CHAPTER ONE

"Improving" Rivers in America

FROM THE REVOLUTION TO THE PROGRESSIVE ERA

RIVERS AS RESOURCE

This chapter was extracted from a book I coauthored with David Billington and D. C. Jackson, *The History of Large Federal Dams: Planning, Design, and Construction,* which was underwritten by the Bureau of Reclamation, U.S. Army Corps of Engineers, and the National Park Service (NPS). Although dealing with "federal involvement in dam construction" in general, the book gave greater focus to the West, where many of the largest federal dams were built. For reasons that had to do more with funding than scholarly appraisal, the Tennessee Valley Authority (TVA) dams were not included in the study, although it should be noted that the Bureau of Reclamation and the U.S. Army Corps of Engineers built the vast majority of major federal dams in the United States. Beyond the discussion of several important dam projects, the book provided substantial detail on the federal role in dam building and the importance of the U.S. Army Corps of Engineers and the Bureau of Reclamation in that venture. My role was largely to contextualize the book in two of the nine chapters, while my colleagues did almost all of the "heavy lifting" and detailed work on dams in the remaining seven chapters.

The History of Large Federal Dams could only begin with a discussion of rivers. Most obviously, to understand dams is to understand what rivers do, how they have been perceived, the role they play in resource management, and the legal structure that emerged to regulate their use. The chapter reproduced here functioned as chapter 1—an introduction, offering a prelude to a much more detailed analysis of specific questions relating to the building and maintenance of large

federal dams. Because of the book's focus, the important role of groundwater—especially in urban development—was not addressed.

As historians Christof Mauch and Thomas Zeller stated, "Sources of both abundance and destruction, life and death, rivers have always had a powerful hold over humankind. They run through every human landscape, whether mythical or actual."[1] In every place on earth, rivers have played a major role in providing transport; water for drinking, agriculture, commerce, and industry; water for power; sources of food; carriers of waste; and places of recreation. For urban development, rivers along with groundwater have been most essential. Rivers historically have transcended their practical value to take central roles in religion and human culture in general, as icons and symbols and as metaphors.[2]

For the purposes of *Precious Commodity*, this chapter is meant to set context, to make the point that the human imprint on America's riverine history—public and private—has been central from the earliest days of the republic. In essence, the intrinsic value of rivers—their ability to remain "forever wild"—was superseded quickly and aggressively by a human demand for control of a vital resource, maybe the most vital resource. Questions over private access to water and its use—be it riparian rights or prior appropriation—were mitigated by the courts, by state action, and by federal laws. At the heart of the question of water rights is property rights, and while the two are intertwined, the history of water has been a story as much about use as ownership.

This chapter particularly highlights the contesting consumers vying for fresh water—including cities—and the historical forces that played a role in allocating the resource in the nineteenth and twentieth centuries. Because they were so dramatic, contests in the "arid" West received a great amount of coverage. But debates over flood control, transportation, and industrial and urban uses of water in the "moist" East—beginning at the Mississippi River—are no less important and receive critical attention as well. In such an expansive country as the United States, as Peter Rogers noted, "public goals concerning water policy have continually shifted because the nature of the problems has changed as the country has grown, both in size and in affluence."[3]

As the contested role of rivers as resource intensified in the nineteenth and into the twentieth century, problems and policies not only changed but became more complex. This first chapter sets the stage for debates over public and private responsibility for water that will be explored in a number of ways in the chapters to follow. "Harnessing" rivers on a national scale meant commodifying water and controlling its use, practices that persisted as fresh water flowed in and out of cities (as most of chapters 2 through 7 especially will testify). Since riverine flows rarely if ever stop at urban boundaries, questions of public and private responsibility for the control of water do not end there either.

THE AMERICAN WATERSHED SYSTEM

The great rivers and their tributaries in the United States are the primary source of the water bounty and are major symbols of American regionalism, ultimately binding together disparate areas into a powerful whole.

The American watershed system is an awesome force. The Mississippi Basin alone drains more than 40 percent of the country's land from the Appalachian Mountains in the East to the Rockies in the West. To the North, the St. Lawrence River drains the Great Lakes. In the Southwest, the Colorado River traverses seven states and Mexico on its route to the Gulf of California, and the Rio Grande forms part of the nation's southern boundary. Along the Pacific Coast, the Columbia River gathers water from the Rocky Mountains and the Cascades, and the Sacramento and San Joaquin Rivers collect water from the Sierra Nevada, linking inland valleys to the Pacific Ocean. The geological and human history of the United States is linked inextricably to its rivers.[4]

American rivers were symbols of a burgeoning nation in the eighteenth and nineteenth centuries. They inspired romantic renderings at the hands of artists, and in some cases—as with painters of the Hudson River School in the 1820s—they were depicted as detailed landscape features with physical and even human qualities.[5] But at times they were regarded as untapped or underutilized resources, raw material waiting to be harnessed, managed, and exploited for human benefit. In the neoclassical tradition of the eighteenth and early nineteenth centuries, "The 'proper' channel for a river is not necessarily the one it has carved for itself: By means of canals and locks it can be guided by men along a straight and level line, thereby improving upon natural design." Rivers, therefore, were most attractive "when they yielded to humanity's needs, whether as mechanisms of transportation or as sites for nascent towns."[6] For aesthetic and for practical reasons, wild rivers served little purpose, historian Theodore Steinberg noted: "As the [nineteenth] century progressed, a consensus emerged on the need to exploit and manipulate water for economic gain. A stunning cultural transformation was taking place, a shift in people's very perception of nature. By the latter part of the nineteenth century, it was commonly assumed, even expected, that water should be tapped, controlled, and dominated in the name of progress—a view clearly reflected in the law."[7] Steamboats, canals, and dams became the technologies of choice to accomplish those goals.

THE RISE OF AN INDUSTRIALIZING NATION

The impulse to "improve" waterways was stimulated by the profound changes transforming the young nation. Beginning as early as 1820, the In-

dustrial Revolution ushered in a period of unprecedented economic development for the United States. Manufacturing began to challenge agriculture as the nation's leading economic enterprise. While agriculture was responsible for the largest single share of production income before the Civil War, the growth and importance of manufacturing, especially in the East and along the Great Lakes, rose rapidly during the decades that followed the war. In 1859, there were 140,000 industrial establishments in the United States—many of them hand or neighborhood industries. Forty years later, there were 207,000 industrial plants, excluding hand and neighborhood industries.[8]

The economic transformation of the nation paralleled the rise of cities. The first federal census in 1790 showed that city dwellers represented less than 4 percent of the nation's population. Urban growth stagnated until 1820, but by the end of the decade the urban population had almost doubled.[9] While only seven out of every one hundred Americans lived in cities or towns at that time, the urban population grew by 552 percent (from 1.1 million to 6.2 million) between 1830 and 1860, which was the fastest rate of urbanization the nation had ever experienced.[10]

Industrialization also inspired the mechanization of agriculture and stimulated demand for a variety of products that helped to build a national market economy. Irrigation ultimately became a tool for expanding the agricultural market in the West to supply a variety of goods for growing urban centers at home and abroad. As early as the 1770s, an emerging capitalist economic system was evident in the Northeast, the Mid-Atlantic region, the South, and the back country. A booming transatlantic market for grain and other agricultural products, a rising number of American capitalist entrepreneurs, surplus labor available to work for wages, and state and national governments encouraging and promoting economic growth underlay the emergence of a market revolution along the American rural frontiers.[11]

The promise of economic growth had long attracted the interest of government. In the manufacturing belt of the East Coast and the Great Lakes, the states and the federal government had been active agents in stimulating commerce and industrialization. Competition between the states beyond the Appalachians for access to ports on the Atlantic had been intense. Rivalries between the states for a variety of public works projects focused on economic opportunities to be won and lost.

THE ORIGINS OF FEDERAL WATER RESOURCE POLICY

With respect to water resource issues, rivalries between the states suggest a partial answer for an increased role by the federal government. However, no comprehensive water resource policy ever emerged in the nineteenth or twentieth centuries. Federal navigation policy, flood-control policy, and ir-

rigation policy were conceived and administered separately over the years, and water issues even today remain a combination of local, state, and national interest.[12] Supporters of national initiatives for water and navigation projects chronically vied with advocates of states' rights, who opposed outright subsidies for waterway construction. Steering a middle course, an emerging "water bureaucracy"—including the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the TVA—often urged government planning without directly challenging state control of water projects.[13]

There is merit in Richard N. L. Andrews's observation that federal responsibility for water resource management "evolved almost unintentionally from the convergence of nineteenth-century public-land and internal-improvements policies."[14] Disposal of public lands set several precedents about how the federal government would deal with the nation's resources. At one time or another, more than 78 percent of the nation's 2.3 billion acres was owned by the federal government. There was no uniform method of land distribution during early colonial days. Since much of the frontier remained within the boundaries of the states after the American Revolution, state legislatures often developed the first land schemes to deal with estates confiscated from Loyalists. Land speculation on federal lands initially focused on the Ohio River region, an area wedged between the new nation and the vast frontier. After the Louisiana Purchase, a new land law that lowered the minimum purchase to a quarter section (160 acres) made western migration attractive to easterners and European immigrants. Between 1850 and 1900, the number of farms in American territory increased from 1.4 million to 5.7 million. Indian land rights, however, were often ignored or manipulated in providing settlers with land. In essence, much of the productive land in the West had already been claimed before the famous Homestead Act of 1862, and after its initial disposal, former public land increasingly became a speculative commodity.[15]

The disposal of public lands was not merely an end in itself from the first land ordinances in the eighteenth through the nineteenth century, the federal government intended to generate revenue and to stimulate economic development by a rapid transfer of public lands to private individuals. This was not accomplished without fierce debate, characterized most graphically by Thomas Jefferson's image of a nation of self-sufficient yeomen farmers and Alexander Hamilton's promotion of manufacturing, inland navigation, and the development of new economic markets.

In dealing with the states, the federal government could offer public lands in exchange for their support on development projects or other policies. Public lands also were used to provide capital for private businesses, such as the railroads. The first land laws in the 1780s and 1790s (including

the Northwest Ordinance of 1787), however, were primarily directed toward using land to raise revenue, to retire the public debt, and to create a market in western lands.[16]

While land subsidies for public works projects were not provided for in federal law, many land grants were made to subsidize road building, river improvements, and railroad construction. For public lands to have value, they needed to be accessible to facilitate settlement and the transportation of raw materials and crops to the East and to Europe. The federal government funded "internal improvements" through general revenues, the sale of public lands, and land grants.[17] But as John Lauritz Larson perceptively observed, "the campaign for internal improvements, so universally appealing in the abstract, proved incredibly controversial at all levels of government as soon as workmen struck their spades into the earth."[18]

Prior to 1789, private investors provided internal improvements. At the Constitutional Convention of 1787, Benjamin Franklin was the primary advocate for federal sponsorship for internal improvements, but he could not carry the day. The Constitution ultimately reserved that responsibility for the states. However, with poor economic conditions in many states, Congress began appropriating funds for specific improvements beginning in 1802. In 1808, Secretary of Treasury Albert Gallatin submitted his report recommending federal aid for a system of roads and canals that would link the Atlantic seaports with the nation's interior.[19]

Artificial canals became the foremost technology in the early nineteenth century to connect the riverine system to the sea. The virtue of such canals was to "free" rivers from their natural courses and to direct them into channels that would serve the economic ends of the nation.[20] East Coast rivers were only navigable up to the fall line, a barrier at the foothills of the Appalachians. In the late eighteenth century, several short canals and the twenty-seven-mile Middlesex Canal in Massachusetts had been constructed, but by 1816 only about a hundred miles of canals existed in the United States. These human-made waterways proved to be demanding engineering feats and financial liabilities, and it became difficult to find investors for new projects.

The construction of the Erie Canal, linking Albany and Buffalo by means of an artificial waterway 364 miles in length, set off a canal boom in the United States that ultimately attracted federal dollars to future projects. The New York legislature authorized the construction of the Erie Canal in 1817 without a promise of federal support, and the canal was completed in 1825. By 1840, various states had invested approximately $125 million in 3,200 miles of canals. Between 1815 and 1860, the total public and private expenditures for canal construction was about $195 million. While the federal government had refused to help New York State build its canal, and states

were the primary financial contributors in the early canal era, the federal government ultimately provided financial support through land grants and subscribed more than $3 million in canal company stock. Expensive enlargement programs, the Panic of 1837, and competition from railroads brought the canal boom to an end by the 1840s.[21]

WATER LAW AND THE USE OF RIVERS

MILLS AND DAMS IN THE EARLY INDUSTRIAL ERA

Complicating the creation of a national water resource program was the fact that fresh water, unlike land, was common as opposed to private property. Navigable waterways, for example, could not be treated like the public lands, that is, could not be disposed of to generate revenue or to promote economic development. They were open to common use and thus required special treatment. Water usage also was subject to unique practices imbedded in the law.[22]

Water, among other things, was an important source of energy before and during the early stages of the Industrial Revolution and was thus the focus of voluminous litigation over water rights. The bulk of litigation arose from disputes over the use of streams for waterpower.[23] Mills and dams raised for the first time legal questions over the relationship between property law and private development, when "antidevelopmental doctrines of the common law first clashed with the spirit of economic improvement."[24] Evolving water rights law had a greater impact on the effort to adapt private law doctrines to the promotion of economic growth than any other branch of law.

The water mill inevitably came into conflict with other stream uses. Aside from the waterwheel, the dam was the most essential element of a mill. Preindustrial dams were low, crude structures designed to increase water fall by raising the stream level. The dam created a storage reservoir, or millpond, that not only obstructed navigation and log floats but also the seasonal movement of fish.[25]

Water mills challenged prevailing water rights law and practices such as riparian rights, commonly recognized in the eastern United States in the eighteenth and nineteenth centuries. This English common-law doctrine granted ownership of a water privilege with the land bordering the two banks of the stream. The landowner did not own the stream, but only the rights of water usage. Even usage was subject to rights and claims of other users, including navigation interests, owners of riparian farmlands above and below a specific water privilege, lumber and other commercial interests, upstream communities, and mill owners themselves.[26]

Before the nineteenth century, common-law doctrines were generally

based on the natural flow of water, and jurists rarely looked with favor on the use of water to irrigate or to run machinery. Possessing a narrow view of the productive capacity of water, they generally placed strict limits on its appropriation.[27] With the onset of the Industrial Revolution, the increasing number of conflicting claims and shades of interpretation of privilege challenged the water rights of riparian owners.[28]

Since navigation rights had priority on streams sufficiently large to carry regular traffic, the parts of the law referring to that activity were the least controversial. As power needs increased, government officials began to favor mill owners—especially in New England—over other riparians. This also was true for capitalists who wanted to divert water from natural sources to build canals.[29]

The most typical water rights controversy pitted downstream riparian landowners against upstream owners whose dams obstructed the natural flow of water for mills or irrigation. Other cases pitted upstream mill owners against downstream mill owners or landowners flooded by the dam. Some courts virtually refused to recognize any right to interfere with the flow of water to a mill.[30]

"Reasonable use," or a balancing test, was the most important challenge to the common-law doctrine of riparian water rights. Although the concept did not find general acceptance until around 1825, some early decisions set the stage. By the Civil War, most courts accepted a balancing test in which reasonable use of a stream depended on the extent of detriment to riparian landowners downstream.[31]

In determining reasonable use, it was common to take into account what constituted a proportionate share of the water. In *Cary v. Daniels* (1844), however, Massachusetts Chief Justice Lemuel Shaw tended to weaken the standard of proportionality by giving priority to the proprietor who first erected his dam, thus placing greater emphasis on maximizing economic development at the expense of equal distribution of the water privilege.[32] Not until the nineteenth century was a theory of priority used offensively to maintain a right to obstruct the flow.[33] What brought on the change was the building of large dams, which widened the possibilities for injury by causing potential damage to mill owners both upstream and downstream from the dam.

The two doctrines—reasonable use and prior appropriation—were becoming less and less interchangeable, at least as they operated within the context of economic development in the emerging industrial age. Thus a tension between the two, which had moved beyond the natural rights doctrine characteristic of preindustrial societies, found its way into the courts. By midcentury, almost all courts rejected prior appropriation because it so

obviously interfered with competition. Riparian rights, modified by reasonable use, prevailed in the East in dealing with economic development. In addition, the advent of the steam engine and the railroad made concessions to mill dams and canals temporary.[34]

WATER LAW IN THE WEST

While waterpower development and canal building framed much of the water law in the East, in the West mining activity and agriculture helped shape the law.[35] The traditional interpretation stresses that water rights in the nineteenth-century West, as opposed to the East, have been closely associated with the prior appropriation doctrine.[36] When Anglo-American settlers arrived in the West, neither land nor water rights issues had been clearly resolved. Until the Civil War, the federal government controlled the public domain. Legislation enacted by Congress in the 1860s and 1870s, however, recognized the rights of settlers to utilize water on the public lands for a variety of purposes. Thus, the prior appropriation doctrine in the West owes a great deal to local circumstance.[37] Donald Pisani, however, has persuasively argued that "water law evolved slowly in both California and the West, constructed piece by piece, like a quilt, rather than from whole cloth." The courts and legislatures, he added, "rarely looked beyond immediate economic needs" in determining water rights.[38]

THE WESTERN SETTING

In humid eastern America water is an essential resource. But control over water resources does not define the central character of that society. In contrast, water is dramatically scarce in the arid West and that "precious liquid" occupies a pivotal position in regional development and in the larger political economy. Much of the West's historical character arises from a pervasive lack of rainfall.[39] It has become clear that water resources development is a key factor in regional growth.[40] Moreover, in the history of western water use, the work of the federal government—in particular the U.S. Reclamation Service after 1902 and the U.S. Army Corps of Engineers after 1933—has had enormous influence in transforming the environment and fostering economic development.[41]

Precipitation in the West is not evenly distributed over the landscape, and while billions of gallons of water might be dumped on the desert in the period of a few days or weeks, such storms can be spaced years apart. With much surface water originating either as seasonal snowmelt or infrequent torrential rainstorms, the ability to support widespread agriculture—as well as mining, municipal growth, and hydroelectric power development—has by necessity become dependent upon artificial means of controlling water.

Leaving aside groundwater that can be lifted to the surface by either windmills or electric pumps, irrigated agriculture depends upon water diverted from rivers, transported in canals, and then distributed over fields to sustain crops. The engineering techniques and the political instruments devised to foster irrigation in the West later comprised the basis for water resources development throughout the nation.

THE CALIFORNIA DOCTRINE, 1851—1886

During the California gold rush, the right to a claim went to the first person working it. Not surprisingly, this "first in time, first in right" principle (or prior appropriation doctrine) could also apply to water—a commodity essential to mining. A miner did not acquire property in the running water itself, but only its use if he continued to work the claim. But this prior appropriation doctrine coexisted with riparian rights in the 1840s and early 1850s, since many miners did not want streams diverted from their natural courses. The California State Legislature, eager to promote mining, supported prior appropriation for the gold country in 1851, the state court accepted it in 1855, followed by its congressional endorsement for public lands generally in 1866.[42] The federal action endorsed prior appropriation not only for mining but also for agricultural, manufacturing, and other uses, and it further acknowledged the states' power to regulate water rights. The prior appropriation doctrine promoted economic development but gave no preference to communities over individuals. Eventually every western state endorsed some form of the doctrine, and nine states adopted it as their sole water law.[43]

In practice, prior appropriation worked well enough when water was abundant, but when water was scarce it created confusion. An appropriator could sue to defend his rights, and the courts reviewed the records to determine a prior claim. But the amount of water available was not always known. A title established in one case protected an appropriator from one claimant only. Although the states gradually evolved more orderly approaches, the system remained confused.[44]

Although California set a precedent in the application of prior appropriation, riparianism also gained legal recognition early in the state's history. In 1850, the first legislature adopted as its basic system English common law, subsequently modified by state courts in response to statutory and case law, and "for nearly three decades the state dealt with the problem of two contradictory legal systems by reaffirming the legitimacy of both and seeking to soften their differences." However, when irrigation appeared necessary for some forms of agriculture, the courts demonstrated flexibility, "taking a cue from eastern states, which had begun modifying their riparian law tradition in favor of some appropriation practices."[45]

Drought in the 1860s and 1870s, and especially increased irrigation, threatened to challenge the uneasy status quo. The development of refrigerated railroad cars, for example, meant that high-profit fruit and vegetable crops produced through irrigation could be shipped to distant markets.[46]

While the California courts ruled in favor of some irrigation under riparianism by the 1870s, accommodation had not been made for an irrigation boom. During the 1880s, the area of irrigated land in the arid West increased four- or fivefold. The clash of the water doctrines reached an acme in 1886. In *Lux v. Haggin,* the California Supreme Court affirmed a dual system of water rights, the so-called California Doctrine.[47] The court held that riparianism was law in California, applicable in all private lands and public lands that became privately owned. An appropriator could have a superior claim if he used the water before a riparian user had acquired the property. Timing was crucial.[48] As unpopular as the decision was within the public at large—since large landholders would be affected much less than small farmers—the California Doctrine eventually was adopted along the Pacific Coast (Washington and Oregon) and in the Great Plains (Nebraska, Oklahoma, Texas, Kansas, North Dakota, and South Dakota).[49]

In the 1880s, Colorado invalidated riparian rights to surface water and began enforcing appropriative rights under state authority. Prior appropriation became the sole water right and came to dominate much of the Rocky Mountain region. Five other states (Utah, Wyoming, Arizona, New Mexico, and Idaho) soon accepted the Colorado Doctrine, with Montana and Alaska following in the early twentieth century.[50]

A third approach developed in Wyoming, emphasizing a different type of enforcement. The state constitution gave the state title to all water. Officials could reject water claims and overturn existing appropriations not believed to be in "the public interest." In essence, the so-called Wyoming Doctrine gave greater protection to appropriators than under the Colorado system. Besides Wyoming, Nebraska, Oklahoma, North Dakota, and South Dakota claimed full control over their water.[51]

Despite the flurry of activity that led to the three major water doctrines, water rights—let alone water policy—were not completely rationalized, nor were conflicts ended among economic interest groups. Battles over irrigation, farming and livestock raising, mining, and the demands of urban growth kept the water issue at center stage.

Inevitably, the federal government would be active in the controversies, which was welcomed by some and not welcomed by others. The commitment in the early twentieth century to the construction of federal dams in every major watershed occurred in the wake of the long-contested uses of water. That water law favored the states only complicated the ability of fed-

eral dams to provide stored water to a variety of consumers. However, under the property clause (Article 4, Section 3) of the U.S. Constitution, the federal government had legal authority to accept, manage, and dispose of public domain lands, and this provided the basis for subsequent laws and regulations pertaining to public lands and other resources. With regard to water resource policy, the federal government presumably holds "reserve rights" to enormous amounts of annual water flows in the West, since it was the earliest formal owner of the public lands. However, the federal government has never fully asserted these rights and the U.S. Supreme Court has never formally recognized them.[52]

Prior appropriation exacted heavy social and environmental costs in the West. Water was an economic commodity, although private gain resulting from the use of water did not translate into revenue for the states. Instead, several large corporations and monopolies benefitted, and many farmers adopted wasteful irrigation practices. Prior appropriation led to a rapid economic development that "exacerbated the boom-and-bust mentality endemic to the mining industry, encouraging speculation and maximum production." Moreover, it failed to preserve water quality as did riparian rights, and it allowed vast environmental destruction.[53]

Environmental policy was in the developmental stages in the late nineteenth century.[54] The emergence of resource conservationism, as opposed to nature preservation, grew out of concern about the depletion of natural resources, which could stall further economic development.[55] Resource exploitation was central to the actions of a rapidly industrializing society; laissez-faire capitalism was more regaled than condemned for stoking the fires of economic growth.[56] Particularly in the West, where the forests, rivers, and mineral wealth were directly linked to economic opportunity, conservationism was largely dismissed in the nineteenth century.[57] But even practical concerns, such as the marshaling of such a scarce resource as water, generated intense conflict. A more widely held interest was how to tap yet-to-be exploited water sources.

THE U.S. ARMY CORPS OF ENGINEERS IN THE NINETEENTH CENTURY

The U.S. Army Corps of Engineers and the Bureau of Reclamation have been the most important government bodies responsible for water resource management in the United States. Their stories are central to riverine history.

THE CORPS AND THE FRENCH ENGINEERING TRADITION

In a March 16, 1802, congressional act, the U.S. Army Corps of Engineers was separated from the Corps of Artillerists and Engineers and stationed at West