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INTRODUCTION

Water is crucial to all that exists in the American West: cities, environment, culture, politics, agriculture, development, and imagination. Water is life. It touches everything. The idea for *Western Water A to Z* emerged on various road and raft trips when I realized that few portable sources of information exist about western water even though water and water features are ubiquitous in many people's lives. On those adventures, our evening conversation often wound its way to water, and we ended up talking about history, the environment, and all the things that people do to the rivers that we love. Think of *Western Water A to Z* as an extension of those conversations. *Western Water A to Z* has its roots in those handy twentieth-century field guides (to birds, fish, trees, etc.) but is updated for a twenty-first-century audience. Perhaps by bringing this information together, I can help answer people's questions about rivers, water projects, the culture of water, the ecosystems water projects have created or destroyed, and the reliance of cities, farms, and industries on this critical resource.

History shapes popular perceptions, and as such, has the power to influence attitudes and opinions. Western water is no exception. I feel it is essential to include the most salient stories and provide some background regarding their origins and implications. Additionally, water often finds itself at the center of our cultural discourse, in art, cinema, or literature. These, too, play vital roles in shaping our understanding and experience of western water. Likewise, I include various larger-than-life personalities that are nearly synonymous with western water (John Wesley Powell, Elwood Mead, Floyd Dominy, among others). Their lives were intertwined with and often influenced the course of water development across the region.

Understanding western water requires a simultaneous review of both the physical and cultural systems that govern the hydrologic cycle and the distribution of water. Here people, along with their cultural and engineering creations, mingle with the natural environment to create the unique geography of water that we see in the West.

ABOUT THE SCOPE OF THIS BOOK

Writing *Western Water A to Z* confirmed a suspicion that I held when I began; that is, it's virtually impossible for a single author to tackle something as broad and diverse as a guide to western water. But I'm not trying to channel some nineteenth-century scribe and list every fact and detail that exists about this subject. The field of water is so vast that there is no conceivable way to cover everything that might be of interest to somebody. There are literally thousands of dams, tens of thousands of ditches, and countless natural water features in the western United States. To attempt to provide an exhaustive list would expand this book beyond any reasonable size and make any sane person glaze over in a stupor, or better, use it for campfire kindling.

Conversely, ignoring various monumental, or historic, structures would also diminish the value of *Western Water A to Z*. To strike a balance, I've included crucial projects that I believe any serious student of western water should know about. And as part of this guide, I've included descriptions and images of structures that aid in understanding the region. Likewise, there are literally dozens of terms listed in various water, geomorphology, and ecology glossaries that I do not include here. I incorporate some essential ones but omit those outside the scope and purpose of this book. If you are interested in delving deeply into the meaning of the more esoteric terms, pick up the appropriate text or take the relevant college course. Also, I include information about Indigenous water use, such as their canals and ritual beliefs (such as the Avanyu deity and the water glyphs) because most Euro-Americans almost completely neglect traditional knowledge in conversations about western water. This Indigenous knowledge is valuable and deserves a place within the discourse of western water. If you are an expert, and there are many of you, you will immediately find many places to nitpick at subjects that I only superficially address. Undoubtedly, others would incorporate specific projects relevant to them, and leave others off, or include terms I omit. Please do accept my apologies for any oversights, omissions, and abbreviations that bother you. If you find an error, please let me know! I will strive to make corrections and improve future editions. With that mea culpa, I hope you will find *Western Water A to Z* useful, entertaining, and thought-provoking.

THE ORGANIZATION OF WESTERN WATER A TO Z

In writing *Western Water A to Z*, I've attempted to reimagine what a guidebook can do. I always found the traditional field guides truly handy for identifying mushrooms and trees, but they never quite satisfied my curiosity about the

species they discussed. My goal then, in writing *Western Water A to Z*, was to provide information about key subjects in western water but to go beyond cold factual descriptions and give you a sense of how things work and why, what makes them important to us, and how all these things are interconnected. Otherwise, one might just look up the definition of *headgate* or *alluvium* without learning their broader significance. By the way, speaking of traditional field guides, I will posit that most people don't actually *enjoy* reading the *Field Guide to Western Trees* and just use it as a resource akin to a dictionary. If only the *Field Guide to Western Trees* told us how Indigenous people used spruce trees or how this majestic tree was critical in nineteenth-century shipbuilding, perhaps one might get motivated to learn even more about spruce trees or look forward to turning the page and reading the next entry.

I also tried to describe each subject succinctly in about one page and provide one or two striking photographs. By writing *Western Water A to Z* this way, I harken back to the style of the classic field guide. There is just enough information to give you an overview of each subject, but not so much as to overwhelm you with details. In other words, just the facts. Even though each subject description stands alone as a topic, the more you read, the more you will see connections between topics. Not only do various threads connect the people whom I profiled but the landscape, culture, history, and physical environment all weave together into an intricate and beautiful tapestry that is western water. As another departure from traditional field guides, I include a few personal stories and anecdotes. This is intentional and I think necessary for reinventing the guidebook genre. Most of all, by relaying some of my experiences, you will see that we all share parts of this story, and that we're not just armchair pundits considering western water from afar.

Studying western water is a multidisciplinary endeavor. People generate knowledge about water in many different political and intellectual arenas. Each kind of knowledge is valuable and essential for gaining a better understanding of the West's water. Each source of knowledge informs the broader conversation. Anyone who fails to give equal weight to traditional knowledge, the arts, history, the physical sciences, politics, and the law does so at their peril. When I began this book, I thought about organizing it around sections about the arts, traditional knowledge, history, and so on. But the more I thought about it, by keeping subjects mixed along the A to Z format of part 2, I hoped that this strategy would nudge folks towards thinking about western water from multiple perspectives.

Somewhere in my mind, I am hoping that *Western Water A to Z* will find its way into a river guide's library of books floating down the Grand Canyon to answer

participants' questions about water. Or, perhaps it will end up in the back seat of a cross-country traveler's car who might be wondering what all those water structures are that he or she sees along the way.

ABOUT THE PHOTOGRAPHY

Photographs have a unique ability to convey information and emotion about the world not easily captured in words. The philosopher Roland Barthes wrote how old photographs possess more authority than a drawing or engraving, that photographs provide “a certainty that such a thing had existed: not a question of exactitude, but of reality.”⁴ It is this essence that makes viewing old western photographs so rewarding. It shows us that a great canyon once existed where a reservoir now sits, or that groundwater was once so abundant that it could spray into the air. As a case in point, William Henry Jackson's photographs of geysers and hot springs helped secure congressional support for making Yellowstone America's first national park. Likewise, dam proponents often used photographs to promote reservoir projects. Conversely, Eliot Porter's heartrending images of Glen Canyon in the days before it was flooded helped bring an end to the big-dam era in the United States. And because water is so central to the western experience, we are fortunate to have exceptional works in the public archives by both famous and unknown photographers that illuminate many aspects of the subject. I have attempted to assemble in this book as many excellent photographs as I could find that illustrate the topics covered here. Also included are many images that I made to capture specific features or ideas when I could not locate a better archival photograph. Intentionally, *Western Water A to Z* is equally a work of photography as it is of water. Western water development coincides closely with the rise of photography, so images play a critical supporting role in our understanding of this story. That being so, images comprise a central position in the cultural dialogue on water and deserve recognition as something more than a documentary rendering of structures.⁵

I attempted to faithfully utilize the protocols of photojournalism in processing and presenting the images in this book. Most importantly, I have never *manipulated* any of the photos presented here. Nowhere have I moved or changed actual pixels (except removing sensor dust) in the images. However, I have *processed* the images, such as cropping, dodging and burning, converting to black and white, and have performed various conventional toning and color adjustments so that the reader sees the highest quality photographs possible.



Figure 1.1. This US Bureau of Reclamation publicity photo of the Shoshone Dam in Wyoming has an image of the US Capitol superimposed on it to illustrate the magnitude of this early reclamation project. By using photographs such as this, its boosters tried to imprint the aura of American might on the structure. Photograph courtesy of the US Bureau of Reclamation.

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Figure 1.2. Eliot Porter used his photography to help sway public opinion against big dam projects in the United States. Although environmentalists were unsuccessful in protecting Glen Canyon, Porter's images ultimately contributed to the political consensus that limited further dam construction. Shown here is Eliot Porter's image *Green Reflections in Stream, Moqui Creek, Glen Canyon, Utah, September 2, 1962*, dye transfer print 10½ x 8¼ in. Collection of the New Mexico Museum of Art. Gift of Eliot Porter 1988 (1993.3.28). © Amon Carter Museum of American Art, Fort Worth, Texas. Photo by Blair Clark.

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In a few instances, I came across some exceptional but faded color photographs in the archives. Here I faced a quandary: I had found a great photo, except that it was seriously worse for the wear with time. When this occurred, I used the digital tools available to me to restore some of the original colors and reverse the fading so that the image appeared (at least in my mind) to align with what the original photographer may have expected when he/she received the photos back from the printer. Of course, I truly cannot hope to know what they expected from the print. Still, the archival images that received this treatment were vernacular and produced as illustrations in reports and not presented as fine art (even though many are great photos). Therefore, I do not think I subverted or reinterpreted the intent of the photographer. But by processing them, I believe that these particular images can now be viewed anew and by a wider contemporary audience.

Let me share one last observation I made after spending extensive time in the archives. It seems that the older black-and-white images have tended to withstand the test of time far better than more recent color photos. I hoped to include more color images from the 1960s and 1970s, but so many had faded to the point of uselessness. So, unless the image was significant, I tended to use older photos because they simply looked better. Archival color photographs from the 1960s and 1970s will be lost to us as the dyes within the images continue to degrade unseen in archival collections.

WHAT IS THE AMERICAN WEST?

The historian Wilbur Jacobs once described the difficulties of defining “the West.” “As you move back and forth,” Jacobs explains, “the West as a place floats on the map, almost like a puddle of mercury. The sub-puddles, spinning around, have so many socioeconomic, political, environmental, and cultural eddies that they are almost impossible to control when we try to write a coherent account.”⁶ With Jacob’s wisdom in mind, it’s tempting to stop right there, move on, and dodge the question of “what is the American West?” But I will resist this urge because confronting it will help add perspective to the topics and questions concerning western water that follow.

Central to any conversation about the West is how do we describe its remarkably diverse people? What different groups call themselves—and what they want others to call them—is especially critical for having respectful and informative conversations. I recognize that there are many different terms for describing various groups, and that terminology appears in almost constant flux. Many people

consider words formerly used for some groups as out-of-date or even insulting if used today. In *Western Water A to Z*, I have endeavored to use consistent, deferential terms when discussing various populations. For these reasons, unless the words *Indian* or *Native American* appears in a Tribal name, historical event, or quote, I use *Indigenous* to refer to the original inhabitants of the West. Since this book discusses the water systems of northern New Mexico, and because these systems have roots extending back to Spain, I use the term *Hispanic* to inclusively describe all of the people who can trace their origins to Mexico, Central America, and Spain. When I use the word *Euro-American*, I apply this in the broadest sense possible. I include all American citizens (regardless of race or continent of origin) and the European colonists who came to North America and migrated west. Additionally, I feel the terms *settler* and *pioneer* are quite dated as they do not accurately reflect the reality that the Euro-Americans colonized lands occupied by others. For this reason, I use *colonist* and not *pioneer* or *settler*.

Most archaeological evidence points to the peopling of North America at about fourteen thousand years ago. However, that date remains controversial, and more recent findings suggest significantly earlier occupations.⁷ Without debating archaeology, one can confidently state that much of North America contained substantial populations of Indigenous people for a minimum of fourteen thousand years. For these people, there was no American West. To each tribe, wherever we might place them on a modern map, they lived at the center of their world. To the descendants of these Indigenous people, the idea of the American West was an imposed foreign concept. As Tohono O’odham Nation Chairman Ned Norris Jr. put it, “The O’odham have lived in Arizona and northern Mexico since time immemorial. We experienced the impact of a border through our lands in 1854—a border that was drawn without regard for our history, our original territory boundaries, or our sovereign rights.”⁸

When Hernán Cortés and the conquistadores conquered the Aztecs in 1519, they established a Spanish colony in the heart of Mesoamerica, with Mexico City as their capital and colonial center. Like the Indigenous people before them, the Spaniards possessed no concept of an American West. To them, the western half of North America was part of the Spanish possessions they claimed as New Spain. The Spaniards divided up what we now know as the western United States into the provinces Alta California, Nuevo Mexico, Alta Louisiana, Baja Louisiana, and Texas. For the Spanish, and the Mexicans after 1821, the idea of a western United States was seditious.

What eventually came into focus as America’s northern and southern boundaries resulted from a series of overlapping conquests of North America.⁹

Beginning with Cortés, Spanish (and after 1821 Mexican) incursions and conquests gradually moved the frontier between Spanish and various Indigenous tribes north from Mexico. Some two hundred years later, British, French, and eventually American incursions and conquests gradually pushed the western frontier between the Europeans and Indigenous inhabitants westward, first across the Appalachians, then the Mississippi, and finally to the Pacific. American expansion inevitably led to conflict with Mexico, giving rise to the contemporary southern border with Mexico with the signing of the Treaty of Guadalupe Hidalgo in 1848 and the Gadsden Purchase of 1854. Territorial conflicts and competition in North America between the United States and Great Britain, beginning with the American Revolution, were finally resolved by signing the Oregon Treaty in 1846. This treaty established America's northwestern border along the forty-ninth parallel to the Strait of Georgia, just short of the Pacific Ocean. These various treaties demarcated the north and south sideboards on what we now know as the western United States.

If we take the Pacific Ocean as the continental United State's natural western boundary, then there is one remaining and very thorny question to consider: Where on the east side of this great box does the West begin? For some geographers, the Mississippi River marks a convenient boundary. To others, the Rocky Mountain Front, that boundary between the eastern slope of the Rocky Mountains and the Great Plains, is a logical demarcation. Some might prefer a line separating the High Plains' grasslands from the forests of the Rocky Mountains. Perhaps we should think of the edge in economic terms, say along the lines of William Cronon's analysis of regional dominance that distinguishes the easterly region dominated by Chicago from the westerly area dominated by Los Angeles and San Francisco.¹⁰ Then there is a political option: say that the West begins at the eastern boundaries of Montana, Wyoming, Colorado, and New Mexico. Finally, if you are a hydrologist—and this is a book about water—call the West's start at the one hundredth meridian, that general line of longitude that roughly marks the transition from the humid East to the arid West. That, after all, is the logic that Major John Wesley Powell used to distinguish the West from the East.¹¹

It seems that defining the West is a matter of one's perspective.¹² As we can see, there is no right or wrong answer, just the one that best suits your needs. For this book, I'll define the West as a great box bounded by the Pacific Ocean on the west, the Canadian and Mexican borders on the north and south, and I will throw my lot in with Major Powell and say that its eastern margin begins at approximately the one hundredth meridian.¹³

HISTORY OF THE WEST AND ITS ENVIRONMENT: A LAND OF SCARCITY?

We often speak of the American West in terms of its aridity. And by most definitions, it is, in fact, an arid or semiarid place. Deserts and steppes dominate the western environment even though islands of wetter mountain terrain tend to grab our visual attention. It is in these deserts and steppes that we dig ditches to bring water to our agricultural land. In the East, they dig ditches to move water off of fields so that it does not drown crops. To be sure, it is wet in many of the western mountains, but relatively few people live high up. Most folks live in the valleys and on the plains where constructed waterworks make the place habitable. So, we get to the central conundrum of the American West: in this arid land, it is water that is the region's most defining trait. And if we wish to garner a deeper understanding of the West, we must get to know the natural and human-made features that are only here because of water and our use of it.

But there is also a second, subtler, conundrum at work here. Put simply, although this is a desert land, water itself is not necessarily *scarce*. Bear with me on this one. Just look at Lake Powell. Its water level might be quite a bit lower than its builders would wish it to be, but still nevertheless contains an enormous lake. The Colorado River that fills Lake Powell is fully appropriated, overused, and overloved, but even so, it remains for most of its course a grand river. Even its delta—which is often dry due to the hands of humans—is still a vast area that formed over millennia through the force of water. The problem is that our culture is one that seems blind to the reality of natural limits. What we have is more a problem of allocation than a water deficit. We treat the resource as if it is an infinite commodity. We keep engineering our waterways to squeeze more water out of them rather than do the obvious, albeit politically tricky thing, and redesign our cities and legal codes to better share what we already use and live within this land's essential environmental constraints. In writing this book, I hope that you reach the same conclusion I did a long time ago, namely, that there is a remarkable natural abundance of water in the western deserts and steppes. I believe this paradox shows that water scarcity and drought are at its core culturally manufactured phenomena. Although that may sound a bit odd at first, it means that the solutions to this scarcity lie within creating a willingness to adapt our culture and politics more than further manipulating our environment. I believe that, in the long term, we will find more success in figuring out how to share water and use it better than to mine the environment further or import it from afar.

CONQUEST

In short order, I will discuss prior appropriation water rights. However, before I can meaningfully do that, I must first address head-on the unsavory back story that made this legal doctrine (and for that matter, modern water development in the West) possible. In the nineteenth century, the United States expanded its borders west of the Mississippi River through war, treaties, and purchases with France, Mexico, and Great Britain. These actions gave the United States titles to the western lands that it could then pass to colonists. The Indigenous people had no say or standing in these proceedings even though these events dramatically impacted (and in many cases ended) their lives. Mapping by explorers, such as Lewis and Clark, John Charles Fremont, and John Wesley Powell, among others, aided in America's westward advancement. Manifest Destiny as experienced by the Indigenous people meant war, genocide, ethnic cleansing, forced treaties, and colonization. For Hispanic peoples, it meant forced assimilation into a new country. The violence, hypocrisy, and arrogance of this era is monumental.¹⁴

In the western territories, many Euro-American colonists actively worked to kill or remove Indigenous people who would stand in the way of their settlements. The tragic events surrounding the Sand Creek Massacre, and Colorado's colonists' underlying motivations to participate in the massacre, offer a case in point.¹⁵ Many colonists acquired titles from the United States to the lands they were squatting after participating in this crime. For the territorial elites, the spoils were even greater as they received vast tracts of land along with the forest, grassland, water, and mineral resources as title passed from the Indigenous people to the federal government and then either directly on to the elites or indirectly to them as railroad land grants. Colorado's colonists were by no means alone acquiring their land and water this way, as the Indian wars that afflicted every western territory demonstrate. Because of this, when I discuss water management's legal framework, keep in mind that the subjugation of Indigenous people preceded Euro-American claims to water under the Prior Appropriation Doctrine.

In the aftermath of the Mexican-American War, the United States was concerned about appeasing the Mexican population that found themselves on the new border's American side. The Americans knew that their military presence was weak and had little ability to suppress potential unrest within the (former) Mexican settlements. Take the Taos Revolt of 1847. This brief insurrection led to the death of Territorial Governor Charles Bent and several other Americans. Territorial authorities swiftly dispatched US troops to Taos. A short and bloody battle ensued in which US troops killed approximately 150 insurgents. The

Americans captured the ringleaders and after a quick trial hung six of them in the Taos village square.¹⁶ To maintain control, the United States had to assuage the local population's fears that their freedom and property were safe. Consequently, in 1848 as a significant concession in the negotiations formally ending the war, the Treaty of Guadalupe Hidalgo provided that "property of every kind, now belonging to Mexicans not established there, shall be inviolably respected. The present owners, the heirs of these, and all Mexicans who may hereafter acquire said property by contract, shall enjoy with respect to it guarantees equally ample as if the same belonged to citizens of the United States."¹⁷ This provision formed the basis for recognizing Hispanic land grants and water rights in the American Southwest. Territorial legislatures later recognized and adopted many aspects of water law from the Mexican era such as rules governing the operation of the traditional ditches that they call *acequias*.

The history of American conquest and colonization leads to an odd contradiction in writing about western settlement. On the one hand, many Euro-Americans participated in brutal wars of conquest. On the other hand, many of these same colonists built vibrant cities, farms, and universities. Moreover, Euro-American migrants copied the Hispanic and Indigenous agricultural and irrigation practices, adopted some of the language to describe the landscape, and then relied on Hispanic and Indigenous labor to work their new farms and ranches. Thus, we see the same people simultaneously criticized for their colonial abuses and heralded for their nation building.¹⁸

PRIOR APPROPRIATION AND THE INSTITUTIONS OF WATER MANAGEMENT

By putting Western development in context of nineteenth century events, I now turn to the American colonist's activities in managing and developing water resources. When early Euro-Americans came to the West, they were a practical bunch. On arriving in places like Colorado or Utah, they often built their ditches first, and then attended to other matters like constructing houses, filing for water rights, or organizing ditch companies. The reason they did this was simple: without ditch water, they couldn't grow crops, and without crops, they would have nothing to eat come winter. They could figure out the legal niceties after they secured a stable food supply.

Once the colonists had a little spare time, they started to work out how to manage the land and water they had stolen from the Indigenous people. The first Euro-Americans were squatters on the public domain and Indigenous territory.

The Homestead Act did not exist when the earliest Euro-Americans arrived. And many of the treaties that ceded Indigenous land to the Americans were not yet inked. These first colonists imported the legal customs for managing water that they learned in the eastern United States.

Initially, the legal framework for managing water that the colonists used was known as the Riparian Doctrine. This doctrine allowed landowners bordering a water body to acquire certain rights to use the water. As legal scholar David Getches once put it, “Each landowner bordering a waterbody may make reasonable use of the water on the same land if the use doesn’t interfere with reasonable uses of other riparians.” Twenty-nine states still use the Riparian Doctrine in one form or another. Most scholars believe that the Riparian Doctrine came to the United States from English common law, but there are good arguments for French origins too. Regardless of the specific European country where the Riparian Doctrine originated, this doctrine became the primary way for administering water in the United States in the aftermath of the American Revolution.¹⁹

At first, some western territories adopted the Riparian Doctrine. But in the massive influx of Euro-Americans to California during the 1849 Gold Rush and then to Colorado in *its* Gold Rush, the migrants found the Riparian Doctrine ill-suited in the arid West. A system that limited water rights to only those people that bordered streams could drastically constrain development. Under this system, one person could acquire stream-front property and cut everybody else off from water. The old adage that if you control the water then you control the land was certainly true in the nineteenth-century West. Colonists feared that water monopolies would strangle economic growth before it could even get started. So, when the Euro-Americans turned their attention to writing the laws for gold mining and water distribution, they rejected the Riparian Doctrine as unsuitable for their needs. What emerged was the Prior Appropriation Doctrine.

Essentially, the Prior Appropriation Doctrine is a set of ideas that westerners formalized into law over the last one hundred and fifty years. Perhaps the most critical concept in the doctrine is the notion of first in time, first in right. This notion comes from the California 49ers, who said that the first person to work a mining claim had the most senior right to the site. It’s kind of like getting in line early to get a ticket for a front row seat at your favorite concert. When farmers adapted this idea to water use, it came to mean that the first person to claim water had the highest priority to the stream. The second person had the second most senior right, and so on. From a practical standpoint, it means that

as a stream dries up, the final person to lay claim to water is the first one that the local water commissioner shuts off. And the one that owns the earliest water right is the one that is the last to be shut down due to dry conditions.

Another idea embodied in the Prior Appropriation Doctrine is the “use it or lose it” principle. Use it or lose it means that you must keep up your water use, and if you fail to use water, a court may find that you have abandoned it, thereby moving junior rights up in priority. Yet another part of the doctrine is the notion of beneficial use, which compels users to manage their water carefully so as not to produce excessive wastewater so that other users can get some too. And importantly, the Prior Appropriation Doctrine also allows water to get diverted or transferred from one watershed to another.

As Euro-American colonists worked out the ideas for what became the Prior Appropriation Doctrine, it became clear that they required documentation to establish the relative priority of rights on each stream. It was in Colorado that the courts and legislature began fleshing the components of water rights and the paperwork for recording them. To this end, Colorado authorized the first “stream adjudications,” the court proceedings that recorded details about water rights, including the relative priorities of one right to another.

These water rights are the legal documents that permit a user to divert water from a natural source. In the West, water rights specify the location where a user may divert water, the source of the water, how much water they can divert, the location of use, and the appropriation date. Under the Prior Appropriation Doctrine used throughout the West, the earlier the appropriation date, the more valuable the right tends to be. Many states including Colorado reserve the ownership of water to the people of the state, but then grant a right to use that water. Unlike other real estate, someone can forfeit their water rights if they let the rights fall into disuse.

Notably the value of water rights is rarely taxed at the time of a sale, even though water rights often make up a sizable portion of the cost of a property. Moreover, water rights owners can sell the rights separately from the land. Even so, the new owner must then secure permission to change the type of use allowed, timing of use, or location where the water is applied before actually being able to use the water at a new site.²⁰

Significantly, the Prior Appropriation Doctrine has its origins in agrarian anticorporate populism. In the nineteenth century, many colonists were very concerned that large corporations or wealthy individuals might monopolize water resources and thereby deny whole regions of the water supplies needed for development. States such as Colorado declared that water is the property of

Abstract
of Testimony taken by
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Figure 1.3. Recording and documentation of water rights throughout the West is critical in maintaining orderly water use. During the first years that colonists worked out all the bugs in the water rights administration system, courts took testimony and assigned the relative priorities of water rights for future administration. These court processes were known (then and now) as adjudication proceedings. The first formal adjudications in the American West took place on creeks along Colorado's Front Range. Here is the abstract for the adjudication that took place on Boulder Creek near Boulder, Colorado, in 1881. Each page of testimony recorded all manner of information, including the ditch construction date, who dug it, when they began, how much water they diverted, and so forth. Photo courtesy of the author.

the people and put a decidedly democratic socialist stamp on the constitutional and legal framework for water use that remains in place today. In other words, the legal principles for water use across the West, and in particular the economies of rural agricultural areas, depend on an inherently socialistic system for their vitality.

One twist is that a few western territories initially adopted the Riparian Doctrine but later converted to the Prior Appropriation Doctrine. Faced with reconciling two contrary legal principles, the legislatures and courts in these territories wound up blending aspects of the riparian and appropriation systems

to end up with a hybrid, or “California doctrine.” California, Oregon, and Washington adhere to this hybrid system.²¹

WATER DEVELOPMENT

As American colonization progressed, boosters of irrigation projects promoted their ideas with the zeal of carnival barkers. Some resorted to pseudoscience or outright lies to encourage investment. For example, Samuel Aughey induced thousands of migrants to settle arid farmsteads in the High Plains by declaring that “rain follows the plow.” William Ellsworth Smythe espoused the promise of irrigation with an evangelist’s passion that led untold colonists onto barren western lands in the belief that prosperity was all but assured. Dam promoters of the early twentieth century pledged that their projects were the critical ingredient that guaranteed that great cities would grow out of the desert. Engineers shamelessly compared their concrete structures to the pyramids of the ancient Pharaohs. Deserts shall become an oasis, rain would follow the plow, and independence shall spring from dependency.²²

During the same time that promoters and entrepreneurs dug ditches or sold land, inventors, engineers, and scientists solved many practical problems that impeded water development. Inventors created machines that could economically dig ditches or efficiently irrigate fields. Engineers and scientists worked out how to measure water flows by designing gages and giving us standardized water measurements such as “acre-foot” and “cubic feet per second.” They advanced many aspects of water science on subjects as diverse as evaporation and river dynamics. Others devised ways to construct even bigger dams and purify water, transport water more efficiently, or build hydroelectric power plants. It is in these numberless inventions, innovations, and improvements that the modern West emerged.

During the nineteenth and twentieth centuries, the West became connected to the eastern United States and eventually the broader world by building railroads, developing ports, and constructing superhighways. In the West, agriculture gradually shifted away from individual farmsteads that supported families to larger operations producing commodities. By the mid-twentieth century, considerable numbers of small farmers either sold out to larger operations and moved to the city or became contractors for corporatized farms. Instead of raising a few cows for a family, ranchers began raising herds to ship to metropolitan areas. The patterns of water use shifted along with these changes. Some farmers sold their water to cities or industries, and large farms acquired the water rights

from small farms. Many regions began specializing in crops best suited for that area. Western cities could grow by absorbing nearby farms, ranches, and their water rights. And western cities could sustain higher population densities than local agriculture could otherwise support by importing farm commodities from other states and nations. By relying on intranational and international food supply chains, the arid West has seemingly become independent of some of the climatic constraints imposed by their local dry climate.

As the twentieth century progressed, the federal government became one of the major benefactors for western water development. The federal government also set aside vast tracts of public domain as National Parks and Monuments, Wilderness Areas, Wildlife Refuges, and Wild and Scenic Rivers. Figures such as Elwood Mead and Floyd Dominy used their influence as the commissioners for the US Bureau of Reclamation to get reservoirs such as Hoover, Grand Coulee, and Glen Canyon Dams constructed. Other agencies, such as the US Army Corps of Engineers, completed massive hydroelectric projects. Building western water projects did not occur without resistance. As directors of the Sierra Club, John Muir and David Brower fought to protect American rivers. And writers such as Ed Abbey and Norman Maclean showed Americans the value of free-flowing rivers. Overall, many thousands of Americans built ditches and dams, worked to secure clean drinking water, or strove to create parks and natural areas. We can read much of the West's history in its water.

In thinking about the course of water development, it's helpful to keep in mind all of the physical, hydrological, and biological conditions that influenced or constrained people's decisions for building water projects.²³ Geographers call the environmental factors that influence, often unconsciously, human decision-making "environmental determinism." In the broadest sense, the West's aridity pushed people toward building ditches and dams. Likewise, the physical environment dictated where people constructed farms, transportation routes, water infrastructure, and cities. And once people started building up infrastructure, existing projects often dictated where new projects would go next. For example, this "path dependency" means that once a dam gets built on a river, the planners designing the next water project must consider existing dams and all the other environmental and human factors they face.

In America, water development became a cultural metaphor for progress during the twentieth century. It also became a symbol for despoliation of the environment, corruption, and pork barrel politics. Artists, photographers, writers, and filmmakers all tilled fertile grounds in their explorations of what water means for our western culture. Much of our collective understanding of the West

comes from how these artists represented the region. These representations in turn mold our perceptions of western water and our political choices governing water development.

Across the West, many water projects were conceived but never built, or built and later abandoned. These projects failed due to any number of issues, including staggering costs, the collapse of political will, insufficient water, unsupportable maintenance, siltation, unrealistic aspirations, and hubris. Projects that never left the drawing board include proposals to transport icebergs from the arctic and massive canals from the Columbia and Missouri Rivers to the cities of California and Colorado. The Bureau of Reclamation made plans to construct dams in Grand Canyon National Park and Dinosaur National Monument that never materialized due to stiff grassroots opposition, cold feet by politicians, and shifting priorities to preserve natural environments in their ancient state. Proposals for dams to slake the thirst of Denver (Denver Water's Two Forks), Las Vegas (Southern Nevada Water Authority pipeline), or High Plains farms (Narrows Dam) got scuttled for want of clear need, their exorbitant cost, local opposition, and potential environmental harm. Scattered among the wreckage of large projects are multitudes of small ditches, stock ponds, and minor reservoirs that have fallen into disuse as ranchers and farmers age, aquifers decline, or the promised benefits of the structures never materialized.

If we want to gain a more complete understanding of western water, it's important to include as many perspectives as possible. When we talk about water in the West, it's easy to shift between topics that touch on cities, environment, agriculture, art and culture, politics, development, people, colonization, history, and imagination. Having a baseline understanding of these topics increases our collective fluency for discussing western water.