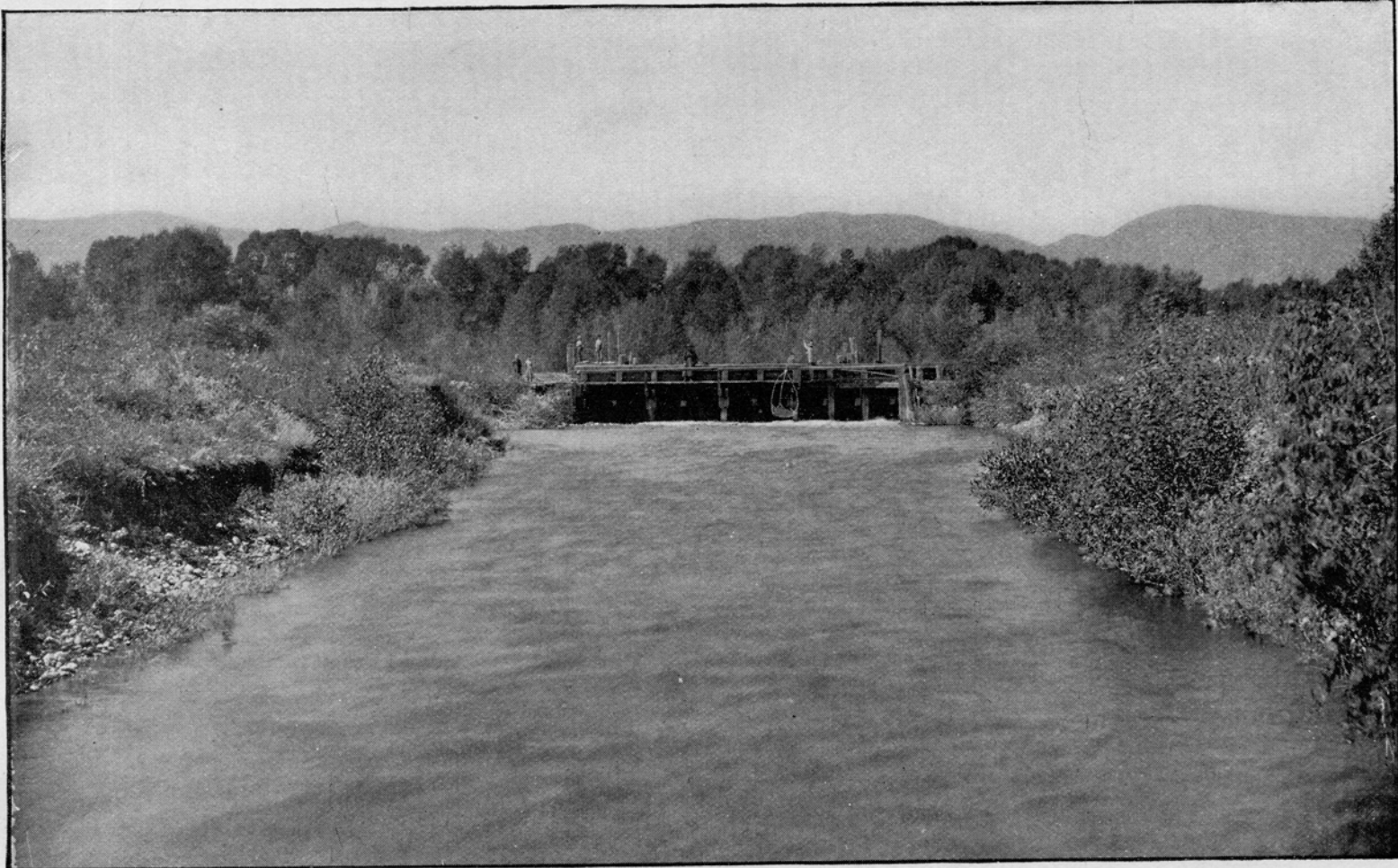


VIEW OF SKY LINE CANAL.

Taking water from the upper sources of the Big Laramie River and diverting it into the Poudre above Chambers Lake at the height of 8,000 feet

Skyline Ditch, circa 1897

Poudre valley irrigators built trans mountain canals at high elevations to funnel more water into the Cache la Poudre. Skyline was built by the Water Supply and Storage Company in 1893.
Photo from David Boyd, *Irrigation Near Greeley, Colorado*



VIEW OF HEAD GATES OF LARIMER AND WELD CANAL AND OF THE CANAL BELOW THEM.

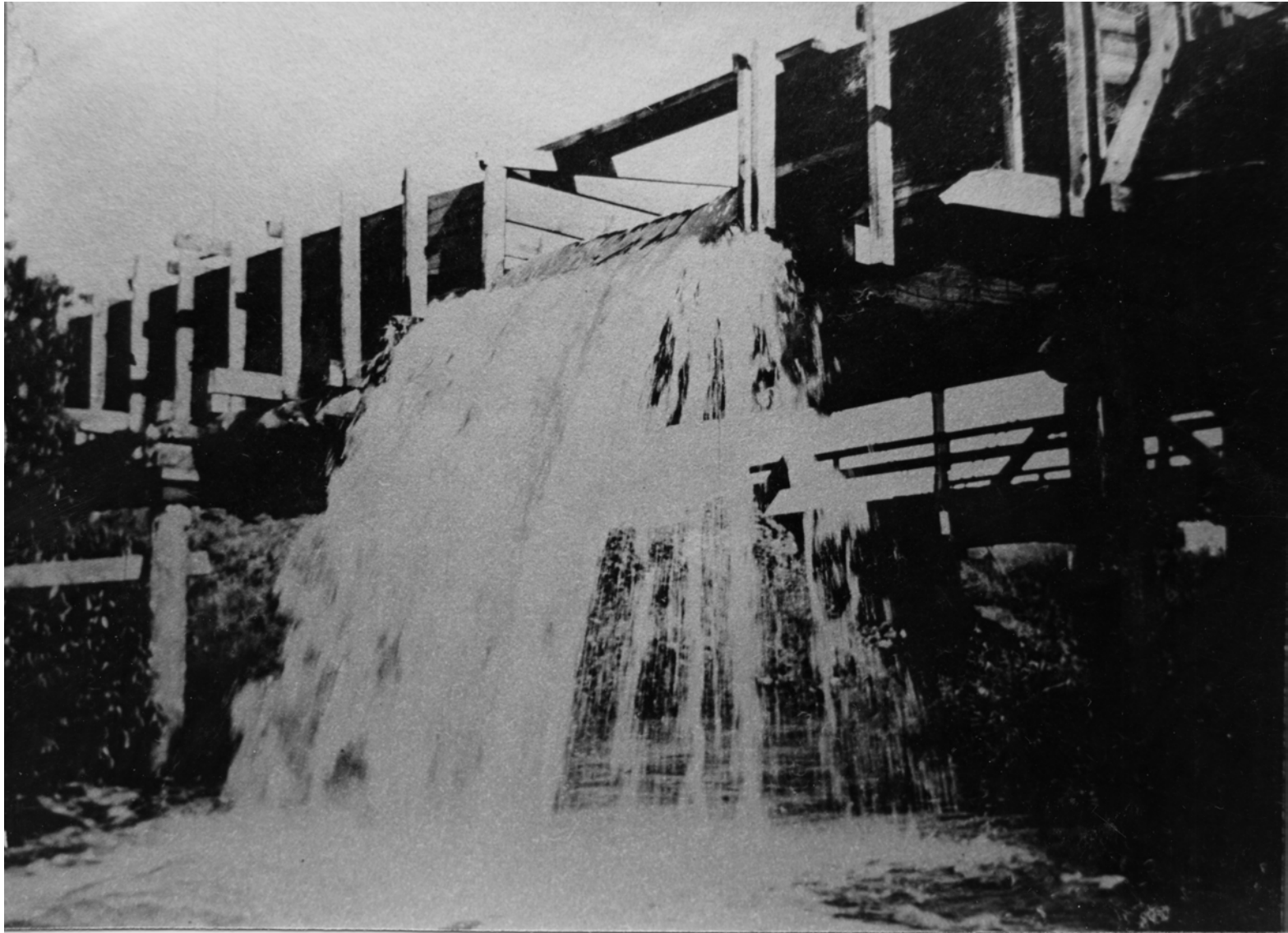
Headgates of Larimer and Weld Canal, circa 1897

Photo from David Boyd, *Irrigation Near Greeley, Colorado*



Coy dam at entrance to Coy Ditch, circa 1900

Photo courtesy of Fort Collins Public Library



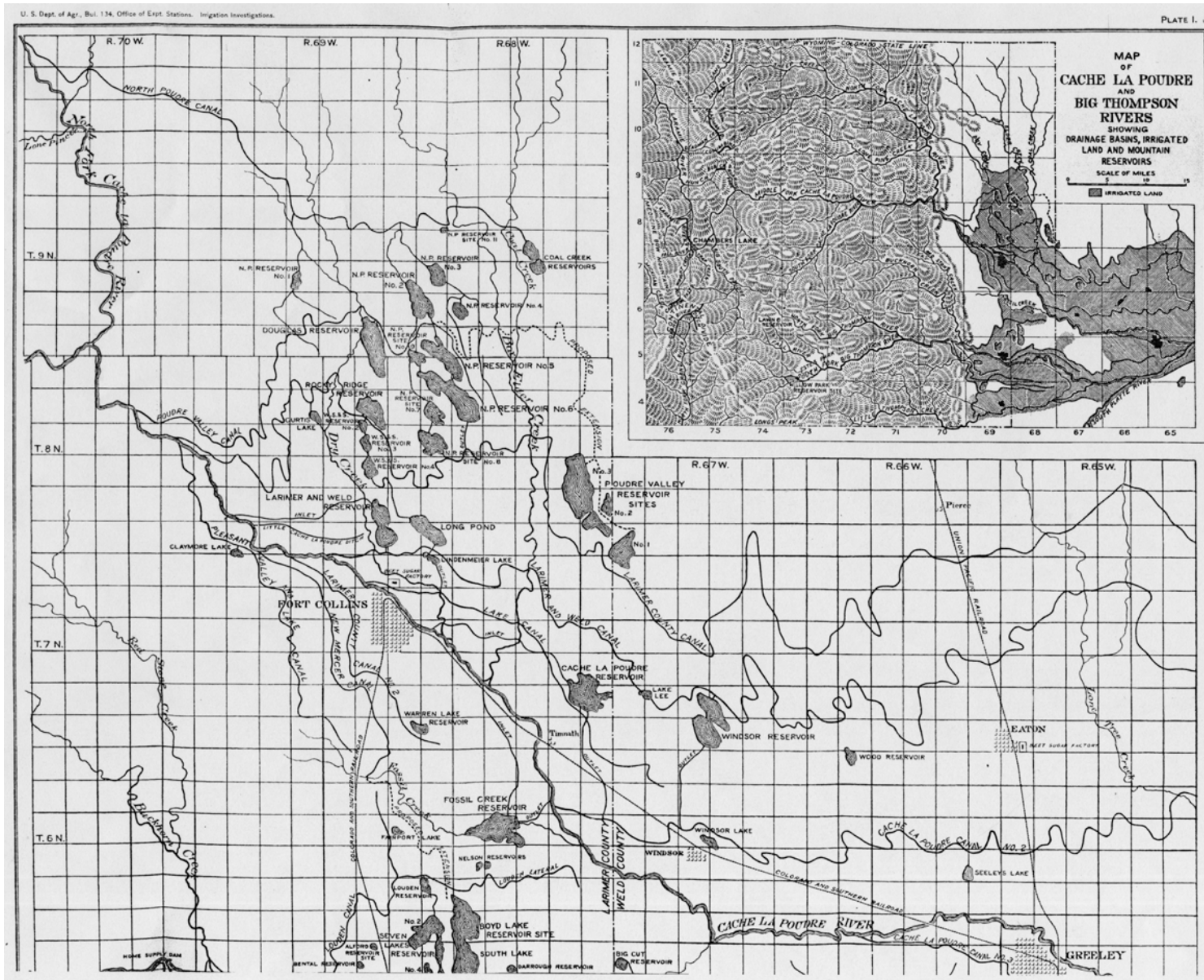
Irrigation flume near Greeley, circa 1902

Photo courtesy of the City of Greeley Museums, Permanent Collection



Building Fossil Creek Reservoir, circa 1902

Photo courtesy of the City of Greeley Museums, H.E. Johnson Collection



Map of Cache la Poudre showing some of the region's reservoirs, circa 1903

Map from C.E. Tait, *Storage of Water on Cache la Poudre and Big Thompson Rivers*



Irrigating potatoes near Greeley, circa 1900

Photo courtesy of the City of Greeley Museums, Permanent Collection



Sugar beets irrigated with water from the North Poudre Irrigation system, circa 1910

Photo courtesy of Fort Collins Public Library



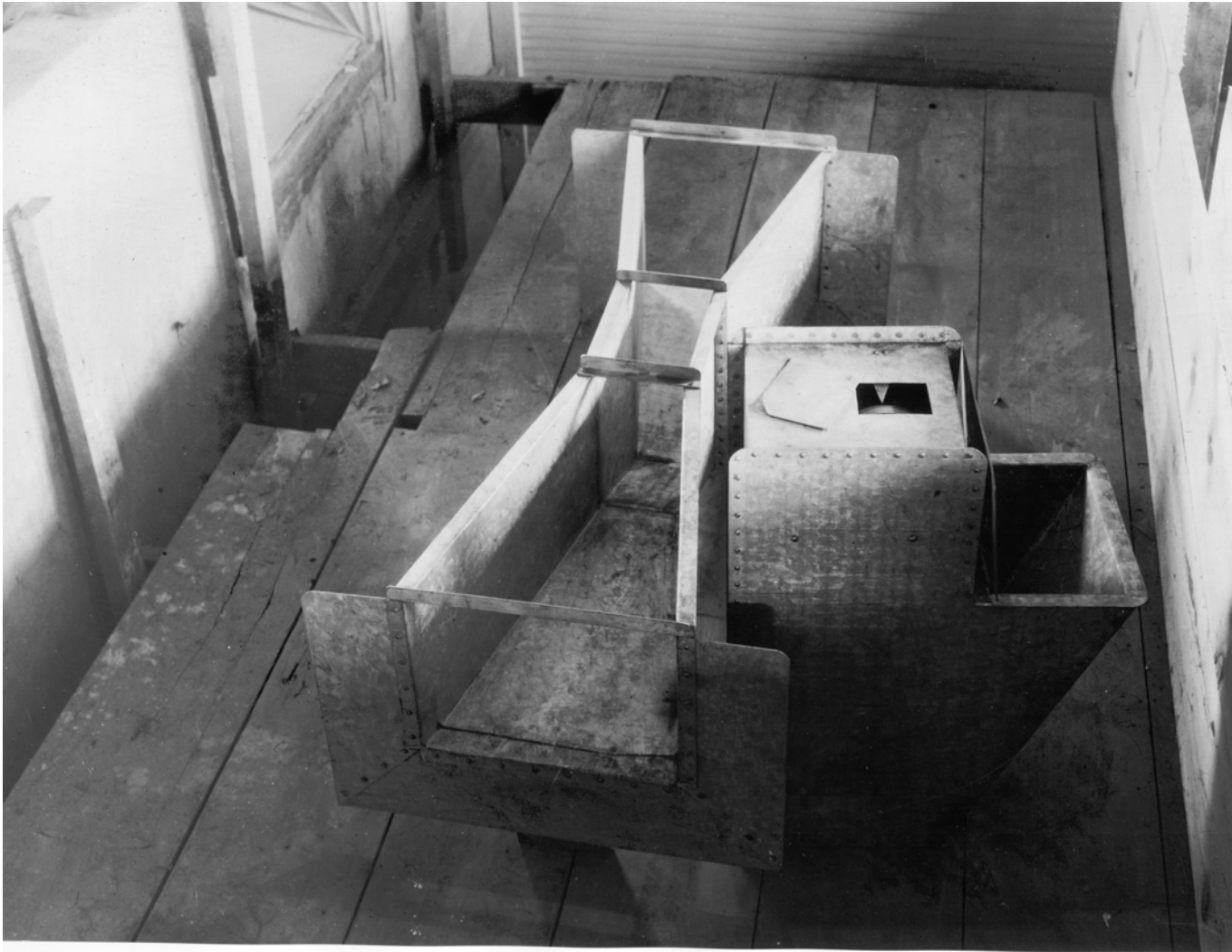
The Great Western Sugar Factory in Fort Collins, circa 1915

Sugar beets were a lucrative irrigated crop in the Poudre valley and in other parts of Colorado after the turn of the twentieth century.
Photo courtesy of Colorado State University, Photography and Digital Imaging Department



Bellvue laboratory on the Cache la Poudre, circa 1920s

Ralph Parshall perfected his measuring flume at this laboratory run jointly
by the Colorado Agricultural Experiment Station and the U.S. Department of Agriculture.
Photo courtesy of Colorado State University, Photography and Digital Imaging Department



A Parshall Measuring Flume

Ralph Parshall, professor of engineering at Colorado Agricultural College (now Colorado State University), perfected this highly accurate measuring device at a laboratory on the Cache la Poudre.

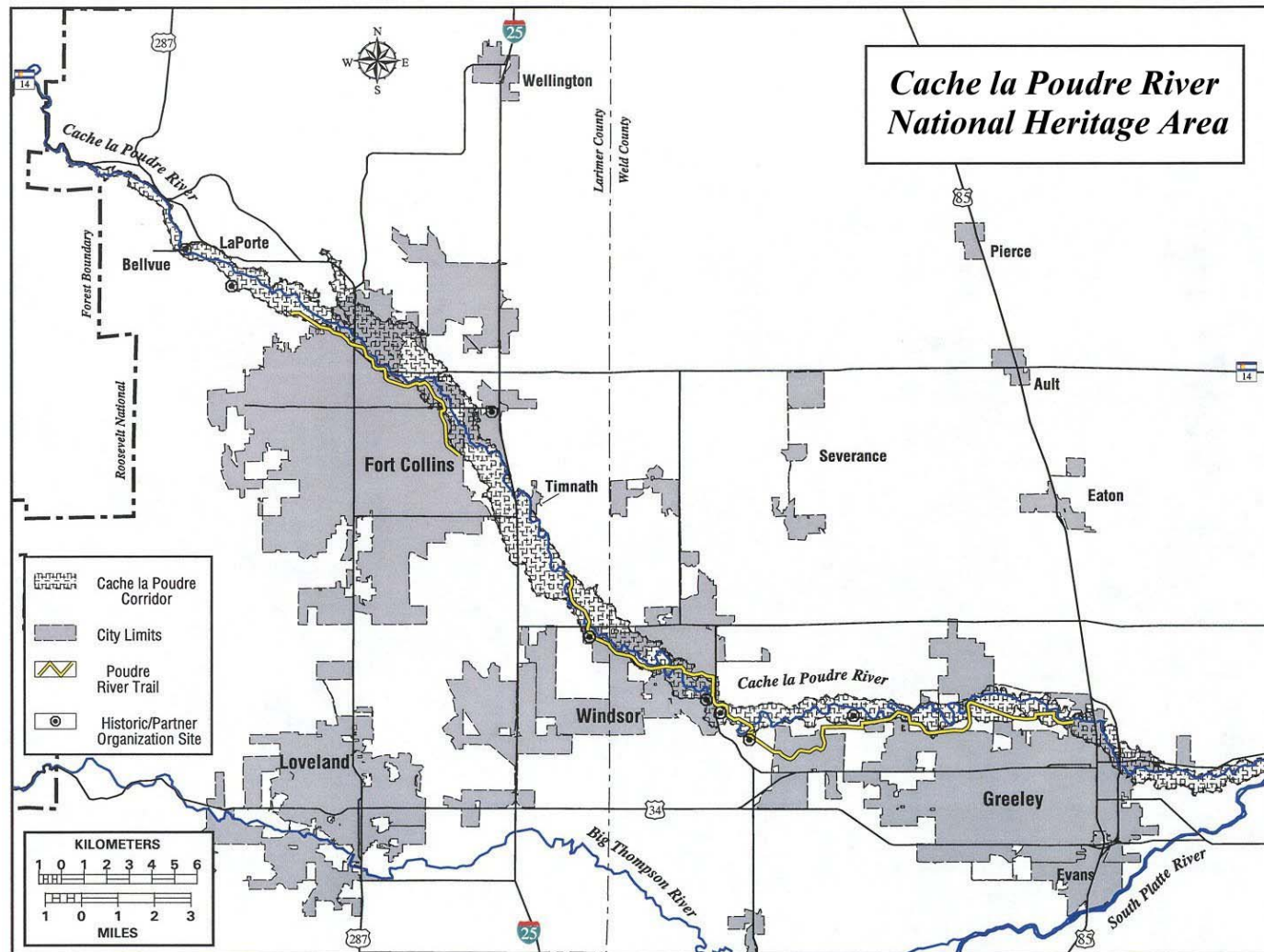
The device is used around the world today to measure irrigation water.

Photo courtesy of Colorado State University, Photography and Digital Imaging Department



Ralph Parshall with a measuring stick next to a working Parshall Flume, circa 1940s

Photo courtesy of Colorado State University, Photography and Digital Imaging Department



The Cache la Poudre River National Heritage Area

The Cache la Poudre River National Heritage Area was created in 1996. It encompasses forty-four miles of the river from the canyon mouth to its confluence with the South Platte River east of Greeley, Colorado.

Map courtesy of the National Park Service



Lake Canal Diversion Dam near the College Avenue Bridge in Fort Collins

Lake Canal was built in 1873 and, along with Larimer County Canal No. 2, posed a threat to the downstream Union Colony's water supply at Greeley, despite the colony's older water rights. Tension over prior rights to water reached a head in the summer of 1874 in the Poudre valley and acted as a catalyst to the creation of water legislation at an irrigation conference four years later.

Photo courtesy of the National Park Service



Double diversion dams for New Mercer and Larimer County No. 2 Canals

Photo courtesy of the National Park Service



Coy Ditch diversion dam, circa 2003, looking northeast, near College Avenue Bridge in Fort Collins

The Coy ditch was originally constructed in 1865. The diversion dam today is punctuated by a canoe shoot (in center) and a fish ladder (right of canoe shoot).

Photo courtesy of the National Park Service



The Cache la Poudre River looking south from the Environmental Learning Center near Fort Collins

Photo courtesy of the National Park Service



The Cache la Poudre near central Greeley

A system of trails follows much of the river through the cities of Fort Collins and Greeley.

Photo courtesy of the National Park Service



Greeley Canal No. 3

Canal No. 3 was the first canal constructed by the Union Colony in the summer of 1870. This was the first large, cooperatively built canal in the Poudre valley that carried water out of the river bottoms onto the higher benchlands. All Union Colony members contributed financially or physically to the creation of the colony's canals.

Photo courtesy of the National Park Service



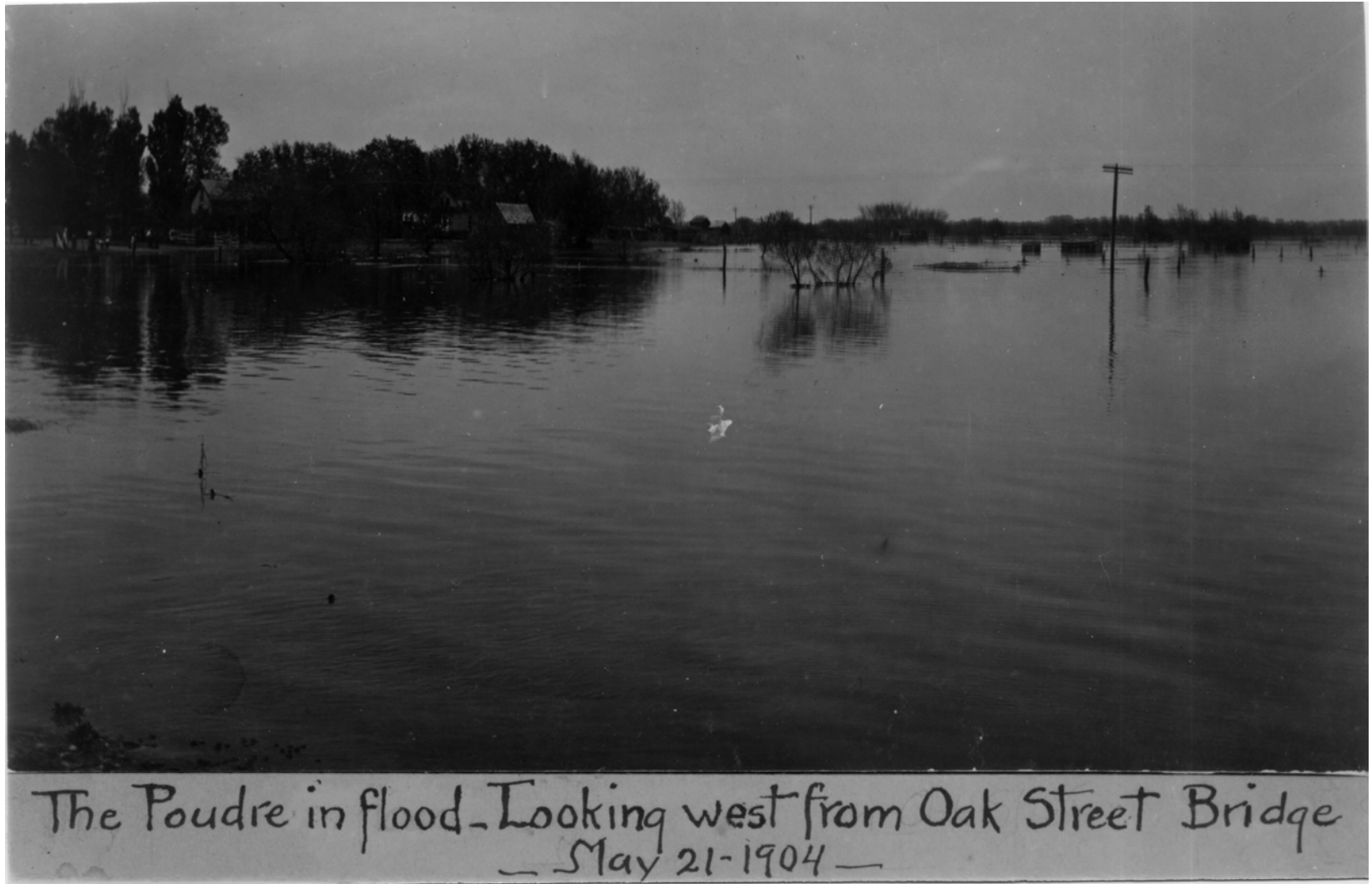
View of the Cache la Poudre near the mouth of the Canyon during the droughts of the 1930s

Photo courtesy of the Fort Collins Public Library



The 1904 flood on the Cache la Poudre, near Buckingham Place in Fort Collins

Photo courtesy of Fort Collins Public Library



The Cache la Poudre near Greeley during the flood of 1904

Photo courtesy of the City of Greeley Museums, Permanent Collection



Gravel pits, south of East Mulberry Street in Fort Collins, circa 1968

Photo courtesy of Fort Collins Public Library



Rip-rap on the banks of the Cache la Poudre, east of Greeley, 2001

Photo courtesy of the National Park Service



Cottonwoods near the delta of the Cache la Poudre and the South Platte Rivers, 2001

Photo courtesy of the National Park Service