

**The Making of a Multiple Purpose Dam:  
Engineering Culture, the U. S. Bureau of Reclamation, and  
Grand Coulee Dam, 1917-1942**

by

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Submitted to the Program in Science, Technology and Society  
in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

at the  
Massachusetts Institute of Technology

February 2000

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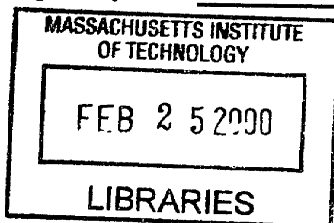
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Submitted to the Program in Science, Technology and Society  
on December 17, 1999  
in Partial Fulfillment of the Requirements for  
the Degree of Doctor of Philosophy

**ABSTRACT**

This dissertation examines how Americans have transformed the environment through the construction of new technologies and the roles of technical professionals in bringing about these changes. In the twentieth century, federal engineers, working with local Western boosters and their federal superiors, transformed the West's waterscape. Between 1900 and 1970, engineers of the U.S. Bureau of Reclamation—only one of three federal agencies that built dams—constructed over 400. On the Columbia River alone, federal engineers constructed thirteen large dams that turned the nation's fourth largest river into a chain of lakes.

Engineers wrought this transformation with multiple purpose dams—a new style of dam building in the twentieth century. This style combined a new way of understanding how dams should be used with new approaches to financing the construction of dams and to designing and siting dam structures. Engineers built dams that developed water resources for multiple uses: navigation, flood control, irrigation, and hydroelectricity production. They financed these dams by allocating the costs among uses and then obtaining funds either through federal grants (for navigation and flood control) or loans (for irrigation and hydroelectricity). Engineers frequently designed these dams as traditional concrete gravity structures and sited them at prime locations on major rivers.

This work examines the rise of the multiple purpose style of dam building through the history of Grand Coulee Dam. Located on the Columbia River in Washington State, Grand Coulee Dam is one in a group of large dams planned in the 1920s and built in the 1930s during whose design and construction federal engineers worked out this new style of building. It shows that engineers came to prefer this style because it fulfilled conservationists' hopes for "comprehensive planning" of water resources and it eliminated financial problems with federal irrigation activities. Engineers alone did not launch this building program: local constituencies favored development and Franklin Roosevelt's new administration supported relief projects, conservation programs, and government involvement in the electrical industry. Working together, these three groups built a political coalition for multiple purpose dams that successfully underpinned expanded building.

Thesis Supervisor: Deborah Fitzgerald  
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## Acknowledgements

This dissertation has been a long time in the making. During that period, I have acquired substantial debts that I can only repay with thanks.

The MIT STS Program provided funds for travel without which I could not have conducted the archival research for this project. Friends and family also opened their homes to me as I traveled. A fellowship from the Dibner Institute for the History of Science and Technology gave me the luxury of two years to devote to the conceptualization and writing of this project.

Without substantial aid from archivists and librarians across the U.S., I would not have been able to unearth the materials from which this narrative is constructed. The staff at the National Archives—Rocky Mountain Region, especially Joan Howard and Eileen Bolger, explained the complicated organization system of the U.S. Bureau of Reclamation papers and happily brought me many many boxes from that collection. Karen DeSeve at the Eastern Washington State Historical Society and Cheney Cowles Museum; Stephanie Edwards at the Gonzaga University Libraries; Lawrence Stark at the Washington State University Libraries; and Gary A. Lundell at the University of Washington Libraries helped me, as did the staffs at the National Archives in Washington and College Park, the Library of Congress, and the Washington State Archives. The staff of MIT's Retrospective Collection helped me to find seemingly endless, decaying early twentieth century engineering journals. The interlibrary loan staff at MIT patiently ordered me many articles from journals that do not exist east of the Mississippi River. The Government Documents librarians at Harvard University and the Boston Public Library helped me locate numerous hearings, reports, and other valuable materials. Reference librarians at Cornell's Olin Library helped me find the initial sources I used in formulating this project. The history and records staff at the Bureau of Reclamation in Denver, especially Brit Storey, Roy Wingate, Bob Autabee, and Toni Linenberger, also welcomed me and helped me obtain materials.

I had the great pleasure of working on this dissertation in four different academic communities and each has left a mark on the work. I formulated this dissertation while visiting the Department of Science and Technology Studies at Cornell University. The scholars there welcomed a peripatetic graduate student. Ray Fouche and Stephen Weldon (from Wisconsin) listened to my earliest ideas about the history of Grand Coulee Dam and encouraged me to keep formulating. Suzanne Moon has likewise been an invaluable sounding board. Ron Kline and Bill Storey commented on early formulations of the argument and encouraged me to keep working.

From Cornell, I returned to Boston and spent two years at the Dibner Institute. The graduate student, post-doctoral, and faculty fellows in 1996-7 and 1997-8 provided me further encouragement. Officemates Alix Cooper and Slava Gerovitch gave me peace to work and pleasant breaks. Conevery Bolton, Greg Clancey, Diane Greco, and Hannah Landecker contributed to making the graduate student hall a vibrant place. Noah Efron, Dave McGee, and Jim Voelkel showed me graceful transitions into intellectual life after graduate school. Bruno Belhoste, Jack Brown, Daryl Hafter, Paul Josephson, Pat Malone, Lenny Rosenband, and Terry Shinn broadened my understanding of history of technology—especially French technology. Talking dams with D. C. Jackson was great fun. Rita, Trudy, and Carla made the Dibner a pleasurable place to be. Rebecca Herzig provided more personal and intellectual support that she can know.

I finished the dissertation while serving as a teaching assistant in the Department of the History of Science at Harvard University. Colleagues there, especially Everett Mendelsohn, Alix Cooper, and Conevery Bolton, encouraged my interest in the intersections of history of technology and environmental history.

My home institution for this project was the Program in Science, Technology and Society at MIT. My thesis advisor, Deborah Fitzgerald, let me take on a project outside her

areas of immediate expertise and provided encouragement, comments on my writing, and hard truths. My readers, Roe Smith and Chris Appy, gave me good practical advice. Visiting from the University of Pennsylvania, Tom Hughes introduced me to the history of technology and, visiting from Duke University, Alex Keyssar, to labor history. I benefited enormously from conversations with my fellow students studying the history of technology including: Greg Clancy, Linda Endersby, Brendan Foley, Greg Galer, Rob Martello, Dave Mindell, Brian O'Donnell, Ben Pinney, and Tim Wolters. Jessica Wang and Russ Olwell encouraged my interest in the intersection of history of American science and American political history. Roberta Bivins always complained at the right time. Joe Schultz, Roberta Brawer, and I all started the graduate program the same year and they have provided continual encouragement.

I owe my greatest debts, intellectual and other, to my family and friends. My grandmothers, Marguerite Cain and Dorothy Ellison, showed me that women could simultaneously nurture mind, family, and soul. My father, Curtis Ellison, has always shared his love of and fascination with American culture and his realism about life in academia. My mother, Barbara Ellison, shares her enthusiasm for science and technology and always encourages me to do what I want. My sister, Evelyn Twitchell, graciously lent her editing skills to the final draft of this work. Terri, Judy, Jean, Cathie, Shirley, and Marcia supported me from near and far. My husband Clark Miller's contribution cannot be stated briefly. We began discussing science and technology studies many years ago, when I took an undergraduate seminar on the sociology of knowledge. While that conversation has never ended, the amount of support Clark has supplied in everyday living has continually increased.

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## Chapter 1—Multiple Purpose Dams and the Transformation of the American Waterscape

This is a history of federal engineers, a multiple purpose dam, and how those engineers chose to build that particular dam. Between 1918 and 1942 engineers of the U.S. Bureau of Reclamation (USBR)<sup>1</sup> designed and built a multiple purpose dam at the Grand Coulee dam site on Washington State’s Columbia River. Grand Coulee was not the first dam on the Columbia. It was not the first multiple purpose dam built by the USBR. It was one of a handful of early multiple purpose dams, planned in the 1920s and built in the 1930s. After World War II, these dams became exemplars for federal construction that changed many American rivers into chains of lakes.

This dissertation has two central questions: first, how did multiple purpose dams become the dominant style for federal water resource development in the mid-twentieth century United States? In the late 1930s, “multiple purpose” was a new way of naming dams. A combination of location, structure, use, environmental impact, and financial structure characterized this style. Government engineers began with prime spots on the nation’s major rivers. In these locations, they built enormous gravity dams—triangular prisms of material that block a river with weight. For example, the USBR constructed Hoover,<sup>2</sup> Shasta, Grand Coulee, Friant, and Marshall Ford Dams between 1931 and 1945. These concrete gravity dams rose between 270 and 726 feet high and contained between 1.9 million and 10.2 million cubic yards of concrete.<sup>3</sup> Multiple purpose dams served a combination of purposes, including navigation, irrigation, hydroelectric power production,

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<sup>1</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period and general references.

<sup>2</sup> Called Boulder by USBR engineers from 1918, the Interior Secretary named this dam Hoover when he announced its construction in 1930. The next Interior Secretary, Harold Ickes, changed the name to Boulder Dam in 1933. Congress restored the name Hoover Dam in 1947. For simplicity, I will refer to it as Hoover Dam throughout. William E. Warne, *The Bureau of Reclamation* (New York: Praeger Publishers, 1973), 36.

and flood control. Further, these dams did not stand alone conceptually. Engineers planned a multiple purpose dam as one of a group of structures, which would derive maximum use from a river. For example, the design for Grand Coulee Dam came from a report, which recommended a series of ten dams to completely utilize the Columbia River.<sup>4</sup> These comprehensive systems often produced similar waterscapes. The Columbia, Tennessee, Missouri, and other American rivers became chains of lakes: dams stopped flow of water on the entire river as reservoirs—or lakes—behind each dam extended upstream to the foot of the next dam. Finally, the federal government changed its manner of financing dams. From the early nineteenth century, Congress paid for the Army Corps of Engineers to build dams for navigation and unofficially flood control. In 1902, Congress added a system to loan Western farmers interest-free money to build dams and irrigation works. Starting in the late 1920s, however, the government combined these two approaches to funding dams and began selling hydroelectric power from its dams. The government wrote off part of the cost of a dam as an investment in navigation or flood control and treated the rest as a loan to consumers of electricity and farmers, who used the water for irrigation.

I consider multiple purpose dam building a technological style because of the hybrid nature of the phenomenon. Unlike a gravity dam or a Francis turbine, a multiple purpose dam was not simply a technology in a material sense. Engineers did not write texts that described the physical characteristics of multiple purpose dams. Rather, engineers and politicians used the term "multiple purpose" to describe a kind of development that combined a material technology with an understanding of how that technology ought to be implemented and an approach to financing this form of technological development. Other features of this style—location and environmental impact—followed from these three basic elements. I adopt the concept "technological style" from Thomas Hughes's work on

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<sup>3</sup> "World's Five Largest Concrete Dams," *Reclamation Era* 30 (February 1940): 44-45.

<sup>4</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 73rd Cong.,

regional differences between electrical power systems.<sup>5</sup>

I unpack the phenomena that underlay the transition to a multiple purpose style of federal dam building by analyzing the ways in which one particular early multiple purpose dam—Grand Coulee—became that kind of project. I chose this case study approach because it allowed me to analyze the people involved in dam building, their relationships, and design decisions. I chose Grand Coulee Dam because a series of acrimonious debates over how to irrigate Washington State’s arid Columbia Basin and how to develop the water resources of the Columbia River presented two serious alternatives to multiple purpose development for this area.

Building Grand Coulee Dam and its peers—the early large multiple purpose dams—launched federal building in this style by solidifying a heterogeneous set of groups, ways of thinking about dams and water resources, and relationships. Local boosters, executive branch officials, and federal engineers all became important groups in building multiple purpose dams. Local boosters provided the demand, enthusiasm, and lobbying power for these environmental and economic development projects. Presidents and their advisors provided the vision and political capital to move river development projects through Congress. Engineers made things work. Not only did their technical expertise give form to the projects, but, in addition, they built relationships with both boosters and politicians and coordinated the interactions necessary for dam building. Conservation and the government’s system of financing dams guided these groups toward the multiple purpose style.

The second major question that guides this work is: What roles did federal engineers play in the rise of this style of dam building? I focus on engineers because their influence pervaded the rise of this style. In addition to directing the technical work, engineers contributed to formulating development approaches and nurturing political

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1st sess., 1933, H. Doc. 103.

<sup>5</sup> Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930*

coalitions. In planning, engineers defined what could be done. As a result, the reasoning processes of engineers played an essential role in imagining development possibilities. Once construction began, federal engineers had a stake in maintaining the political coalition behind a dam.

In examining the roles of USBR engineers in the decisions to make Grand Coulee a multiple purpose dam, I characterize the engineering culture of that agency. I ask: Who were the engineers of the USBR? What values drove their decision-making processes? How did they interact with other groups active in dam building?<sup>6</sup>

Briefly, a stable and homogeneous group of engineers directed the USBR during the 1920s and 1930s. These men came of professional age during the Progressive Era. Building multiple purpose dams was the finale of many of their careers. Clear priorities about resource use and finances guided many of their decisions about dams. The leaders of the USBR built a set of dynamic relationships in which they could both lead and follow. These ties provided a stable base for their dam building activities.

The multiple purpose style of dam building and the roles of engineers in it must be understood in a series of overlapping contexts. The federal government had been building dams and other kinds of water projects since the early nineteenth century. The shift to multiple purpose dam building, however, was doubly important because the federal

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(Baltimore: The Johns Hopkins University Press, 1983), 404-460.

<sup>6</sup> Studies of work cultures have been a vibrant topic in recent historical literatures. This approach builds on: Edward Palmer Thompson, *The Making of the English Working Class* (New York: Vintage Books, 1963) and David Montgomery, *Workers' Control in America: Studies in the History of Work, Technology, and Labor Struggles* (Cambridge: Cambridge University Press, 1979). Scholars of women's work have been particularly important in developing this approach. I have been especially influenced by Susan Porter Benson, *Counter Cultures: Saleswomen, Managers, and Customers in American Department Stores, 1890-1940* (Urbana: University of Illinois Press, 1986); Barbara Melosh, "*The Physician's Hand*": *Work, Culture and Conflict in American Nursing* (Philadelphia: Temple University Press, 1982), and Sharon Hartman Strom, *Beyond the Typewriter: Gender, Class, and the Origins of Modern American Office Work, 1900-1930* (Urbana: University of Illinois Press, 1992). In history of science, Robert Kohler pursued a similar intellectual agenda in Robert E. Kohler, *Lords of the Fly: Drosophila Genetics and the Experimental Life* (Chicago: University of Chicago Press, 1994). My analysis of work culture has also been influenced by Charles Rosenberg's essays on agricultural history in Charles E. Rosenberg, *No Other Gods: On Science and American Social Thought*, rev. ed. (Baltimore: Johns Hopkins University Press, 1997).

government vastly increased its dam-building activities with the rise of this style. Literatures on the history of water development in the American West, electrical history, and the history of American engineering establish important frameworks for this history. Grand Coulee Dam, while an important exemplar of multiple purpose dam building, had a local story too.

### ***Water Development and the Federal Government***

Diverse undertakings in river development prepared the federal government for multiple purpose dam building. The federal government began sponsoring river development in the early nineteenth century through the Army Corps of Engineers. At the turn of the twentieth century, it expanded its activities with an agency devoted to irrigation: the USRS. As government engineers developed the multiple purpose style of dam building, Congress, at the President's urging, created a third major water development agency: the Tennessee Valley Authority (TVA).

The federal government first sponsored river work to improve transportation on important waterways. Starting in the 1810s, Congress directed the Army Corps of Engineers and its sister Corps, the Topographical Engineers, to map river systems, to recommend ways to improve navigation through river and harbor works, and to construct such works. This work focused on the Ohio and Mississippi Rivers. For example, on the Ohio River, the Corps conducted surveys and basic channel improvement programs. They removed tree limbs, stumps, and other obstructions. They also deepened channels by shaping rivers with "wing dams"—timber frames a few feet high filled with rock, brush, or wood. The Corps recommended canals and locks for stretches of river with rapids or falls. Typically, state or local bodies, at times with partial federal support, undertook major improvements such as canals.<sup>7</sup>

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<sup>7</sup> Louis C. Hunter, *Steamboats on the Western Rivers: An Economic and Technological History* (Cambridge: Harvard University Press, 1949), 181-205 and Forest Garrett Hill, *Roads, Rails and Waterways: The Army Engineers and Early Transportation* (Norman: University of Oklahoma Press, 1957)

In the late nineteenth century, federal and local efforts together expanded both the scope of river development and the number of rivers worked on for transportation. For example, federal and private engineers improved the entire Ohio River for transportation. Between 1880 and 1930, engineers built a system of fifty movable dams to insure water for transportation all along the river during low water periods. Further, federal navigation work expanded to encompass more rivers in the Ohio Valley during this period. Before the Civil War, Army Engineers worked only on the Ohio and Cumberland Rivers. After the war, the Corps applied its skills to the Ohio, Cumberland, Tennessee, Wabash, Monogahela, and Great Kanawha Rivers, as well as others.<sup>8</sup>

In the West in the same period, the federal government encouraged irrigation, and federal engineers called for the expansion of the goals of federal water development activities. Federal efforts to encourage irrigation began with the Desert Land Act of 1877. This act modified homesteading procedures for arid lands. It allowed an individual to claim a 640-acre tract, rather than the traditional 160 acres, if he or she brought water to the land. At roughly the same time, John Wesley Powell, a geologist, explorer, and Director of the U.S. Geological Survey from 1881-1894, called for the planned development of water resources in the American West. Powell proposed systematic surveying of the region's resources, withdrawal of water from private control, and development for the common good by local democratic bodies. Congress continued to fund surveys of water resources, but, rather than use these to spur integrated regional development, it instituted separate irrigation incentives directed at state governments. The Carey Act of 1894 granted up to a million acres of public lands to any state that provided for irrigation of the land. In 1897, Hiram Martin Chittenden, a major in the Army Corps of Engineers, reiterated a call for systematic development of water resources. In a study of irrigation opportunities in

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narrate the activities of Army Engineers and river improvement in the antebellum period. Todd A. Shallat, *Structures in the Stream: Water, Science, and the Rise of the U.S. Army Corps of Engineers* (Austin: University of Texas Press, 1994) provides a much more complex analysis of the history and culture of the river improvement activities of the Army Corps of Engineers in the nineteenth century.

Wyoming and Colorado, he endorsed such development and advocated a central role for the federal government.<sup>9</sup>

In 1902, Congress expanded its activities by placing irrigation on the same footing as the navigation work conducted by the Army. It empowered the Secretary of the Interior to construct irrigation works. Secretary Ethan Allen Hitchcock implemented this power by creating the U.S. Reclamation Service. The Reclamation Act in 1902 brought together Progressive natural resource development ideals, a popular crusade for irrigation farms, growing Western power in Congress, the personal efforts of Nevada Senator Francis Newlands, and a timely push from President Theodore Roosevelt. This act set aside money from public land sales to build dams and irrigation works. The preceding “irrigation crusade” had glorified irrigation as a way of strengthening the nation through converting troublesome immigrants into sturdy yeoman farmers. Therefore, the new legislation included provisions to make family farmers the primary beneficiaries of federal irrigation. Congress restricted farms receiving federal water to 160 acres—the size of a traditional homestead. (However, scholars have shown this restriction was ineffective.) The new U.S. Reclamation Service began construction on twenty-five irrigation projects between 1903 and 1907, and these occupied it until the 1920s.<sup>10</sup>

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<sup>8</sup> Hunter, *Steamboats on the Western Rivers*, 205-215.

<sup>9</sup> Michael C. Robinson, *Water for the West: The Bureau of Reclamation 1902-1977* (Chicago: Public Works Historical Society, 1979), 6-9, 11-12, and 14; Norris Hundley, *The Great Thirst: Californians and Water, 1770s-1990s* (Berkeley: University of California Press, 1992), 111-113; Donald C. Swain, *Federal Conservation Policy, 1921-1933* (Berkeley: University of California, 1963), 73-75; Wallace Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (Boston: Houghton Mifflin Company, 1953); and Gordon B. Dodds, *Hiram Martin Chittenden: His Public Career* (Lexington: University Press of Kentucky, 1973).

<sup>10</sup> Donald J. Pisani, *To Reclaim a Divided West: Water, Law, and Public Policy, 1848-1902* (Albuquerque: University of New Mexico Press, 1992), 273-325; Robinson, *Water for the West*, 13-20; Swain, *Federal Conservation Policy*, 75-6; Warne, *Bureau of Reclamation*, 70-85; Hundley, *Great Thirst*, 113-118 and 257-270; and Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West* (Oxford: Oxford University Press, 1985), 156-188. Book length histories of the USBR include: Robinson, *Water for the West*; Warne, *Bureau of Reclamation*; Alfred R. Golze, *Reclamation in the United States* (New York: McGraw-Hill, 1952); George Wharton James, *Reclaiming the Arid West: the Story of the United States Reclamation Service* (New York: Dodd, Mead and Company, 1917); Brookings Institution and Institute for Government Research, *The U.S. Reclamation Service: Its History, Activities and Organization*, Service Monographs of the United States Government, no. 2 (New York: D. Appleton

With rivers, land, and immigrants at play, the question of what the U.S. Reclamation Service “reclaimed” begs asking. In the early twentieth century, people used “reclamation” to mean the process of turning desert or, much less frequently, swamp land into productive farmland. Of course, much of this land had never been farmland and so the agency was not literally re-claiming it. The use of the term, however, points out that Americans thought of a humid pastoral landscape as the norm and their technological interventions as an environmental return to normalcy.<sup>11</sup>

The U.S. Army Corps of Engineers also grew in the early twentieth century. Renewed interest in navigation, flood control acts, and the advent of hydroelectricity greatly expanded the work of the Corps. The idea of using rivers as a major transportation network regained strength in the early twentieth century. Progressives hoped that shipping could provide competition to railroads, which would reduce rates. At the same time, larger populations in areas subject to flooding, environmental degradation, and activist Progressive businessmen and politicians all spurred federal flood control activities. In 1917, Congress first asked the Army Corps of Engineers to plan for flood control and directed the Corps’s attention to the Mississippi and Sacramento Rivers. Periodic flood control acts during the 1920s and 1930s increased the scope of the Corps’s activities from making recommendations to constructing projects. At the same time, Congress increased the number of rivers with such activity.<sup>12</sup>

The Army Corps of Engineers joined the U.S. Forest Service and the USRS in the

and Company, 1919); and Doris Ostrander Dawdy, *Congress in its Wisdom: The Bureau of Reclamation and the Public Interest* (Boulder: Westview Press, 1989).

<sup>11</sup> On the importance of the pastoral landscape in the American imagination see: Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (Oxford: Oxford University Press, 1964).

<sup>12</sup> Raymond H. Merritt, *Creativity, Conflict and Controversy: A History of the St. Paul District, U.S. Army Corps of Engineers* (Washington, D. C.: GPO, 1979), 42-52; Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Harvard: Harvard University Press, 1959), 91-100; Swain, *Federal Conservation Policy*, 103-111; Roland M. Smith, “The Politics of Pittsburgh Flood Control,” *Pennsylvania History* 42 (January 1975): 5-24; Martin Reuss, “The Army Corps of Engineers and Flood-Control Politics on the Lower Mississippi,” *Louisiana History* 23 (Spring 1982): 131-148; and Edward C. Cass, “Flood Control and the Corps of Engineers in the Missouri



earliest federal activities in the field of hydroelectric power. Roughly a decade after Edison demonstrated his electric light and power system in New York City, private entrepreneurs had built hydroelectric power plants at Niagara Falls, in California's mountain ranges, and in the Appalachian Mountains in the Southeast. Californians' led in the development of American hydroelectric power and lack of other cheap sources of electricity drove their pursuit of this technology. The federal government rapidly entered the field by regulating the construction of private dams and by building public hydroelectric facilities. In the 1890s, Congress began requiring permits to build power dams on navigable rivers and public lands. Further, it required the Army Corps to approve the plans and specifications for dams before it would grant permits. In 1920, Congress created the Federal Power Commission and further institutionalized these activities. Throughout this period, government regulation of hydroelectric development was very controversial and the efficacy of the attempts has been criticized. The federal government began producing hydroelectricity early too. In 1906, an amendment to the Reclamation Act gave the USRS the right to sell surplus electric power produced at its dams. It did so immediately.<sup>13</sup>

Some Progressive Era conservationists would have gone further than simply expanding federal activities, and their ideas prefigured the federal shift to multiple purpose dam building in the 1920s and 1930s. Politicians and federal scientists, such as Nevada Senator Francis Newlands, Chief Forester Gifford Pinchot, and USRS Director Frederick Newell, renewed Powell and Chittenden's call for planned development of water resources. They sought dams to provide for navigation, irrigation, flood control, hydroelectric power, and municipal water supplies. They also hoped for an independent federal board of engineers to draw up and implement such plans for the whole country. Hydroelectricity played an important role in the renewal of this call. Conservationists saw

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Valley, 1902-1973," *Nebraska History* 63 (Spring 1982): 108-122.

<sup>13</sup> Hughes, *Networks of Power*, 262-284; Hays, *Gospel of Efficiency*, 114-21, 160-165, and 230-240; Swain, *Federal Conservation Policy*, 111-121; Merritt, *Creativity, Conflict and Controversy*, 48-49; Robinson, *Water for the West*, 27-29; and Warne, *Bureau of Reclamation*, 86-90.

no reason for private individuals or corporations to benefit financially by producing hydroelectric power while the government paid to develop waterways for other reasons. Combining development aims allowed the government to use income from electricity sales to pay for navigation, flood control, and irrigation.<sup>14</sup>

Congress created the third major federal dam building agency as the federal government shifted to multiple purpose dam building. To reduce reliance on importing during World War I, the Army Corps of Engineers constructed two nitrogen-fixation plants and Wilson Dam (to provide inexpensive electricity for the power-intensive process) at Muscle Shoals on the Tennessee River. Throughout the 1920s, Congress fought over whether to sell the dam and plant to a private developer or to allow the federal government to operate them. Franklin Roosevelt settled this debate by enthusiastically backing the creation of a federal regional planning and resource development agency in the Tennessee Valley. Congress passed appropriate legislation during the first hundred days, and, during the 1930s, the TVA built multiple purpose dams all along the Tennessee River.<sup>15</sup>

By the 1930s, then, the federal government stood poised to embrace multiple purpose dam building. The missions of federal dam building agencies had expanded to encompass all the purposes that would be combined in the new style. The Army Corps began building dams to improve navigation in the early nineteenth century. It added flood control and hydroelectric activities in the early twentieth century. Creation of the USRS in 1902 brought the federal government into the business of irrigation and later into selling electricity. Further, federal scientists such as John Wesley Powell, Hiram Martin Chittenden, and Frederick Newell had proposed integrated development of water resources under the aegis of the federal government. The TVA signaled a major federal commitment to multiple purpose development.

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<sup>14</sup> Robinson, *Water for the West*, 25-27 and Hays, *Gospel of Efficiency*, 100-121.

<sup>15</sup> There is a vast literature on the TVA. On its origins see: Preston J. Hubbard, *Origins of the TVA: The Muscle Shoals Controversy, 1920-1932* (Nashville: Vanderbilt University Press, 1961) and Paul K. Conkin, "Intellectual and Political Roots," in *TVA: Fifty Years of Grass-Roots Bureaucracy*, ed. Erwin

### *Mid-Twentieth Century Expansion of Federal River Development*

As the creation of the TVA as a new federal dam building agency suggested, the change to multiple purpose dam building was not solely stylistic. A simultaneous increase in federal water development activities added importance. In the twentieth century, engineers and politicians radically transformed American rivers by building an unprecedented number of dams. For example, in 1920 no major dams slowed Washington State's Columbia River. By 1973, thirteen turned the river into a chain of lakes.<sup>16</sup> The Mississippi, the Colorado, the Saint Lawrence, the Tennessee, and many other rivers underwent similar engineering. Historians agree that a major shift took place in American river development in the mid-twentieth century. Growth of federal agencies, as well as histories of rivers across the U.S., illustrated the quantitative aspect of this change.

Historians broadly concur that something dramatic happened in the building of dams in mid-twentieth century America. USBR historian and enthusiast Michael Robinson summarized the era as one of "multi-purpose triumphs."<sup>17</sup> Likewise, William Warne, a former USBR official, opined: "The great expansion of the Bureau of Reclamation's program in the 1930's and early 1940's.... These [years] are considered by many to have been the 'Golden Years of Reclamation.'"<sup>18</sup> Historian Norris Hundley called the mid-twentieth century "hydraulic society triumphant."<sup>19</sup> Critics of irrigation and dam building also identified the mid-twentieth century as a time of frantic activity. Donald Worster labeled the period "florescence,"<sup>20</sup> while Marc Reisner spoke of "the go-go years."<sup>21</sup>

Along with expansion of the mission of the Army Corps of Engineers and the creation of TVA, mid-century growth of the USBR illustrated the quantitative side of the

C. Hargrove and Paul K. Conkin (Urbana: University of Illinois Press, 1983), 3-34.

<sup>16</sup> Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water*, rev. ed. (New York: Penguin Books USA Inc., 1993), 164.

<sup>17</sup> Robinson, *Water for the West*, 49.

<sup>18</sup> Warne, *Bureau of Reclamation*, 17.

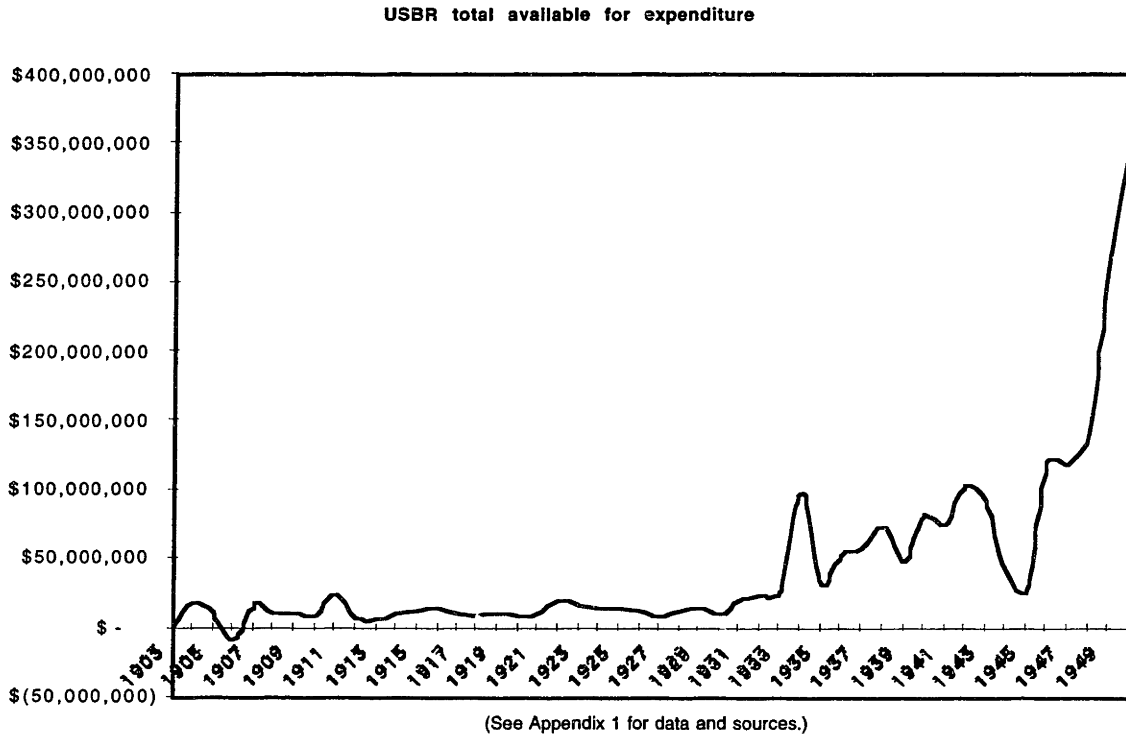
<sup>19</sup> Hundley, *Great Thirst*, 201.

<sup>20</sup> Worster, *Rivers of Empire*, 127.

<sup>21</sup> Reisner, *Cadillac Desert*, 145.

change in federal dam building. The agency's funding began to increase in the 1930s and the increase only accelerated after World War II. Mirroring funding growth, personnel and dam construction numbers showed the USBR's dramatic expansion.

In the 1930s, the USBR began a period of breath-taking growth. The agency adopted twenty-five projects in its first four years and worked to complete these for its first

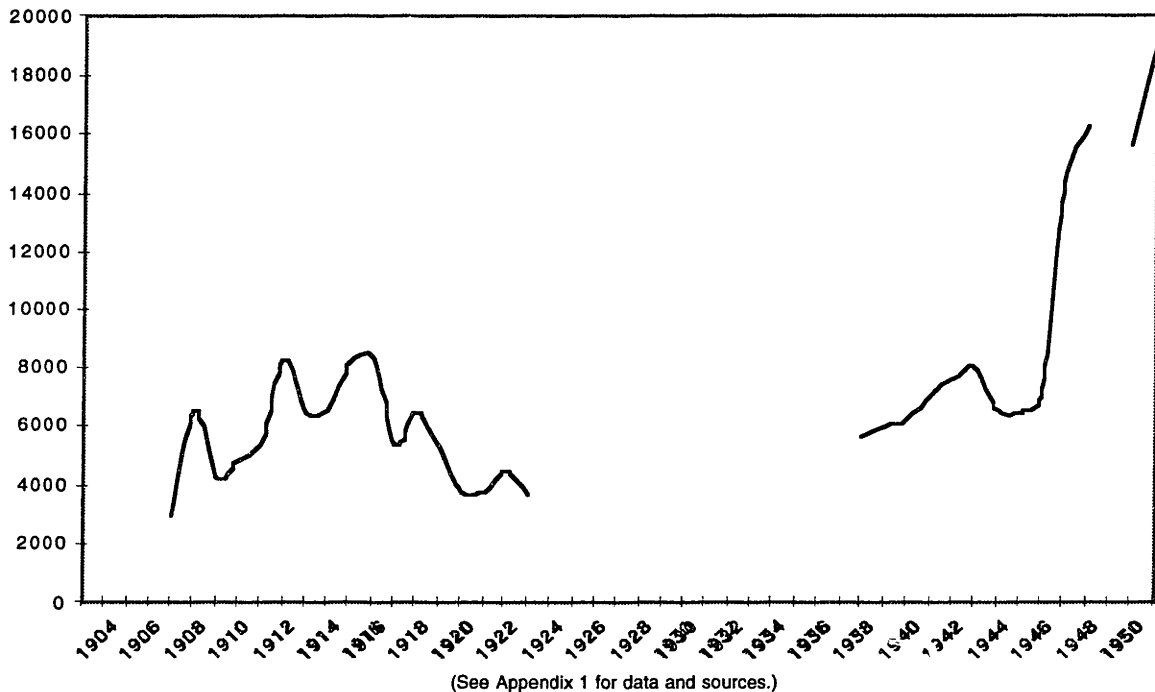


three decades.<sup>22</sup> Both the number and scale of projects expanded dramatically at mid-century. USBR funding had ups and downs in the first thirty years as the amount available for spending wavered between \$855,000 in the first year and a peak of \$25 million in 1911. Not until 1933 did funding again reach \$25 million. From that point, the money available for expenditure grew rapidly, quadrupling to a pre-war peak of \$103 million in 1942. After World War II, expansion of funds was even more dramatic. By 1950, the budget was \$358 million—over fourteen times the \$25 million limit of the first thirty years.

<sup>22</sup> Robinson, *Water for the West*, 19-20.

Like funding, mid-century personnel expansion indicated the growth of federal river work. Between 1906 and 1925, the full-time staff of the USBR—primarily engineers and clerks—rose and fell between 3000 and 8400, peaking between 1911 and 1915. When the agency resumed reporting in 1937, it had grown from 4500 employees to 5500 in

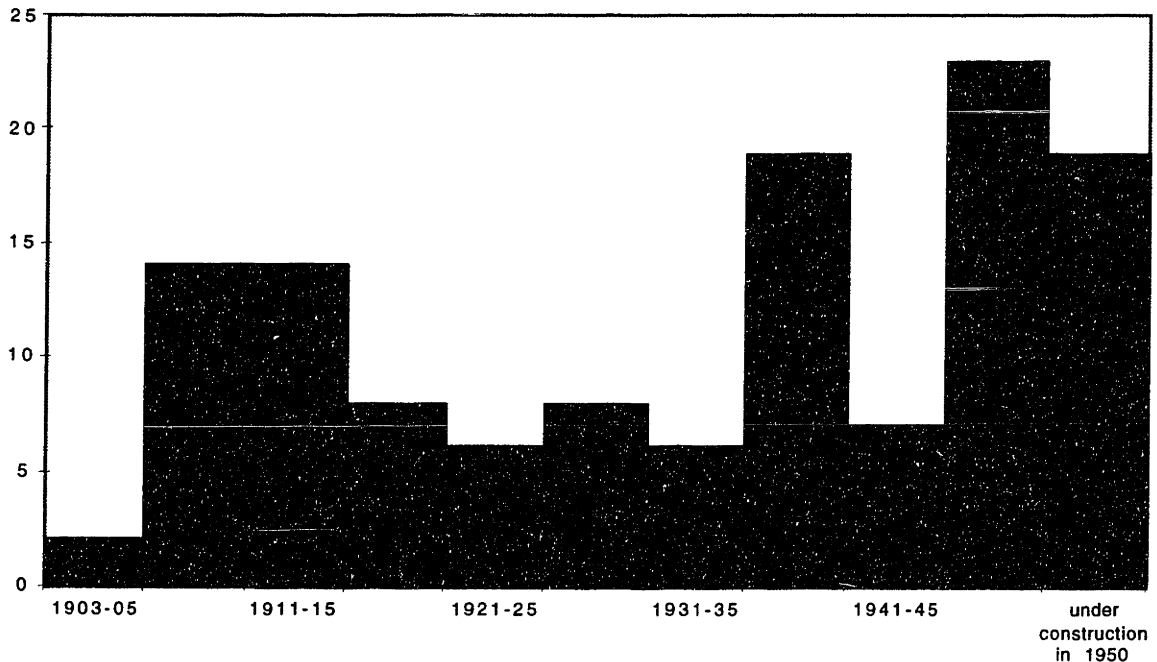
USBR full-time employees



thirteen years. Between 1937 and 1945, expansion continued as full-time workers increased from 5500 to 7000. After World War II, positions really boomed. In 1946, the USBR had 14,400 employees—more than twice number in the previous years. By 1950, the figure was 19,000. Further, the USBR hired construction firms to supply the labor for its construction projects. Counting contractors' employees more than doubled the number of USBR workers in 1950 from 19,000 to 41,000 people.

Dam building, too, escalated dramatically in the late 1930s. During the years 1915-1935, the USBR completed no more than eight dams in any five-year period. With expanded construction, the USBR completed nineteen dams between 1935 and 1940 and twenty-three between 1945 and 1950. Further, the agency had nineteen more dams under

Dams completed by USBR



(See Appendix 1 for data and sources.)

construction in 1950.

Changes to individual rivers further bore out this building spree. Beyond thirteen major dams on the Columbia River, construction on the Colorado and Tennessee Rivers was exemplary. Beginning in the 1920s, federal engineers, with help from state and local peers, built extensively on the Colorado River. Between 1928 and 1936 the USBR constructed the 726-foot Hoover Dam, which dominated the lower Colorado. Subsequently, engineers built four enormous multiple purpose dams upstream in the Colorado system—Glen Canyon, Flaming Gorge, Aspinall, and Navajo—and a plethora of smaller dams, including Parker, Davis, Imperial, Laguna, and Moreolos. Likewise, the TVA took up with gusto the work started by the Army's construction of Wilson Dam during World War I. By 1945, nine large dams controlled the main river. Today, TVA operates over fifty dams throughout the Tennessee's watershed. In total, the USBR built

408 dams by 1971.<sup>23</sup>

The growth was phenomenal. Although the federal government has never built as many dams as state, local, and private initiatives, federal dam building underwent a quantitative change, as well as a stylistic one in the mid-century. The shift to multiple purpose building accompanied expansion of the work of the Army Corps of Engineers; the creation of the TVA; funding, personnel, and project growth in the USBR; and extensive construction on many of the nation's major rivers.

***Historiographic Contexts: Western Water History, Electrical History, and the History of American Engineering***

This work on the rise of the multiple purpose style of dam building contributes to three historical literatures: Western water history, electrical history, and history of American engineering. First, I show that neither the federal government nor local interests controlled Western water development absolutely. While not equal players, dam boosters, federal engineers, and presidential administrations all had critical roles in supporting multiple purpose dam building. Second, I argue that the development of hydroelectric power drove both Western water development and federal electric power policy. Unlike earlier periods when water for irrigation and city water supplies drove water development, hydroelectric development underpinned multiple purpose dam building. Owning hydroelectric plants meant the federal government had to sustain development of electric power policy. Finally, my characterization of the USBR's engineering culture contributes to a growing body of work demonstrating the complexity and survival of a reform impulse in engineering professionalism. Federal engineers pursued an independent professional status in dam building and exercised that power in the "public interest."

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<sup>23</sup> Reisner, *Cadillac Desert*, 119-144 and 255-305; *North America: North American Geographic Features of Special Interest: Drainage System and Waterways: Colorado River: History and Economy: Economic Development* [web page] (Britannica Online, 1994-1998 [cited 4 March 1998 1998]), available from <http://www.eb.com:180/cgi-bin/g?DocF=macro/5004/65/158.html>; *Tennessee River* [web page] (Britannica Online, 1994-1998 [cited 4 March 1998 1998]), available from <http://www.eb.com:180/cgi-bin/g?DocF=micro/586/74.html>; and Warne, *Bureau of Reclamation*, 257-8.

What did water development in the American West reveal about the American federal system of government? Historians of water in the West have frequently probed the American political system. Many have found unchanging relationships between local, state, and federal players. Other historians have explained the processes that guided water development as more dynamic. I contribute to the latter group.

While agreeing that a single social dynamic dominated the development of Western water resource, historians widely disagree on who controlled that process. Donald Worster provided a “top-down” account of water development. He argued that technical and social elites controlled irrigation systems and the societies that surrounded them to the detriment of “the little guy” and nature. For the American West, an oligopoly that included federal representatives ruled. The USBR and agribusiness completely harnessed American rivers to a system that made absentee landowners wealthy while economically and environmentally impoverishing the rest of society, especially agricultural workers, he argued. Alternatively, Donald Pisani revealed a rich set of federal, state, and local irrigation advocates, initiatives, and institutions. Complexity led to fragmentation and rule by local interest. The federal voice was either lost or allied with one of the local voices. Combining federal and local, Daniel McCool argued that “iron triangles”—tripartite coalitions between federal executive agencies, congressional committees, and local interest groups—dominated water policy. Cycles of agency growth, congressional largesse, and satisfaction of interest group wishes created powerful policy engines. Everyone won.<sup>24</sup>

Norris Hundley characterized federalism and Western water history as more dynamic. Like Pisani, Hundley told complex histories of diverse participants. The federal voice, however, was not locked into a minor position in Hundley’s work. He interpreted

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<sup>24</sup> Worster, *Rivers of Empire*; Donald J. Pisani, *From the Family Farm to Agribusiness: The Irrigation Crusade in California and the West, 1850-1931* (Berkeley: University of California Press, 1984); Pisani, *To Reclaim a Divided West*; Daniel McCool, *Command of the Waters: Iron Triangles, Federal Water Development, and Indian Water* (Berkeley: University of California Press, 1987); Donald J. Pisani, “Deep and Troubled Waters: A New Field of Western History?,” *New Mexico Historical Review* 63 (October 1988): 319-322; and Norris Hundley, “Water and the West in Historical Imagination,” *Western*



long-term patterns of rise and fall of federal activism and leadership.<sup>25</sup>

Like Hundley, I show federalism to be dynamic. Sometimes local boosters led the process that produced Grand Coulee Dam. Other times administration policy or federal engineers led. USBR engineers ultimately chose the style of Grand Coulee Dam, but the project could not have succeeded without local initiative in the 1920s or administration endorsement in the 1930s.

I also differ with many Western water historians about the uses that drove water development. Most histories presented irrigation and city water supplies as the important factors driving water development. At Grand Coulee, hydroelectric power development superseded both of these. Further, federal production of hydroelectricity shaped New Deal electric power policy. Hydroelectric generation by executive agencies required a long-term commitment to developing electric power policy.

My argument that hydroelectric power development drove development of Western water resources complements and extends literature on the development of water in the American West. Nineteenth century scientists, engineers, and promoters wrote about the use of water for irrigation. For example, explorer and federal administrator John Wesley Powell argued that irrigation communities, planned around rational development of limited water resources, should develop the West. Similarly, journalist and promoter William Smythe advocated small irrigation homesteads. Early historians of the nineteenth century West continued this emphasis on agriculture. They considered aridity and responses to it the defining characteristics of the West. In 1931, Walter Prescott Webb established the motif of defining the West in terms of environment primarily through an analysis of nineteenth century development. While some historians writing more recently rejected the conceptualization of the West as a uniformly arid region, many have retained a focus on the development of water for agriculture. Donald Pisani provided rich tales of conflict over

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*Historical Quarterly* 27 (Spring 1996): 12-13, 15-16, and 27-28.

<sup>25</sup> Hundley, *Great Thirst* and Hundley, "Water and the West", 20.

water rights, water policy, and the development of irrigated agriculture up to 1930. While countering Pisani's story of diversity and conflict and analyzing the twentieth century as well as the nineteenth, Donald Worster similarly focused on irrigated agriculture by casting the West as a "hydraulic society" dominated by government irrigation experts and agribusiness elites.<sup>26</sup>

Other recent studies of water in the twentieth century West generally looked beyond irrigation. They identified expanding city water supplies as the main driving force for water development. For example, Abraham Hoffman, William Kahrl, John Walton, and Margaret Davis all wrote histories that described the interdependent growth of Los Angeles and its water system. With the construction of aqueducts to the Owens and Colorado Rivers, Los Angeles led Western communities in claiming water supplies and building waterworks. Norris Hundley described the importance of urban growth in twentieth century Californian water development more broadly.<sup>27</sup>

Hydroelectric power has not been completely ignored as a reason for the development of water. In the twentieth century, irrigation and city water supply were not completely separate from hydroelectricity. Systems often relied on electricity to pump water for these other uses. Further, a small literature identified the independent importance of hydroelectricity. Donald Jackson demonstrated a connection between hydroelectricity and John Eastwood's development of multiple arch dams in the Progressive Era. Linda Lear's analysis of policy implications of the Hoover Dam and Donald Swain's study of

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<sup>26</sup> John Wesley Powell et al., *Report on the Lands of the Arid Region of the United States*, 2d ed. (Washington, D. C.: GPO, 1879); William Ellsworth Smythe, *The Conquest of Arid America* (New York: Harper and Brothers, 1900); Walter Prescott Webb, *The Great Plains* ([Boston]: Ginn and Company, 1931); Pisani, *Family Farm*; Pisani, *To Reclaim a Divided West*; and Worster, *Rivers of Empire*. See also Lawrence B. Lee, "Water Resource History: A New Field of Historiography?," *Pacific Historical Review* 57 (November 1988): 457-8 and Hundley, "Water and the West," 5-11.

<sup>27</sup> Abraham Hoffman, *Vision or Villainy: Origins of the Owens Valley-Los Angeles Water Controversy* (College Station: Texas A&M University Press, 1981); William L. Kahrl, *Water and Power: The Conflict over Los Angeles' Water Supply in the Owens Valley* (Berkeley: University of California Press, 1982); John Walton, *Western Times and Water Wars: State, Culture, and Rebellion in California* (Berkeley: University of California Press, 1992); Margaret L. Davis, *Rivers in the Desert: William Mulholland and the Inventing of Los Angeles* (New York: Harper Collins, 1993); and Hundley, *Great*

federal conservation in the 1920s, as well as histories of the USBR by Michael Robinson and William Warne, extended this argument. They argued that selling hydroelectricity stabilized the financial structure of the USBR and led the USBR to prefer multiple purpose projects.<sup>28</sup>

I show that hydroelectric development, as much or more than irrigation or city water supply, drew support to the Grand Coulee Dam—a project of the 1920s and 1930s. Dam boosters sought cheap electricity to attract industry, as well as water for agriculture. In the 1920s, hydroelectricity differentiated design options as engineers sought to combine uses of water. In the 1930s, developing hydroelectric power, as well as water for irrigation, appealed to USBR engineers as a way to fund construction. Indeed, the new opportunity to sell hydroelectricity fundamentally changed the financial prospects of irrigation development. In the early twentieth century, the cost of building irrigation systems increased dramatically without a like increase in income from farm products. Electricity sales could fill this growing income gap. Finally, Roosevelt and his top advisors, such as Harold Ickes, saw dams as potential weapons in their fight with the electric power industry.

Although the Roosevelt administration viewed dams as potential weapons, it is unclear whether it had an organized plan of attack or even battle goals. Historians Thomas McGraw and Philip Funigiello found the making of New Deal electric power policy to be haphazard rather than programmatic. In contrast, Ronald Tobey argued that systematic policies led to mass electrification of American homes and significantly re-ordered American political life.<sup>29</sup> I identify executive agency projects, such as Grand Coulee Dam,

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*Thirst*. See also Hundley, "Water and the West," 20-22.

<sup>28</sup> Donald C. Jackson, *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* (Lawrence: University Press of Kansas, 1995); Linda J. Lear, "Boulder Dam: A Crossroads in Natural Resource Policy," *Journal of the West* 24 (October 1985): 82-94; Swain, *Federal Conservation Policy*, 87-95 and 122; Warne, *Bureau of Reclamation*, 86-103; Robinson, *Water for the West*, 27-8 and 53-7; Lee, "Water Resource History," 465, and Hundley, "Water and the West," 13.

<sup>29</sup> Thomas K. McCraw, *TVA and the Power Fight, 1933-1939* (Philadelphia: J. B. Lippincott Company, 1971); Philip J. Funigiello, *Toward a National Power Policy: the New Deal and the Electric*

as a source of stabilization in a sea of policy initiatives. Agency officials changed less often than the upper government, and ongoing management of a project required sustained attention to policy.

In the early twentieth century, electric power development was a dynamic social phenomenon. Engineers and industry managers expanded Thomas Edison's neighborhood central power stations to citywide interconnected systems between 1890 and World War I. During the 1920s, financiers took over leadership of the electrical industry and expanded urban utilities into regional ones. Further, they combined these into a small number of national holding companies. Extensive Federal Trade Commission investigation of the industry, which began in 1928, and the spectacular collapse of Samuel Insull's Middle West Utilities in 1932 made the electric power industry a prime public symbol of the evils of run-away monopoly capitalism. At the same time, the potentials of electric power development inspired dreams of new utopian societies. Planner and social critic Lewis Mumford, for example, hoped electrification, light metals, and other new technologies would usher in a new and liberating industrial era. Mumford thought these technologies would facilitate modernization without the evils of city living by allowing small communities both to produce and use modern conveniences.<sup>30</sup>

The first government activities in the area of electricity sparked a fierce competition between corporations and all levels of government over rights to develop electricity. By the 1920s, politicians held a spectrum of opinions on the appropriate relationship between the

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*Utility Industry, 1933-1941* (Pittsburgh: University of Pittsburgh Press, 1973); and Ronald C. Tobey, *Technology as Freedom: The New Deal and the Electrical Modernization of the American Home* (Berkeley: University of California Press, 1996).

<sup>30</sup> An expansive history of electrification which focuses on technology and business development is Hughes, *Networks of Power*. Funigiello discusses the Federal Trade Commission investigations in Funigiello, *National Power Policy*, 3-31. Thomas Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm* (New York: Penguin Books, 1989), 226-243 provides a concise discussion of Samuel Insull's career and Middle West Utilities. On electrical utopians see: Wesley Arden Dick, "Visions of Abundance: The Public Power Crusade in the Pacific Northwest in the Era of J. D. Ross and the New Deal" (Ph. D. diss., University of Washington, 1973), 5-36. Lewis Mumford develops his theory of industrial eras in: Lewis Mumford, *Technics and Civilization* (New York: Harcourt, Brace and Company, 1934).

federal government and the electrical industry. On one extreme, Senator George Norris from Nebraska advocated government ownership of the electrical industry. On the other, pro-business Republicans, such as Presidents Coolidge and Hoover, sought minimal government regulation. People in between favored strong regulation, public planning without public ownership, or partial government ownership.<sup>31</sup>

During the 1930s, the Roosevelt administration walked a middle road in electric power policy, by combining ownership and regulation. Franklin Roosevelt and his advisors set out to moderate the excesses of the electrical industry and extend electric service to all American households. With the Holding Company Act of 1935, Roosevelt instituted regulation to curb utilities. Rural electrification and housing programs extended electrification to neglected parts of the American public. Federal hydroelectric dams served both goals. As exemplars of good practice, they encouraged industry reform. As a source of electricity controlled by the government, they directly helped extend electric service.<sup>32</sup>

Scholars of New Deal electric power policy Philip Funigiello and Thomas McGraw found that expediency, more than planning or a clear vision, shaped this moderate policy. Divisions among Roosevelt administration officials hindered formation of anything bolder. For example, TVA Directors David Lilienthal and Arthur Morgan fundamentally disagreed about the merits of working with private electric utilities. This difference of opinion complicated TVA policymaking.<sup>33</sup>

In sharp contrast, Ronald Tobey argued that Roosevelt had clear goals for changing

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<sup>31</sup> Tobey, drawing on Martin Sklar's analysis of progressive responses to trusts, outlines a three part spectrum of political positions in Tobey, *Technology as Freedom*, 55-57. Thomas McCraw introduces a similar spectrum by dividing power development traditions between private and public and then further dividing the public tradition into regulatory and ownership. McCraw further identifies the "yardstick" approach of partial public ownership as middle ground between simple regulation and a state owned industry. McCraw, *TVA and the Power Fight*, 1-25. On George Norris see: Richard Lowitt, *George W. Norris: The Making of a Progressive, 1861-1912* (Syracuse: Syracuse University Press, 1963); Richard Lowitt, *George W. Norris: The Persistence of a Progressive, 1913-1933* (Urbana: University of Illinois Press, 1971); and Richard Lowitt, *George W. Norris: The Triumph of a Progressive, 1933-1944* (Urbana: University of Illinois Press, 1978).

<sup>32</sup> The best overview of New Deal electric power policy is Funigiello, *National Power Policy*.

<sup>33</sup> McCraw, *TVA and the Power Fight*, 47-66 and 155-159.

the electric industry and that New Deal policy was a powerful force in the electrification of American homes. Tobey showed that during the 1930s the majority of homes in Riverside, California, underwent “electrical modernization”—installation of large appliances and the wiring capable of supporting them. New Deal programs played an important role in this revolution. They promoted home owning, lowered electric rates, and provided credit for both homes and appliances.<sup>34</sup>

Through the history of Grand Coulee Dam, I offer a middle ground interpretation of New Deal electric power policy. While administration policy shifted and had ad hoc qualities, large projects, such as Grand Coulee Dam, provided a thread of stability. Engineers and politicians planned and constructed Grand Coulee Dam over a twenty-five year period. During that time, administrations came and went, interest in the project peaked and waned, and aspirations for the project shifted. In this context, dams encouraged stability in two ways. First, the agencies that built dams changed much less than the highest levels of the federal government. Once USBR engineers decided that a multiple purpose dam would be the best way to develop the Columbia Basin, they stuck to this view. Second, after an agency began a project, the agency had an interest in seeing the dam succeed. Thus, once started, dams motivated federal engineers to sustain administration attention to electric power policy.

The history of American engineering provides the final historiographic context for this dissertation. Since the early 1970s, Edwin Layton and David Noble have defined this field. They established a framework for understanding engineering professionalism in terms of the relationships between science, business, and engineering. Several strains of scholarship have since revised this framework—rejecting both Layton and Noble’s characterizations of the relationships between science, business, and engineering and their approaches to analyzing professionalism. My work extends this revisionary literature.

Noble and Layton agreed that turn of the century engineering had great potential to

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<sup>34</sup> Tobey, *Technology as Freedom*.

act as a positive social force. The adoption of scientific research methods created an opportunity for engineers to change society for the better. However, by the 1920s, American engineers had lost their potentially revolutionary voice. Engineers stood firmly allied with business. Layton and Noble disagreed about how this linkage and loss happened. Noble argued that science-based engineering and corporate capitalism arose together in the late nineteenth century and were mutually reinforcing. Corporations relied on the patents and new products produced by science-based engineering to achieve and maintain market positions. At the same time, engineers relied on corporations for employment. Further, engineers and businessmen both embraced standardization, patent system reform, engineering education reform, development of new management practices, and expansion of science-based research. These common interests drew engineering and business together. Alternatively, Layton argued that engineers were caught between scientific professionalism and business. The former fostered a public service ethic while the latter demanded firm loyalty. After brief experimentation with independent professionalism, American engineers fell in with business in the 1920s.<sup>35</sup>

Countering Noble and Layton, many scholars have interpreted the relationship between engineering professionalism and business as interactive. Business and engineering did not rise together nor did business simply absorb engineering. Rather, both business and engineering changed as research and technology became a critical part of the former. Bernard Carlson demonstrated this dynamic interaction in the creation of the MIT-GE Cooperative Engineering Course. MIT electrical engineer Dugald Jackson wanted his students to play management and leadership roles in technical corporations. GE officials needed large numbers of technicians to inspect company products. The degree program that Jackson and GE created combined these goals. MIT provided GE with numerous able

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<sup>35</sup> Edwin T. Layton, *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Cleveland: The Press of Case Western Reserve University, 1971) and David F. Noble, *America By Design: Science, Technology and the Rise of Corporate Capitalism* (Oxford: Oxford University Press, 1977).

students and corporate experience helped MIT graduates become leaders of technical businesses. Similarly, John Servos found MIT chemical engineers to be active in creating a contract research program that met goals of both engineers and business. Clarke Spence showed the interplay between professionalism and business in the work of mining engineers in the American West. Studies of early industrial research laboratories, such as Leonard Reich's work on GE and AT&T, supported this interpretation. Reich demonstrated that both research and firms changed with the creation of these new laboratories. Ronald Kline illustrated the complexity of the interactions between engineering, business, and science in education, research, and other aspects of the career of electrical engineer Charles Steinmetz. Peter Meiskins took the revision further. He argued that science-based professionalism drove only a small part of Progressive Era engineering activism. Rather, "rank and file" engineers sought "bread and butter" concessions from their corporate employers. Only an elite group of engineering leaders sought professional independence, he suggested.<sup>36</sup>

Several studies also challenged Layton's conclusion that engineering activism declined in the 1920s. According to Layton, efforts to consider broad public goods, such as safety, in addition to capitalist goals, such as cost, characterized reform professionalism. These "public interest" activities, however, declined in the 1920s. In contrast, Bruce Seely argued that engineers in the Bureau of Public Roads influenced highway policy most directly between 1921 and 1936. After a period of adjustment, the public role of this professional group continued into the 1950s. These engineers used scientific expertise and

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<sup>36</sup> W. Bernard Carlson, "Academic Entrepreneurship and Engineering Education: Dugald C. Jackson and the MIT-GE Cooperative Engineering Course, 1907-1932," *Technology and Culture* 29 (July 1988): 536-567; John W. Servos, "The Industrial Relations of Science: Chemical Engineering at MIT, 1900-1930," *ISIS* 71 (December 1980): 531-549; Clark C. Spence, *Mining Engineers and the American West: The Lace-Boot Brigade, 1849-1933* (New Haven: Yale University Press, 1970); Leonard S. Reich, *The Making of American Industrial Research: Science and Business at GE and Bell, 1876-1926* (Cambridge: Cambridge University Press, 1985); Ronald R. Kline, *Steinmetz: Engineer and Socialist* (Baltimore: Johns Hopkins University Press, 1992); and Peter Meiskins, "The "Revolt of the Engineers" Reconsidered," in *The Engineer in America: A Historical Anthology from Technology and Culture*, ed. Terry S. Reynolds (Chicago: University of Chicago Press, 1991), 399-426.



their positions as experts to sway policy. Similarly, Charles Steinmetz undertook a broad range of social improvement activities until his sudden death in 1923. He participated in socialist organizations, ran for State Engineer, and promoted Soviet electrification.<sup>37</sup>

Important studies provided alternative approaches to understanding professionalism too. Layton used a classical sociological approach to analyze professionalism. He structured his analysis around the idea that possessing expert knowledge gave engineers special responsibilities and special powers. Autonomy, peer review, social responsibility and status figured prominently in this analysis of professionalism. Alternately, scholars such as Bruno Latour have argued that the work of scientists and engineers simultaneously created scientific knowledge and social order. Latour encapsulated this argument in a discussion of Charles Lyell. Lyell and his peers made both geological knowledge—ideas about the age of the earth and rock formations—and the social institutions of the discipline of geology—university departments, professional societies, journals, etc. Further, Lyell and his colleagues became an “obligatory passage point” for other social groups. To do geology, one had to interact with Lyell and the institutions surrounding him. Starting from a Latourian perspective, then, studying professionalism is not about examining the norms and values of groups with control over specialized bodies of knowledge. Instead, scholars study the activities of groups and individuals that create and sustain knowledge and social systems.<sup>38</sup>

My history of Grand Coulee Dam contributes to these revisions of Layton and Noble’s interpretations of the relationship between science, business, and engineering. I too find the relationships between engineers and their employers to be dynamic. USBR

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<sup>37</sup> Bruce Edsall Seely, *Building the American Highway System: Engineers as Policy Makers, Technology and Urban Growth* (Philadelphia: Temple University Press, 1987) and Kline, *Steinmetz*, 244-264.

<sup>38</sup> Layton, *Revolt of the Engineers*, 1-24 and Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge: Harvard University Press, 1987), 146-153. For a provocative use of a similar approach by a historian see: Amy Elisabeth, “Origins of a Modern Form: The Reinforced-Concrete Factory Building in America, 1900-1930” (Ph. D. diss., University of Pennsylvania, 1995).

engineers worked for the federal government and, indirectly, local communities rather than a business. I find many instances of give and take between engineers, federal officials, and local project advocates and propose that the skills required to maintain these complex relationships were an important part of the expansion of multiple purpose dam building. Like Bruce Seely, I argue that federal engineers with Progressive pedigrees actively participated in policy processes into and after the 1920s. Engineers of the Army Corps and the USBR played essential roles in making multiple purpose dam building the dominant mid-century style of water resource development. In particular, the ways engineers related dam design to conservation and their financial situation made them insist on multiple purpose dams. Finally, I make these arguments more in Latour's style than Layton's. I interpret the creation of expert knowledge as part of professionalization and study professionalism in the work of engineers.

In all, I aim to contribute to three historical dialogues with this dissertation. My characterization of Grand Coulee's boosters and USBR engineers shows the Progressive roots of the multiple purpose style of dam building and challenges the idea that engineering reform utterly failed. The centrality of hydroelectric power in the role of conservation and the government's system of financing dams in the rise of multiple purpose dam building illustrates its importance in Western water history and federal electric power policy. My explication of the dynamic relationships between engineers, local boosters, upper-administration officials, and contractors contributes to revisionary literatures on Western water history and the history of engineering.

### ***Grand Coulee Dam***

In this dissertation, I present an account of how engineers chose to build Grand Coulee Dam as a multiple purpose dam to posit an explanation for the rise of this style of dam building. Located on the Columbia River in central Washington State, Grand Coulee Dam was one of the major projects planned in the 1920s and built during the Depression—a project on the leading edge of major federal involvement in river

development. Local advocates of water development, federal engineers, and the New Deal administration of Franklin Roosevelt all worked for a water-development project in central Washington at critical points. Support of all three groups and the development of dynamic relationships between them underpinned multiple purpose building. Two important periods of conflict preceded the construction of a multiple purpose dam at the Grand Coulee site. These two episodes reveal important ways these groups thought about resource development. These assessments became givens that further solidified multiple purpose dam building. (See Appendix 2 for a picture of Grand Coulee Dam.)

The idea for Grand Coulee Dam started in dreams encouraged by the relationships between water, land, and people in Washington State. The relationships between people and water varied greatly. Like the rest of the West, Washington State had dramatic local climates. Paralleling the coast, the Cascade Mountains dominated the climate of western and central Washington. Fronts dropped their moisture on the western slope as they rose to cross the mountains. Coastal areas got so much rain that some parts were temperate rain forests. In contrast, the Cascades' rain shadow made central Washington a land of sagebrush and tumbleweed. Still further east lay a semiarid region where people grew wheat using moisture conservation methods, rather than irrigation. Although much of the state was short of water from precipitation, an abundance of water ran through central Washington in the Columbia River. The fourth largest river in the United States by volume, the Columbia rushed through a canyon far below the plains.<sup>39</sup> (See Appendix 2 "Hail Columbia Country" for a map.)

Boosters thought the Columbia Basin or "Big Bend country" had all the resources for transformation by technology and the federal government. A bend in the Columbia River enclosed this arid region of central Washington on three sides. A large glacial ravine called the Grand Coulee and over a million acres of potential farmland lay in the Columbia

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<sup>39</sup> *First Annual Report of the Commissioner of Reclamation Service* (Washington, D. C.: GPO, 1902), 20 and Reisner, *Cadillac Desert*, 155.

Basin. The Grand Coulee ran almostly north-south and connected the north most point of the large bend in the river with the lands. Engineers would find that the Columbia River could support a dam at the head of the Grand Coulee.

Near this potential hinterland stood a city with ambition. Roughly 100 miles southwest of Spokane, the prospective irrigation project was clearly within the city's domain. Spokane leaders dreamed of an "Inland Empire" reaching from southern British Columbia to Oregon's Blue Mountains and from the Cascade Mountains in Western Washington to the Rocky Mountains in Montana. Geographer Donald Meinig estimated the region actually dominated by Spokane was more modest—marked by the Canadian boarder on the north, the Bitterroot Mountains in Montana on the east, the Snake River on the south, and the north-south stretch of the Columbia on the west.<sup>40</sup>

Spokane, however, faced competition for influence over the Columbia Basin and its prospective development project. *Wenatchee Daily World* editor Rufus Woods preferred to interpret the much smaller Wenatchee as the center for Chelan, Okanogan, Douglas, and Grant counties. He named the region "North Central Washington" in an attempt to distinguish it from areas dominated by Spokane to the east and Yakima to the west.<sup>41</sup>

Early twentieth century growth patterns of both these eastern Washington cities put the citizens in a position to look to a large irrigated agriculture development as a new industry for the region. When men from Washington began pushing for an irrigation project for the Columbia Basin just after World War I, Spokane was facing a mid-life crisis. Officials of the Northern Pacific Railroad, the earliest northern transcontinental, platted Spokane in 1878. Mining, especially, brought the town dynamic growth up until 1910. From a few mills at the falls on the Spokane River, the city grew to be the largest west of Minneapolis and north of Salt Lake City. It joined Portland, Oregon, and Seattle,

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<sup>40</sup> Donald W. Meinig, "Spokane and the Inland Empire: Historical Geographic Systems and a Sense of Place," in *Spokane and the Inland Empire: An Interior Pacific Northwest Anthology*, ed. David H. Stratton (Pullman: Washington State University Press, 1991), 14.

<sup>41</sup> Robert E. Ficken, *Rufus Woods, the Columbia River, and the Building of Modern Washington*

Washington, as the major urban centers in the Pacific Northwest. However, by 1910, the city had expanded beyond the limits of its extractive economy and its growth stagnated. By the end of the 1910s, city leaders were searching for new sources of growth for the regional economy. Wenatchee, too, was a railroad and river town. Founded in 1888 where the Wenatchee River flowed into the Columbia, first the Seattle, Lakeshore, and Eastern railroad and later the Great Northern Railway passed through town. Wenatchee stayed small until the establishment of a very successful irrigated-apple industry in the Wenatchee River Valley in the first decade of the century. City leaders, especially Woods, thought diversification would benefit the region.<sup>42</sup>

In 1917, two men proposed gigantic irrigation developments for the Columbia Basin. While European settlers had imagined and studied irrigating the Columbia Basin since they first saw it, people remembered the proposals of state official Elbert F. Blaine and Ephrata's Billy Clapp. The year 1917 served as the beginning point for the continuous advocacy and study that preceded the construction of Grand Coulee Dam.<sup>43</sup> Between 1919 and 1922, the Washington State funded a series of studies on irrigating the Columbia Basin and endorsed the idea. In 1923, Washington senators obtained funds for a series of federal studies. Following these in the late 1920s, Washington officials began negotiations with the other states in the Columbia River's watershed over distribution of the water and sought congressional authorization for an irrigation project. (Congress had to authorize water projects before it could appropriate funds for them.) Events in the early 1930s derailed both these efforts. In a 1931 report "on the Columbia River above the mouth of the Snake River," Army Corps of Engineers Major John Butler recommended a project that would not require an interstate compact establishing water rights to the Columbia.<sup>44</sup> In 1933, newly inaugurated President Franklin Roosevelt made a dam for the Grand Coulee site part of his

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(Pullman: Washington State University Press, 1995), 22-23.

<sup>42</sup> Meinig, "Spokane and the Inland Empire," 13-21 and Ficken, *Rufus Woods*, 10-12.

<sup>43</sup> Paul C. Pitzer, *Grand Coulee: Harnessing A Dream* (Pullman: Washington State University Press, 1994), 9-18.

relief program and sidestepped congressional approval.<sup>45</sup>

Throughout the 1920s, state officials and Spokane men controlled Washington State activities. However, Rufus Woods and a group of lawyers and businessmen from the small Basin town of Ephrata sought a voice in the proceedings. During this period, the interaction of these three groups dominated the local politics surrounding irrigating the Columbia Basin and gave the dialogue a contentious edge. In Chapter Two, I examine these three groups of Washington State supporters of a development project for the Columbia River and Columbia Basin and the reasons for their support.

Drawn into a discussion about irrigating the Columbia Basin by Washington State boosters, USBR engineers maintained a wary stance toward the prospective project throughout the 1920s. A homogeneous group of engineers steeped in Progressive engineering reform traditions, the USRS leaders had faced continuous social and financial problems with their projects during the agency's second decade. Struggles with settlers and agricultural development throughout the West, as well as the fractious Washington state politics, disposed USBR leaders to shy away from the vast proposal from Washington. Strong professional traditions, however, meant that engineers of the USBR also continually worked to assess the project and guide its development on their own terms. In Chapter Three, I examine the USBR engineers and their stance toward Grand Coulee Dam and irrigating the Columbia Basin.

The history of the planning of Grand Coulee Dam during the 1920s has been told as a battle between two groups of local supporters over how to irrigate the Columbia Basin.<sup>46</sup> I recast this history by introducing federal engineers and Washington State officials as

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<sup>44</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*.

<sup>45</sup> Pitzer, *Grand Coulee* is the only full length history of Grand Coulee Dam. George Sundborg, *Hail Columbia: The Thirty-Year Struggle for Grand Coulee Dam* (New York: The Macmillan Company, 1954) is a biography of dam booster James O'Sullivan. Ficken, *Rufus Woods* is a biography of the central Washington newspaper editor who also promoted development of the Columbia Basin.

<sup>46</sup> See, for example, Bruce C. Harding, "Water from Pend Oreille: The Gravity Plan for Irrigating the Columbia Basin," *Pacific Northwest Quarterly* 45 (April 1954): 52-60; Sundborg, *Hail Columbia*; Earl Clark, "Rufus Woods: Grand Coulee Promoter," *Montana: the Magazine of Western History* 24 (October

separate and important players in determining how to develop the water resources in central Washington. During the 1920s, these groups debated two technologies for developing the Columbia River and Basin. The “gravity plan” would bring water to irrigate the Columbia Basin overland from the Pend Oreille River, a tributary to the Columbia, through an unprecedented series of tunnels and canals. This plan was outlined by Washington State engineers in 1920 and advocated by Spokane businessmen and Washington State officials.<sup>47</sup> Alternatively, water could be pumped out of the Columbia’s gorge closer to the Columbia Basin lands. The “pumping plan” entailed damming the Columbia near the north end of the Grand Coulee, pumping water from the reservoir behind the dam to an artificial lake in the Grand Coulee, and bringing water to basin lands in a short canal from the south end of the new lake. Electricity would be required to pump water from the Columbia River to the Grand Coulee. Engineers proposed to generate hydroelectricity at the Columbia River Dam for the pumping.<sup>48</sup> During the 1920s, selling all hydroelectricity that the river could produce beyond that needed for pumping became an integral part of this approach. Wenatchee and Ephrata men championed the idea of a dam. However, federal engineers, guided by the conservation idea of “comprehensive planning,” developed the detailed plan for this alternative. In using comprehensive planning in studies of the Columbia River and Basin, engineers also contributed to the transformation of comprehensive planning from an idea into a professional practice. As this happened, federal engineers additionally used it to stake out a place in the contested planning process. The perspective of comprehensive planning, from which engineers viewed combining irrigation and hydroelectric power production as preferable to simply irrigating, also increased the significance of hydroelectricity in plans for the Columbia River. I examine the selection of a dam, rather

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1979): 38-50; Pitzer, *Grand Coulee*; and Ficken, *Rufus Woods*.

<sup>47</sup> Columbia Basin Survey Commission, *The Columbia Basin Irrigation Project* (Olympia: Frank M. Lamborn Public Printer, 1920).

<sup>48</sup> The state reports briefly discussed pumping plans but the first detailed analysis published was Senate Committee on Irrigation and Reclamation, *Columbia Basin Project: Report of Special Commission, August 25, 1925*; Board of Engineers' Report, February, 1925; Board of Engineers' Report, April 6, 1924;

than a canal system, for irrigating the Columbia Basin and the importance of federal engineers and “comprehensive planning” in that decision in Chapter Four.

Although federal engineers lay to rest the “gravity plan” versus “pumping plan” controversy in 1932, new turmoil in plans for development of the Columbia River and Basin blossomed in 1933. President Roosevelt approved the construction of a Grand Coulee Dam but not the one on which local boosters and federal engineers had agreed. Roosevelt would spend only \$62 million for a Washington State dam. USBR engineers designed a 250-foot “low dam,” which could be expanded into the 450-foot “high dam” of the previous year. Between 1933 and 1937, USBR engineers significantly changed Grand Coulee Dam’s design three more times. The last of these changes reestablished the 1931 plan for a hydroelectric power and irrigation project based on a high dam. Engineers’ concerns over the financial stability of the dam drove this series of design changes. Along with the conservation idea of comprehensive planning, these fiscal concerns became important ways of thinking about dams that stabilized the multiple purpose style of dam design. The centrality of financial concerns, like comprehensive planning, increased the importance of hydroelectric power in project plans because engineers believed income from electricity, not irrigation, would repay government loans. In Chapter Five, I examine the high dam versus low dam decisions of the 1930s and the role of cost concerns of USBR engineers in the reestablishment of a multiple purpose design for Grand Coulee Dam.

In the 1930s, the federal administration of Franklin Roosevelt became the third important group to support a dam at the Grand Coulee site and multiple purpose dam building, generally. The President and his advisors saw multiple purpose dams as valuable parts of relief, electric power, and conservation policy. The relative importance of these three rationales for building dams shifted over the decade but administration commitment to Grand Coulee remained. I discuss the relationship between Grand Coulee Dam and Franklin Roosevelt’s New Deal in Chapter Six.



In Chapter Seven, I argue that the interactions between local supporters, government leaders, contractors, and government engineers shaped the dam and educated a generation of federal engineers in managing the planning and construction of public works. Real give and take between these groups gave engineers central roles in the dam-building process without absolute control over it. With all these groups, engineers at times led, at times followed, and at times cooperated. As USBR engineers applied these management skills in the West and the Army Corps and TVA went through similar processes nationally, federal engineers spread federal multiple purpose dam building throughout the nation, and the strength of government engineers as independent professionals grew.

In framing the history of Grand Coulee Dam around the question of how multiple purpose dam building became the dominant style of a mid-century building boom, I have chosen to leave out many other important aspects of the history of Grand Coulee Dam. I do not discuss destruction of salmon runs, flooding of the lands of native peoples, or other environmental and social disasters. The decision-makers I studied did not consider these issues. The USBR did sponsor a program of hatcheries and transplantation to address the closing of the upper Columbia watershed to salmon. However, it hired outside experts to conduct this work after the design of Grand Coulee had been selected. Likewise, neither politicians nor engineers invited native peoples to participate in the processes of deciding how to use the Columbia River. Further, the people in the process did not consider the effect of their decisions on native peoples.<sup>49</sup> We can justly lament these failures.

Similarly, women and construction workers barely appear in this history. Again, this unfortunate aspect is because of the historical events that I have chosen to study. The USBR did employ women, but primarily as clerical workers. As clerks, women did not participate in design decisions. The one exception to this generalization was Mae Schnurr. She worked closely with Elwood Mead in the USBR's Commissioner's office in the 1920s

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<sup>49</sup> For a brief discussion of these topics see: Pitzer, *Grand Coulee*, 219-230.

and 1930s and at times served as acting commissioner during his absence. She, however, appears tangentially in the history of Grand Coulee Dam. In addition, few women worked in the areas from which the dam boosters and federal officials came—politics, law, and business. None figured as active advocates for the dam from Washington State or within the federal administration.<sup>50</sup> Likewise, workers did not participate in designing dams. The USBR had an extremely stratified system for dam building. USBR engineers did the design and research work, and contractors—construction firms of all sizes—built the dam. Virtually all laborers worked for the contractors, rather than the USBR. Many levels of hierarchy separated the senior USBR engineers responsible for dam design from the workers who built the dam.<sup>51</sup>

My omission of questions concerning Grand Coulee Dam as a spectacle has a similar root. Grand Coulee most certainly was a spectacle. Like other large projects, it undoubtedly functioned as a morale booster.<sup>52</sup> However, again, this aspect of dam building did not figure in the debates over how to develop the Columbia River and Basin.

Overall, I offer this account of the history of Grand Coulee Dam with the hope of creating a better understanding of multiple purpose dams and one group of federal engineers. How did this technology become pervasive in the American landscape? Who made it so? How important were engineers and their professional culture in changing America's rivers?

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<sup>50</sup> Pitzer, *Grand Coulee*, 111-112, 179-180, and 200 discusses women's employment on the Grand Coulee project.

<sup>51</sup> For a brief description of the labor force see: Pitzer, *Grand Coulee*, 110-113.

<sup>52</sup> Reisner, *Cadillac Desert*, 159-161 briefly discusses the symbolic importance of Grand Coulee Dam. There is a small historical literature on dams as symbol and spectacle. See, for example, Walter L. Creese, *TVA's Public Planning: The Vision, the Reality* (Knoxville: University of Tennessee Press, 1990) and Richard Guy Wilson, "Machine-Age Iconography in the American West: The Design of Hoover Dam," in *Dams*, ed. Donald Jackson, 305-355 (Brookfield, VT: Ashgate, 1997).

## Chapter 2—Washington State Boosters: Irrigation, Hydroelectricity, and Development

For James O'Sullivan, Grand Coulee Dam was a cause. The lawyer from Ephrata traveled between the small towns of the Columbia Basin drumming up support for damming the Columbia River, irrigating the Columbia Basin, and producing hydroelectricity. He read up on dams and irrigation. He wrote copiously in support of a dam for the *Wenatchee Daily World* and any other interested periodicals. He corresponded regularly with numerous politicians and engineers. When the time came, O'Sullivan traveled to Washington, D.C. to lobby and testify before Congress. Briefly, he held state office coordinating work for the dam.<sup>1</sup>

While no one matched O'Sullivan in devotion, between 1917 and 1937, a variety of Washingtonians worked for development of the Columbia Basin and the Columbia River. As late as preparation for construction in 1934, these boosters differed over how their land and water resources should be developed. They had in common aspirations for development and local examples of industrial agriculture and hydroelectricity.

Three distinct groups promoted various approaches to developing the Columbia River and Basin. Small town professionals from the Columbia Basin backed “pumping plans”—combination irrigation and public electric power developments supplied by damming the Columbia at the head of the Grand Coulee. In contrast, businessmen from Spokane preferred the “gravity plan.” This development approach would have diverted water from a tributary to the Columbia River only for irrigating the Columbia Basin. Less devoted to a particular approach as a group, state officials—both Washington representatives in the U.S. Congress and state office holders—were still important advocates of development.

In the 1920s and early 1930s, Washingtonians' advocacy of a development project for the Columbia River and Basin reflected both their economic achievements and limits of

the previous fifty years. Eastern Washington blossomed between 1860 and 1910. A vibrant agricultural sector developed and irrigation farmers had their first successes. However, like farmers nationwide, many faced a post-war agricultural depression and drought in the 1920s. Hydroelectricity was also an important but volatile business in Washington. While businessmen built strong private electric utilities, city governments developed one of the largest public electric power organizations in the country. But, public and private electric utilities fought and their contention increased in the 1920s.

### ***Washington State: Regional Development, Agriculture, and Electric Systems***

Spokane's pattern of development exemplified many patterns of regional growth that set the stage for proposals to develop the Columbia River and Basin. The earliest white development near present day Spokane, however, was transitory and had no particular significance for the later construction of Grand Coulee Dam. In the 1810s and 1820s, Spokane House—the first European-American community in the area—served as a base for Canadian fur traders. Located on the Columbia's tributary the Spokane River, this trade center likely had farms, mills, and artisans. The traders, however, moved to another location and their settlement faded away. The area remained a region of fur traders and missionaries through the 1840s. Between 1847 and 1858, Yakima, Cayuse, other native peoples, and white Americans fought for control of Eastern Washington. These battles ended with the establishment of a reservation system and expanded white settlement.<sup>2</sup>

Between 1870 and 1910, railroads and mining brought people to Spokane and made it a dynamic city looking for additional development opportunities. By 1873, settlers had built a few mills at the falls on the Spokane River. In 1883, the Northern Pacific Railroad gave Spokane its first transcontinental line. The Oregon Railway and Navigation Company, which connected to the Union Pacific, followed in 1884 and the Great Northern

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<sup>1</sup> Sundborg, *Hail Columbia*.

<sup>2</sup> Meinig, "Spokane and the Inland Empire," 5-9.

in 1892. The Chicago, Milwaukee, Saint Paul, and Pacific completed Spokane's complement of four transcontinental railroads in 1909. The rails brought national capital, manufactured goods, and immigrants into the region and moved its products out. Discovery of silver near Coeur d'Alene, Colville, and Kootenay in the same year that the Northern Pacific was completed further sparked Spokane's growth. In 1880, Spokane was a town with 350 inhabitants. By 1890, this number had grown to 20,000. The population doubled to 40,000 in the next decade and, with 104,000 inhabitants in 1910, Spokane joined Portland, Oregon and the Seattle/Tacoma area of Puget Sound as a major urban area in the Pacific Northwest.<sup>3</sup>

Eastern Washington rapidly developed agriculture to complement mining, and farming experiences made irrigating the Columbia Basin appear attractive. Like many parts of the West, the area around Spokane developed grazing, dry farming, and irrigated agriculture. The McGregor family business exemplified one pattern of farming in Eastern Washington. A pair of McGregor brothers immigrated to eastern Washington in the early 1880s. They started in agriculture as hired shepherds for free range flocks. After a few years, they bought their own flocks. Like many sheep ranchers, in the 1880s and 1890s they made additional investments and shifted to grazing on enclosed land. In the 1910s, the brothers diversified their business and began farming wheat. Eastern Washington, and especially the Palouse region in the southeast corner of the state, was a vibrant wheat-producing region. Farmers had been growing wheat since the 1860s and exporting it to Europe since the 1870s. To grow their wheat, the McGregor brothers used a technique much promoted in the early decades of this century—dry farming. To make the most of the moisture available, farmers tilled the top layer of soil repeatedly—as many as ten times a year. The resulting "dust mulch" soaked up water.<sup>4</sup>

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<sup>3</sup> Meinig, "Spokane and the Inland Empire," 13-19.

<sup>4</sup> Alexander C. McGregor, "From Sheep Range to Agribusiness: A Case History of Agricultural Transformation on the Columbia Plateau," in *Experiences in a Promised Land: Essays in Pacific Northwest History*, ed. G. Thomas Edwards and Carlos A. Schwantes (Seattle: University of Washington Press, 1986),

Early efforts at irrigation in Washington could not have inspired additional development. By the 1920s, however, federal irrigation efforts in Washington suggested such ventures could succeed. Like wheat farming, irrigated agriculture in the Pacific Northwest dates to the 1860s. Before 1900, irrigation in Washington was a minor and precarious business compared to irrigation in the neighboring states of Oregon and Idaho. In 1900, Oregon had 387,095 acres irrigated by small individually owned diversions. Idaho had watered 608,718 acres, many in state projects. Washington had comparatively modest irrigation development—135,470 acres in 1900—and corporations controlled much of that acreage. Unfortunately, corporate irrigation developments frequently failed, and those in Washington were no exception. For example, the Yakima Canal Company and the Northern Pacific Railroad wasted money by investing a million dollars in seven reservoirs and three canals to water only 64,000 acres. The federal government, however, turned this venture around. The U.S. Reclamation Service (USRS)<sup>5</sup> took it over in 1902 as one of its initial projects. The USRS expanded the project and by 1944 had 412,000 acres producing nicely. Combined with the USRS irrigation project in the Okanogan Valley, the rehabilitated Yakima project suggested that irrigation could succeed in Washington.<sup>6</sup>

Even farm problems in the 1920s and 1930s did not squelch all enthusiasm for future agricultural development. After World War I, European countries took measures to encourage the rebuilding of their devastated agriculture industries. These protective actions

84-98 and Wayne D. Rasmussen, "A Century of Farming in the Inland Empire," in *Spokane and the Inland Empire: An Interior Pacific Northwest Anthology*, ed. David H. Stratton (Pullman: Washington State University Press, 1991), 33-51.

<sup>5</sup> This agency was the U.S. Bureau of Reclamation (USRS) after 1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period and general references.

<sup>6</sup> Rasmussen, "Farming in the Inland Empire," 35-36; Carlos Arnaldo Schwantes, *The Pacific Northwest: An Interpretive History*, rev. and enl. (Lincoln: University of Nebraska Press, 1996), 295-301; Dorothy O. Johansen and Charles M. Gates, *Empire of the Columbia: A History of the Pacific Northwest* (New York: Harper & Row, 1957), Chapter 24; and Oscar Osburn Winther, *The Great Northwest: A*

cut off large markets for American farm products. With the supply of many crops exceeding demand, prices began dropping. This dynamic carried agriculture into depression a decade before the rest of the nation. In the early 1930s, farmers in the Pacific Northwest faced drought and dust storms as well as financial ruin. Some farmers and politicians, however, continued to believe irrigation agriculture for local consumption and exporting would produce long term benefits.<sup>7</sup>

Successful hydroelectric systems and successful publicly owned municipal electric utilities in Washington, in addition to a substantial city and faith in agriculture, set the stage for advocacy of a large government irrigation development and power dam. Spokane's private utility company, Washington Water Power (WWP), exemplified successful development of hydroelectricity in Washington State. George Fitch brought electric arc-lighting to Spokane in 1884 only five years after Charles Brush opened the first electric central station and light system in San Francisco. Fitch's small water-powered generator supplied street lights. A series of reorganizations by Spokane businessmen and Edison company representatives Sidney Z. Mitchell and Henry Hoyt created WWP. By 1895, Spokane men controlled a generation and distribution system powered by hydroelectricity. In 1890, the company opened its first plant, the Monroe Street Station, on the Spokane River in the city. In 1926, the company obtained a permit for its eighth dam and power plant. As it built dams, WWP also expanded its distribution system by buying small utilities in eastern Washington and northern Idaho. In 1928, relatively late, the Spokane utility again came under the direct control of a major East Coast utility company. American Power and Light, a subsidiary of Electric Bond and Share, added WWP to its holdings.<sup>8</sup>

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*History*, 2d ed. (Westport, CT: Greenwood Press, Publishers, 1950), 301-3.

<sup>7</sup> Rasmussen, "Farming in the Inland Empire," 43-4 and Schwantes, *Pacific Northwest*, 364-365.

<sup>8</sup> "Washington Water Power Company." *Electrical West* 129 (August 1962): 309-24; Michael Knight Green, "Politics and Kilowatts: The Washington Water Power Company and Public Power, 1918-1941" (Master's thesis, University of Idaho, 1962), 12-15; Daniel M. Ogden, "The Development of Federal Power Policy in the Pacific Northwest" (Ph.D. diss., University of Chicago, 1950), 50-52; Schwantes, *Pacific Northwest*, 391-392; Winther, *Great Northwest*, Chapter 21; and Alan I. Marcus and Howard P. Segal, *Technology in America: A Brief History* (San Diego, CA: Harcourt Brace Jovanovich, Publishers,

In addition to successful hydroelectric development, supporters of Grand Coulee Dam had examples of successful government-owned electric systems to guide them. Cities made the earliest public electric power ventures in the Pacific Northwest. In Washington, Seattle and Tacoma had the earliest and largest such systems. Seattle began building its first city power plant in 1902 in response to citizen demand for better street lighting and electric service. Cedar Falls River, which provided the municipal water supply, became the site of the city's first hydroelectric facility. Seattle City Light provided its first streetlight and private service in 1905.<sup>9</sup>

Beyond exemplars of government electrification, conflict between public and private utilities also characterized the electrical industry in Washington State. This situation meant proposals for a government dam on the Columbia River met a highly charged atmosphere. Seattle had a major private utility as well as Seattle City Light, and the two utilities fought loudly and publicly over customers and opportunities to expand production. In the late 1920s, a battle over state legislation to facilitate creation of public utilities further increased emotions.

A typical pattern of consolidation created Puget Sound Power and Light (PSP&L), Seattle's private utility. In 1892, several small companies merged and made the Union Electric Company heir to Seattle's earliest electrification endeavors. Stone and Webster, a growing Boston-based electric holding company, bought Union Electric in 1899. By the second decade of this century, Stone and Webster had launched an expansion and consolidation program in western Washington. In 1912, the holding company merged a number of utilities in the Puget Sound area to create PSP&L. By 1940, PSP&L had absorbed 150 utilities.<sup>10</sup>

From its inception, Seattle City Light competed with private power companies,

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1989), 141-158.

<sup>9</sup> Ogden, "Development of Federal Power," 43-47; Schwantes, *Pacific Northwest*, 393-394; and Winther, *Great Northwest*, Chapter 21.

<sup>10</sup> Ogden, "Development of Federal Power," 49-50 and Schwantes, *Pacific Northwest*, 393.



especially those of Stone and Webster. Seattle City Light used low rates to attract customers. It priced power significantly lower than that of private utilities in 1905. When the private companies responded by cutting rates, the competition had begun. In 1911-12, Seattle City Light and PSP&L waged a vicious round of rate wars over whether to charge customers for transmission distance. The public and private utilities also fought for dam sites. Perhaps the most flamboyant of these exchanges was in the 1910s. Seattle City Light had its eye on the Hebb site on the White River, on Lake Cushman, or on the Sunset Falls site on the Skykomish River. PSP&L prevented government construction at these locations with legal actions. At the same time, PSP&L sought rights to build on the Skagit River—the best power stream west of the Cascade Mountains. Failure of the private company to build in a timely fashion allowed Seattle City Light to steal the location. Gorge Dam in 1924 and Diablo Dam in 1930 on the Skagit River became Seattle City Light's next two major facilities.<sup>11</sup>

In the late 1920s, Public Utility Districts (PUDs) increased skirmishing between publicly owned utilities and private utilities and increased tensions that proposals for Grand Coulee Dam met. PUDs were a form of local government the size of a county or smaller, which provided utilities such as water, gas, or electricity. In Washington State, the movement for utility districts grew out of the inability of city power organizations to supply farmers just outside city limits. The Grange worked hard for PUD legislation. This powerful political and social organization of farmers sought lower rates and fair extension of electric service. The Grange particularly objected to requirements that farmers who wanted electricity build their own lines to connect to the power network and then deed the lines to the power companies. An initiative organized by the Grange brought PUD legislation up before the Washington State House and Senate. When the House did not act and the Senate voted the motion down, the initiative went to a public vote in 1930. Despite heavy industry opposition—including a break-in at Grange headquarters, editorials against

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<sup>11</sup> Ogden, "Development of Federal Power," 48 and 53-62.

PUDs, and expanded rural services—the PUD initiative passed in 1930.<sup>12</sup>

Overall, in 1917, when men in eastern Washington proposed both the gravity plan and the pumping plan for developing the Columbia River and Basin, experiences in the state provided reasons to support and oppose creating either a large tract of irrigated farmland or a large government hydroelectric power plant. Spokane provided a sizable urban center and transportation network that could support any large development project. Supporters of irrigation could point to success in agriculture, broadly, and irrigated agriculture, in particular. The beginning of a twenty-year farm depression in the 1920s, however, complicated arguments for expanding agriculture. However, reservations flourished more outside the state than inside it. Supporters of a large government hydroelectric plant could point to WWP as a successful utility operating on hydroelectricity and to Seattle City Light as a successful public electricity organization. Conflict between public and private utilities—battles over customers, expansion, and state legislation—complicated proposals for a hydroelectric dam. Much more than irrigation, proposals for a hydroelectric facility polarized public opinion about building for the Columbia River and Basin.

### *Dam Boosters*

Within Washington State, broadly speaking, three groups of men worked for either an irrigation project or a combination irrigation and hydroelectric development for the Columbia Basin: professionals from small towns in the Big Bend region, businessmen and their engineering colleagues from Spokane, and state officials. On the simplest level, these three groups all wanted a project for regional development. Each group, however, came to activism with different experiences and perspectives, and these backgrounds shaped what kind of development project each wanted. Further, how each group worked for development differed. The small town men, who had been Progressive activists, used

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<sup>12</sup> Ogden, "Development of Federal Power," 62-86.

grassroots organizing and devoted personal resources to obtaining a large irrigated farming project and government hydroelectricity. Businessmen from Spokane championed an approach to irrigation that would not bring the federal government into the electricity business. They did this by pouring money into a campaign to convince U.S. congressmen that a gravity plan had merit. State leaders, as a group, cared less about the development approach than obtaining federal development aid. Some individual state officials, however, strongly endorsed one of the two approaches to developing the Columbia Basin. This group contributed to the conceptual development of plans for the Columbia River and Basin, worked to create the legislative structure for the project, and rallied support for development.

### *Men from the Columbia Basin*

Beginning in 1917, men from the small towns of the Columbia Basin, especially Ephrata and Wenatchee, formed a number of organizations and undertook activities to encourage the government to dam the Columbia River, irrigate the Columbia Basin, and subsidize irrigation by selling electricity. These men began by widely promoting the “pumping plan.” According to legend, the idea of using a pumping approach to irrigate the Columbia Basin grew out of a conversation between William (Billy) Clapp, A. A. Goldsmith, Paul Donaldson, and Warren Gale Matthews in the summer of 1917. Sam Hill may also have been present. The men discussed the failure of an irrigation bond measure and the formation of the Grand Coulee—the coulees throughout eastern Washington formed when glaciers diverted the Columbia River from its course and it dug new outlets. Clapp put these two ideas together and suggested that men could again dam the Columbia, divert the water through the Grand Coulee, and irrigate much of the Big Bend area. The spread of this idea typified a major approach to promotion of the pumping boosters. Rufus Woods printed an article about Clapp’s idea in the *Wenatchee Daily World*. Woods and the *Wenatchee Daily World* insistently championed a combination irrigation and hydroelectric project in the early and late 1920s. (For several years in the mid-1920s, the pumping

boosters were inactive.) Through the Columbia River Dam, Irrigation and Power Association (founded in 1920), Columbia Basin Landowners League (founded in 1927), and the Columbia River Development League (founded in 1929), these men followed up on Clapp's idea and complemented Woods's advocacy. For example, they organized large public gatherings whenever national politicians visited the area. They also paid engineer Willis Batcheller, promoter James O'Sullivan, and others to travel to Washington to testify at hearings on legislation concerning the Columbia Basin.<sup>13</sup>

A small group of men repeatedly took leadership roles in supporting pumping projects. Four lawyers from Ephrata—Billy Clapp, Gale Matthews, Ed Southard, and Nathaniel Washington—participated in these organizations and provided stable support. James O'Sullivan and Rufus Woods, Progressive/populist reformers, provided dynamic leadership and articulated a vision of the project that integrated irrigation and power development.

James O'Sullivan was the most devoted booster of the dam. A native of Michigan, O'Sullivan moved west shortly after completing a law degree at the University of Michigan and passing the bar. After a few years as a concrete foreman and teacher in Seattle and Bellingham, respectively, O'Sullivan moved to Ephrata in 1910. There he purchased land to farm near Moses Lake and began practicing law. Due to his father's ill health, O'Sullivan returned to Michigan to help with the family construction business in 1914. He did not return to Washington for any duration until 1929. He did, however, make three-month visits in both 1919 and 1920. During these trips, he developed ideas through technical reading about how to irrigate the Columbia Basin, met USRS Director A. P. Davis and showed him the dam site, and wrote a series of articles on the dam for the *Wenatchee Daily World*. Apparently, these activities wetted O'Sullivan's appetite for promotion. After returning in 1929, James O'Sullivan devoted the rest of his life to

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<sup>13</sup> Pitzer, *Grand Coulee*, 9-80 carefully narrates the activities of the boosters and engineers through 1932. Clark, "Rufus Woods," 45 states that the small town men sent Batcheller to Washington, D.C. to

working for the dam. Often he barely collected enough money to pay the bills for his organizing activities and living expenses. During the 1930s, he traveled to Washington, D.C. repeatedly to lobby for dam approval and funding. O'Sullivan also served as secretary for the state's Columbia Basin Commission in 1933 and 1934. This body coordinated state promotion of the project and managed a state contract with the USBR for designs and preliminary investigations. Finally, O'Sullivan corresponded extensively with USBR engineers and the Washington congressional delegation on both the political and technical progress of the project.<sup>14</sup> (See Appendix 2 for a picture of James O'Sullivan.)

A Bull Moose candidate for the Washington legislature in 1912 and a Democrat in the 1930s, O'Sullivan spun a vision for Grand Coulee Dam clearly informed by Progressive ideas. O'Sullivan preached selling electricity from a dam to pay for irrigation. He fleshed out this dream by glorifying small farmers and vilifying the "power trust." O'Sullivan did not trust anyone connected to private electric companies. He further suspected that the "power trust" influenced Spokane supporters of the gravity plan to conspire against a dam.<sup>15</sup>

If O'Sullivan was the committed Democrat supporter of the dam, Rufus Woods was the prominent Republican. Like O'Sullivan, Woods migrated to Washington, studied law but did not practice much, and made his most prominent contributions to boosting the dam between 1917 and 1920 and after 1929. The Nebraska boys, Rufus and his twin brother Ralph, spent the summers of their young adult lives in Alaska and Washington. In 1903, Rufus Woods and his brother moved to Washington for good. After several unsuccessful ventures on the coast, Rufus settled in Wenatchee. He had passed through

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testify in 1928.

<sup>14</sup> Pitzer, *Grand Coulee*, 25-29 and 68 and Sundborg, *Hail Columbia*. The latter is a popular biography of James O'Sullivan that focuses on his activities as an advocate of Grand Coulee Dam.

<sup>15</sup> Pitzer, *Grand Coulee*, 26-27 and Sundborg, *Hail Columbia*, 23. For examples of O'Sullivan's feelings about WWP and the electrical power industry, see: J. O'Sullivan to C. H. Leavy, 1 Jan. 1933, 6:18 O'Sullivan MSS; J. O'Sullivan to W. G. Ronald, 3 Oct. 1934, 8:3 O'Sullivan MSS; and J. O'Sullivan to Boots, 30 Mar. 1938, 1:12, O'Sullivan MSS. For a key to the abbreviations used in archival citations, see "Abbreviations" which immediately precedes the "Bibliography."

the town one summer and thought it had potential. Woods spent his career as a newspaper editor transforming the *Wenatchee Daily World* into a regional paper and promoting most any plan he thought would contribute to regional development. At crucial points, Woods believed that Grand Coulee Dam was the key to development and so the *Wenatchee Daily World* became an important outlet for information on the dam and a critical forum for advocating the project. Woods also worked for the dam by serving in leadership positions for several of the pumping organizations, serving on the state's Columbia Basin Commission in 1933-4, and providing the pumping boosters contacts with state and national politicians.<sup>16</sup> (See Appendix 2 for a picture of Rufus Woods.)

Again like O'Sullivan, Rufus Woods drew on Progressive ideas as he constructed his notions about a development project for the Columbia Basin. Woods worked for a number of Progressive causes. He actively supported Theodore Roosevelt as President and in the 1912 election. Woods strongly advocated Conservation—federal ownership of natural resources and the development of those resources for maximum use. In Washington State, he worked for direct democracy in the form of primaries, initiatives, and referendum. From this Progressive perspective, Woods sought a federal project that would diversify local development and lessen the dominance of Spokane over the smaller towns of the Columbia Basin. Woods wrote often of creating an “agricultural and industrial empire.” Woods believed that irrigation would stabilize farming in the Big Bend and complement Wenatchee's strong base in apple growing. Cheap power from the dam would attract industry to the area to balance farming.<sup>17</sup>

### *Men from Spokane*

The men from Spokane contrasted dramatically with these small town Progressive professionals. The Spokane Chamber of Commerce and its businessmen members organized much better financed activities to support a gravity plan irrigation project. These

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<sup>16</sup> Ficken, *Rufus Woods* and Clark, "Rufus Woods."

men spoke only of agricultural development to complement mining and timber industries. O'Sullivan and his friends accused these men of conspiring to foil their dam, and several historians have extended this interpretation. I find the evidence of conspiracy overstated.

Wealthier and more politically connected than their small town counterparts, the Spokane men and their organizations carried on a campaign for the gravity plan with deeper pockets than that of the pumping boosters. In the 1920s, the men from Spokane organized promotional activities through the Columbia Basin Commission of their Chamber of Commerce and, after 1922, through the Columbia Basin Irrigation League (CBIL). CBIL boasted members from Seattle, Tacoma, and Washington's neighboring states, as well as Eastern Washington. The leaders of these groups were businessmen, bankers, and politicians such as James Ford, managing secretary of the Chamber of Commerce, and Roy Gill, a hardware merchant. CBIL lasted ten years and raised roughly \$300,000 in contrast to the \$4,500 raised by O'Sullivan and the pumping crowd between 1929 and 1931. In addition to holding and publicizing large annual meetings, CBIL supported lobbyists in Washington, D.C. on more than O'Sullivan's threadbare shoestring. When state funds ran short, the group paid all of General George Goethals's expenses for a trip to Washington and a quarter of his \$20,000 fee for the report he prepared on irrigating the Columbia Basin. CBIL also paid for and hosted trips to the region for several of the U.S. congressional committees considering Columbia Basin legislation.<sup>18</sup> (See Appendix 2 for a picture of Roy Gill.)

Promoters of the gravity plan wanted agricultural development rather than both agriculture and hydroelectricity. In promotional articles, they either simply described the irrigation opportunities or urged irrigation development because of the value of agricultural production. For example, in the early 1920s, E. F. Blaine promoted irrigation farming as a good occupation for veterans and critical for regional development. State Hydraulic

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<sup>17</sup> Ficken, *Rufus Woods*, 29-32 and 96 and Pitzer, *Grand Coulee*, 35-6.

<sup>18</sup> Pitzer, *Grand Coulee*, 24, 32-33, 39-41, 44, and 56-7.

Engineer Marvin Chase, a strong supporter of a gravity plan, described only the merits of that project. He described the size and quality of the land to be irrigated, the "ample" water supply, the cost of development, the access to markets, and the "splendid" climate before launching into a detailed technical summary of the gravity plan. Less optimistic about immediate agricultural development late in the decade, supporters of irrigation recommended further studies rather than immediate construction of the gravity plan. Still, they recommended studies because they thought that the region would need additional agricultural land in the future.<sup>19</sup>

O'Sullivan, Woods, other dam boosters, and several historians have argued that the men from Spokane actively fought a dam and the pumping approach to irrigating the Columbia Basin because the dam would produce electricity. These critics believed that the interests of WWP dominated the Spokane business community. Further, they thought that the gravity plan coincided with the financial interests of WWP while the pumping plan did not. Finally, they interpreted numerous events in the 1920s as active attempts on the part of the Spokane crowd to prevent the construction of a dam.<sup>20</sup>

WWP clearly had an important voice in the Spokane business community. Spokane businessmen founded WWP. Even after American Power and Light bought WWP in 1928, Frank Post, a local businessman, remained president. Further, WWP

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<sup>19</sup> "Northwest Irrigation and Development Congress Holds Important Session," *Pacific Builder and Engineer* 26 (24 September 1920): 9, 25, 26, 28, 31, and 32; "Main Features of Columbia Basin Irrigation Project, Washington," *Engineering News-Record* 84 (4 March 1920): 456; Marvin Chase, "The Columbia Basin Irrigation Project," *Pacific Builder and Engineer* 26 (30 July 1920): 7-9; Marvin Chase, "The Columbia Basin Irrigation Project—Part 2," *Pacific Builder and Engineer* 26 (27 August 1920): 7-8; E. F. Blaine, "The Future Growth of the Pacific States Mainly Dependent on Reclamation," *Pacific Builder and Engineer* 28 (24 November 1922): 9-11; Marvin Chase, "Present and Future Development of the Water Resources of the State of Washington," *Pacific Builder and Engineer* 29 (26 January 1923): 8-11 and 33; Fred A. Adams, "This is the 'Scheme of Development Upon Which the Inland Empire is Bent:' A Statement of the What and Where of the Proposed Columbia River Basin Project," *Modern Irrigation* 1 (October 1925): 15-6, and 41; R. K. Tiffany, "State Reclamation in Washington," *ASCE—Proceedings* 53 (May 1927): 913-23; R. K. Tiffany, "World's Largest Irrigation Project Now Being Planned by Four States of Northwest," *Modern Irrigation* 3 (September 1927): 16-17, 80-81; and R. K. Tiffany, "Report of the Committee of the Irrigation Division on 'A National Reclamation Policy'—Discussion," *ASCE-Proceedings* 55 (November 1929): 2382-3.

<sup>20</sup> Examples of this style of interpretation can be found in: Ficken, *Rufus Woods*; Pitzer, *Grand*



employed more people than any other organization in Spokane.<sup>21</sup>

Likewise, WWP might well have preferred the gravity plan for two reasons. First, the gravity plan implied less competition for WWP. Diverting water from the Pend Oreille River at Albeni Falls would have destroyed a water power site controlled by a competitor. Further, the gravity plan did not propose a government dam on the Columbia River that would compete with WWP. Second, the gravity plan would have increased the amount of electricity produced by WWP at no cost to the company. This plan provided that water from the Pend Oreille River would be diverted into the Spokane River when not needed for irrigation. Conveniently, WWP had a series of hydropower facilities downstream of the diversion point. Further, water would have been available at the most financially beneficial times for the utility.<sup>22</sup>

Regardless of opportunity and motive, the events interpreted as evidence of attempts to sabotage consideration of a dam bear further consideration. O'Sullivan and his friends complained that Spokane men manipulated state studies to dismiss the pumping plan. The men from Ephrata had many grievances with the state studies of irrigating the Columbia Basin. First, published state studies endorsed gravity plans with very little consideration of pumping plans. Second, men from Spokane dominated state bodies concerned with the Columbia Basin. Third, state officials suppressed their own engineering work concerning pumping projects. Fourth, a state official released false information about the geology of the Grand Coulee site. The pumping boosters also feared that WWP's request for permission to build a dam above the Grand Coulee location was a plot to limit Grand Coulee Dam. Historians added an episode between USRS Director A. P. Davis and Washington men as further indication of ill will toward a dam. While these events can be taken as circumstantial evidence that state officials and Spokane businessmen set out to undermine even consideration of a dam, the events can also be explained by

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*Coulee*; Clark, "Rufus Woods;" Green, "Politics and Kilowatts;" and Sundborg, *Hail Columbia*.

<sup>21</sup> Green, "Politics and Kilowatts," 12-15 and "Washington Water Power," 310-312.

common sense, concerns for professional standards, and machinations of a single individual.

State studies of the 1920s did advocate gravity plans over pumping plans. The state sponsored two published studies of irrigating the Columbia Basin in the early 1920s. The Columbia Basin Survey Commission (CBSC) conducted the initial study of irrigation possibilities between 1919 and 1920. For added publicity, the state hired General George Goethals, of Panama Canal fame, to review the CBSC's work. Both the resulting reports described gravity plans at length and dismissed pumping plans. For example, in the 185-page CBSC report, only a nineteen-page appendix discussed pumping plans. Further, the report primarily flagged potential problems with pumping plans, such as international treaty violations and excessive cost.<sup>23</sup> This bias in coverage could have been the upshot of an unequal application of common sense rather than conspiracy. The magnitudes of both the dam and canal systems proposed for irrigating the Columbia Basin were absurd in the 1920s. First, the high cost of development made either plan impossible to justify. Engineers estimated that both the gravity plan and the pumping plan would cost twice as much for each acre of land developed as contemporary irrigation systems. Unfortunately, even irrigation farmers with the contemporary investment costs were not earning enough money to make a profit.<sup>24</sup> Second, both the gravity plan and the pumping plan far exceeded any existing USRS irrigation project on several measures. The amount of land to be irrigated with either approach was only a beginning. The gravity plan proposed large reservoirs and a main canal of unprecedented capacity and length. Further, this canal

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<sup>22</sup> Green, "Politics and Kilowatts," 21-22.

<sup>23</sup> CBSC, *Columbia Basin Irrigation Project* and George W. Goethals and Company Incorporated, *Columbia Basin Project* (Olympia, WA: Washington State Department of Conservation and Development, 1921).

<sup>24</sup> The CBSC estimated the gravity plan would cost \$171 per acre and pumping plan \$173-\$183 per acre. CBSC, *Columbia Basin Irrigation Project*, 9 and 151. In contrast, in 1924 water users on the Payette-Boise project, one of the USRS's original projects, were paying \$80 per acre. Brain Q. Cannon, "'We are Now Entering a New Era': Federal Reclamation and the Fact Finding Commission of 1923-1924," *Pacific Historical Review* 66 (May 1997): 196. In the mid-1920s, farmers on USRS projects had severe financial problems. See: Cannon, "Entering a New Era" and Robinson, *Water for the West*, 37-40.

required shockingly long and large tunnels. The pumping plan posited an unprecedented pumping height and a high overflow dam in a gigantic river. The latter seemed difficult because something would have to be done with the energy that the water coming over the spillway would produce. These plans bit off a lot.<sup>25</sup> When state engineers dismissed the pumping plan, then, they acted rationally. Their blind spot was endorsing the gravity plan. On that account, perhaps they could not see the ridiculous quality of their own proposal.

Dam boosters further complained and historians have argued that men from Spokane and WWP controlled state investigations of the Columbia Basin Project. The way that historians have presented the CBSC will serve as a good example of how this argument was constructed. Paul Pitzer and Robert Ficken draw the connection between the CBSC, Spokane, and WWP through the CBSC's members and staff.<sup>26</sup> Robert Ficken offered that all the members of the CBSC lived in Spokane or small towns dominated by it. First, since Spokane was the state's second largest city, this claim could have been made of anyone who did not come from Puget Sound. Second, the members were also an understandable mix of state office holders and men representing banking—a sector whose support would be required to finance farm start-up costs involved in a large irrigation venture. The members of the Commission were: Marvin Chase, Elbert F. Benson, Osmer

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<sup>25</sup> The gravity project as designed by Washington State engineers would irrigate 1,753,000 acres. To do this, engineers proposed to build storage reservoirs of 1,506,000 acre-feet and 1,180,000 acre-feet and a main canal 130 miles long with a carrying capacity of 20,000 second-feet. The main canal would further require thirty-three miles (174,240 feet) of tunnel. For comparison, in 1920 the largest project run by the USRS was the North Platte in Nebraska and Wyoming. It could irrigate 251,639 acres. The USRS had only three reservoirs as large or larger than those proposed for the Columbia Basin development—Roosevelt, Elephant Butte, and Flathead Lake. Its largest canals carried only 2,500 second-feet of water. Further, the canals of this capacity did not run over 35 miles. The single canal that approached the length of the main canal proposed for the Columbia Basin carried only 1,430 second-feet of water. Finally, its largest tunnel ran 30,645 feet and carried 1000 second-feet of water. The pumping plan, too, far exceeded projects that existed in 1920. It would water 1,413,000 acres—less than the gravity plan but still far more than any existing USRS project. Further, this plan called for pumps to lift water 400 feet when the highest lift then existing on a USRS project was 200 feet. USRS engineers called the main dam of the pumping plan “a serious engineering problem” because of the volume of water that would flow over a high dam. USRS, “Review of Report on the Columbia Basin Project Washington,” 13 December 1920, Reports 10-55, ERC, RG 115, Appendix 2, p. 1 and Appendix 3, p. 1 and *Nineteenth Annual Report of the U.S. Reclamation Service, 1919-20* (Washington, D. C.: GPO, 1920), 32-33 and 536-549.

<sup>26</sup> Ficken, *Rufus Woods*, 64-66 and Pitzer, *Grand Coulee*, 24-28 are the discussions of the CBSC

Waller, Peter McGregor, and Arthur Jones. Chase served as the state hydraulic engineer, Benson as the state commissioner of agriculture, and Waller as the department chair of civil engineering at the state college. McGregor and Jones worked in banking and investments respectively. Pitzer and Ficken also linked the CBSC's engineering staff to WWP. The staff consisted of twelve men: Arthur J. Turner, J. C. Ralston, Fred A. Adams, Ivan E. Goodner, Lars Langloe, T. H. Judd, O. A. Pearson, Guy C. Finley, F. W. Welch, Irving Worthington, J. C. Sharp, and A. D. Robinson. Pitzer identified Ralston, Turner, Goodner, and Langloe, the engineering leadership, as simultaneous or earlier employees of WWP. I find it unsurprising that men in the area with the appropriate engineering skills would have at some point worked for the major hydroelectric utility in the region. Further, Pitzer left the professional experience of eight of the twelve men unidentified.<sup>27</sup>

Pumping boosters and historians also believed that state officials suppressed the major favorable study of pumping plans conducted under the state's auspices. As a follow-up to the CBSC study in 1922, Washington State commissioned Seattle consulting engineer Willis Batcheller to conduct a study of power production at Foster Creek—a location downstream from the Grand Coulee site. Without the knowledge of his superiors in the Department of Conservation and Development, Batcheller extended his study to the Grand Coulee site. Further, he found prospects for a dam there very promising. When Batcheller's superiors discovered his action, they fired him and kept his report from wide circulation.<sup>28</sup> While state officials clearly made access to Batcheller's work difficult, professional conduct may have been as much an issue as the content of the report. Batcheller had clearly exceeded his authority. In addition, Batcheller and his superiors conflicted over a point of professional etiquette. Batcheller insisted that his name appear on his work, while his supervisors maintained that their normal practice was to attribute work

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and its study.

<sup>27</sup> CBSC, *Columbia Basin Irrigation Project*, 12-13.

<sup>28</sup> Ficken, *Rufus Woods*, 67-68 and Pitzer, *Grand Coulee*, 32 and 34-5.

to the sponsoring agency.<sup>29</sup>

The pumping booster's fourth grievance with the state concerned false information on the foundation at the Grand Coulee site. In 1922, Washington State paid for core drilling at the Grand Coulee site to determine whether the location had geological structures appropriate for a major dam. The initial reports from this work indicated unsuitable foundations. When dam boosters expressed concerns about the accuracy of these reports to USRS engineer David Henny, Henny visited the men in charge and warned them to release true results. Subsequent reports showed hard granite near the surface—an excellent foundation for a dam. This episode may well have been a case of a state official deliberately working against a dam and power development. However, such efforts may not have been wide spread. Fred Adams may have been a relatively isolated perpetrator of such activity. Adams served as the “educational director” for the CBSC and later worked for the Department of Conservation and Development in connection with Columbia Basin studies. Adams was primarily a promotion man. He made numerous speeches boosting the project and did some lobbying work in Washington, D.C. Further, Adams directed several of the more egregious episodes of the early 1920s. Adams fired Batcheller. He released the false information about the core drilling. He also wrote to USRS Director Arthur P. Davis criticizing a *Wenatchee Daily World* article in which Davis had been misrepresented. Finally, he maneuvered shamelessly to have men who favored a gravity plan appointed to conduct a federal study of irrigating the Columbia Basin in 1923.<sup>30</sup>

In addition to feeling that the state studies indicated a conspiracy against a dam, dam boosters and historians interpreted WWP filing for a permit to build a dam at the Kettle Falls site as a threat. Kettle Falls was located upstream from the Grand Coulee on the Columbia River. WWP did file for a permit for this site with the Federal Power

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<sup>29</sup> D. A. Scott to F. A. Adams, 20 Jan. 1922, 9:Incoming Corresp., Batcheller MSS and D. A. Scott to I. E. Goodner, 16 Jan 1922, 9:Incoming Corresp., Batcheller MSS

<sup>30</sup> Pitzer, *Grand Coulee*, 24-32 and A. P. Davis to F. E. Weymouth, 28 Feb. 1923, 416:791 9/23 to 9/24, EC-CB, CE, RG 115.

Commission in 1922. The utility, however, may actually have been considering building there. According to the Army Corps of Engineers' report that established the ultimate plan for Grand Coulee Dam, Kettle Falls was a good dam site and had an attractive feature for management. It could be developed efficiently little bits at a time. Major Butler only recommended against developing Kettle Falls because he proposed a dam at Grand Coulee high enough to drown the site. Historians strengthened the implication that this permit application was a ploy against a dam at Grand Coulee by pointing out that WWP made the application in the midst of activities supporting a gravity project. While 1922 was an active year for the gravity plan boosters, the early 1920s was also an active period for this kind of dam proposal. In 1920, after roughly twenty years of conflict, Congress established a routine procedure for private requests to build on navigable waterways such as the Columbia River. Finally, a dam at Kettle Falls would not have interfered with any plans for a dam at Grand Coulee considered by engineers during the early and mid-1920s. In 1931, Major Butler was the first engineer to analyze or endorse a dam that would back water beyond Kettle Falls.<sup>31</sup>

Historians Pitzer and Ficken further interpreted an exchange between USRS director A. P. Davis and members of the CBSC and CBIL as showing the latter's hostility toward a dam. In 1920, when visiting Washington State for an irrigation convention, A. P. Davis made a spontaneous side trip to view the Grand Coulee site with James O'Sullivan. After this trip, O'Sullivan stated in the *Wenatchee Daily World* that Davis had found a dam "feasible." Fred Adams of the CBSC took Davis to task about this report. The objections from Adams may have been, however, about professional standards and federal "interference" as well as Davis's alleged views. In at least one other instance, Washington hydraulic engineer Marvin Chase clearly stated that federal engineers had no authority to second guess Washington State conclusions about the Columbia River.

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<sup>31</sup> Ficken, *Rufus Woods*, 100-101; Pitzer, *Grand Coulee*, 31 and 160; House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 720-755 and 1002-1009, and Swain, *Federal*

Further, Davis himself strenuously objected to O'Sullivan's article. Davis emphasized that he could not have made a judgement of feasibility based on a brief visual inspection of the site.<sup>32</sup>

Overall, supporters of the gravity plan from Spokane do not have to be understood as conspirators against a dam. Clearly, these businessmen directed their well-financed lobbying toward a project for irrigating the Columbia Basin without producing hydroelectricity. Evidence for the commonly held view that these men conspired against a government power development at Grand Coulee, however, is mostly overstated.

### *State Officials*

Beyond local booster groups from the Basin towns and Spokane, between 1917 and 1937 many Washington State officials contributed to the development of plans for the Columbia River and Basin. State officials came from two groups. The members of the U.S. congressional delegation from Washington, such as Clarence C. Dill, moved studies and the dam along at critical points by introducing legislation and building support among their congressional colleagues and presidential administrations. State office holders, such as CBSC secretary Osmer L. Waller, contributed to the emerging development plans by both doing technical work and building public support. Broadly speaking, all these men supported an irrigation and/or hydroelectric project for the Columbia River and Basin for regional development. For some, support of development was just bald political expediency. Many of the men, however, supported these activities as one of many efforts to promote either irrigated agriculture or expansion of government activities in the electrical industry.

Washington Senator Clarence C. Dill worked with plans for an irrigation and/or

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*Conservation Policy*, c. 115.

<sup>32</sup> Ficken, *Rufus Woods*, 66-67; Pitzer, *Grand Coulee*, 29; James Bates Cavanaugh et al., *Report to the Federal Power Commission on the Uses of the Upper Columbia River* (Washington, D. C.: GPO, 1923), 51-61; and A. P. Davis to E. F. Blaine, 24 May 1922, 511:300.01[no date given], Entry 7/19-29-CBP, WDC, RG 115.

hydroelectricity project at critical points over the longest period. Dill served in the U.S. House of Representatives from March 1915 to March 1919 and as the first Democratic senator from Washington from 1923 to 1935. Other than working as a journalist and teacher for a few years after college, Dill's primary occupation, when not an elected politician, was law. He served in the U.S. Attorney General's office between 1946 and 1953 and practiced in Spokane before and after his times in the District of Columbia. Dill particularly contributed to the construction of Grand Coulee Dam during the early days of the New Deal. Dill's position as a Democratic senator who had held office before the 1932 elections and a 1932 Democratic National Convention delegate who had supported Franklin Roosevelt made him powerful. Dill worked with state and federal officials and organizations to smooth the process of building the dam. For example, along with Washington State Grange Master Albert Goss, Dill asked the President to make the dam a public works project in the spring of 1933. At the President's request, he followed this up by contacting USBR Commissioner Elwood Mead to request technical advice on building the dam. Dill also served as an intermediary between the USBR and Washington State as they arranged to devote \$377,000 of state recovery funds to plans and preliminary work on the dam. After these initial events, Dill continued to work with the USBR and coached state bodies, such as the Columbia Basin Commission. (Governor Clarence Martin and the Washington legislature created this organization in the early spring of 1933 to lobby for the construction of Grand Coulee Dam.) Although the small-town boosters doubted Dill's commitment to Grand Coulee Dam and Washington public electric power advocate Ken Billington concluded that Dill benefited personally from his advocacy of government-owned electric power, Dill clearly worked for Grand Coulee Dam at a number of critical points. Beyond the political expediency of working for a development project that brought substantial money to central Washington, Dill may have genuinely supported the dam because of its hydroelectric features. Over his public career, Dill worked for several public electric power causes. Dill campaigned at length for the highly contested PUD legislation



in 1930. He also represented the Pend Oreille County Public Utility District in a series of lawsuits after World War II. (See Appendix 2 for a picture of Senator C. C. Dill.)<sup>33</sup>

Many other members of the Washington congressional delegation built support for Grand Coulee at critical points. For example, Miles Poindexter, a prominent Progressive Republican congressman from 1909-11 and senator from 1911-23, introduced the bill to fund the first federal study of irrigating the Columbia Basin in 1922. Wesley Jones, a Progressive Republican congressman from 1899-1909 and senator from 1909-1932, managed the legislation that funded the Army Corps of Engineers' study of the Columbia River, which produced the basic plan for Grand Coulee Dam and the Columbia Basin Project. Sam B. Hill, Democratic congressman from 1923-1936, orchestrated a difficult and crucial vote to provide the dam proper legal standing. Homer Bone served as a Democratic senator from 1933-1944. A lawyer from Tacoma, Bone worked extensively for public electric power at both the state and national levels and supported Grand Coulee legislation.<sup>34</sup>

Officials in the Washington State government also aided the eventual construction of Grand Coulee Dam by building support for studies of the Columbia River and Basin. In addition, state officials contributed to the conceptual work of these studies. Civil engineer Osmer Waller exemplified state officials who contributed to the conceptual development of plans for the Columbia River and Basin. A teacher and lawyer from 1884-1893, Waller held the position of professor of mathematics and civil engineering at Washington State

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<sup>33</sup> *Biographical Directory of the American Congress 1774-1971: The Continental Congress September 5, 1774 to October 21, 1788 and the Congress of the United States from the First through the Ninety-first Congress March 4, 1889 to January 3, 1971, Inclusive*, 92nd Cong., 1st sess., 1971, 92-8, 862; Ken Billington, *People, Politics, and Public Power* (Seattle, WA: Washington Public Utility Districts' Association, 1988), 427-439; Pitzer, *Grand Coulee*, 67-70; C. C. Dill to E. Mead, 31 May 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; C. C. Dill to M. McIntyre, 6 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/19-29-CBP, WDC, RG 115; [W. Batcheller] to F. D. Roosevelt, 4 Nov. 1933, 9:Outgoing Letters 21-33, Batcheller MSS; and Ficken, *Rufus Woods*, 41 and 79-80. See also: Clarence C. Dill, *Where Water Falls* (Spokane: 1970) and Kerry Irish, "Clarence Dill: The Life of a Western Politician" (Ph.D. diss., University of Washington, 1994).

<sup>34</sup> *Directory of Congress*, 610, 1119-20, 1208, and 1553. See also: Pitzer, *Grand Coulee*, 40, 43, and 121-126; Schwantes, *Pacific Northwest*, 349-350, 361, and 377-378; and Ogden, "Development of

College (now University) in Pullman from 1893-1930. In this position, Waller developed an expertise in irrigation systems. He worked for the U.S. Department of Agriculture in the summers between 1900 and 1904. He consulted for the State of Idaho on irrigation developments in 1907-8 and 1912. He also wrote bulletins on irrigation and irrigation law. From 1909 until his retirement, Waller also served as vice president of Washington State College. In 1919, Washington Lieutenant Governor Louis Hart appointed Waller to the CBSC. Waller served as secretary of that body. Subsequently, USBR Commissioner Elwood Mead appointed Waller to serve on the federal Board of Engineers (1924-5) that extended studies of irrigating the Columbia Basin. Waller was one of two experts hand-picked by Mead to consider issues of agricultural development in connection with the plans for irrigation. As a contributor to both these studies, Waller helped develop plans for making the Columbia Basin an irrigation project in the 1920s.<sup>35</sup> (See Appendix 2 for a picture of O. L. Waller.)

Other state officials played critical roles in building support for the project. For example, Elbert F. Blaine, chairman of the Washington State Public Service Commission and the State Railroad Commission, proposed the gravity plan in 1917. Blaine, also a horticulturist and landowner in the irrigated Yakima Valley, promoted the idea widely in 1918. Most importantly, he pitched the plan to the Spokane Chamber of Commerce, Washington Governor Ernest Lister and Seattle Mayor Ole Hanson. Governor Clarence Martin is another example of a state official who create institutional and public support for the project. In 1933, Martin orchestrated Washington's Columbia Basin Commission. He also participated in a variety of ceremonies celebrating the dam, such as a ground breaking in July 1933. These sorts of events served as rallying points for public support.<sup>36</sup>

Unlike the two booster groups, which clearly supported different approaches to

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Federal Power," 62-72.

<sup>35</sup> "Waller, Osmar Lysander," in *Who Was Who in America* (Chicago: The A. N. Marquis Company, 1942), 1293; Pitzer, *Grand Coulee*, 24; and E. Mead to O. L. Waller, 19 August 1924, 512:301 23 & 25, Entry 7/19-29-CBP, WDC, RG 115.

developing the Columbia River and Basin, state officials as a group did not prefer one plan to the other. Commitment to irrigation or government electrical development, however, motivated individual state officials to back plans to develop the Columbia River and Basin or, later, Grand Coulee Dam. The significant contributions to public electric power initiatives beyond Grand Coulee Dam of Senators Jones, Dill, and Bone suggest these men may have promoted a dam for its ability to produce electricity. Wesley Jones sponsored the Federal Power Commission Act of 1920, which gave the federal government control over hydropower sites on most of the nation's rivers. Further, he managed legislation in the mid-1920s that instructed the Army Corps of Engineers to make plans for the development of the nation's major rivers. In addition to providing the basic plan for Grand Coulee Dam, these studies were a major initiative in integrating hydroelectric power, irrigation, navigation, and flood control. Senators Dill and Bone promoted PUD legislation for Washington. Bone, in addition, dealt with public electric power issues extensively in his law practice.

Irrigated agriculture was another cause that motivated state officials to support the development of the Columbia Basin. Osmer Waller promoted irrigation beyond the Columbia Basin. E. F. Blaine, too, was an active promoter of irrigation. An irrigation farmer in the Yakima Valley, Blaine served as the president of the Washington Irrigation Institute and chaired the arrangements committee for the Northwest Irrigation and Development Congress in 1920.<sup>37</sup>

### ***Conclusion***

In all, three groups of Washington men provided important kinds of support for the development of the Columbia River and Basin. State officials—both office holders in Washington State and members of the U.S. Congress delegation from

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<sup>36</sup> Pitzer, *Grand Coulee*, 17-18 and 67-8 and 74-5.

<sup>37</sup> Ficken, *Rufus Woods*, 62; "Northwest Irrigation," 9; Blaine, "Future Growth;" and Harding, B. C., "Water from Pend Oreille," 52.

Washington—contributed to the intellectual work of making development plans, took the legislative steps necessary for studies and later the dam, and helped rally support for the plans. Groups of boosters also built support for development. The two main groups, however, split over how the Columbia River and Basin should be developed. As supporters of agriculture but not government ownership of electric power facilities, businessmen from Spokane sought to extend regional growth with a gravity plan irrigation development. The small town professionals, who offered the alternative vision of integrated irrigation and public electric power development, preferred a pumping plan and its massive dam. Proposals to develop the Columbia River and Basin also flourished because local experience validated irrigation, hydroelectric development, and government electrification. By 1920, eastern Washington boasted successful exporters of wheat and irrigated apples. WWP, Eastern Washington's major private utility, depended on hydroelectricity. Municipal electric systems in Seattle and Tacoma and, in the late 1920s, PUD legislation illustrated the strength of the tradition of government ownership of electric systems in Washington State.

## **Chapter 3—The U.S. Bureau of Reclamation: Progressive Professionals**

Promotion, legislation, and preliminary studies alone did not build Grand Coulee Dam. The tasks of finalizing plans for Grand Coulee Dam and the Columbia Basin irrigation development, overseeing construction, and directing operation of the new project fell on the U.S. Bureau of Reclamation (USBR).<sup>1</sup> Washington officials and boosters began soliciting federal assistance with their development project before the first study of irrigation possibilities in 1919-1920. Beyond providing assistance to Washington State studies, the USRS conducted several of its own investigations in the 1920s. In the 1930s, President Roosevelt directed the USBR to construct Grand Coulee Dam.

USBR engineers were a very different breed from Washington State lawyers, businessmen, and politicians. At the turn-of the century, engineers who would later lead Progressive reform movements within the engineering community and Progressive politicians created the USRS. In many ways, their plans for the new USRS exemplified Progressivism. During the 1920s and 1930s, the period in which USBR engineers worked on Grand Coulee Dam, engineers who had contributed to the Progressive impetus and the generation of engineers that had been trained in the Progressive reform ethos of the USRS led the USBR. This latter group of staid professionals bridged the Progressive idealism of the USRS's founding and its phenomenal growth after World War II by embracing multiple-purpose dam building.

The stance of USBR engineers toward a project for the Columbia Basin likewise differed from that of the other groups. During the 1920s, these engineers would have avoided involvement with a project for Washington's Columbia Basin, if they could have. The USBR leaders pursued a conservative policy of completing and strengthening existing

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<sup>1</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period

projects rather than starting new ones. Further, federal engineers had no desire to be drawn into the local political maelstrom swirling in central Washington. Once drawn into the planning by Washington State boosters, however, the USBR engineers fought fiercely to retain their own voice in the process and to make the project succeed on their terms.

### ***Progressive Heritage***

While a number of factors came together to underpin the entrance of the federal government into the business of directly developing irrigated farms, Progressive reform ideals most profoundly shaped the character of the new USRS. Engineering reformers Frederick Haynes Newell and Arthur Powell Davis, along with political reformers President Theodore Roosevelt and Nevada Senator Francis Newlands, played central roles in creating the USRS. The new USRS had the potential to strengthen the moral fiber of the country, to centralize control of water resources, and to enhance government engineering prowess. However, in the first twenty years, the USRS failed to fulfill these Progressive dreams.

As a key figure in drafting USRS legislation, Chief Engineer (1902-7), and Director (1907-14), Frederick Haynes Newell played a major role in shaping the USRS in the Progressive engineering reform mold. Throughout his career, Newell championed engineering reform, especially within government engineering organizations. After graduating from the Massachusetts Institute of Technology in mining engineering in 1885 and working a variety of jobs for a couple of years, Newell began his government engineering career in the U.S. Geological Survey (USGS) in 1889. From 1882-1894, John Wesley Powell, the colorful explorer and administrator, directed the USGS. Powell followed up his "Report on the Lands of the Arid Region of the United States" with a major study of water resources and dam sites in the Western states between 1888 and 1890. This study built on Powell's idea that the limited water resources of the West demanded

coordinated development. Newell worked on this project and learned from Powell. Later, he too championed the ideas of coordinated development of water resources and expert-based Conservation as the basis for federal natural resources activities and policy. Between 1902 and 1914, Newell pursued this reform agenda through the USRS. After Newell left the USRS, he sought to reform the engineering profession through his Committee on Cooperation and the American Association of Engineers.<sup>2</sup> (See Appendix 2 for a picture of Frederick H. Newell.)

The USBR's Assistant Chief Engineer (1902-4), Chief Engineer (1904-14), and second Director (1914-23), Arthur Powell Davis, also embraced Progressive reform and led the USRS in that direction. Davis earned undergraduate degrees at Kansas State Normal School and Columbia University (now George Washington University) in 1882 and 1888, respectively. Simultaneous with studying for his second bachelor's degree and Davis, like Newell, began his engineering career in the USGS. Under the guidance of his uncle, Director John Wesley Powell, Davis, too, began working on water development. Later, Davis played an important role in formulating the reform tradition plan for the development of the lower Colorado River, the plan which first proposed the construction of Hoover Dam. Again like Newell, Davis actively participated in engineering professional societies. Beyond belonging to many, he was President of the Washington Society of Engineers (1907), the Cosmos Club of Washington (1918), and ASCE (1920-1). When Davis left the USRS in 1923, he continued his work as a government hydraulic engineer. He served as Chief Engineer and General Manager for the East Bay Municipal Utility District in Oakland, California, a consultant to the Soviet government, and a consultant to Los Angeles's Metropolitan Water District. (See Appendix 2 for a picture of Arthur Powell

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<sup>2</sup> "Newell, Frederick Haynes," in *The National Cyclopaedia of American Biography*, vol. 23 (New York: James T. White and Company, 1933), 162-163; Warne, *Bureau of Reclamation*, 4 and 238; Thomas G. Manning, *Government in Science: The U.S. Geological Survey, 1867-1894* ([Lexington]: University of Kentucky Press, 1967), 168-203; Robinson, *Water for the West*, 11-12; Donald C. Jackson, "Engineering in the Progressive Era: A New Look at Frederick Haynes Newell and the U.S. Reclamation Service," *Technology and Culture* 34 (July 1993), 544-549; and Layton, *Revolt of the Engineers*, 116-125.

Davis.)<sup>3</sup>

President Theodore Roosevelt demonstrated support for the reform agenda of Newell and Davis when he began a series of Conservation water policy initiatives by providing the final push that moved Reclamation legislation through Congress. Roosevelt declared his support for the USRS in his first address to Congress in December 1901. He followed up this announcement with a thinly veiled threat to veto funding for the river and harbor work of the Army Corps of Engineers if Congress did not pass the Reclamation Act. Roosevelt saw the USRS as a complement to the work of the Army Corps of Engineers outside the West and an important way to “rationally” develop Western water resources. Beyond the USRS, Roosevelt supported Conservationist water policies broadly. Roosevelt vetoed a series of private waterpower licenses, including a bid to develop the Tennessee River at Muscle Shoals. Roosevelt sought greater federal control over the development of public resources and public benefit from corporate development of hydroelectricity. Along this line, the General Dam Act of 1906 allowed the federal government to require navigation provisions in private dams and to revoke permits if projects were not completed within three years. Even more broadly, Roosevelt supported the work of the Inland Waterways Commission (1908) and National Conservation Commission (1908). These panels proposed coordinated federal planning and development for all the nation's waterways.<sup>4</sup> (See Appendix 2 for a picture of President

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<sup>3</sup> “Davis, Arthur Powell,” in *The National Cyclopaedia of American Biography*, vol. 24 (New York: James T. White and Company, 1935), 116-117; Gene M. Gressley, “Arthur Powell Davis, Reclamation, and the West,” *Agricultural History* 42 (1968): 241-257, and Norris Hundley, Jr., “The Politics of Reclamation: California, the Federal Government, and the Origins Of the Boulder Canyon Act - a Second Look,” *California Historical Quarterly* 52 (Winter 1973): 292-325.

<sup>4</sup> Pisani, *To Reclaim a Divided West*, 311-312 and 318-319; Robinson, *Water for the West*, 16-17; Theodore Roosevelt, “Letter from President Roosevelt Endorsing the Newlands Bill, June 13, 1902,” in Frank Ellis Smith, ed., *Land and Water, 1900-1970*, vol. 3 of *Conservation in the United States, a Documentary History* (New York: Chelsea House Publishers, 1971), 34; Theodore Roosevelt, “President Roosevelt's Veto of Private Use of Muscle Shoals, March 3, 1903,” in *Land and Water*, 164; “The General Dam Act, June 21, 1906,” in *Land and Water*, 165-7; Theodore Roosevelt, “Letter from President Roosevelt on Waterways, February 26, 1908,” in *Land and Water*, 78-82; Theodore Roosevelt, “President Roosevelt's Veto of Private Power Rights, January 15, 1909,” in *Land and Water*, 168-174; Theodore Roosevelt, “Special Message of the President Transmitting the Report of the National Conservation Commission,



Roosevelt.)

Senator Francis Newlands also shaped the USRS in the Progressive Conservationist mold as part of a broader campaign to reform federal water resources policy. Newlands drafted several versions of Reclamation legislation seeking a viable version and helped build congressional support for the West's new program. After the creation of the USRS, the Nevada senator continued to work for broad federal planning and funding of river development. For many years, Newlands championed a bill to create a commission with broad powers to plan and implement coordinated river development throughout the U.S. In 1917, Congress finally passed Newlands's legislation. War, however, delayed implementation, and, in 1920, Congress passed the Federal Water Power Act, which revoked the commission before it had ever been appointed.<sup>5</sup> (See Appendix 2 for a picture of Senator Francis Newlands.)

These men designed USRS legislation to reflect Progressive water policy and reform ideas about government. The legislation had the potential to found a strong centralized USBR in which experts served the public good. As the USRS moved from planning to reality, however, limitations of the legislation became more evident. Many of the experiences of the USRS's first two decades did not live up to the founders' dreams.

Attempts to make federal irrigation primarily aid family farms grew out of Progressive moral traditions. Supporters of the USRS stipulated that it could only provide water to farms of 160 acres or less—the established size for homesteads under American law—to ensure that government irrigation would support small family farms. They hoped that “yeoman farmers” would improve the moral fabric of the nation. Irrigation farms

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January 22, 1909,” in *Land and Water*, 24-33; and Hays, *Gospel of Efficiency*, especially 105-109, 114-119, and 127-135.

<sup>5</sup> Francis Newlands, “Speech by Representative Francis G. Newlands on Water Policy, January 9, 1901,” in *Land and Water*, 69-74; “The Waterways Commission Bill, December 4, 1907,” in *Land and Water*, 75-77; “The River Regulation Amendment, August 8, 1917,” in *Land and Water*, 115-116; William D. Rowley, *Reclaiming the Arid West: The Career of Francis G. Newlands, American West in the Twentieth Century* (Bloomington: Indiana University Press, 1996); Pisani, *To Reclaim a Divided West*, 299-304; and Robinson, *Water for the West*, 15-18.

would provide a safety valve for the unemployed, immigrants, and other urban troublemakers. Like Settlement House activities, farming would convert problem city dwellers into valuable citizens for the American democracy. Simultaneously, federal aid to family farms would curb monopoly. Building irrigated farms on federal lands would reduce the importance of large wheat farms and ranches. Although not a major justification for irrigation programs, other Progressive water development initiatives also proposed to counter railroads' monopoly on transportation by reinvigorating rivers as shipping routes.<sup>6</sup>

The USRS's self-financing features and the Interior Secretary's control reflected Progressive aspirations for expert-based government independent from political manipulation. Legislators made the USRS self-financing by establishing a revolving fund to pay its expenses. Proceeds from federal land sales (and later other sources, such as mineral leases) funded construction of irrigation works. Over a set period, farmers who benefited from these facilities repaid the government's investment (but not interest). These returns financed additional irrigation development without need for Congress to act. Legislators also gave the Interior Secretary wide latitude with the Reclamation Act. The legislation did not establish a body or specify positions to carry out its provisions; it simply empowered the Interior Secretary to build irrigation projects. The original law also left the selection of projects entirely to the Interior Secretary. Neither Congress nor the President had the power to choose or approve locations for federal irrigation works. Like city managers and other Progressive institutional mechanisms to place government decisions in the hands of experts, self-financing and vesting the Interior Secretary with the authority to create the USRS and approve irrigation endeavors removed the new irrigation program from constant political meddling.<sup>7</sup>

The USRS did not live up to its founders' Progressive aspirations of uplifting citizens and providing expert direction in its first twenty years. The Reclamation Act also

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<sup>6</sup> Pisani, *To Reclaim a Divided West*, 285-294; Robinson, *Water for the West*, 13-16; Warne, *Bureau of Reclamation*, 70-71; and Hays, *Gospel of Efficiency*, 90-100.

had the potential to facilitate the opposing goals of increasing large-scale agribusiness and continuing use of water resources for immediate local benefit. Small farmers struggled, Western politicians influenced USRS activities, and federal engineers failed to demonstrate technical expertise.

The Progressive ideal of encouraging small farmers caused the USRS unending problems. For the first twenty years, USRS farmers had hard times making ends meet and protested loudly. Predictably, USRS engineers complained that the quality of the settlers posed a major problem. Beyond shortcomings of both the USRS and its settlers, irrigation farming was not well suited to changing immigrants, unemployed, and others into prosperous citizens. To make an irrigation farm successful, settlers needed capital and practical experience, and few people in the target groups had these resources. In the end, the USRS found myriad ways around the 160-acre rule and served agribusiness as much or more than it served family farmers.<sup>8</sup>

Giving control of irrigation to the Interior Secretary had the potential to increase local influence as well as decrease it as Progressive reformers hoped. True, giving the USRS to the Interior Secretary removed the direct ability of Western congressmen to sponsor pet projects or exercise the power of the purse. However, placing irrigation in the Department of Interior, rather than Agriculture or War, increased the ability of Western politicians to indirectly influence the USRS. Irrigation could logically have been given to the Army Corps of Engineers, which conducted river development programs in the East. It also could have gone to Agriculture, which worked with farmers. While the Army Corps of Engineers had rejected irrigation as a valid federal water development activity, Agriculture actively investigated irrigation before the creation of the USRS. Elwood Mead directed an Office of Irrigation Investigations in the Department of Agriculture. Mead and Newell, however, fought stubbornly for competing versions of federal irrigation

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<sup>7</sup> Warne, *Bureau of Reclamation*, 9-10 and 59-65 and Robinson, *Water for the West*, 19.

<sup>8</sup> Robinson, *Water for the West*, 37-40, Warne, *Bureau of Reclamation*, 72-85; and Cannon,

legislation. When Newell gained President Roosevelt's favor, Agriculture lost irrigation. The separation of irrigation from the existing centers of water and agriculture policy, coupled with historic ties between Interior and Western States, increased local influence in USRS activities. Further, the Reclamation Act increased state prerogatives in resource development through its water-rights provisions and the way it allocated funds. The legislation specifically acknowledged state water-rights laws. It also mandated that 51 percent of the proceeds from a state's public lands that financed federal irrigation be spent in that state.<sup>9</sup>

Finally, Donald Jackson has argued persuasively that the early years of the USRS did not exemplify the Progressive ideals of expertise or "efficiency." Jackson found the engineering and financial outcomes of the early USRS construction program wanting. The USRS constructed ordinary dams and could not control costs. Jackson argued that Newell focused on appearance—building imposing and familiar gravity structures and using contractors—rather than economizing through using less expensive and more technically demanding structural dams or government construction forces. Major cost over-runs resulted on all the early projects. (For a further discussion of money matters, see Chapter Five.) The creation of the USRS out of the USGS contributed to these kinds of problems. The first two directors—Frederick Newell and Arthur Davis—had technical experience in hydrography from their work for the USGS but no experience in civil engineering, construction, or agriculture. They knew something of measuring and mapping rivers but not building irrigation works or running successful farms. The consultants and contractors, who could have compensated for the USRS leaders, knew little more. At least on the Salt River Project, they too had related experience, rather than direct. While the USRS hired civil engineers and heavy construction firms, none had dam and canal building

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"Entering a New Era."

<sup>9</sup> Pisani, *To Reclaim a Divided West*, 273-285, 304-310, and 323-325.

experience in particular.<sup>10</sup>

In the early 1920s, then, the USRS had a mixed heritage. The early directors, Frederick Newell and Arthur Powell Davis, as well as the politicians who worked with Reclamation legislation, worked in the reform tradition. They set out to create a Progressive water resources agency with particular emphasis on family farms and apolitical expert direction. The first twenty years of USRS activities did not, however, fulfill these promises. The USRS struggled with its farmers, its ability to escape local influence, and its technical work.

### *USBR Leaders in the 1920s and 1930s*

During the 1920s and 1930s, a small and remarkably homogeneous group of engineering leaders literally bridged the USRS's founding in the Progressive reform tradition and the dramatic transformation of both the USBR and the American waterscape after World War II. Physically, space separated the USBR engineers. A commissioner and a small staff led the USBR from Washington, D.C. By far, however, most of the employees and leaders worked in the West. The Chief Engineer's office in Denver served as the technical hub for the USBR. In addition, each irrigation project had a field office. Divided geographically, a staid professional cultural homogeneity reigned in the USBR. Typical of American technical institutions of the time, the USBR employed white family men who held bachelor's degrees from land grant institutions and participated in professional societies. This group of staid professionals, then, provided the living connection between the USRS's Progressive heritage and multiple purpose dams.

A commissioner based in Washington, D.C. led the engineers who bridged the founding and the transformation of the USBR.<sup>11</sup> The commissioners primarily interacted with others in the capital. For example, commissioners during the 1920s and 1930s

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<sup>10</sup> Jackson, "Engineering in the Progressive Era."

<sup>11</sup> Before 1923, a "director" led the "USRS." In 1923, the Interior Secretary changed the names to "commissioner" and "USBR" as part of a set of reforms. He did not, however, substantially change the

assisted and received assistance from the Washington congressional delegation with legislation concerning Grand Coulee Dam. Commissioners also worked closely with Interior Secretaries and other upper-administration officials.<sup>12</sup>

Agricultural engineer Elwood Mead took the commissioner's office in 1923. Mead had a lengthy career in water resources before coming to the USBR. After working in a lower position in a survey team during his teenage years, Mead earned a Bachelor of Science at Purdue University and a bachelor's in civil engineering at Iowa State College in the early 1880s. A short tenure as professor of irrigation engineering at Colorado Agricultural College led to the position of State Engineer of Wyoming during the 1890s. In Wyoming, Mead participated in writing a water law that made the state the sole owner of all water. This legislation became the basis for revision of water rights doctrine in several western states. Subsequently, he promoted irrigated agriculture through the following positions: director of irrigation investigations in the U.S. Department of Agriculture; chairman of the State Rivers and Water Supply Commission in Victoria, Australia; and director of the state planned irrigation communities at Durham and Delhi, California. He also worked as a professor at University of California, Berkeley.<sup>13</sup> (See Appendix 2 for a picture of Elwood Mead.)

When Mead died in 1936, Interior Secretary Harold Ickes appointed civil engineer John C. Page acting commissioner and then commissioner. Page was a much less well-known engineer. Other than a year as assistant city engineer of Grand Junction, Colorado, Page spent his entire career in USBR. His training consisted of a Bachelor of Science from University of Nebraska and a year of graduate study at Cornell University. Page's work in

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USBR's organization. On the 1923 reorganization, see: Cannon, "Entering a New Era."

<sup>12</sup> Warne, *Bureau of Reclamation*, 21-25 described the function of the commissioner's office in the early 1970s. While the subdivisions within the Interior Department and the USBR's Washington, D.C. office differed in the 1920s and 1930s from those described by Warne, the basic tasks were the same.

<sup>13</sup> "Mead, Elwood," in *The National Cyclopaedia of American Biography*, vol. 26 (New York: James T. White and Company, 1937), 44-45; James R. Kluger, *Turning on Water with a Shovel: The Career of Elwood Mead* (Albuquerque: University of New Mexico Press, 1992); and Paul K. Conkin, "The Vision Of Elwood Mead," *Agricultural History* 34 (April 1960): 88-97.

the early 1930s as the second in charge of the field office for Hoover Dam moved him from USBR staff to USBR leadership.<sup>14</sup> (See Appendix 2 for a picture of John Page.)

A chief engineer served as the USBR's second-in-command. He held final authority for all technical matters. From Denver, the chief engineer and his staff coordinated construction, design, and research for the USBR. Construction men served as chief engineers in the 1920s and 1930s. They oversaw all the decisions that went through Denver, attended irrigation conferences, and traveled to major events on the projects, such as the openings of major bids for the construction of Grand Coulee Dam. During this period, the chief engineer's staff grew dramatically. In the early 1920s, a few senior engineers coordinated USBR engineering from Denver. By the 1930s, an assistant chief engineer, a chief designing engineer, an assistant chief designing engineer, a chief electrical engineer, a designing engineer of dams, a designing engineer of canals, a mechanical engineer, and an engineer on technical studies oversaw a staff of over 750.<sup>15</sup>

As with the commissioner's position, two men held the job of chief engineer during the 1920s and 1930s. Frank Weymouth served from 1916-1924. A civil engineer from the University of Maine (1896), Weymouth joined the USBR in 1902 after holding positions in Massachusetts, Canada, Nicaragua, and Ecuador. When Weymouth left the USBR, he continued to work in important water development positions in the U.S. and abroad. The J. G. White Engineering Corporation and Los Angeles's Metropolitan Water District in turn employed him as chief engineer. In the latter position, he supervised construction of the aqueduct that brought water from Hoover Dam to southern Californian cities. When Weymouth left, Raymond (Ray) Walter became chief engineer. Walter had joined the USBR at its creation and spent his career there. This Chicagoan with a civil engineering degree from Colorado State College held the position of chief engineer until his

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<sup>14</sup> "Page, John Chatfield," in *Who Was Who in America*, vol. 3 (Chicago: Marquis Who's Who, 1960), 660.

<sup>15</sup> Warne, *Bureau of Reclamation*, 25-27 and Robinson, *Water for the West*, 56, 71-73, and 75.

death in 1940.<sup>16</sup> (See Appendix 2 for pictures of Frank Weymouth and Raymond F. Walter.)

After the chief engineer, the most important man in Denver was John (Jack) Savage, the chief designing engineer (1916-45). Savage held final authority for all aspects of design, planning, and research in the USBR. The area heads reported to Savage—not directly to the chief engineer. The engineering community outside the USBR respected Jack Savage more than it respected any other USBR engineer. Savage held three honorary doctorates. The National Academy of Sciences and the American Academy of Arts and Science elected him a member. The four engineering “founder societies”—the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers—awarded Savage the John Fritz Medal for notable achievement in 1945. In addition, the Concrete Institute awarded him its Turner gold medal for his work on hydraulic structures. Except for eight years with a small consulting engineer firm, Savage spent his entire career with the USBR. His formal training consisted of a Bachelor of Science in civil engineering from the University of Wisconsin.<sup>17</sup> (See Appendix 2 for a picture of John Savage.)

In addition to the central staffs in Washington, D.C. and Denver, the USBR detailed engineers to oversee major construction projects. These consisted of surveyors, construction inspectors, and “office engineers.” This last group drafted, made cost estimates, and performed other engineering office tasks. Construction Engineer Frank

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<sup>16</sup> “Weymouth, Frank Elwin,” in *Who Was Who in America*, vol. 1 (Chicago: The A. N. Marquis Company, 1942), 1326 and “Walter, Raymond Fowler,” in *Who Was Who in America*, vol. 1 (Chicago: The A. N. Marquis Company, 1942), 1295.

<sup>17</sup> “Savage, Dr. John Lucian,” in *American Men of Science*, 11th edit. (New Providence, NJ: R. Bowker, 1968), 4669; Edgar C. McMechen, “The Billion Dollar Engineer,” *Reclamation Era* 27 (April 1937): 82-84; *John Fritz Medal: Biography of John Lucien Savage, Medalist for 1945* (New York: John Fritz Medal Board, 1945); Abel Wolman and W. H. Lyles, “John Lucian Savage,” in *Biographical Memoirs: National Academy of Sciences*, vol. 49 (Washington, D. C.: National Academy of Sciences, 1978), 225-239; and Benjamin D. Rhodes, “From Cooksville to Chungking: The Dam-Designing Career of John L. Savage,” *Wisconsin Magazine of History* 72 (Summer 1989): 243-272.



Banks, Office Engineer James Miner, Field Engineer Alvin Darland, and, in the 1940s, Director of Economic Surveys Horace Parker headed the Grand Coulee Dam staff.<sup>18</sup> (See Appendix 2 for pictures of these men.)

Frank Banks, like his superiors in Washington, D.C. and Denver, spent his career working for the USBR. Banks studied for his degree in civil engineering at the University of Maine, although not in the same years as Chief Engineer Weymouth. Banks joined the USBR immediately upon graduation in 1906. He supervised the construction of several major dams before Grand Coulee. Immediately before Grand Coulee Dam, Banks oversaw the construction of Owyhee Dam in Oregon—at the time the USBR’s largest dam. Banks’s superiors valued his work. Suspecting that the Tennessee Valley Authority might try to hire Banks, Walter wrote to Mead “I do not believe we should give them our best construction engineer to possible detriment of our own work.”<sup>19</sup>

Finally, the USBR hired consulting engineers to monitor major construction endeavors like Hoover and Grand Coulee Dams. These met as a board a couple of times a year to review designs and specifications, to inspect the quality of the work and procedures, and to provide opinions on issues raised by the USBR regular staff. For Grand Coulee Dam, the USBR’s consulting board consisted of Columbia University Professor of Geology Charles Berkey, retired Stanford Professor of Mechanical Engineering and Fluid Mechanics William Durand, Seattle consulting engineer and former USBR employee Joseph Jacobs, and Dayton, Ohio, consulting engineer Charles Paul, also a former USBR engineer.<sup>20</sup> (See Appendix 2 for a picture of these men.)

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<sup>18</sup> The USBR engineers compiled “Annual Project Histories,” which describe the staff members at Grand Coulee Dam and their activities. See, for example, USBR, “Columbia Basin Project: Annual Project History,” vol. 1, 1934, Entry 10, WDC, RG 115. See also: “H. A. Parker Now Irrigation Engineer, Columbia Basin Project,” *Reclamation Era* 29 (January 1939): 20.

<sup>19</sup> Quote from R. Walter to E. Mead, telegram, 28 July 1933, 478:101.03, Entry 7/30-45-CBP, WDC, RG 115. See also: “Honorary Degrees Conferred on Reclamation Officials,” *Reclamation Era* 30 (September 1940): 262-263 and “Banks, Frank Arthur,” in *Who Was Who in America*, vol. 3 (Chicago: Marquis Who's Who, 1960), 47.

<sup>20</sup> The “Annual Project Histories” also describe the activities of the consulting boards. See, for example, USBR, “Columbia Basin Project,” 1934, Entry 10, WDC, RG 115, 35-37. See also: “Berkey,

	Commissioners	Denver Leaders, 20s†	Denver Leaders	Grand Coulee Dam Leaders	All
Northeast		1	1	3	5
Midwest and Plains states	3	1	6	1	11
Reclamation West			3	1	4
South		1			1
Europe	1	1			2
not available		1	3	2	6
total	4	5	13	7	29

\* Sources for all the tables in this chapter are given in Appendix 3.

† A small group of men left the Denver office during the 1920s after the agency's reorganization. I give their data in a separate column because their behavior differed significantly from that of the rest of the Denver leaders.

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
married	4	4	10	3	21
not married					
not available		1	3	4	8
total	4	5	13	7	29

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
children	4	3	8	3	18
no children		1	2		3
not available		1	3	4	8
total	4	5	13	7	29

Charles Peter," in *Who Was Who in America*, vol. 3 (Chicago: Marquis Who's Who, 1960), 70; "Durand, William Frederick," in *Who Was Who in America*, vol. 3 (Chicago: Marquis Who's Who, 1960), 244; and "Paul, Charles Howard," in *Who Was Who in America*, vol. 1 (Chicago: The A. N. Marquis Company, 1942), 945.

The commissioners, Denver office leaders, and field staff leaders (the latter as represented by the heads of the office for Grand Coulee Dam) were a very homogeneous professional group. Geographically, socially, and educationally, these men typified technical professionals of their time. Further, like many technical professionals, they participated in professional societies and consulted internationally. With respect to public service, these men held a moderate position. They committed their careers to public service. However, unlike radicals of the 1930s, USBR leaders did not pair their government service with condemnation of corporate engineering. Geographically and socially, USBR leaders were similar to other technical professionals. With three of the four commissioners and chief engineers of the period 1923-1943 hailing from the Midwest or Plains states, Mead, Page, Weymouth, and Walter exemplified their colleagues. In all, eleven of twenty-nine, or over one-third, came from this region. The West and Northeast split the second third. Only one man came from the South and two from Europe.<sup>21</sup>

Socially, as well, these men were very typical. The large majority married and had children. Commissioner Mead, for example, married Florence Chase in 1882 and, after she passed away, married Mary Lewis in 1905. In all, Mead had six children. While most USBR leaders had fewer children, all twenty-one of the USBR leaders for whom information was available married, and eighteen of the twenty-one had children.

Like their agricultural expert peers, these men overwhelmingly held bachelor's as their highest degrees and attended state universities (often land-grant schools). For example, Chief Engineer Walter earned a Bachelor of Engineering from the Colorado State College. For twenty of twenty-nine, a bachelor's degree ended their formal education. Further, only three men—all commissioners—had more education, and only two had less. The only man without any formal education, David W. Davis, also served as commissioner. USBR engineers overwhelmingly chose state universities—twenty-three of

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<sup>21</sup> For a historical discussion of a similar professional group, see Charles Rosenberg's essays on American agricultural professionals in the late nineteenth and early twentieth centuries. Rosenberg, *No*

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
none	1				1
some college			1		1
bachelor's		3	11	6	20
second bachelor's	1				1
some graduate work	1				1
master's	1				1
not available		2	1	1	4
<b>total</b>	<b>4</b>	<b>5</b>	<b>13</b>	<b>7</b>	<b>29</b>

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
state university	4	3	11	5	23
private university				2	2
small college	1		1		2
other			1		1
none	1				1
not available		2	1	1	4
<b>total*</b>	<b>6</b>	<b>5</b>	<b>14</b>	<b>8</b>	<b>33</b>

\* Totals exceed other tables because some men attended more than one school.

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
civil engineering	2	1	5	3	11
electrical engineering			2	1	3
other engineering		1	1	1	3
none	1				1
not available	1	3	5	2	11
total	4	5	13	7	29

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
ASCE	3	3	9	3	18
AIEE			3	1	4
American Concrete Institute		1	3		4
Colorado Society of Engineers			5		5
Chi Epsilon		1	2		3
Tau Beta Pi		1	3	1	5
Sigma Xi		1	4		5
Sigma Tau	2			1	3

<b>Table 8: Positions beyond USBR</b>					
	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
Major electrical companies, such as General Electric or Pacific Gas & Electric			2	2	4
The Army Corps of Engineers or TVA	1	1	2	3	7
Metropolitan Water District (Los Angeles)		4			4
International work	2	3	3	1	9

<b>Table 9: Portion of Career with USBR</b>					
	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
entire	2		5	2	9
end block	1		4	2	7
middle out			1	1	2
middle block		4	1		5
short	1		1	2	4
not available		1	1		2
total	4	5	13	7	29

thirty-two institutions. No single school, however, had conspicuous ties to the USBR. Leaders came from state schools all across the West and Midwest.

There are fewer records on, and less consistency in, the field of education chosen by USBR engineers than either final degree or type of institution. Biographical dictionaries did not reveal the field of study for over a third of the USBR leaders. An equal number—eleven—studied civil engineering. The rest of the men also took engineering degrees: three electrical, one general, one mining, and one topographical.

Like many professionals of the period, USBR engineers also participated in professional societies. By far, the most men joined the American Society of Civil Engineers (eighteen of twenty-nine). Three other organizations—the American Institute of Electrical Engineers, the American Concrete Institute, and the Colorado Society of Engineers—ranked next in popularity. Each claimed four or five USBR leaders among its members.

Many American technical professionals of the early decades of the twentieth century consulted or worked internationally. Nine USBR leaders—two commissioners, six Denver office men, and one of the Grand Coulee leaders—worked on a range of international projects. These included planning irrigation communities in Australia, building waterworks in Mexico, and working on the Panama Canal. The Near East, Far East, British Empire, and Central and South America provided virtually all the international experiences to USBR men.

Unlike some Progressive reformers, USBR engineers demonstrated a commitment to government service without condemning corporate work. The career choices of the USBR engineers showed a commitment to government service. Both career paths and number of years spent in the USBR illustrated devotion to government engineering. Of twenty-nine men, sixteen—over half—either spent their entire career with the USBR or stayed once they joined it. Only four leaders worked for the USBR for a short period. In

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
less than 10	1		1	2	4
10-19	1	2			3
20-29		2	3	1	6
30-39	2		6	1	9
40-49			2		2
50 or more				1	1
not available		1	1	2	4
total	4	5	13	7	29

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
1880-1889	2				2
1890-1899		3	1		4
1900-1909	2	1	6	4	13
1910-1919			5	1	6
not available		1	1	2	4
total	4	5	13	7	29

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
1902-1909	2	3	5	3	13
1910-1919		1	5		6
1920-1929	2		1		3
1930-1939			1	4	5
not available		1	1		2
Hired under F. H. Newell or A. P. Davis	2	4	10	3	19
total	4	5	13	7	29



terms of years, twelve men spent over thirty years working for the USBR. Frank Banks, the construction engineer for Grand Coulee Dam, set the record with fifty-one years. Another nine men worked for the USBR between ten and twenty-nine years. Only four worked for the USBR for less than ten years. However, USBR engineers did not pair these actions with a strong anti-corporate stance. A Progressive-like, anti-corporate sentiment did exist in the 1930s. Boosters from the small towns of the Columbia Basin displayed strong anti-corporate sentiments. Beyond suspecting the “power trust” of a conspiracy against damming the Columbia River, James O’Sullivan and his friends tried to prevent any men who had previously been employed by a private electrical firm from working on Grand Coulee Dam.<sup>22</sup> USBR leaders, in contrast, did not see former corporate employment as a litmus test for suitability. Two of the leaders of the Grand Coulee Dam staff and two of the men in leadership positions in the Denver office had worked for such corporations.

USBR leaders of the 1920s and 1930s bridged the Progressive and post-World War II periods by beginning their careers during the former period and ending them launching the institutional transformation of the latter. USBR leaders began their careers between 1885 and 1915. Most—two-thirds—started working in the first two decades of this century. More specifically, leaders of the 1920s and 1930s began working for the USRS under its reform-oriented Directors Newell and Davis during the Progressive Era. Nineteen of twenty-nine leaders did so. These men launched the massive building after World War II by building the early multiple purpose dams of the 1930s and early 1940s as the climax to their careers. These men directed the construction of these dams as their last

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<sup>22</sup> For examples of O’Sullivan’s feelings about the electrical power industry, see: J. O’Sullivan to C. H. Leavy, 1 Jan. 1933, 6:18 O’Sullivan MSS; J. O’Sullivan to W. G. Ronald, 3 Oct. 1934, 8:3 O’Sullivan MSS; and J. O’Sullivan to Boots, 30 Mar. 1938, 1:12, O’Sullivan MSS. Other pumping boosters who suspected the “power trust” of backing the gravity plan included Frank Funkhouse and Willis Batcheller. For example, see : Frank Funkhouse, “Recent Developments in the Columbia Basin Project,” Radio address delivered over KHQ, Spokane and KOMO, Seattle, 9 May 1933, 7:2, O’Sullivan MSS and [W. Batcheller] to F. D. Roosevelt, 4 Nov. 1933, 9:Outgoing Letters 21-33, Batcheller MSS. For specific criticism of hiring engineers who had worked for large electrical corporations, see: [W. Batcheller] to F. T.

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
1850s	1				1
1860s		2			2
1870s	1	1	4	1	7
1880s	2	1	5	2	10
1890s			1	1	2
not available		1	3	3	7
total	4	5	13	7	29
range	1858-1887	1865-1881	1870-1892	1877-1891	1858 - 1892

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
1920-1929	1	4			5
1930-1939	1		3	2	6
1940-1949	2		6	1	9
1950-1959			2	1	3
still employed in 1949			1	3	4
not available		1	1		2
total	4	5	13	7	29

	Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders	All
no employment	2		4	2	8
consulting	2		4		6
corporate/local government position		4	1		5
federal position			2	1	3
not available		1	2	4	7
total	4	5	13	7	29

major professional endeavor. Their leadership positions came late in their careers and, for many, preceded retirement. Mature engineers held the USBR positions. Born between 1858 and 1892, the oldest leader was seventy-two and youngest thirty-eight in 1930. Many of these men served as USBR leaders as their last regular professional position. At least half of these men retired or died in office in the 1930s and 1940s. Fifteen men stepped down in these two decades. Of the eighteen who left between 1930 and 1960, eight retired from engineering entirely. Another six continued to work, but only as consulting engineers. After a group of five left the USBR between 1924 and 1926, only four men departed for regular positions. Three of these continued similar work in other federal dam building agencies—the Tennessee Valley Authority and the Army Corps of Engineers.

In all, a special group of men led the USBR during the 1920s and 1930s. Commissioners, chief engineers, Denver office department heads, and the top staff of large projects bridged the USBR's Progressive heritage and its multiple purpose dam building era. The men also exemplified American technical professionals. The USBR hired Western or Midwestern white family men for its leaders. Virtually all of these men held undergraduate degrees from land-grant universities and participated in at least one professional society. While these men provided a direct link to Progressive engineering reform and multiple purpose dam building, they did not hold to all the Progressive reform norms. They committed their careers to public service but did not look down upon corporate engineering.

### ***USBR Leaders and Grand Coulee Dam, 1920-1934: Reluctance and Independence***

It was ironic that USBR leaders of the 1920s and 1930s bridged the USBR's founding and its transformation into a major builder of multiple purpose dams. At least in the case of Grand Coulee Dam, USBR engineers did not want to be part of building an

enormous irrigation and/or hydroelectricity development.<sup>23</sup> Until well into the 1930s, USBR leaders primarily desired not to become entangled in Washington State politics. From the earliest studies, however, Washington State officials sought federal moneys for the development of the Columbia Basin. Toward this end, they tried to win federal engineers' endorsements of their efforts. Once USBR engineers recognized that they could not escape, they moved to preserve an independent voice in the development debates. In the 1920s, the USBR engineers primarily fought to conduct technical studies as they saw fit. In particular, they wanted to compare pumping and gravity plans using their own standards. The approaches to interacting with local boosters that USBR engineers honed in these battles contributed to the strong professional and reform stance encouraged by their backgrounds. This dance between USBR engineers and Washington State supporters of development began in 1920 with the state study of irrigating the Columbia Basin and carried through the spring of 1934 when Harold Ickes, the head of the Public Works Administration, declared Grand Coulee Dam a federal project.

Washington State officials persistently sought USRS endorsement of the 1920 Columbia Basin Survey Commission (CBSC) study of irrigating the Columbia Basin. Washington Governor Ernest Lister actually first proposed a joint federal-state study. When Interior Secretary Lane demurred, Washington State officials undertook an independent study and asked the USRS to consult. When the CBSC engineers completed their work, the CBSC asked the USRS to review it.<sup>24</sup>

USRS Director Arthur Davis preferred independence and only reluctantly complied with these requests. Davis assigned David Henny, the USRS's engineer stationed in Portland, Oregon, and James Munn, a senior engineer in the Denver office, to serve as consultants. In December, Davis directed engineer Charles Pease to join Henny and Munn

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<sup>23</sup> The history of Hoover Dam suggests that USBR engineers did not generally resist working with large multiple purpose projects. See: Hundley, "Politics of Reclamation."

<sup>24</sup> Pitzer, *Grand Coulee*, 23-24 and Ficken, *Rufus Woods*, 64-67.

in reviewing the state's work.<sup>25</sup>

A series of testy exchanges between the USRS and the CBSC further demonstrated both the desires of Washington State officials to cast the USRS in the narrow role of endorsing state plans and the wish of USRS engineers to be independent. First, the CBSC and Director Davis bickered over a brief visit Davis made to the proposed dam site at the head of the Grand Coulee in September 1920. As described in Chapter Two, the CBSC's Fred Adams denounced Davis's failure to consult the CBSC before visiting the site and condemned Davis's alleged endorsement of a dam. Davis reacted indignantly to both Adams and James O'Sullivan, who produced the presumptuous report of endorsement, because he felt both crossed professional lines.<sup>26</sup>

Davis and the CBSC had a similar disagreement over the USBR review of the CBSC's study. While USBR engineers generally praised the work of the CBSC, they found the difference between the estimated costs for gravity and pumping plans exaggerated. They also recommended further study of the damming of the Columbia River and stated that the data, cost estimates, and conclusions of the CBSC study could only be viewed as preliminary. The CBSC attacked the quality of this assessment, which went far beyond endorsing the state's conclusions. Davis again supported the work and objective approach of the USRS.<sup>27</sup>

Another confrontation occurred a few months later. Washington State officials asked for a recommendation on how to best use a further appropriation for studies of the Columbia Basin. Davis and his men reiterated their opinion that Washington State should test the quality of the rock at the proposed dam site. Although the state undertook this

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<sup>25</sup> Pitzer, *Grand Coulee*, 23-24 and 30; Ficken, *Rufus Woods*, 64-67; CBSC, *Columbia Basin Irrigation Project*, 13; and USRS, "Review of Report on the Columbia Basin Project Washington," 13 December 1920, Reports 10-55, ERC, RG 115, 21.

<sup>26</sup> Pitzer, *Grand Coulee*, 29; Ficken, *Rufus Woods*, 66-67; and A. P. Davis to E. F. Blaine, 24 May 1922, 511:300.01, Entry 7/19-29-CBP, WDC, RG 115.

<sup>27</sup> USRS, "Review of Report on the Columbia Basin Project Washington," 13 December 1920, Reports 10-55, ERC, RG 115 and A. P. Davis to E. F. Blaine, 24 May 1922, 511:300.01, Entry 7/19-29-CBP, WDC, RG 115.

work, Fred Adams released false information on the results. USRS Engineer Henny, upholding scientific objectivity, demanded that Adams release correct information. Adams did, but he also launched a smear campaign against Henny and the USRS in the Spokane press. Again, the Washington State man sought confirmation of the state's work, and the USBR man stood for "objective" study.<sup>28</sup>

In 1923-5, Washington State officials butted heads with the USRS over a new study of developing the Columbia River and Basin. Encouraged by Spokane's Columbia Basin Irrigation League (CBIL), Washington Senator Clarence Dill introduced and Congress passed legislation to fund a \$100,000 federal irrigation survey. Administration of the study became an immediate focus in a fight between the USRS and Washington State. CBIL sought a board to direct the study. The CBIL representative, Fred Adams, had a consistent goal for a board: outnumber the USRS representative with men in favor of the gravity plan. Adams proposed boards of three to five men. He suggested that members represent several different executive departments and Washington State. He also nominated consulting engineer General George Goethals. USRS leaders reacted by fighting for control of the appropriation. In a rare expression of opinion on a non-technical matter, Chief Engineer Weymouth clearly voiced his concerns and preference for control. He wrote:

I presume that if your advice is followed and the work placed entirely under your supervision, the Columbia Basin crowd would then "throw rocks" at every step the Service would take in connection with the investigations. On the other hand, if a commission of five is appointed and you are made a member of it, the Reclamation Service will be used whenever the Columbia Basin crowd find it is to their advantage to use it, as they have done in securing the appropriation, and oppose the Service whenever it is to their advantage to do so, so whatever happens the Service will be "made the goat."

Viewing the situation from the Reclamation Service standpoint alone, I think it would be better if it could avoid having anything further to do with the matter, and let the Secretary appoint a commission or anyone he sees fit outside the Service to carry out the investigations and let the new organization build up its own organization and make its own investigations without reference to the Service....

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<sup>28</sup> Pitzer, *Grand Coulee*, 30-32.

I think this whole Columbia Basin proposition is a bad mess and the more the Service has to do with it, the harder it will be to extricate ourselves with honor, and all that I can see is for the Service to “pull out” entirely before we get in so deep that there will be no way to get out.

Would it not be a good scheme to tell the Columbia Basin crowd that if they want to run the whole affair, we are perfectly willing to let them do it and the Service will stay out, but if they want the help of the Service, we should be permitted to make the investigations as seems to us wise.<sup>29</sup>

Davis agreed that the men from Spokane would try to manipulate the USRS and also preferred to have nothing to do with the study. Davis, however, feared the USRS could not escape participation. Therefore, he attempted to get the appropriation directed to the USRS alone. Davis tried to frame the study around a technical issue to justify USRS control. Earlier in the year, a Federal Power Commission board of engineers had essentially recommended issuing no hydroelectric power permits for the Upper Columbia River until the question of whether to irrigate the Columbia Basin with a gravity plan or a pumping plan had been resolved. Davis pitched the new federal study as a way to make that decision and unblock the permit process. Further, he stressed that the impartiality of the USRS made it best able to conduct such an investigation. As another strategy, Davis also refused to serve on any committee that would impinge on USRS control. In the end, the Interior Secretary compromised between the Washington boosters and the USRS. Secretary Work appointed a commission of two to oversee the study and gave final authority in technical matters to the USRS. This setup changed nothing in the interaction between the USRS and Washington State.<sup>30</sup>

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<sup>29</sup> F. E. Weymouth to A. P. Davis, 5 Mar. 1923, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115.

<sup>30</sup> Pitzer, *Grand Coulee*, 40; A. P. Davis to F. Weymouth, 11 July 1922, 416:791 5/21-22, EC-CB, CE, RG 115; A. P. Davis to F. Weymouth, 13 July 1922, 416:791 5/21-22, EC-CB, CE, RG 115; A. P. Davis to Columbia Basin Reclamation Association, 30 Dec. 1922, 511:300.01 thru 29, Entry 7/19-29-CBP, WDC, RG 115; A. P. Davis to E. M. Chandler, 8 Jan. 1923, 512:301 to 12/31/22, Entry 7/19-29-CBP, WDC, RG 115; A. P. Davis to F. E. Weymouth, 23 Feb. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; A. P. Davis to F. E. Weymouth, 28 Feb. 1923, 416:791 9/23 to 9/24, EC-CB, CE, RG 115; A. P. Davis to C. C. Dill, 1 Mar. 1923, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115; A. P. Davis to J. W. Summers, 1 Mar. 1923, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115; A. P. Davis to E. Mead, 1 Mar. 1923, 511:300.01, Entry 7 19-29-CBP, WDC, RG 115; A. P. Davis to D. Henny, 6 Mar.

Director Davis next strove to guarantee USRS independence by selecting Engineer Homer Gault to head the investigation. Beyond Gault's engineering experience, Davis cited Gault's modesty, impartiality, and discretion as major reasons for his appointment. Davis also stated that Mr. Gault "has the great virtue of persistent silence." Davis felt Gault would produce an independent study and do so without dragging the USRS further into Washington State politics.<sup>31</sup>

In the spring of 1923, no one could have guessed how this investigation would turn out. Gault began work in March 1923 with the understanding that he would submit his report in December 1924. However, Secretary Work, pushed by CBIL, soon moved the deadline up to the winter of 1923-24. When Gault submitted his findings, he estimated that irrigating the Columbia Basin would cost at least \$230 per acre. This figure—\$60 per acre more than the estimate of the CBSC—infuriated CBIL members. Since the accelerated study had not spent all the funds, these men angled for a substantial review of Gault's work by an outside board of engineers. Meanwhile, as Gault conducted the survey, the Interior Secretary fired USRS Director Arthur Davis over the dismal financial situation of USBR projects. After banker and politician David W. Davis briefly held the top position, Secretary Work appointed agriculture engineer Elwood Mead as commissioner of the renamed USBR. The Spokane men, then, applied to Mead, and not Davis, for a review of Gault's work.<sup>32</sup>

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1923, 511:300.01, Entry 7 19-29-CBP, WDC, RG 115; A. P. Davis to F. E. Weymouth, 8 Mar. 1923, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115; A. P. Davis to F. E. Weymouth, 8 Mar. 1923b, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115; and A. P. Davis to C. C. Dill, 10 Mar. 1923, 511:300.01 thru 29, Entry 7 19-29-CBP, WDC, RG 115.

<sup>31</sup> Quote from: A. P. Davis to F. E. Weymouth, 8 Mar. 1923, 510:101.03, Entry 7 19-29-CBP, WDC, RG 115. See also: Meisel to F. E. Weymouth, telegram, 12 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; A. P. Davis to H. Work, 15 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and A. P. Davis to H. J. Gault, 16 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115.

<sup>32</sup> CBIL to H. Work, 26 May 1923, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. E. Weymouth, 26 May 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; CBIL, H. Lindley, and F. A. Adams, "Columbia Basin Irrigation Project. A Secondary Project," [May or June 1924], 416:791 9/23-9/24, EC-CB, CE, RG 115; O. L. Waller to E. Mead, 26 July 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 99; and Robinson, *Water for the West*, 44-45.



New leadership and yet another study, however, did not substantially change the pattern of Washington booster-USBR interaction. The locals still initiated studies of the project and the USBR sought independence. Mead's approach did differ somewhat from that of Davis. While Davis consistently sought an independent voice, Mead advocated collaborating with local experts. At the same time, Mead had a stronger specific agenda for USBR work; he emphasized creating stable agricultural communities.

In response to the review request, Mead agreed to appoint a review board but insisted the development of a plan for agriculture be part of the effort. After extensive discussions and negotiations with Chief Engineer Weymouth, CBIL, and various consulting engineers, Mead appointed the following board that carefully balanced USBR concerns about professionalism and agricultural development with the demands from Washington State:

- 1) Louis Hill, former USBR senior construction engineer and frequent USBR consultant;
- 2) Joseph Jacobs, Seattle civil engineer and former USBR employee;
- 3) Charles Locher, a civil engineer who had consulted on numerous projects including the Miami Conservancy District and the New York subway;
- 4) Richard Lyman, hydraulic engineer and former professor of civil engineering in Utah;
- 5) Arthur J. Turner, former chief engineer of the CBSC study; and
- 6) Osmer Waller, civil engineer at Washington State College and former secretary of the CBSC study.

Assistant Interior Secretary Francis Goodwin, negotiating for the Spokane men, brought in Charles Locher as an expert on construction costs, Arthur Turner as a representative of Washington State, and Joseph Jacobs as a USBR engineer with Washington State connections. Chief Engineer Weymouth proposed Louis Hill to represent the USBR establishment. Mead added Waller, who had expressed interest in farm development questions, and Lyman to report on the prospects of farming in the Columbia Basin. (With

substantial aid from Washington State College Vice-Dean of Agriculture George Severance, Waller and Lyman produced the first study of this kind for the Columbia Basin Project.)<sup>33</sup>

When the federal government funded the construction of Grand Coulee Dam during the New Deal, Washington State boosters again initiated work and the USBR engineers sought to preserve an independent voice. Washington Senator Clarence C. Dill and Washington State Grange Master Albert Goss asked President Roosevelt to include Grand Coulee Dam in the recovery bill. Roosevelt agreed and chose the USBR to oversee the technical work. Confusion over the status of the dam, however, again led to tension between Washington State officials and USBR engineers. Theoretically, the Public Works Administration (PWA), through which Roosevelt initiated federal construction of Grand Coulee Dam, sponsored projects in two ways. It funded federal projects directly through executive agencies, and it funded projects by loaning funds to state and local governments. Initially, Roosevelt and Harold Ickes, who served as both Interior Secretary and PWA Administrator, intended to build Grand Coulee Dam as a state project. Accordingly, in June 1933 the Columbia Basin Commission (CBC), representing Washington State, hired the USBR to complete preliminary studies and designs for the dam. A short time later, administration lawyers decided the project would have to be federal because the Washington constitution forbade substantial debt. In the fall, then, the PWA released the initial federal funds for the dam directly to the USBR. The CBC, however, still oversaw its contract for investigations and designs and played an active role on the ground.<sup>34</sup>

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<sup>33</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 44-58; F. Goodwin to E. Mead, telegram, 29 July 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; E. Mead to F. Goodwin, 2 Aug. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; E. Mead to F. E. Weymouth, telegram, 14 Aug. 1924, 416:791 9/23-9/24, EC-CB, CE, RG 115; F. E. Weymouth to E. Mead, telegram, 15 Aug. 1924, 416:791 9/23-9/24, EC-CB, CE, RG 115; E. Mead to O. L. Waller, 19 Aug. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; E. Mead to R. R. Lyman, 4 Sept. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; "Hill, Louis Clarence," in *Who Was Who in America*, vol. 1 (Chicago: The A. N. Marquis Company, 1942), 564; "Charles H. Locher, Engineer, Was 85," *The New York Times*, 17 January 1948; "Lyman, Dr. Richard Roswell," in *American Men of Science*, 5th edit. (New Providence, NJ: R. R. Bowker, ), 698; and "Waller, Osmar Lysander."

<sup>34</sup> Pitzer, *Grand Coulee*, 69, 72, 77-78 and Harold L. Ickes, "Spending \$3,300,000,000 PWA Accomplishments—Expenditures Should Accelerate Recovery for Rest of 1934," *Barron's: The National*

Chief Engineer Walter and Commissioner Mead objected to this confusion over authority. Their complaints on two occasions illustrated their objections. First, Walter expressed dissatisfaction over CBC Secretary James O’Sullivan’s efforts to involve the CBC’s board of consulting engineers in the ongoing design process. In the end of October 1933, Secretary O’Sullivan initiated a series of requests for information on the design so that he could bring his consulting board into the design process. A grumpy Walter adroitly headed off this bid for state input into technical decision making. After commenting that “I am afraid they [the CBC’s board of engineers] are going to be a nuisance,”<sup>35</sup> Walter and his advisors carefully crafted the response that the state of the work—notes and drawings scattered among the work of various engineers—prevented them from sending copies to Washington. Instead, Walter suggested state engineers could participate in reviewing the designs. This review came much later—March 1934—and endorsed the USBR plans without changes.<sup>36</sup>

This design review provoked the second direct expression of dissatisfaction over efforts of the CBC to participate in USBR activities. O’Sullivan had been busy again. He objected to a proposed member of the USBR board of engineers and asked if he and a couple of CBC engineers could arrive in Denver for the board meetings early to examine plans. Mead brought “the difficulties we are encountering over the uncertainty as to who is building Grand Coulee Dam”<sup>37</sup> to the attention of the PWA.<sup>38</sup>

*Financial Weekly*, 9 April 1934, Articles, Ickes MSS.

<sup>35</sup> Handwritten note on: J. O’Sullivan to R. F. Walter, 30 Oct. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115.

<sup>36</sup> F. Banks to R. Walter, 27 Oct. 1933, 438:791-D-1 10/31-3/34, EC-CB, CE, RG 115; J. O’Sullivan to R. F. Walter, 30 Oct. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. Walter to F. Banks, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. Walter to J. O’Sullivan, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. F. Walter to J. O’Sullivan, 11 Nov. 1933, 14:7, CBC MSS; R. F. Walter to F. Banks, 11 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; W. C. Morse, A. F. Darland, D. C. Henny, and H. E. Smith to CBC, 31 Mar. 1934, 415:791 10/31-9/34, EC-CB, CE, RG 115; and C. P. Berkey, W. F. Durand, J. Jacobs, and C. H. Paul to R. Walter, 31 Mar. 1934, Reports 10-55, ERC, RG 115.

<sup>37</sup> E. Mead to F. Schnepfe, 22 Mar. 1934, 534:301.17/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115.

<sup>38</sup> J. O’Sullivan to R. F. Walter, 13 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP,

The joint review of designs for Grand Coulee Dam in the spring of 1934 ended a long series of tense interactions between Washington men and the USBR over the control of this development project. The Washingtonians had tried to enroll the USBR in their plans repeatedly: in the 1920 CBSC study, in the 1923 federal study, in the 1924 review of Gault's work, and through the CBC in the 1930s. The USBR engineers responded by seeking to maintain independence and "scientific objectivity." Director Davis had the CBSC's work reviewed in a normal USRS fashion. Davis fought for and won the opportunity for a USRS engineer to conduct the federal study. Commissioner Mead agreed to a review of Gault's work but added an agricultural review too. Although the USBR engineers did work with the CBC in the early 1930s, they kept the Washington men out of the most technical decisions, and legal decisions quickly gave them complete control of the construction of Grand Coulee Dam.

### *Conclusion*

In the end, federal engineers got the chance to build Grand Coulee Dam as they saw fit because a combination of state and federal legal factors led the Roosevelt administration to make the dam a federal project. During the 1920s and early 1930s, the USBR engineers, especially Director Arthur P. Davis and Commissioner Elwood Mead, constantly fought to maintain a position as independent technical professionals. The life experiences of the USBR engineering leaders, such as Chief Engineer Ray Walter and Grand Coulee Dam Construction Engineer Frank Banks, contributed to their insistence on maintaining this independence. These white family men came mostly from the West and Midwest and displayed a staid professionalism. They devoted their careers to government engineering, took undergraduate engineering degrees from state schools, and participated in professional organizations. Further, a strong Progressive professional heritage from the founding of the USRS supported this independent stance. In its first two decades, strong

Progressive leaders—Frederick H. Newell, Arthur P. Davis, Theodore Roosevelt, and Francis Newlands—shaped the USRS. The men who led the USBR during the 1920s and 1930s either participated in this Progressive leadership or matured professionally under these leaders. This second group in the consensus for multiple purpose water development provided a bridge between Progressive reform engineering and post-war USBR expansion.



## **Chapter 4—Gravity versus Pumping: Conservation and the Conceptualization of a Multiple Purpose Dam in the 1920s**

During the 1920s and early 1930s, federal engineers thought about dams in two ways that led them to recommend a combination irrigation and hydroelectricity project for the Columbia River and Basin based on a multiple purpose dam. In the 1920s, engineers of the Federal Power Commission (FPC), the U.S. Army Corps of Engineers (Army), and the U.S. Reclamation Service (USRS)<sup>1</sup> all used conservation ideals about water resources development to shape studies of central Washington. This approach led the engineers to analyze pumping plans and ultimately to select a combination project. In the 1930s, the USBR began building Grand Coulee Dam as simply a hydroelectricity facility because of political expediencies. Financial concerns, however, motivated USBR engineers to significantly change the design for Grand Coulee Dam three times after its initial approval in the spring of 1933. In the end, concerns about money drove USBR engineers to return to the late 1920s plan for a larger dam and both irrigation and hydroelectric development. I discuss the financial roots of multiple purpose building in the next chapter. Here, I explore the relationships between the conservation idea of “comprehensive planning,” conservationists’ advocacy of water storage reservoirs, and the formulation of a plan to build Grand Coulee Dam as a large multiple purpose dam.

During the first two decades of this century, federal engineers and scientists consolidated and elaborated ideas that natural resources should be managed to provide maximum long-term use. These conservationists called for “comprehensive planning” for the development of water resources and the construction of water storage reservoirs. By “comprehensive planning,” engineers meant determining the possible uses of a body of water, setting priorities for use, and formulating a development approach that maximized

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<sup>1</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period

use in as many ways as possible. Through the 1920s, engineers most often considered navigation, irrigation, flood control, and hydroelectric development as beneficial uses. “Comprehensive” at times referred to the geographical extent of a development plan, as well as the maximization of a spectrum of uses. “Comprehensive plans” often encompassed entire watersheds. For conservationists, storage reservoirs often had a place in a comprehensive plan. Conservationists, however, also valued storing water independently. The call for storage reservoirs originated with scientists and engineers in the West. They sought to increase the usefulness of their limited water resources by holding water in natural or artificial lakes and managing its release for particular uses, such as irrigation or city water supplies. While Progressive scientists and engineers debated the technical merits of these ideas, new federal programs began to implement these notions.

Building on conservationists’ ideas, engineers from the FPC, Army, and USBR developed a plan to dam the Columbia River, produce hydroelectricity, and irrigate the Columbia Basin in the 1920s. The FPC and the Army examined the Columbia River twice in the 1920s. These engineers sought to establish a comprehensive plan for development of the river to guide federal licensing of hydroelectric dams. Similarly, in the early 1920s, the USRS studied irrigation of the Columbia Basin from this comprehensive planning framework. Because of these goals, these engineers made the basic technical studies of damming the Columbia River at the head of the Grand Coulee and selected this development over a gravity plan.

For the USBR, however, conservation ideas did not provide a simple or sufficient reason to support damming the Columbia River and irrigating the Columbia Basin during the 1920s. The USBR recommended against irrigating the Columbia Basin entirely in the 1920s. At the same time, USBR experiences with hydroelectricity and Hoover Dam changed its perspective. When in 1931 the Army opined that the Upper Columbia River and Columbia Basin should be developed later as a combination irrigation and hydroelectric



power venture, the USBR went further. It adopted the Army's technical plans and recommended immediate federal construction.

### *Conservation and Rivers, 1900-1920*

In shaping studies and plans for the Columbia River and Basin in the 1920s, federal engineers drew on conservation ideas laid out in the previous fifty years by their federal colleagues and predecessors. Individuals in government service called for coordinated development of water resources in the late nineteenth century. By the 1910s, scientists, engineers, and policy makers had consolidated these ideas into a program. These conservationists fought for maximum sustained development of a variety of natural resources. They advocated two sets of ideas about water development: "comprehensive planning" and a need for reservoirs. Between 1900 and 1920, the federal government began adopting conservation goals in its water development activities. Despite a popular conservation movement and federal conservation activities, scientists and engineers continued to debate the technical merits of comprehensive planning and reservoirs. A turn toward analytic analyses of these ideas by the scientific community in the 1920s complemented their expanded implementation in federal planning, such as in the federal studies of the Columbia River and Basin.

### *The Conservation Movement and its Ideas*

Between 1900 and 1920 a bold but brief conservation movement laid out an approach to river development that guided federal activities for more than fifty years. The most programmatic statements of these conservation ideas came out of presidential initiatives, such as the National Conservation Commission (NCC). Drawing on the work of federal engineers in mapping and assessing the resources of the West in the previous thirty years, these men called for "comprehensive planning" of resource development, reservoirs to manage water supplies, and independent experts to oversee the implementation of these ideas. In many senses a definitional Progressive movement,

conservation water policy drew on all three of the Progressive rhetorics characterized by Daniel Rodgers: anti-monopoly, social bonds, and efficiency.<sup>2</sup>

During Theodore Roosevelt's presidency, a conservation movement blossomed. Yet, it faded rapidly once Roosevelt left office. Gifford Pinchot, a wealthy Pennsylvanian, European trained forester, and head of the U.S. Forest Service, led men, such as Interior Secretary James Garfield and U.S. Geological Survey (USGS) scientist Marshall O. Leighton, in overhauling natural resource policies. These men called for long-term maximum development of resources for the common good. They targeted forests, fossil fuels, soil, and grazing land, as well as water. Forest management that harvested and then replanted to sustain the ability of a forest to produce wood typified conservation policies. By 1908, conservationists faced resistance. Roosevelt's chosen successor, William Taft, did not share the President's enthusiasm for the movement. Further, Congress and the War Department resented conservationists' efforts to curtail traditional prerogatives, such as congressmen's ability to propose river development schemes. In response, Pinchot and his colleagues reached out to broader public audiences and launched a conservation movement. In this later phase of conservation, groups, such as the General Federation of Women's Clubs, brought a more aesthetic and moral sense to the movement. Newcomers stressed preservation of nature, rather than planned use. The term conservation also ballooned to encompass all sorts of causes beyond natural resources. For example, activists opposing child labor, supporters of public health, and eugenicists all drew on conservation rhetoric. In the 1910s, conflicts within the expanded conservation movement, as well as resistance from the outside, caused it to collapse.<sup>3</sup>

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<sup>2</sup> Daniel T. Rodgers, "In Search of Progressivism," *Reviews in American History* 10 (December 1982): 113-132.

<sup>3</sup> Hays, *Gospel of Efficiency*. See also: Clayton R. Koppes, "Efficiency, Equity, Esthetics: Shifting Themes in American Conservation," in *The Ends of the Earth: Perspectives on Modern Environmental History*, ed. Donald Worster (Cambridge: Cambridge University Press, 1988), 230-251; Joseph M. Petulla, *American Environmentalism: Values, Tactics, Priorities* (College Station: Texas A&M University Press, 1980), 34-39; and J. Leonard Bates, "Fulfilling American Democracy: The Conservation Movement, 1907 to 1921," *Mississippi Valley Historical Review* 44 (June 1957): 29-57.

Conservationists' ideas on water policy grew out of the work of late nineteenth century federal scientists and engineers. As early as the 1870s, John Wesley Powell, a geologist, explorer, and director of the USGS, called for the planned development of water resources in the American West. In *The Lands of the Arid Regions of the United States*, Powell proposed systematic surveying of the region's resources, withdrawing water from private control, and developing water for the common good. He felt local democratic bodies should direct this effort. In 1897, Hiram Martin Chittenden, a major in the Army, surveyed Wyoming and Colorado with an eye toward possible irrigation development. He reiterated the call for systematic development of water resources, and he added a central role for the federal government.<sup>4</sup>

The NCC laid out one of the boldest Progressive visions for water policy. Appointed by the President in 1908, the NCC produced an inventory of natural resources and recommendations for policy. The NCC worked on four areas: waters, forests, lands, and minerals. Roosevelt chose congressmen to head each section and executive branch conservationists to serve as secretaries who compiled reports. W. J. McGee, geologist, anthropologist, and former assistant to John Wesley Powell in the USGS, served as the secretary for the water division.<sup>5</sup>

Typical of conservation ideas about water development, McGee's section of the NCC report called for "systematic improvement, on a large and comprehensive plan."<sup>6</sup> Conservationists often used the language of comprehensiveness to describe their approach to river improvements. Plans could be comprehensive in at least two ways. First, conservationists conceived of the uses of water broadly and comprehensive meant simultaneous development for all desirable uses of a source. For example, McGee states:

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<sup>4</sup> Robinson, *Water for the West*, 11-14. See also: Stegner, *Beyond the Hundredth Meridian*; A. Hunter Dupree, *Science in the Federal Government: A History of Policies and Activities to 1940* (Cambridge: Belknap Press of Harvard University Press, 1957), 195-214 and 232-236; Manning, *Government in Science*; and Dodds, *Hiram Martin Chittenden*.

<sup>5</sup> "Report from the National Conservation Commission, December 7, 1908," in *Land and Water*, 95-110 and Hays, *Gospel of Efficiency*, 102-104 and 130-134.

Broad plans should be adopted providing for a system of waterway improvement extending to all uses of the waters and benefits to be derived from their control, including the clarification of the water and abatement of floods for the benefit of navigation; the extension of irrigation; the development and application of electricity; the prevention of soil wash; the purification of streams for water supply; and the drainage and utilization of the waters of swamp and overflow lands.<sup>7</sup>

A comprehensive plan canonically addressed navigation, irrigation, electricity, and flood control. Second, comprehensive plans encompassed entire watersheds, rather than individual projects, such as dredging of a stretch of river to improve navigation. In the NCC report, McGee called for the treatment of a river as "a unit from its source to the sea."<sup>8</sup>

Also typical of conservationist water planners, McGee focused on storing water and regulating rivers. McGee stated, "The first requisite for waterway improvement is the control of the waters...."<sup>9</sup> This directive obliquely called for storage. Conservationists wanted storage reservoirs, especially in the headwaters of river systems, to increase water supplies and people's ability to use them. In most places in the United States, precipitation was seasonal and erratic. Storage reservoirs allowed engineers to capture precipitation whenever it occurred. The engineers then chose when to release water in a river system. For example, navigation required a minimum water level. With a storage system, engineers extended the portion of the year that vessels navigated a river. Engineers allowed reservoirs to fill during high-water periods, often spring rainy seasons, and released water from reservoirs to maintain water levels during summer and fall dry periods.<sup>10</sup>

McGee downplayed the leadership of experts in his proposals, in contrast to earlier conservation manifestos. For example, the Inland Waterways Commission directly called for expert direction of resource development. It wrote:

<sup>6</sup> "National Conservation Commission," 107.

<sup>7</sup> "National Conservation Commission," 108.

<sup>8</sup> "National Conservation Commission," 107.

<sup>9</sup> "National Conservation Commission," 108.

<sup>10</sup> Hiram Martin Chittenden, "Government Construction of Reservoirs in Arid Regions," *The North American Review* 174 (February 1902): 245-248 and M. O. Leighton, "The Conservation of Water Resources," *New England Water Works Association* 22 (December 1908): 381-388.

We recommend that the Congress be asked to make suitable provision for improving the inland waterways of the United States at a rate commensurate with the needs of the people as determined by competent authority; and we suggest that such provision meet these requirements viz: expert framing of a definite policy; certainty of continuity and coordination of plan and work; expert initiative in the choice of projects and the succession of works; freedom in selection of projects in accordance with terms of cooperation; and the widest opportunity for applying modern business methods.<sup>11</sup>

McGee only implied the need for experts in his concluding recommendations. He called for additional data collection, "To promote and perfect these plans scientific investigations, surveys, and measurements should be continued and extended..."<sup>12</sup> Presumably, experts would have done this work.

Finally, the NCC opened its report with rhetoric connecting conservation to the Progressive themes of anti-monopoly, efficiency, and public good. The NCC, like Progressives generally, condemned the greed of monopolies. In particular, the NCC asserted that monopolies captured and used natural resources for personal and immediate profit. More generally, conservationists promised that rational development of water resources could curtail three offending industries. First, improved navigation would reinvigorate shipping as an alternative to railroad transportation. Second, irrigation development for small farmers, as promised by the Reclamation Act, would stop cattle and sheep ranchers from occupying all the valuable land in the West. Third, conservationists wanted to regulate hydroelectric power development to prevent monopoly control of dam sites by private utility companies. Conservationists thought the government should lease power sites rather than grant companies permanent rights to these resources. They also sought fees to control the profit electric companies could make from hydroelectricity. The NCC evoked efficiency rhetoric by calling for the elimination of waste in the use of resources. It even catalogued destruction, misuse, and non-use as the ways people wasted resources. Finally, the NCC drew on the rhetoric of public good by claiming the wise use

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<sup>11</sup> "Report from the Inland Waterways Commission, February 26, 1908," in *Land and Water*, 92.

<sup>12</sup> "National Conservation Commission," 108.

of resources benefited the public.<sup>13</sup>

Touching the Progressive chords of anti-monopoly, efficiency, and public good, federal conservationists solidified a set of goals for water policy between 1900 and 1920. Gifford Pinchot and his peers, such as W. J. McGee, advocated comprehensive planning, building reservoirs, and giving control of resource development to experts. In these proposals, they built on the work of earlier federal scientists. Substantial implementation of these proposals, however, did not come until later.

### *The Implementation of Comprehensive Planning*

In addition to encouraging the development of conservation ideas and a conservation movement, Theodore Roosevelt took actions that initiated the implementation of these conservation ideals. In respect to waterways, Roosevelt supported the creation of the USRS, vetoed several permits for private hydroelectric dams, and supported ground rules for hydroelectric dam permits. In the late 1910s and 1920, a flood control act, a comprehensive waterways bill, and the FPC expanded the implementation of conservation ideals.

With the Reclamation Act of 1902, the federal government embarked on a program of irrigation development that relied on a favorite technology of conservationists—storage reservoirs. USRS engineers, especially Director Frederick Newell, promoted the idea of capturing spring floods in headwater reservoirs and putting the previously wasted water to constructive use. Many early USRS projects acted on this premise. Writing under the title, “The Government’s Great Storage Dams: What They Will Accomplish Toward the Conservation and Development of the Natural Resources of the West,” USRS Chief Draftsman Henri Lemémager laid out these basic conservation ideas and described three

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<sup>13</sup> Rodgers, "In Search of Progressivism," 121-127 divided Progressive rhetoric into these three categories. "National Conservation Commission," 95-98. For framing of conservationist water policy in response to railroads, see: Roosevelt, "Letter on Waterways" and "Inland Waterways Commission." On regulation of hydroelectric development, see: T. Roosevelt, "Veto of Private Power Rights." On the relationship between the Reclamation Act and fear of land monopoly, see: Pisani, *To Reclaim a Divided*

large dams under construction by the USRS that would implement the ideas. In addition to Roosevelt Dam in Arizona and Shoshone and Pathfinder Dam in Wyoming, the USRS built Elephant Butte Dam on the Rio Grande River and Arrowrock Dam in Idaho as large storage dams in the 1910s. Further, the Truckee-Carson, Minidoka, Umatilla, Belle Fourche, and Riverton Projects<sup>14</sup> featured smaller storage dams.<sup>15</sup>

The USRS only began putting conservation ideas into practice. The Reclamation Act did not direct the USRS to make comprehensive plans. Congress did not demand coordination of irrigation with other uses of water or treatment of river systems as single units.<sup>16</sup>

In addition to supporting irrigation, Roosevelt and Congress took a series of actions regarding permits for private hydroelectric dams that furthered the development of waterways under the conservation approach of combined uses. To remedy the legislative overload created by individual permit applications and Presidential vetoes, Congress passed the General Dam Act in 1906 and amended it in 1910. The original act required the Secretary of War and the Chief of the Army Corps of Engineers to approve dams. It also allowed them to require the developer to provide navigation improvements in addition to the primary use of the dam. By adding navigation facilities to hydroelectric dams, government engineers began coordinating water development. In 1910, Congress strengthened this aspect of the legislation. It required coordination of water electricity and navigation on entire rivers. The amendment provided:

The Chief of Engineers and the Secretary of War shall consider the bearing of said structure upon a *comprehensive plan* for the improvement of the waterway over which it is to be constructed with a view to the promotion of its navigable quality

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West, 294-298.

<sup>14</sup> These projects were located in Nevada, Wyoming and Idaho, Oregon, South Dakota, and Wyoming respectively.

<sup>15</sup> Robinson, *Water for the West*, 19-23 and Henri V. Lemenager, "The Government's Great Storage Dams," *The American Review of Reviews* 37 (June 1908): 689-698.

<sup>16</sup> "The Reclamation Act, June 17, 1902," in *Land and Water*, 35-38.

and for the full development of water electricity.<sup>17</sup>

The Flood Control Act of 1917 added another goal of water development to the mandate of the Army and directed this organization to make comprehensive plans. This act enlarged the official scope of Army projects on the Mississippi and Sacramento Rivers from simple navigation projects to navigation and flood control projects. (The Army had been unofficially working to control floods on the Mississippi River since the mid-nineteenth century.) The act also required all surveys of these rivers and their tributaries to:

include a *comprehensive study* of the watershed or watersheds, and the report thereon in addition to any other matter upon which the report is required shall give such data as it may be practicable to secure in regard to (a) the extent and character of the area to be affected by the proposed improvement; (b) the probable effect upon any navigable water or waterway; (c) the possible economical development and utilization of water electricity; and (d) other such uses as may be properly related to or coordinated with the project.<sup>18</sup>

However, the Army resisted the conservation agenda for the Mississippi River. Army engineers rarely exercised their authority to conduct comprehensive studies. In addition, they outright fought building of reservoirs. In the 1860s, Army Captain Andrew A. Humphries and Lieutenant Henry L. Abbot concluded that levees—containment structures that paralleled the river—provided all the control necessary to prevent the lower Mississippi River from flooding. The Army generalized from the Mississippi to other rivers and continued to reject reservoirs in favor of a levees-only policy into the 1920s.<sup>19</sup>

In 1917, Congress also passed legislation establishing a waterways commission to oversee comprehensive waterway development. The provision advocated by Nevada Senator Francis Newlands provided for a commission of experts to coordinate water policy

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<sup>17</sup> Quote from “An Amendment to the 1906 Dam Act, June 23, 1910,” in *Land and Water*, 176. Emphasis added. In addition, see: Hays, *Gospel of Efficiency*, 114-121.

<sup>18</sup> “The First Flood Control Act, March 1, 1917,” in *Land and Water*, 284. Emphasis added. See also, Merritt, *Creativity, Conflict and Controversy*, 49-50 and R. M. Smith, “Pittsburgh Flood Control,” 15-17.

<sup>19</sup> Martin Reuss, “Andrew A. Humphreys and the Development of Hydraulic Engineering: Politics and Technology in the Army Corps of Engineers, 1850-1950,” in *The Engineer in America: A Historical Anthology from Technology and Culture*, ed. Terry S. Reynolds (Chicago: University of Chicago Press, 1991), 89-121 and Swain, *Federal Conservation Policy*, 103-111.



between federal agencies, to investigate potential river development projects, and to carry out this work. The legislation also directed the commission to “formulate and report to Congress, as early as practicable, a comprehensive plan or plans.”<sup>20</sup> Further, it laid out numerous ways this plan should be comprehensive:

in investigating, with respect to all watersheds in the United States, questions relating to the development, improvement, regulation, and control of navigation as part of interstate and foreign commerce, including therein the related questions of irrigation, drainage, forestry, arid and swamp land reclamation, clarification of streams, regulation of flow, control of floods, utilization of water electricity, prevention of soil erosion and waste, storage, and conservation of water for agricultural, industrial, municipal, and domestic uses....<sup>21</sup>

In the end, the waterways commission legislation, too, had little impact.

Preoccupied with World War I, President Woodrow Wilson failed to appoint a commission. In 1920, Congress repealed the legislation when it created the FPC.<sup>22</sup>

While much more limited in scope than the waterways commission legislation, the Water Power Act of 1920 pushed the federal government to coordinate waterway development. This act formalized licensing of hydroelectric developments on rivers under federal jurisdiction—navigable waters and those on public lands. The Secretaries of War, Interior, and Agriculture sat together as the FPC. The act empowered the FPC to investigate, to report to Congress, and to grant permits and licenses for hydroelectric dams. The act required that licensed projects be “best adapted to a *comprehensive scheme* of improvement and utilization for the purposes of navigation, of water-electricity development, and of other beneficial public uses.”<sup>23</sup>

By 1920, the federal government had begun to put water conservation ideas into

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<sup>20</sup> “River Regulation Amendment.”

<sup>21</sup> “River Regulation Amendment,” 115. See also Hays, *Gospel of Efficiency*, 110-114 and 230-238; Swain, *Federal Conservation Policy*, 97-8; and “Inland Waterways Commission.”

<sup>22</sup> Hays, *Gospel of Efficiency*, 200-208, 238-240 and Swain, *Federal Conservation Policy*, 97-8.

<sup>23</sup> “The Federal Power Commission Act, June 10, 1920,” in *Land and Water*, 183-201. Quote from 190. Emphasis added. See also: Swain, *Federal Conservation Policy*, 113-115 and Milton B. Conover, *The Federal Power Commission: Its History, Activities and Organization*, Institute for Government Research. Service Monographs of the United States Government, no.17 (Baltimore, Maryland: Johns Hopkins Press, 1923).

practice. President Theodore Roosevelt took the first steps by supporting an agency that built storage dams and encouraging limits on private river development. During the years after Roosevelt, the federal government extended these efforts. The Flood Control Act of 1917 expanded the work of the Army and pushed it toward comprehensive planning. The FPC legislation sustained these efforts to encourage comprehensive planning.

### *Dissent*

As initiatives of the federal government began to direct engineers to implement conservation ideas about water development, a lively debate over these ideas flourished in the engineering community. No one disagreed that headwater reservoirs could store floodwaters or that such storage could benefit irrigation and hydroelectric power development. However, did storage benefit navigation or flood control? Could development for these various aims be combined? Both the proponents and opponents of comprehensive planning for water resources had powerful arguments. Engineers from the USGS and the Army exchanged these arguments with particular vim in 1908 over a proposal by USGS Chief Hydrographer M. O. Leighton to build headwater reservoirs in the Ohio River system. In the 1910s and 1920s, increasing reservoir size and mathematical analyses of reservoir management resolved this debate in the conservationists' favor.

In 1908, *Engineering News* published a series of exchanges about reservoirs between USGS engineers M. O. Leighton and A. H. Horton and Army engineers William Connor, H. C. Newcomer, and Hiram Martin Chittenden.<sup>24</sup> These engineers argued about the ability of headwater reservoirs to reduce flooding and improve navigation. They also

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<sup>24</sup> M. O. Leighton, "The Relation of Water Conservation to Flood Prevention and Navigation in the Ohio River," *Engineering News* 59 (7 May 1908): 498-504; M. O. Leighton, "The Proposed Reservoir System in the Ohio River Basin: A Reply to Major H. C. Newcomer, Corps of Engineers, U.S.A.," *Engineering News* 60 (5 November 1908): 504-507; A. H. Horton, "The Effect of the Conservation of Flow in the Ohio Basin on Floods in the Lower Mississippi," *Engineering News* 59 (11 June 1908): 631-633; William D. Connor, "The Application of the Reservoir System to the Improvement of the Ohio River," *Engineering News* 59 (11 June 1908): 621-625; H. C. Newcomer, "Proposed Reservoir System in Ohio River Basin," *Engineering News* 60 (8 October 1908): 376-383; and H. M. Chittenden, "Forests and Reservoirs in their Relation to Stream Flow with Particular Reference to Navigable Rivers,"

debated the feasibility of managing reservoirs for the combination of flood control, navigation, and electricity. For historians Martin Reuss and Samuel Hays, this debate illustrated the rigid rejection of conservation ideas by the Army and its misguided, if understandable, commitments to a levees-only policy for flood control.<sup>25</sup> In contrast, I argue that Army engineers had some reasonable concerns and their thinking reflected a broader position of the engineering community.

USGS engineer M. O. Leighton marshaled arguments for building reservoirs for flood control, navigation, and electricity in the Ohio River's watershed. Leighton proposed numerous reservoirs on the Allegheny, Monongahela, Kanawha, and Tennessee Rivers, as well as seven smaller rivers. These reservoirs would catch and hold flood waters to provide flood protection. Release of waters during low water periods would increase the navigable depth of the river. Leighton envisioned reservoirs large enough to contain "the entire year's runoff from the stated area."<sup>26</sup> Leighton also described potential reservoir sites and sketched a cost estimate for the system. He ended with the suggestion that developing water electricity at the reservoirs could pay for the system. A second USGS engineer added that control of the Ohio River would substantially reduce floods on the Mississippi River, as well, because the Ohio River was the latter's largest tributary.<sup>27</sup>

Leighton's proposal provoked critiques from Army engineers William Connor, H. C. Newcomer, and Hiram Martin Chittenden. These men raised the issues of cost, destruction of lands for reservoirs, and safety. In response to these critiques, Leighton acknowledged that his proposal required choices. However, he felt the benefits justified reservoirs. More seriously, USGS and Army engineers debated reservoir management.<sup>28</sup>

Chittenden and his colleagues questioned whether reservoirs could serve multiple

ASCE—*Proceedings* 34 (September 1908): 924-997.

<sup>25</sup> Reuss, "Andrew A. Humphreys" and Hays, *Gospel of Efficiency*, 199-218.

<sup>26</sup> Leighton, "Flood Prevention and Navigation," 499.

<sup>27</sup> Leighton, "Flood Prevention and Navigation" and A. H. Horton, "Effect on Floods."

<sup>28</sup> W. D. Connor, "Improvement of the Ohio River;" Newcomer, "Proposed Reservoir System;" Chittenden, "Forests and Reservoirs;" and Leighton, "Proposed Reservoir System."

uses with distinct demands. As they understood reservoirs, operation for flood control, navigation, or hydroelectricity each required an independent logic. Ideally, a flood control reservoir was always empty so that its entire capacity would be available to capture waters in case of excessive precipitation. For electric power, in contrast, engineers in the early twentieth century sought to provide maximum flow year-round. Electric companies paid the government substantially more for regular output. For reservoir management, this meant storing water during periods of high water and releasing it during low. Management for electricity then raised the possibility that a reservoir might be too full to accommodate a flood. It also meant that, to ensure uniform electricity production, water might be released that would contribute to a downstream flood. Navigation and electricity production shared more of a basic logic than electricity and flood control. To improve navigation conditions, engineers wanted to maintain uniform channel depths. As with electricity production, they achieved this by reducing high water and supplementing low. This dynamic, however, brought navigation, like electricity development, into conflict with flood control.<sup>29</sup>

People other than Army engineers worried about coordinating uses of a reservoir in the early twentieth century. USRS and California State engineers published articles addressing similar worries between 1900 and 1925. These Western engineers mostly explored the coordination of irrigation with other uses. Irrigation had yet another logic of water use. Irrigation reservoirs were typically filled by the early spring and then drained over the course of the growing season to maximize agricultural production. With the optimism of a conservationist, future USRS Director A. P. Davis argued that irrigation helped flood control because irrigation reservoirs always had a little more space. Further, irrigation systems delivered water to land in a controlled fashion. Others disagreed. For example, USRS engineer F. W. Hanna argued that irrigation and navigation did not complement one another except in that reclamation produced foodstuffs, which could be

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<sup>29</sup> Chittenden, "Forests and Reservoirs," 970-8 and W. D. Connor, "Improvement of the Ohio River," 624.

shipped. Engineers also argued all sides of the relationship between irrigation and hydroelectric production. L. K. Sherman noted that water law gave irrigation precedence over electricity in Southern California. (Since state law determined water rights, this pecking order could not be generalized.) In contrast, John Beebe observed that irrigation development often supported electricity development because developers built electricity plants in conjunction with irrigation reservoirs. Everett Bryan contributed a lengthy analysis of ways to coordinate electricity and irrigation.<sup>30</sup>

Army skepticism of Leighton's proposal went deeper than concerns about coordinating uses of water. Chittenden, in particular, argued that headwater reservoirs could not change downstream water levels and thus aid either flood control or navigation. First, Chittenden pointed out that water levels depend on run-off from the entire watershed above any point. One dam or even a series of dams on one tributary would be only one of many factors contributing to down-river water levels. These myriad sources of water meant that engineers could neither calculate the effect of individual tributaries on the water level at a given point nor cause a predictable change at that point by manipulating a reservoir. Second, Chittenden raised the issue that a flood changes character as it moves through a river system. Floods—measured by volume of water passing a given point—tend to spread from short in duration but high in peak to a much longer duration but less dramatic rise in water level. Consequently, a flood of great volume in the headwaters, which a reservoir might reduce, would decrease as it traveled downstream even without manipulation efforts.<sup>31</sup>

The engineering community had an ongoing disagreement over the effect of

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<sup>30</sup> Arthur P. Davis, "National Irrigation and Flood Control," *Engineering Record* 58 (14 November 1908): 554-555; F. W. Hanna, "The Relations of Irrigation to Navigation," *Engineering News* 61 (25 March 1909): 316; L. K. Sherman, "The Condition of Water and Power Development in Southern California," *Journal of the Western Society of Engineers* 5 (September and October 1900): 340-346; John C. Beebe, "Water Power and Its Relation to Irrigation in Southern Idaho," *Journal of the Association of Engineering Societies* 54 (February 1915): 63-78; and Everett N. Bryan, "Hydro-Electric Power as a By-Product of Agricultural Storage," *ASCE—Proceedings* 51 (1925): 80-92.

<sup>31</sup> Chittenden, "Forests and Reservoirs," 977-8.

headwater reservoirs on lower river floods. For example, engineers differed over the significance of headwater reservoirs on the Mississippi River. The Army built a series of reservoirs in the Mississippi headwaters above Saint Cloud, Minnesota that it operated to aid navigation on the upper river. Six natural lakes, dammed to control releases, provided 2,200,000 acre-feet of reservoir capacity. Timber crib dams built in 1884 created this system, and, around 1900, the Army replaced the original dams with concrete. Analyses of the effect of these reservoirs on the lower Mississippi supported arguments that headwater reservoirs contributed little to flood control or navigation on the lower river. For example, James Seddon concluded that the headwater reservoirs did not affect the river below Grafton, Illinois—the small town at the confluence of the Mississippi and Illinois Rivers just north of Saint Louis, Missouri. Similarly, Army engineers Hibbert M. Hill and Ralph P. Johnson found that reservoirs, at times, aided navigation in Minnesota but that they had little effect on river flow below Cairo, Illinois, where the Ohio River empties into the Mississippi River.<sup>32</sup>

By the 1920s, this discussion of whether a single water supply could meet multiple demands became one over how to understand and manage a multiple purpose reservoir. Two changes helped end dissent. First, larger reservoirs gave engineers more water and more space with which to work. At Hoover Dam, for example, engineers resolved the problem by dividing the huge reservoir among different uses. Second, engineers began using mathematical analyses of reservoirs to understand their effects on rivers and to aid their management for multiple uses. Early papers, such as Leighton's 1908 proposal to build reservoirs on the Ohio, only used basic data tables and graphs of water levels to support claims. Starting in the 1910s and clearly by the 1920s, engineers applied more sophisticated mathematical analyses to these issues. For example, in 1918 Robert Horton

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<sup>32</sup> James A. Seddon, "Reservoirs and the Control of the Lower Mississippi," *Journal of the Western Society of Engineers* 5 (August 1900): 259-291 and Hibbert M. Hill and Ralph P. Johnson, "Reservoirs on the Upper Mississippi River: Constructed and Operated by the United States," *Civil Engineering (NY)* 2 (May 1932): 299-303.

presented a differential equation that demonstrated reservoirs reduced floods. Similarly, in 1911 and 1926 respectively, A. H. Perkins and Melvin Casler published regimens for managing reservoirs. Only the latter used graphical methods to analyze reservoir operation.<sup>33</sup>

By the 1920s, conservation ideas had reached a new stage in development. Initially, scientists and engineers questioned the technical merits of comprehensive planning and storage reservoirs. In the 1910s, however, scientists moved from rejecting these notions to using increased reservoir size and mathematics to accommodate multiple uses.

This shift toward mathematics signaled growing adoption of conservation ideas. Conservation coalesced as a movement among federal scientists and engineers in the Progressive Era. These men called for comprehensive planning for waterway development—both coordinating uses, such as navigation, flood control, irrigation, and hydroelectric power, and planning for entire river systems. They also advocated building storage reservoirs. During the first two decades of the century, federal programs began implementing these ideas. The USRS built irrigation reservoirs. The Army added flood control to its activities. The FPC regulated private production of hydroelectricity. Congress began asking these organizations to create and consider comprehensive plans as part of these activities. These ideas, however, initially lacked unanimous support. Army engineers raised serious concerns about whether various uses of water could be combined and about whether reservoirs could significantly affect river flow. As reservoir size increased and scientists began analyzing these questions mathematically, more scientists and engineers accepted conservation ideas.

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<sup>33</sup> Robert E. Horton, "Determining the Regulating Effect of a Storage Reservoir," *Engineering News-Record* 81 (5 September 1918): 455-8; A. H. Perkins, "Effects of Storage Reservoirs upon Water Powers," *Engineering Record* 63 (15 April 1911): 413-4; and Melvin D. Casler, "Operation of River Regulating Reservoirs," *Engineering News-Record* 96 (20 May 1926): 812-6.

### ***Conservation and the Planning of Grand Coulee Dam as a Multiple Purpose Structure***

Grand Coulee Dam and the other major dams planned in the 1920s and built in the 1930s embodied both the conservation traditions of water storage and comprehensive planning. The USBR, the FPC, and the Army used conservation ideas in developing plans for the Columbia River and Basin. This framework led them to select a high multiple purpose dam as the main structure in an irrigation and hydroelectricity development for the Columbia River and Basin.

#### ***The FPC, the Army, and Dams***

Federal engineers used “comprehensive planning” to create a detailed plan to develop the Columbia River and Basin for both irrigation and hydroelectricity. This pumping plan required a large dam on the Columbia River and the head of the Grand Coulee. In the late 1910s, businessmen from Spokane began to lobby for an irrigation development in the Columbia Basin. In response, Washington State funded a study of irrigation options and state engineers endorsed using a gravity approach to irrigate the Columbia Basin. The engineers laid out a plan to divert water from a tributary of the Columbia River and to deliver it to the Columbia Basin through an elaborate system of canals, lakes, and tunnels. At the same time, men from the small towns in the Columbia Basin began to lobby for irrigation using a pumping approach. These boosters envisioned a large dam on the Columbia River diverting water for irrigation and producing electricity to pump that water out of the Columbia River’s gorge. Traditionally, the history of Grand Coulee Dam in the 1920s has been written as a battle between these two groups of boosters over the approach to irrigating the Columbia Basin. However, federal engineers, not small town irrigation boosters, placed pumping plans on a competitive footing with gravity plans in the 1920s. Federal engineers did the work of creating technical plans for the pumping approach comparable to the studies of the state’s gravity plan. Federal engineers also decided in favor of a dam. Framing investigations in terms of comprehensive planning



directed federal engineers toward dams. In the early 1920s, an FPC board of engineers started this process by declaring a need for more information with which to compare a pumping project to the state's gravity system. In the late 1920s, the Army provided this information and resolved the pumping-gravity debate in favor of a dam.

In the hands of an FPC consulting board, comprehensive planning led to a federal call for studies of dams. During the early 1920s, the FPC conducted a series of investigations to establish guidelines for granting hydroelectric dam permits. These studies focused on rivers for which development of electricity might conflict with navigation, irrigation, or other uses of the water. Comprehensive planning guided these reviews and the FPC chose the Columbia River as one of the first to examine. With this study, the federal government first attempted to establish a comprehensive plan for the Columbia River. The FPC set irrigation and hydroelectricity as important uses for the Upper Columbia River. This dual development goal led federal engineers to question Washington State's commitment to a gravity plan rather than a pumping plan. The gravity approach to irrigating the Columbia Basin destroyed the ability to produce electricity where as pumping approaches, provided a major dam that could be used for hydroelectricity. However, rather than endorse either plan, the FPC called for further studies. Since Washington State had already conducted an extensive study of gravity plans, this call for information amounted to a call for a study of pumping plans.<sup>34</sup>

The FPC's board made the first attempt to lay out a "comprehensive plan" for the Columbia River. Congress directed the FPC to grant permits for hydroelectricity facilities in accord with comprehensive plans. The FPC's executive secretary set out to do this by first establishing comprehensive plans for waterways and second granting permits. FPC Secretary O. C. Merrill opined:

If there are possible or projected navigation or irrigation developments which will

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<sup>34</sup> Cavanaugh et al., *Uses Upper Columbia River* and William Kelly, "Co-ordination of Irrigation and Power," *ASCE—Proceedings* 51 (December 1925): 1946-84.

affect possible or projected electricity developments on any stream, it is the duty of the commission to investigate these uses and their effects, and if upon such investigation it finds that a certain scheme of composite development is best adapted to the utilization of the stream for all purposes it is competent for the commission to issue permits or licenses for electricity development in conformity with such finding.<sup>35</sup>

The FPC quickly decided that the Columbia River had conflicting possible uses and set out to establish a plan for granting permits. The FPC appointed an engineering board representing three federal agencies and the three major states of the Columbia's watershed to study the Upper Columbia River. These men were: Army Colonel J. B. Cavanaugh; USRS Engineer D. C. Henny; USGS Engineer Fred F. Henshaw; Montana State Engineer C. S. Heidel; Idaho Commissioner of Reclamation W. G. Swendsen; and Washington Supervisor of Hydraulics Marvin Chase. FPC leaders directed the board to establish a comprehensive plan for the Columbia River "to made a general study of the upper Columbia River, beginning at Flathead Lake, with a view to outlining a scheme to development best suited to the needs of electricity, irrigation, and navigation on the Columbia River."<sup>36</sup>

As the first step in producing a comprehensive plan for the Columbia River, the board established irrigation as the most important use of the waters of the Upper Columbia River and hydroelectricity as second. The board considered development of the Columbia River for flood control, navigation, irrigation, and hydroelectricity. It also analyzed the effect of development on potential reservoirs and Canadian interests. However, it quickly narrowed planning to irrigation and electricity. The engineers concluded floods could damage little and reservoirs would not affect flooding. They dismissed navigation because of the negligible use of this section of the river for transportation and their assessment that the projects under consideration could accommodate navigation. The board quickly provided for Canadian interests too. It established a minimum flow for the Columbia River's major tributary that loops through Canada. Finally, it made irrigation a priority.

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<sup>35</sup> Cavanaugh et al., *Uses Upper Columbia River*, iii.

The board reported that Washington and Idaho policies favored irrigation, as did “general public interest.” Further, the men allowed that even the regional electricity developers did not contest irrigation’s priority over electricity.<sup>37</sup>

This criteria of developing both irrigation and hydroelectricity led the FPC to call for further comparison of gravity and pumping plans. Either a gravity or pumping approach could irrigate the Columbia Basin. The board’s preliminary estimates, however, suggested that a pumping plan might develop 647,000 horsepower more electricity than a gravity plan. The engineers compared a pumping plan based on a dam that would back water to Kettle Falls (approximately 150 feet above low water) with Washington State’s gravity plans. Engineers estimated an electricity difference because a gravity plan would divert water for irrigation five dam sites upstream of the pumping plan. Water could be used for electricity production before irrigation with a pumping plan. This dam—in size comparable to the “low dam” of the early 1930s—would not provide storage and so would not increase the electricity potential of the river. Little data, however, supported these conclusions. In the end, rather than endorsing either approach, the board recommended reserving the resources for both plans until further comparisons could be made.<sup>38</sup>

What was the upshot of this exercise in comprehensive planning? The FPC recommended further comparison of gravity and pumping plans. Washington State engineers had already produced an extensive, if optimistic, study of gravity plans. Further comparison required more information on pumping plans.

The next federal study of the Columbia River and Basin—conducted by USRS engineers in 1923-4—embraced comprehensive planning and extended studies of dams. It provided additional information on both the pumping and gravity approaches to irrigating the Columbia Basin. However, USRS engineers endorsed the gravity approach over

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<sup>36</sup> Quote from Cavanaugh et al., *Uses Upper Columbia River*, 1. See also: iii-vi, and 1-5.

<sup>37</sup> Cavanaugh et al., *Uses Upper Columbia River*, 22-49.

<sup>38</sup> Cavanaugh et al., *Uses Upper Columbia River*, 38-48.

pumping and recommended that the government not pursue either.<sup>39</sup> I discuss this work in more detail below.

A few years after the USRS rejected both pumping plans and immediately irrigating the Columbia Basin in 1923-3, U.S. Army Major John Butler made a much more detailed study framed by comprehensive planning and reversed these recommendations. In the mid-1920s, Congress initiated a major series of comprehensive studies of American rivers under the joint auspices of the FPC and the Army. John Butler, the Army engineer in charge of the study of the Upper Columbia River, embraced the idea of comprehensive planning. His analysis of the river in this manner led him to three conclusions that established the basic constellation for developing the Columbia River and Basin. First, Butler decided that the upper reaches of the Columbia River should be developed with a hydroelectric dam that backed water to the Canadian boundary. Second, he chose a pumping approach over a gravity approach for irrigating the Columbia Basin. Third, he concluded that these electricity and irrigation developments would complement each other and should be linked. In summary, he endorsed development of an irrigation and hydroelectricity project for the Columbia Basin based on a 450-foot dam at the head of the Grand Coulee.

In the mid-1920s, the Congress provided substantial funding for the FPC and the Army to formulate comprehensive plans for the nation's navigable waterways. In the River and Harbor Act of 1925, Congress asked the FPC and the Army to provide a cost estimate for a set of comprehensive plans. It directed the agencies to identify:

navigable streams of the United States, and their tributaries, whereon electricity development appears feasible and practicable, with a view to the formulation of general plans for the most effective improvement of such streams for the purposes of navigation and the prosecution of such improvement in combination with the most efficient development of the potential water electricity, the control of floods, and the needs of irrigation.<sup>40</sup>

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<sup>39</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*.

<sup>40</sup> House Committee on Rivers and Harbors, *Estimate of Cost of Examinations, Etc., of Streams*

In April 1926, Major General H. Taylor, the highest ranking officer in the Army Corps of Engineers, and O. C. Merrill, Executive Secretary of the FPC, wrote Congress recommending study of over 180 rivers at an estimated cost of \$7.3 million. Congress funded these studies in the 1927 River and Harbor Act. The House published the letter recommending these studies as document #308. Consequently, the studies have commonly been called "the 308 reports."<sup>41</sup>

The Columbia River in particular received special attention in this comprehensive planning exercise. Taylor and Merrill recommended \$730,000 for the study of the Columbia River and four of its minor tributaries. This amount exceeded the request for any other single river or a river and its minor tributaries. The second highest estimate—that for the Mississippi River and its minor tributaries—was a good bit lower at \$470,000. The relative amount of money proposed for a study of the Columbia River increased when General Taylor pared down his wish list in a hearing before the House Rivers and Harbors Committee. Taylor reduced the number of studies to twenty and the total estimate to \$3.3 million. The estimate for the Columbia River, however, stood at \$730,000. Under the revised plan, it dwarfed the next highest proposal—\$290,000 for the Mobile River system—and constituted almost one-quarter of the total budget.<sup>42</sup>

In conceptualizing this study of the Columbia River, Major Butler embraced comprehensive planning. Butler began his report with a section on "authority and purpose."<sup>43</sup> In it, he enumerated the canonical conservation goals for river development and his intention to consider all of them and their interactions. Butler stated:

The purpose of this report is to formulate plans for the most effective improvement

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*Where Power Development Appears Feasible*, 69th Cong., 1st sess., 13 April 1926, 1.

<sup>41</sup> House Committee on Rivers and Harbors, *Estimate of Cost* and Swain, *Federal Conservation Policy*, 101-2. See also: *Congressional Record*, 68th Cong., 2d sess., 1925, Vol. 66, pt. 5, 4801-4813 and House Committee on Rivers and Harbors, *Navigation and Water Power Surveys*.

<sup>42</sup> House Committee on Rivers and Harbors, *Estimate of Cost*, 3-4 and House Committee on Rivers and Harbors, *Hearings on Navigation and Water Power Surveys*, 69th Cong., 1st sess., 26 April 1926, 24-5.

<sup>43</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 565.

of Columbia River for the purposes of navigation, and for combining such improvement with the most efficient development of the potential water electricity, the control of floods, and the needs of irrigation.<sup>44</sup>

Butler followed through. In Chapter Four, "Comprehensive Plan," he recommended a set of structures planned to control floods and provide full use of the river for hydroelectricity, irrigation, and navigation. Butler proposed two sets of locks and lateral dams to improve navigation; five electric dams; the electricity and irrigation project at the head of the Grand Coulee; and three storage reservoirs on headwater tributaries. In short, Butler formally advised the federal government to adopt his comprehensive plan to guide future development.<sup>45</sup>

As Butler developed this comprehensive plan for the Columbia River, he drew three conclusions that shaped his recommendations for the Columbia Basin. First, he concluded that the highest reaches of the Columbia River should be developed with a 450-foot dam at the head of the Grand Coulee because this approach maximized hydroelectric power production. Up until Butler's work, engineers envisioned dams for the Grand Coulee site that ranged from 120 feet to 200 feet above low water. The highest of these would back water to the foot of Kettle Falls—an important Native American fishing and ceremonial site and potential dam site. Butler compared dams of 250 feet—the Kettle Falls limit—and 450 feet. The latter would submerge Kettle Falls and back water to the Canadian boarder. Butler recommended a single higher dam over lower dams at Grand Coulee, Kettle Falls, and Fish Hawk. (A high Grand Coulee Dam would also flood this last site on the Spokane River.) He preferred the single dam because he estimated it would provide at least 250,000 kilowatts (kW) more electricity than three smaller dams.<sup>46</sup>

Butler estimated that the single dam would generate more electricity at the Grand Coulee site and increase hydroelectric production at all downstream dams. For the upper

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<sup>44</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 566.

<sup>45</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 1058-1067.

<sup>46</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 726-755, 1003-1006 and 1062-1063.

reaches alone, the 450-foot dam increased electricity production in two ways. First, two dams produced less electricity than a single dam during periods of high water. Butler was planning a system in which each dam backed water to the foot of the next when the river held an average amount of water. During periods of high water, the water level at the foot of each dam increased. This change reduced the amount of electricity each dam produced. Two dams doubled this effect. Second, a single dam reduced friction losses. Butler also preferred the higher dam because it increased the electricity production at all the hydroelectric dams downstream. Engineers could operate the larger reservoir to increase the quantity of electricity that they could produce year-round at all downstream hydroelectric plants. Like any reservoir, engineers could store water during high water periods and release it during times of low water to even out the river. Butler estimated that manipulating water in this fashion would increase engineers' ability to produce electricity with the three largest dams he proposed for the Upper Columbia River by 281,000 kW. If Butler had considered the effect of storage on dams on the lower river, the increase in electricity would have been even larger.<sup>47</sup>

Second, comprehensive planning led Butler to select a pumping plan over a gravity plan for irrigating the Columbia Basin. On the simplest level, Butler recommended a pumping approach to irrigating the Columbia Basin based on cost. Butler found the least expensive pumping plan to cost less than the least expensive gravity plan. Because of this cost difference, only pumping plans met Butler's criteria for economic feasibility. Butler's calculation of cost, however, was intimately tied to the assumption that eventually the Columbia River would be developed in accord with his comprehensive plan. With this expectation, Butler envisioned a pumping project purchasing the electricity to pump water out of the Columbia River's gorge. In contrast, earlier engineers assumed a Columbia River dam and electricity plant would be built as part of the irrigation project. With this

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<sup>47</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 745 and 1004-1005.

latter individual-project perspective, an irrigation development had to bear the entire cost of a dam and power plant rather than the much lower cost of buying electricity. Assumptions encouraged by comprehensive planning led Butler to find the pumping approach cheaper than the gravity plan.<sup>48</sup>

Third, comprehensive planning led Butler to recommend combining electric and irrigation development. Butler judged that farmers alone could not repay the costs of an irrigation project—even his lower-cost pumping projects. To obtain full use of the water even though farmers alone could not pay for irrigation, Butler recommended that the federal government take an active role in developing the Columbia River and Basin. He suggested a government-sponsored combination hydroelectricity and irrigation project. The government would build the dam, power plant, and irrigation works. The combined income from selling electricity and water would repay the government's investment.<sup>49</sup>

During the 1920s, two exercises in comprehensive planning led federal engineers to work out the technical details and select pumping plans based on large dams over gravity plans to develop the Upper Columbia River and Basin. In 1922, the FPC decided not to issue dam permits for the Upper Columbia River system until it had more information with which to compare the effect on water resources of irrigating the Columbia Basin with a pumping plan or gravity plan. Given the work that state engineers had done on gravity plans, this decision directed federal engineers toward developing pumping plans. A large congressional planning initiative gave the task of follow-up to the Army. Between 1929 and 1931, Major John Butler created a comprehensive plan for the Upper Columbia River. He concluded that a 450-foot dam should be built at the Grand Coulee site, that the Columbia Basin should be irrigated by pumping water directly from the Columbia River, and that these two endeavors should be combined.

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<sup>48</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 1009-1014 and 1063.

<sup>49</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 1037-1058 and 1063-1064.



Ironically, neither of the agencies whose work developed these plans and decisions—the FPC and the Army—became the lead federal agency in building Grand Coulee Dam. While the FPC board and Major Butler endorsed combination projects for the Columbia River and Basin, the Army leadership did not think the federal government ought to be involved. In the end, the USBR took over the Army’s design for an electricity and irrigation dam at the head of the Grand Coulee and, with Public Works Administration funding, built the dam during the 1930s.

### *Comprehensive Planning and the U.S. Bureau of Reclamation*

Comprehensive planning led the USRS, as well as the FPC and the Army, to develop pumping plans for irrigating the Columbia Basin in the 1920s. However, the USBR needed direct experience with the benefits of combining hydroelectricity and irrigation before it supported such a comprehensive plan for central Washington. Early in the 1920s, the USRS framed a study of irrigating the Columbia Basin around comprehensive planning and sketched pumping plans to compare with Washington State’s gravity plans. Events in the mid-1920s, however, moved the USBR away from advancing plans for the Columbia River or Columbia Basin. Newly appointed Commissioner Mead announced and pursued a policy of aiding farmers and completing existing projects. This impetus toward agricultural planning and fiscal conservatism slowed planning work for the Columbia Basin. At the same time, other events positioned the USBR to accept comprehensive plans. Engineering leaders in the Denver Office continued developing electricity in conjunction with irrigation agency-wide. They also worked on Hoover Dam—a large storage dam on the Colorado River that would aid irrigation, electricity development, flood control, and city water supply. Positive experiences in these activities predisposed USBR leaders to embrace Major John Butler’s electricity and irrigation project for the Columbia Basin.

In the early 1920s, comprehensive planning led USRS engineers, like those in the FPC and the Army, to develop pumping plans. In 1923, USRS Director Arthur Powell

Davis turned to comprehensive planning to escape local meddling in a study of the merits of irrigating the Columbia Basin. Following the recommendations of the earlier FPC report, USRS engineers structured their study as a comparison of the gravity and pumping approaches. In order to compare the two approaches, a senior USRS engineer put together the first public study of pumping approaches. In the end, however, USBR engineers' concern with cost of development, rather than comprehensive planning, formed the basis for their recommendation of a gravity project to irrigate the Columbia Basin.

In early 1923, USRS Director A. P. Davis used congressional directives for comprehensive planning as the rationale for USRS control of an irrigation study of the Columbia Basin. Spokane boosters of the gravity plan, with the aid of the Washington congressional delegation, had obtained a federal appropriation to study irrigating the Columbia Basin. These men wanted the funds in the hands of engineers known to favor the gravity plan. With this goal in mind, the Columbia Basin Irrigation League (CBIL) gravity plan lobbyist in Washington, D.C. badgered Interior Secretary Work's assistants to appoint a board rather than the USRS to oversee the study. USRS Director Davis tried to counter CBIL's political attempt to manipulate the study by establishing a technical rationale for the USRS to run the survey. That rationale was comprehensive planning. Davis repeatedly argued that Congress funded a study of irrigating the Columbia Basin because the FPC had requested additional comparison of the gravity and pumping approaches. Further, he maintained that the USRS ought to make the comparison. According to Davis, the USRS had no stake in either the pumping or the gravity plan. It also had the technical expertise to conduct the study. The Interior Secretary eventually gave authority to conduct the study to the USRS. He also, however, established a board to guide the USRS's work and advise him.<sup>50</sup>

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<sup>50</sup> A. P. Davis to Columbia Basin Reclamation Association, 30 Dec. 1922, 511:300.01 thru 29, Entry 7/19-29-CBP, WDC, RG 115; A. P. Davis to E. M. Chandler, 8 Jan. 1923, 512:301 to 12/31/22, Entry 7/19-29-CBP, WDC, RG 115; A. P. Davis to F. E. Weymouth, 23 Feb. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; A. P. Davis to F. E. Weymouth, 28 Feb. 1923, 416:791 9/23 to 9/24, EC-CB, CE,

Comparing the gravity and pumping approaches to irrigating the Columbia Basin for comprehensive planning became a major focus of the 1923-4 USRS study. Director Davis and Chief Engineer Weymouth appointed senior USRS engineer Homer Gault to direct the study. Gault introduced his report as a response to the FPC's call for additional information and a decision on an irrigation approach. He stated:

An ample supply of water for irrigation may be obtained either by a gravity diversion from the Clark Fork at Albany Falls, Idaho or by pumping from the Columbia River at Grand Coulee.... The storage and stream flow needed under the gravity plan for irrigation can be used otherwise for electricity production and there is to some extent a conflict of interests. It became important to decide which of the two general plans, by gravity or by pumping, is the better plan for the irrigation project in order to avoid delay in decisions concerning applications for rights for electricity development and for storage needed for electricity. The public interests were considered to be involved in both electricity and irrigation, and in March, 1923, Congress appropriated \$100,000 for an investigation of the Columbia Basin project under the direction of the Secretary of the Interior. The results of the investigation are given in this report.<sup>51</sup>

After discussing both approaches at length, he summarized his work in a table that compared four versions of the gravity plan and two versions of the pumping plan.<sup>52</sup>

In order to compare gravity and pumping approaches, Gault had to establish knowledge of the pumping approach equal to that about the gravity approach. Earlier published studies of irrigating the Columbia Basin primarily focused on gravity approaches. In 1920, Washington State's Columbia Basin Survey Commission (CBSC) discussed the pumping approach briefly only in an appendix. A year later, General George Goethals of Panama Canal fame likewise paid little attention to damming the Columbia River. Beyond the brief analysis, only Seattle consulting engineer Willis Batcheller investigated damming the Columbia River in connection with irrigating the Columbia Basin before the USRS study in 1923-4. While Batcheller enthusiastically endorsed dams, he had a falling out with his superiors in the Washington State Department of Conservation

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RG 115; A. P. Davis to H. Work, 6 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and A. P. Davis to U.S. Geographical Survey Director, 15 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115.

<sup>51</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 98.

<sup>52</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 99.

and Development and they refused to publish his work. Further, they resisted circulating it, so even engineers studying the Columbia Basin had difficulty obtaining Batcheller's report.<sup>53</sup>

In the end, USRS engineers chose an approach to irrigating the Columbia Basin because of costs rather than the values of comprehensive planning. Gault did not draw conclusions from his comparison. Senior engineers connected to the Denver Office—A. J. Wiley, James Munn, and J. L. Savage—undertook this task. In a review of Gault's report, this USBR board found that cost made a gravity approach preferable. The board recognized that a gravity approach would eliminate the ability to build hydroelectric facilities that would produce 316,000 horsepower of electricity. Still, the board favored the gravity approach for three reasons. First, the gravity approach cost less per acre to develop. Second, it would have lower operation and maintenance costs. Third, it would not require periodic replacement of costly machinery.<sup>54</sup>

As the 1923-24 USRS study of the Columbia Basin concluded not to pursue irrigating central Washington, events outside of Washington State reinforced that decision. In 1923, Interior Secretary Hubert Work launched a house cleaning in the USRS. The poor financial condition of USRS farmers and the agency itself prompted Work to fire Director Davis. A board of experts subsequently investigating agency affairs recommended the USBR focus its energies on improving the lot of its farmers and stabilizing its financing rather than building new projects.

A major USBR housecleaning in 1923 and 1924 re-directed the USBR toward addressing complaints of USBR farmers and stabilizing USBR financing. In 1923, Hubert Work assumed leadership of the Interior Department upon Albert Fall's ouster. Fall lost

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<sup>53</sup> CBSC, *Columbia Basin Irrigation Project*, 134-152; Goethals, *Columbia Basin Project*; and Pitzer, *Grand Coulee*, 32-5. Batcheller published a short version of his report in a regional construction journal as Gault began his work. See Willis T. Batcheller, "The Columbia Basin Reclamation Project," *Pacific Builder and Engineer* 29 (30 March 1923): 7-10 and Willis T. Batcheller, "The Columbia Basin Reclamation Project, Part II," *Pacific Builder and Engineer* 29 (27 April 1923): 7-13.

<sup>54</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 87-

the position for profiteering. For example, he leased oil from the U.S. Naval reserves in Teapot Dome, Wyoming, to businessmen in exchange for personal “loans.” Although USRS was not directly involved in Fall’s schemes, the USBR did not escape Work’s zeal to set his department straight. Work quickly identified the USRS’s chronic poor finances as a major problem. (I discuss this aspect of USBR history in the next chapter.) First, Work decided that Director Davis, who had served in a high leadership position since the USRS’s creation and who had an education in engineering rather than business, had to go. He replaced the well-respected engineer with businessman and politician David W. Davis. Work also called for a major external review of the USBR. This task fell to the Committee of Special Advisors on Reclamation—commonly called the Fact Finders Committee. Work appointed the following members: former Arizona Governor Thomas Campbell, Mormon Church leader and irrigation expert John Widtsoe, former conservationist Interior Secretary James Garfield, U.S. Chamber of Commerce member and irrigation law expert Clyde Dawson, and the ubiquitous irrigation expert Elwood Mead. The board conducted extensive studies and made many recommendations. Four major recommendations/remedies stand out in the Fact Finders work and the legislation subsequently passed by Congress: 1) classify and treat project lands according to potential productivity; 2) provide agricultural advice to settlers; 3) hand over management of projects to settlers; and 4) establish repayment plans based on the farmers’ ability to pay, as well as their debt. When the Fact Finders completed their work, the Interior Secretary asked Elwood Mead to take over USBR leadership to implement these recommendations. During the 1920s, Mead oversaw a series of initiatives aimed at improving agricultural development on USBR farms and the agency’s financial condition. The USBR began with the suggestion to assess the agricultural potential of irrigation land. The USBR assessed the lands it had placed under irrigation and released settlers from \$14 million in payments on 185,000 acres, which experts deemed unsuitable for agriculture. The USBR also added

land classification to the process of selecting future areas to irrigate. Second, Mead created an Office of Reclamation Economics to help project farmers. He appointed his friend George Kruetzer to lead this division. Third, by 1927, the USBR gave water-user organizations responsibility for operation and maintenance of over half of its projects. Fourth, Congress reduced farmers' debt burden. In 1924, it allowed repayment contracts to be re-written based on a farmer's average per-acre yearly gross income. This formula substantially reduced people's annual payments. In 1926, Congress reestablished a maximum repayment period for farmers. Still, it extended the repayment period to forty years to maintain the principle of lower payments established in 1924. Fifth, Mead lobbied for more active ways of aiding farmers with financing, such as government loans for farm start-up costs. He never gained congressional approval for such work, however. Finally, this emphasis on agriculture and financial stability, rather than conservation of water resources, shaped Mead's plans for the USBR's future, too. In 1926, the USBR announced a ten-year plan, in which the USBR would concentrate on completing projects under construction and avoid new obligations.<sup>55</sup>

Goals of agricultural and financial stability, rather than comprehensive planning, shaped USBR studies of possibilities for the Columbia Basin in the mid- and late 1920s as well. The USBR conducted two studies of irrigating the Columbia Basin after Gault's work comparing pumping and gravity approaches. Both addressed agricultural economics

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<sup>55</sup> Alan Brinkley, *The Unfinished Nation: A Concise History of the American People* (New York: Alfred A. Knopf, 1993), 649-650; Robinson, *Water for the West*, 44-48; Cannon, "Entering a New Era;" Hubert Work, "Tentative Policy of the Reclamation Bureau," *Reclamation Record* 14 (August 1923): inside front cover; "A Chronology of Reclamation During Past Year," *New Reclamation Era* 15 (April 1924): 53-5; Elwood Mead, "Need for General Revision of the Reclamation Act," *New Reclamation Era* 16 (January 1925): 2; Hubert Work, "Secretary Work Outlines Future Reclamation Policy," *New Reclamation Era* 16 (January 1925): 1-2; "Secretary Work and Doctor Mead Discuss Reclamation," *New Reclamation Era* 16 (May 1925): 65; "Broadening the Scope of Federal Reclamation," *New Reclamation Era* 16 (June 1925): 81-3; "Problems of Federal Reclamation," *New Reclamation Era* 16 (June 1925): 88-9; "Problems That Must Be Met in Future Reclamation," *New Reclamation Era* 16 (July 1925): 97-9; Elwood Mead, "Sound Economic Basis Necessary," *New Reclamation Era* 16 (November 1925): 167; "The Problems of Federal Reclamation," *New Reclamation Era* 16 (November 1925): 162-5; Hubert Work, "Optimistic Outlook on West's Problems Taken by Secretary Work," *New Reclamation Era* 17 (May 1926): 74-5; and "Ten-Year Construction Program for Federal Reclamation," *New Reclamation Era* 18 (January 1927): 2-3.

and farm management issues. In 1924, the USBR sponsored a review of Gault's work by an outside board of engineers that analyzed the economics of irrigation farming in the Columbia Basin. This review had two origins. First, Spokane irrigation boosters wanted lower cost estimates. Second, Commissioner Mead wanted a plan for irrigation farming based on the conditions of central Washington. Gault's work clearly failed to provide Mead with the information he desired. Gault primarily established technical feasibility and costs for the systems required to irrigate the Columbia Basin. He sketched plans for dams, canals, and other parts of systems to divert and distribute water. He also estimated the costs of these systems. In addition, scientists from USGS and USDA conducted a water supply study, an examination of geological characteristics of potential dam sites, and a land classification for the Columbia Basin that appeared as appendices to Gault's work. Yet, none of this work explored whether irrigation farms in the Columbia Basin would make enough money to pay for their water. Mead wanted studies of the kinds of crops farmers might grow in this region and the potential income from such activities to compare with expense estimates. For the 1924 review board, then, Mead and Assistant Secretary of the Interior Francis Goodwin carefully chose engineers with the idea of addressing both construction costs and agricultural economics. They directed two members of the board—Washington State College Professor Osmer Waller and irrigation expert Richard Lyman—to focus on farm economics. These men, with the aid of Waller's colleague Dean George Severance of Washington State's College of Agriculture, wrote the first analysis of irrigation farming in the Columbia Basin. A 1928 study funded by the USBR and written by George Severance and B. E. Hayden further developed this kind of analysis of the prospects of irrigating the Columbia Basin.<sup>56</sup>

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<sup>56</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 44-59 and B. E. Hayden and George Severance, *Columbia Basin Project: Soil and Economic Conditions* (Washington, D. C.: GPO, 1928). On the contents of Homer Gault's report, see: H. Gault, "Columbia Basin Project—Not for Publication," 3 August 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115 and "Gault Report of March 1924," 514:301 Gault Report of March 1924, Entry 7/19-29-CBP, WDC, RG 115. On the setup of the 1924 review board, see: F. Goodwin to E. Mead, telegram, 29 July 1924, 512:301 23&25,

While Mead focused on helping farmers and stabilizing financing, events overseen by the engineering leadership in Denver moved the USBR toward implementation of conservationists' water development goals. Positive experience with electricity production on USBR projects led engineers to favor combining irrigation and hydroelectricity. USBR involvement in planning Hoover Dam reinforced this judgement and changed the scale of agency ambitions.

Early experiences developing electricity in conjunction with irrigation encouraged the USBR to continue coordinating these two uses of water. From the earliest days, USRS engineers built hydroelectric plants to provide energy for construction and for pumping irrigation water. When they began selling excess electricity commercially, the engineers quickly discovered that hydroelectricity provided important income for projects and improved farmers' quality of life. USBR experiences with hydroelectricity on the Minidoka Project in Idaho led this learning curve. In Southern Idaho, USRS engineers initially developed hydroelectricity for pumping irrigation water. In 1909, engineers began operating a 10,000-horsepower electricity plant and four pumping plants that transferred water between canals on the 121,000-acre project. Transmission lines took electricity the twelve to twenty miles from the dam to the pumping plants. In addition, the transmission system delivered energy to nearby towns. During the summer, electricity primarily powered the irrigation pumps. In the winter, beet-sugar factories and alfalfa-meal mills used some electricity, but most heated homes. Electricity became important enough to the settlers for them to supplement the original supply with purchased power beginning in 1921 and for the USBR to expand its plant in 1928.<sup>57</sup>

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Entry 7/19-29-CBP, WDC, RG 115; E. Mead to O. L. Waller, 19 Aug. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; and E. Mead to R. R. Lyman, 4 Sept. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115.

<sup>57</sup> A. P. Connor, "Federal Project at Minidoka, Idaho," *Power* 41 (30 March 1915): 422-5; "Electric Development on Minidoka Project Succeeds," *Reclamation Record* 14(August 1923): 267-8; W. B. Clayton, "Commercial Power on the Minidoka Project, 1924," *New Reclamation Era* 16 (April 1925): 57-8; H. H. Plumb, "Enlargement of Minidoka Power Plant, Minidoka Project, Idaho," *New Reclamation Era* 19 (June 1928): 86-7; Robinson, *Water for the West*, 27-9; and James, *Reclaiming the Arid West*, 146-



USRS engineers saw financial advantages in selling electricity. First, profits from the sale of electricity reduced the charges to water users. Second, project towns benefited from retailing USRS electricity. Income from electricity allowed towns to support schools and road building at lower costs to the residents.<sup>58</sup>

USRS engineers also saw rural electrification as an advantage. Sale of electricity provided rural homes and businesses the option to electrify, and this brought aid and amenities to farmers. In the mid-1920s, the USBR estimated that 50 to 75 percent of Minidoka farmers used electricity. Compared to their farming peers nationwide, this level of rural electrification was high. Nationally, only 10 percent of farmers had electricity in the late 1920s, and half of that number generated it themselves. Like many rural customers, Minidoka farmers used electricity for lighting—both interior and exterior. They also invested in home appliances, such as irons and washing machines. In farm work, electricity drove motors and had some more surprising uses. For example, it helped increase milk production in cattle by powering an electric pump that provided continuous fresh water.<sup>59</sup>

Hoover Dam also encouraged USBR engineers to pursue conservation ideas. In the 1920s, a plan to develop the lower Colorado River emerged from ongoing discussions. Hoover Dam—a large storage dam on the lower Colorado River—would provide flood

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<sup>58</sup> J. M. Gaylord, "Economies of Power Development, North Platte Project, Nebraska-Wyoming," *Reclamation Record* 14 (May 1923): 169-171; "Hydroelectric Power Development on the Projects," *New Reclamation Era* 17 (July 1926): 120; "Salt River Project Power Development," *New Reclamation Era* 18 (July 1927): 111; L. N. McClellan, "Power Development, Yuma Project, Arizona-California," *New Reclamation Era* 19 (November 1928): 170-2; and L. N. McClellan, "Power Development on Government Reclamation Projects," *New Reclamation Era* 20 (June 1929): 90-92.

<sup>59</sup> "How Electricity Helps the Minidoka Project," *New Reclamation Era* 15 (March 1924): 42; "Cheap Electricity Serves Minidoka Water Users," *New Reclamation Era* 15 (December 1924): 190; "Minidoka Project Homes Enjoy Electrical Aids," *New Reclamation Era* 17 (July 1926): 119; J. F. Bruins, "Electricity on an Irrigated Farm, Boise Project, Idaho," *New Reclamation Era* 19 (September 1928): 130-1; "Electricity Acts as Servant On Project Farms," *New Reclamation Era* 19 (November 1928): 167-8; "Running the Farm by Electricity in Washington," *New Reclamation Era* 20 (January 1929): 12; "Rural Electrification Progress on the Salt River Project, Arizona," *New Reclamation Era* 20 (October 1929): 151; and David E. Nye, *Electrifying America: Social Meanings of a New Technology* (Cambridge: MIT Press, 1990), 296-7.

control, irrigation water, municipal water, and electricity to Southern California. The plan, however, did not include development of the entire river. Building Hoover Dam dramatically expanded the scale on which the USBR pursued conservation programs.

Plans for a large storage reservoir on the lower Colorado River and use of that water supply for a combination of purposes grew out of events in the first decade of the twentieth century. Future USRS Director A. P. Davis proposed large storage structures for the lower Colorado River as early as 1902. In correspondence with the USRS consulting engineer for the region, J. B. Lippincott, Davis suggested dams at the mouth of Bill Williams' Fork, Bulls Head, and Black Canyon. No one picked up the idea immediately. Lippincott, for example, imagined reservoirs only in the Colorado River's headwaters and tributaries or none at all. Davis could not get funding for studies to develop his ideas. Two other series of events also built support for Hoover Dam. First, in 1901, private citizens began an irrigated farming development in California's Imperial Valley. The Valley drew water from the Colorado River via a canal that traversed both U.S. and Mexican lands. Technical and political conflicts over this canal led Imperial Valley farmers to lobby vigorously for an "All -American Canal" as a new water supply. Second, a major technical problem with the Imperial Valley irrigation system contributed significantly to flooding. The Colorado River was dramatically tempestuous and, as a result, prone to flooding. The Colorado River rolled and boiled through its canyons, meandered through its delta taking ever changing paths to the Gulf of California, and changed dramatically with the seasons. These dynamics ate levees, causing floods. Further, diversion structures necessary for Imperial Valley irrigation in low water seasons flooded their upstream neighbors who farmed on the USRS project at Yuma, Arizona, during high water. In 1905 a disaster that far surpassed these ongoing problems hit. During particularly high water, the river destroyed the diversion structure for the Imperial Valley farmers' canal. For eighteen months, the Colorado River poured out of its normal bed and created a sea in the California desert. The Southern Pacific Railroad bought a substantial share in the water company that

supplied the Imperial Valley and spent millions of dollars to close the breach.<sup>60</sup>

In the 1920s, then, these strands of storage, flood control, and irrigation came together, along with electricity and municipal water supply, as the foundation for successful legislation for development of the lower Colorado River. After a small survey by the USRS and several failed bills to fund the All-American Canal, Californians wrested funds for a major study of the lower river in 1920. The outcome of that study was the "Fall-Davis Report." This 1922 document, named for Interior Secretary Albert Fall and USRS Director Davis, recommended a large storage dam and the All-American Canal. Further, it suggested that electricity development could pay for the dam. Los Angeles joined the mix in 1923 when its Metropolitan Water District began inquiries about building an aqueduct to the lower river for municipal water and purchasing electricity from the dam. In 1924, the USBR completed extensive studies of the river and the Interior Secretary and Commissioner Mead began advocating Hoover Dam. Late in the decade, planners salved congressmen's objections about paying for this development. A new provision required that, before beginning construction, the Interior Secretary negotiate contracts for electricity sales. These contracts had to reimburse the government's investment in the dam. In December 1928, Congress passed and President Coolidge signed the Boulder Canyon Act. The legislation provided for the construction of Hoover Dam to be used for storage, flood control, and electricity production and for the All-American Canal to bring irrigation water to the Imperial and Coachella Valleys. This plan was "comprehensive" in the sense that it combined a variety of uses of water.<sup>61</sup>

It did not, however, address the entire river system. Hoover Dam served only the

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<sup>60</sup> Hundley, "Politics of Reclamation," 295-311 and Hundley, *Great Thirst*, 203-9.

<sup>61</sup> Hundley, "Politics of Reclamation," 312-318; Hundley, *Great Thirst*, 213-220; "Building of Boulder Canyon Project Recommended," *New Reclamation Era* 17 (February 1926): 202; Elwood Mead, "The Utilization of the Colorado River," *New Reclamation Era* 17 (March 1926): 38-9; Elwood Mead, "The Economic Development of the Colorado River," *New Reclamation Era* 17 (April 1926): 58-9; Hubert Work, "Time Has Come to Build Colorado River Dam, Says Secretary Work," *New Reclamation Era* 17 (June 1926): 94-5; and Elwood Mead, "Commissioner Mead Urges Action on Colorado River Development," *New Reclamation Era* 18 (March 1927): 34.

lower river. In the 1920s and 1930s, the USBR did not plan the development of the upper basin—primarily the river and its tributaries in Utah, Wyoming, and Colorado. After World War II, however, the USBR did major construction on the Colorado River. It built the Colorado River Storage Project—six storage dams and numerous “participating projects” for city water supply, irrigation, etc. The combination created 34 million acre-feet of storage and 1.3 million kW of electricity.<sup>62</sup>

The magnitude of the dam further made it a turning point in USBR history and a powerful force for “comprehensive development.” By any criteria, the Boulder Canyon Project was BIG. In 1928, the design for a 726-foot dam proposed a structure almost twice as high as any dam completed or under construction by the USBR. Owyhee Dam, under construction in Oregon, was the USBR’s highest at 405 feet. Further, engineers planned to store 26 million acre-feet of water behind Hoover Dam. This was roughly ten times the amount of Elephant Butte reservoir—the USBR’s largest in 1928. The 600,000 acres, which would be irrigated in the Imperial and Coachella Valleys, would increase the total land receiving government water by more than one-fifth. The \$165 million approved for building Hoover Dam and the All-American Canal would nearly double the funds under the control of the USBR. Mead estimated the agency’s regular funds at \$172 million in 1928. Perhaps the most dramatic increase was electricity production. In fiscal year 1928-29, the twenty-three electricity plants on USBR projects produced 345 million kW-hours of electricity. When all the generators planned in the 1920s had been installed in Hoover Dam, this single dam produced 3 billion kW-hrs of electricity annually.<sup>63</sup>

Although the USBR moved away from water resource planning for the Columbia Basin in the mid-1920s, positive experiences with electricity development and comprehensive planning at Minidoka, Hoover, and other projects predisposed USBR

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<sup>62</sup> Warne, *Bureau of Reclamation*, 248-50 and Robinson, *Water for the West* 85-87.

<sup>63</sup> *Twenty-Eighth Annual Report of the Commissioner of Reclamation, Fiscal Year ended 6/30/29* (Washington, D. C.: GPO, 1929), 1, 5, 47-51, and 56; Mead, “Economic Development of the Colorado;” and Robinson, *Water for the West*, 49-55.

engineers to embrace a comprehensive plan for the enormous Columbia Basin. In the early 1930s, Army engineers asked USBR engineers to review and comment on their design for an irrigation development in the Columbia Basin in Major Butler's comprehensive plan for the Upper Columbia River. The USBR submitted a companion report to the Army's. In it, the USBR endorsed Butler's irrigation and hydroelectric project for the Columbia River and Basin. Commissioner Mead and the USBR even went beyond the Army. The leaders of the Army Corps of Engineers reversed Major Butler's recommendation that the government sponsor the irrigation and hydroelectric project in the Columbia Basin. USBR engineers, in contrast, called for immediate government construction of the project. Although a bill to this effect died in committee in 1932, the New Deal gave Grand Coulee Dam and irrigation for the Columbia Basin new life. During the 1930s and 1940s, the USBR carried Grand Coulee Dam from its original adoption by the Roosevelt administration through a series of design changes to its completion. In the end, the USBR basically constructed the dam laid out by Major Butler in the late 1920s.<sup>64</sup>

### ***Conclusion***

Government engineers pursued "comprehensive planning" and designed dams. The FPC and the Army did more of the preliminary design work than the USBR for Grand Coulee Dam as a multiple purpose structure. The USBR, however, became the federal advocate for the construction of Grand Coulee Dam.

In contrast, traditional histories of Grand Coulee Dam and a recent revision both focus on Washington promoters of development. Participants wrote the first histories of Grand Coulee Dam. In the 1930s, long time dam supporters James O'Sullivan and Rufus Woods captured positions of influence in the Washington State bodies promoting the Grand Coulee Dam as a relief project. These men wrote the first accounts of the genesis of the plan to build Grand Coulee Dam. They portrayed themselves as an ardent band of

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<sup>64</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 1-5 and 479-

supporters fighting against great odds. Spokane businessmen toadies of the “Power Trust” fought an underhanded and well-funded battle to irrigate the Columbia Basin with a gravity system rather than a dam. Most histories of Grand Coulee Dam either repeated this story of conflict or told the story of only one of the two booster groups and its project. Recently, Paul Pitzer recast this story. He argued that O’Sullivan and his compatriots worked for the dam only at the beginning and end of the 1920s. He credited the Spokane men with carrying the idea of irrigation through the 1920s. While Pitzer provided an important new interpretation of the relationship of two factions in Washington State, he still discounted federal engineers.<sup>65</sup>

Adding federal engineers as important players resolves logical flaws with both these interpretations. The participants' accounts fail to adequately explain how the pumping plan won. How could a small group of men with little influence in state politics oppose the major businessmen of the state’s second largest city? In particular, where did plans for dams come from? Without allies, the dam supporters fought a lost cause. However, the pumping boosters did have allies. Federal engineers implementing the technical practice of comprehensive planning investigated damming the Columbia River and decided that a combination electricity and irrigation dam was the appropriate technology for the Columbia River and Basin. While Pitzer provided a more satisfying account of power relations within Washington State, he still did not explain the development of plans to dam the Columbia River at the head of the Grand Coulee. If the pumping boosters did not carry the

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537 and Pitzer, *Grand Coulee*, 62-65.

<sup>65</sup> James O’Sullivan, “The Struggle for the Grand Coulee Dam,” 1942, 1:24 O’Sullivan MSS and James O’Sullivan, “The Grand Coulee—Columbia Basin Project,” 1946, 1:25, O’Sullivan MSS. Rufus Woods, *The Twenty-Three Year’s Battle for Grand Coulee Dam* (Wenatchee: Wenatchee Daily World, 1944) reprints articles from the combative and pro-dam *Wenatchee Daily World*. Sundborg, *Hail Columbia*; Clark, “Rufus Woods;” and Ficken, *Rufus Woods* tell this history as a conflict between the pumping boosters and the gravity boosters. Batten, Barton, Durstine & Osborn, Inc, “The Eight Wonder of the World (Grand Coulee Dam)” of “Du Pont’s Cavalcade of America,” Radio show on CBS, 9& 10 June 1937, 1:1, Woods MSS is a heroic story of the genesis of the dam featuring Rufus Woods. B. C. Harding, “Water from Pend Oreille” is a history of the gravity plan without significant discussion of the pumping plan, its boosters, or federal engineers. Pitzer, *Grand Coulee* provides important correctives about the limits of the activities of the pumping boosters in the mid-1920s.

dreams of dams, who did? I argue that FPC, Army, and USBR engineers filled that role.

How and why they did so sheds light on the origins of multiple purpose dam building more generally. Federal engineers developed and ultimately selected a plan for a combination irrigation and hydroelectric project for the Columbia River and Basin. Approaching studies of the resources of central Washington from the perspective of comprehensive planning guided this decision. In the Progressive Era, government engineers and scientists launched a conservation movement that preached a utilitarian perspective on resource development. For water development, conservationists sought to use a given source in as many ways as possible. Navigation, irrigation, flood control, and hydroelectricity became the canonical development goals. Conservationists also promoted increasing water supplies by building storage dams. The government engineers set the stage for planning multiple purpose dams by increasing their water development activities in the first two decades of the twentieth century. In the 1920s, engineers of the FPC, Army, and USBR thought about the Columbia River and Basin from this conservationist perspective. Positive experience with electrical development on USBR projects, generally, and Hoover Dam, in particular, reinforced this inclination. The federal engineers concluded that a large storage dam on the Columbia River that would provide irrigation water for the Columbia Basin and produce hydroelectricity would be best.





## **Chapter 5—High versus Low: the U.S. Bureau of Reclamation and the Financial Rationale for a Multiple Purpose Dam in the 1930s**

In the 1930s, engineers and politicians had to re-establish closure on the question of how to develop the Columbia River and Basin. However, unlike the 1920s, people did not debate whether to irrigate the Columbia Basin with a gravity or pumping style project. In the 1930s, people fought over whether to build a “low dam” exclusively to produce electricity or to construct a “high dam” that could provide irrigation water as well. (Politicians and others in the 1930s referred to these two designs as the “low dam” and the “high dam,” although at 250-feet and 430-feet from bedrock to crest, respectively, engineers would have classified both of these designs as “high dams” in the 1930s.<sup>1</sup>) Again, federal engineers played important roles in resolving the issue. With this new debate, a new rationale for building multiple purpose dams came to the fore. U.S. Bureau of Reclamation (USBR)<sup>2</sup> engineers returned to Butler’s enormous irrigation and hydroelectricity project because they felt it was the most likely project to meet their financial goals.

Between 1933 and 1937, USBR engineers significantly changed Grand Coulee Dam’s design four times as people debated the high dam-low dam question. When President Franklin Roosevelt added Grand Coulee Dam to his recovery package, he earmarked only enough money for a low, electricity-only dam. USBR engineers designed a 250-foot multiple-arch dam for this project in May 1933. (This unusual type of structure blocked water with a face supported by arches rather than a solid mass.) In the winter of 1933-4, the USBR engineers changed the design to a 250-foot gravity dam. (A gravity

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<sup>1</sup> P. I. Taylor, “Dams—High, Large, and Unusual (Part 1—United States),” *Reclamation Era* 23 (February 1932): 31 gives a table of high dams. All were 200 feet or taller.

<sup>2</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period and general references.

*dam* should not be confused with the gravity *plan* of the 1920s. In the first case, "gravity" denotes the structural type of the dam. Gravity dams are solid masses of material—most often earth or concrete.<sup>3</sup> The "gravity plan" was an option for irrigating the Columbia Basin. Washington State engineers proposed diverting water from a tributary to the Columbia River and using gravity to bring it to the Columbia Basin through a series of canals and tunnels.) As soon as contractors began work on this low dam, the USBR engineers launched a campaign to substitute Butler's high dam. In June 1935, Interior Secretary Harold Ickes allowed USBR engineers to replace the low dam with the foundation for the high dam. Congress finally voted funds to continue the construction of the high dam in 1937.

In the 1930s, a different aspect of thinking about dams led USBR engineers to endorse and re-affirm Butler's decision to build Grand Coulee Dam as a multiple purpose dam. USBR engineers examined plans for the Columbia Basin with an eye toward whether the project met their financial criteria. Engineers sought to balance the anticipated costs of a project against its potential income. A good plan combined physical structures and a method by which the federal government would be able to recoup its investment. Over the 1920s and 1930s, multiple purpose dams became the USBR's preferred way of achieving this goal. With a multiple purpose dam, the USBR divided the development cost between the purposes they intended the dam to serve. Typically, the dam's purposes included improving navigation, flood control, providing irrigation water, and producing hydroelectricity. The USBR then collected money from the people who availed themselves of one of the dam's features. Commitment of USBR engineers to fulfilling this particular financial goal joined conservation approaches to water development as a way of thinking about dams that underpinned the shift to multiple purpose building.

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<sup>3</sup> Jackson, *Building the Ultimate Dam*, 13-40 is a good discussion of the structural types of dams.

### ***1931-2: A High Grand Coulee Dam***

In 1932, USBR engineers embraced Grand Coulee Dam because a new financial plan made it attractive. In the early 1930s, Army Engineer John Butler proposed damming the Columbia River at the head of the Grand Coulee, producing hydroelectricity, and irrigating the Columbia Basin. This development plan promised to achieve financial stability by adopting electricity sales as an important income source. Hydroelectricity subsidized irrigation. Only a high dam could produce the vast amounts of electric power for commercial sale that would pay for the dam, electric power plant, and irrigation project.

USBR engineers endorsed Butler's proposal for an enormously large dam and comparable electric power plant. Butler envisioned a dam rising 450 feet from the granite bedrock of central Washington, stretching over a mile across the Columbia River (4100 feet), and containing over 11 million cubic yards of concrete. The proposed electric powerhouse would have fifteen 105,000 kW generators—enough capacity to produce over three and one-half times the amount of electricity the entire region used in 1929. The high dam enabled generation of vast quantities of electricity in two ways. First, electricity production at Grand Coulee Dam was directly proportional to the height of the dam. Second, a high dam allowed engineers to store spring flood waters and release them over the year. This reservoir management increased the amount of electricity the facility would produce at all times.<sup>4</sup> (See Appendix 2 for Butler's drawings of the high dam for the Grand Coulee site.)

USBR engineers liked this plan because it had much better cost figures than the plans of the early 1920s. Engineers and politicians compared irrigation projects with

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<sup>4</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 38, 481-5 and 502-4 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 14 describe the dam and provide comparative figures. C. E. Magnusson, "Grand Coulee Dam, the Key Structure in State Development," Radio show on KJR Seattle, 14 April 1935, 17:2, O'Sullivan MSS stresses the increase of electricity production due to water storage.

estimates of the “cost per acre.” This calculation approximated the government’s investment in irrigation works per acre of land that the works would water. It also omitted substantial expenses, such as the interest on the investment and the costs of making a farm out of raw land. Still, Butler’s plan had a better cost per acre figure than either of the two estimates of irrigation costs that USBR engineers calculated in the 1920s. Reviewing the 1920 report on irrigating the Columbia Basin by the Columbia Basin Survey Commission (CBSC), David Henny, James Munn, and Charles Pease calculated that irrigating the Columbia Basin would cost at least \$164 per acre. In 1924, engineer Homer Gault increased this figure dramatically. He estimated \$231 per acre. In contrast, working with Butler’s plan, USBR engineers proposed charging farmers nothing for the first four years of water delivery, \$2.00 per acre per year for the next four years, and \$2.50 per acre per year for the subsequent thirty-two years. Under this plan, the government charged \$88 per acre in total—roughly half the lower estimates from the 1920s.<sup>5</sup>

A new role for hydroelectricity in the financial structure of the project made the improved financial outlook possible. In January 1932, USBR engineers proposed a broadly expanded role for electricity sales in financing the project. Engineers concluded that they could sell the amount of electricity that the dam would produce year-round to municipalities, utilities, and other large consumers. Engineers planned to charge 2.25 thousandths of a dollar for each kilowatt of this primary power that they supplied for an hour. (Mills per kW-hr was a standard method for pricing electricity.) Further, the USBR planned to pump irrigation water with the extra electricity that the dam would produce during spring floods. The engineers designed a system in which this secondary power lifted water from the Columbia River’s gorge to an artificial lake in the Grand Coulee. Irrigators drew water from this lake during the growing season. For that privilege, farmers

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<sup>5</sup> USRS, “Review of Report on the Columbia Basin Project Washington,” 13 December 1920, Reports 10-55, ERC, RG 115, 12; Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 99; and R. F. Walter, “Report by the Bureau of Reclamation, Department of the

paid one dollar per acre each year. The combined income from primary and secondary electricity sales would pay for the construction, interest, operation, and maintenance costs of Grand Coulee Dam and its electric power plant. In addition, these sales would produce a surplus to pay for one-half of the construction costs for the irrigation development.<sup>6</sup>

In contrast, in the 1920s USBR engineers did not plan projects for irrigating the Columbia Basin that tapped hydroelectricity as an important source of income. Engineers Henny, Munn, and Pease did not calculate electricity as a source of income. They mentioned that commercial sale of electricity might reduce the cost of the pumping approach while the gravity plan might destroy waterpower resources. However, they focused their calculations on checking the work of the CBSC and reducing the cost of the Columbia River Dam. This latter goal led Henny, Munn, and Pease to propose a dam just large enough to supply electricity for pumping water rather than a size that would accommodate commercial electricity production and pumping. In 1924, Homer Gault did discuss developing hydroelectric power at Grand Coulee Dam. However, he did not capitalize on electricity sales as a financial asset. Gault had two uses for the electricity from Grand Coulee Dam. First, it would pump water from the reservoir behind the dam to the lands of the Columbia Basin. Second, engineers would sell it commercially, but not to reduce costs to irrigators. Gault divided the cost of the dam and its electric power plant between irrigation and electricity production. Since engineers planned to build the dam for an irrigation development, he expected water users to pay for the entire dam and for the portion of the powerhouse that would produce electricity for pumping irrigation water. Electricity users would pay only for capacity in the powerhouse that produced electricity for commercial sale.<sup>7</sup>

Again, USBR engineers endorsed Butler's plan for an irrigation and

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Interior," in House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 483.

<sup>6</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 481-485.

<sup>7</sup> USRS, "Review of Report on the Columbia Basin Project Washington," 13 December 1920, Reports 10-55, ERC, RG 115, 12-13 and Appendix 3 p. 3-4 and Senate Committee on Irrigation and

hydroelectricity development for the Columbia Basin based on a high dam because it met their financial goals. Butler formulated a plan under which USBR engineers trusted the government would recover its investment. This plan relied on combining irrigation, electricity, and a high dam. A high dam produced enough electricity to allow cheap unit prices. Selling electric power would pay for the dam and more. This subsidy allowed engineers to set the price for irrigation works at a price they felt farmers could pay—eighty-eight dollars per acre.

In 1932, although engineers in the USBR felt that they had a financially feasible project, opponents derailed it. In January, Washington Representative Samuel Hill and Senators Wesley Jones and Clarence C. Dill introduced bills modeled on the legislation that funded Hoover Dam. The bills for the Columbia Basin Project, as the USBR had named the combination of Grand Coulee Dam and the irrigation development, died quietly in committee at the hands of agriculture men, Easterners, and legislators committed to balancing the budget. Secretary of Agriculture Arthur M. Hyde opposed the Columbia Basin Project because it would bring new farmland into production—hardly a need a decade into a farm depression. A group of Eastern congressmen opposed Grand Coulee Dam for the same reason. President Hoover did not support the endeavor either. Hoover and his advisors wanted to balance the federal budget to restore the nation's financial health. A \$260 million special fund for the Columbia Basin Project did not fit with budgetary belt tightening.<sup>8</sup>

### ***The 1920s: Assessing and Rejecting***

In using cost to assess Butler's plan for the Columbia Basin, the USBR engineers simply followed their normal procedures established with good reason. These men had

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Reclamation, *Commission, Boards, and Gault Reports*, 143-145.

<sup>8</sup> For discussion of this legislation: Pitzer, *Grand Coulee*, 61, 63-5 and Sundborg, *Hail Columbia*, 197-215. House Committee on Irrigation and Reclamation, *Hearings on the Columbia Basin Project*, 72nd Cong., 1st sess., 25, 27 May and 1, 2, 3, 13 June 1932, 229-244 and Arthur Hyde to Board of Engineers for Rivers and Harbors, 30 January 1932, in House Committee on Rivers and Harbors, *Columbia River and*

consistently rejected projects for the Columbia Basin because of cost in the 1920s. Further, cost was an integral part of how these engineers assessed potential irrigation developments. USBR engineers did not focus on cost without good reason. Financial problems plagued the USBR from its earliest days. Despite repeated attempts to fix these troubles, they remained until the organization replaced irrigation works with electricity as their main source of income. The large projects of the 1930s, like Grand Coulee Dam, began this transition.

In the 1920s, the USBR shied away from irrigation projects for the Columbia Basin because of costs. In 1920, a USBR review board found the Washington State study of irrigating the Columbia Basin inadequate because of its cost estimates. In the mid-1920s, the USBR more firmly rejected immediate construction of an irrigation project in the Columbia Basin because of high costs.

USBR engineers' first substantial consideration of irrigating the Columbia Basin followed a two-part pattern. The engineers assessed the project on the basis of cost and rejected an exclusively irrigation project on that basis. In 1920, Washington State engineers endorsed a gravity project while only briefly discussing pumping projects. USBR engineers entered the discussion of irrigating the Columbia Basin by reviewing this state report. The board of three engineers, which undertook the task, focused on the cost estimates. They found that Washington State engineers overestimated the expense of a pumping project and underestimated the costs of their gravity plan. The USBR engineers decreased the cost estimates for the pumping plan from \$173 to \$164 per acre while increasing the cost of the gravity plan from \$171 to \$187 per acre. These revisions made a dam approach cheaper than a canal and increased the price difference between the two projects. However, rather than endorsing either approach, the federal board of engineers called for further investigation of the foundation for a dam at the Columbia River location.

In effect, they refused to endorse the project because of lack of information and skepticism about cost estimates.<sup>9</sup>

In a set of studies in the mid-1920s, USBR engineers again followed the two-part pattern of assessing and rejecting irrigation projects for the Columbia Basin because of cost. In the first of these studies, USBR engineer Homer Gault compared four gravity and two pumping plans and arrived at significantly higher cost estimates than had the Washington State engineers. Gault estimated that the least expensive gravity plan would cost \$231 per acre and the least expensive pumping plan \$246 per acre. Gault's work compared only approaches. A review of Gault's report and the letter to the Interior Secretary accompanying his work, however, recommended against building an irrigation project. USBR again found fault with costs. USBR engineers A. J. Wiley, James Munn, and John Savage reviewed Gault's work. They recommended against both methods of irrigation on the basis that the costs were much too high for a successful irrigated farming project. A second Board of Engineers also reviewed Gault's report. While organized and financed by the federal government, Washington State engineers dominated this body. They revised the cost estimates and pronounced their estimates of \$158 per acre for a gravity plan and \$197 for a pumping plan in line with other irrigation projects. Newly appointed USBR Commissioner Elwood Mead, however, made the final USBR recommendation to the Interior Secretary in the 1920s. Mead recommended against immediate adoption of either project. He wrote that the USBR did not have a large enough staff or the expertise to undertake such an enormous farm settlement program. The USBR knew too well that unsuccessful farmers meant financial woes.<sup>10</sup>

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<sup>9</sup> CBSC, *Columbia Basin Irrigation Project*, 9-11 and 151 summarize the commission's findings. USRS, "Review of Report on the Columbia Basin Project Washington," 13 December 1920, Reports 10-55, ERC, RG 115, 17-21, Appendix 2 p. 19, and Appendix 3 p. 8 summarize the findings of the USBR board.

<sup>10</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 1-3, 5-14, 94-95, and 98-99. The second Board of Engineers was made up of three Washington State men and three engineers who frequently worked with the USBR from other states. See: "Waller, Osmar Lysander;"



More generally, USBR engineers viewed cost estimates as one of two basic criteria for assessing potential irrigation projects. USBR engineers conducted a “preliminary investigation” as the first step of considering a new irrigation project. This type of study provided basic information about an area, a plan for development, and recommendations on further action. USBR engineers sought with these studies to determine “technical and financial feasibility” of a potential project.<sup>11</sup>

The role of cost estimates in the construction and reception of one such study, Homer Gault’s investigation of irrigating the Columbia Basin in 1923-4, showed the key role of cost in the decision making processes of the USBR. Gault and his USBR colleagues agreed that cost estimates ought to be a central part of assessing this potential venture. Gault then devoted substantial resources to constructing these cost estimates. They dominated one period of his efforts. He spent a goodly part of the funds for the study on them. He also devoted a fair amount of the text of his report to these findings. When Gault released his work, the cost estimates received comparable attention. Gault’s superiors in the USBR wanted to know costs before anything else. Likewise, engineers and boosters primarily responded to the cost estimates. Even more importantly, USBR engineers understood cost estimates as a fundamental part of engineering. Engineers classified cost estimates as engineering work. They also approached them like other forms of engineering: the chief engineer had authority over cost estimates and he provided technical assistance to his people conducting such work.

Gault and his USBR colleagues set up his study of irrigating the Columbia Basin with cost estimates as a main goal. After winning a fight with Washington advocates of the

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F. Goodwin to E. Mead, telegram, 29 July 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; E. Mead to J. Jacobs, 19 Aug. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115; "Hill, Louis Clarence;" "Charles H. Locher;" and "Lyman, Dr. Richard Roswell." Further, the Washington engineers did a lot of the background work for the board. See: F. Goodwin and E. Mead to O. L. Waller, 23 Aug. 1924, 514:301 Hill, Entry 7/19-29-CBP, WDC, RG 115.

<sup>11</sup> Harold Conkling, “Investigation of an Irrigation Project,” *Reclamation Record* 12 (July 1921): 324-5 and “Reclamation Engineering Number,” *Reclamation Era* 30 (July 1940): 190-191 briefly describe

gravity plan over control, USBR engineers established the work to be done with the \$100,000 appropriation for studies of the Columbia Basin. Chief Engineer Frank Weymouth solicited suggestions from USBR engineers David Henny, Charles Pease, and James Munn. These men had reviewed Washington State's plans for irrigating the Columbia Basin a few years earlier. Henny, Pease, and Munn all recommended cost estimates as a task for the study. Considering these suggestions, Homer Gault and an informal consulting board laid out major tasks for his work. They prioritized:

- 1) a soil survey to determine the character of lands which could be irrigated in the Columbia Basin,
- 2) examination of all dam, reservoir, and tunnel sites by a geologist,
- 3) drilling at important dam, reservoir, and tunnel sites,
- 4) a study of water available in the Columbia and Priest Rivers,
- 5) walking all major canal routes and reservoir sites,
- 6) surveys to complement those conducted by Washington State engineers, and
- 7) "Office studies, including designs, cost estimates, power possibilities, economies of the project and preparing reports."<sup>12</sup>

Cost estimating fell in the last phase of the investigation. Gault also indicated that cost estimates determined the extent of his design activities. He made designs specific enough to be a good base for estimating costs. Further, Gault certified that his cost estimates would allow engineers to achieve one of their major goals for this investigation. USRS Director A. P. Davis won the battle for control with Washington boosters on the grounds that a new study ought to decide between the gravity and pumping approaches to irrigating

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this practice.

<sup>12</sup> Quote from: c. 7 May 1923, "Department of the Interior. Columbia Basin Project," 416:791 1/23-8/23, EC-CB, CE, RG 115. See also: H. J. Gault to F. Weymouth, 26 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; H. Gault, "Columbia Basin Project. Subject for Study," 29 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and H. Gault, "Columbia Basin Project—Not for Publication," 3 August 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115.

the Columbia Basin. Gault promised his cost estimates provided accurate information for this decision. Finally, Gault opened his conclusions: "The main purpose of this investigation is to ascertain the best plan for irrigation of the Columbia Basin and to estimate the cost of the project."<sup>13</sup>

Gault devoted a distinct and lengthy phase of his work to the preparation of cost estimates and other office work. Gault conducted his study of the Columbia Basin and wrote the report in just over one year. Three rough phases of work divided the year—a short period of defining the tasks and two longer periods of field work and office work. Gault spent most of his time from mid-March 1923 to mid-April 1923 in Denver reviewing previous studies of irrigating the Columbia Basin and setting out the work he would do. In mid-April, Gault established an office in Spokane, Washington. Through early November, Gault, his collaborators, and assistants conducted field work, such as surveying, measuring the volume of water in the Columbia River, taking drill cores from the geological formations through which the canals might run, and checking area soils. Between early November and late March of 1924, Gault's group primarily conducted "office studies." During this period, the engineers designed canals, dams, tunnels, and other structures. They also made cost estimates. Finally, Gault wrote his report. In all, after a brief month setting up the study, Gault spent six and one-half months conducting field work and almost the same length of time—five months—on office work, including cost estimates.<sup>14</sup>

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<sup>13</sup> Quote from Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 150. See also: D. Henny to F. Weymouth, 17 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; J. Munn to F. Weymouth, 17 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; C. Pease to F. Weymouth, 22 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 150-154.

<sup>14</sup> On the first period, see: F. Weymouth to Meisel, telegram, 14 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; H. J. Gault to F. Weymouth, 13 Apr. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and H. J. Gault to A. P. Davis, 20 Mar. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115. On the middle period, see: H. J. Gault to F. Weymouth, "Report on Columbia Basin Project, Washington, to April 30, 1923," 30 Apr. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project, Washington, for the month of July, 1923," 1 Aug. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project,

Cost estimates also absorbed a large part of the funds for the study. Gault allocated more money to cost estimates than any other single item. Dividing his budget among fourteen areas, Gault devoted 18 percent to the estimates. On 1 March 1924, Gault had completed his work except for final revisions to the report. He had spent \$9,300 out of \$52,000 on cost estimates.<sup>15</sup>

In the physical report, Gault devoted substantial space to cost estimates. The printed version of Gault report was fifty-six pages long and contained forty-nine tables. Of these tables, roughly thirty, or three-fifths, contained cost data. For example, Table Thirty-seven, "Storage costs," contained estimates of costs to impound water in three lakes upstream from the diversion point for irrigation works for the Columbia Basin. Likewise, Table Forty-one, "Summary and analysis of cost of pumping project with storage and commercial power," gave the absolute and percentage costs of major items, such as the dam and irrigation works for two pumping developments of different sizes.<sup>16</sup>

Cost estimates became the most important finding of the report, too. Chief Engineer Weymouth, Engineer Gault, and Commissioner Mead all summarized the results of the study as a series of cost figures. Before sending the completed report to Washington, D. C., Chief Engineer Weymouth sent a coded telegram summarizing the report to Francis Goodwin of the Columbia Basin Commission. Decoded, Weymouth's

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Washington, for the month of August, 1923," 1 Sept. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; and H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington, for month of September, 1923," 2 Oct. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115. For the final period, see: H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington for month of October, 1923," 1 Nov. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington for month of November, 1923," 30 Nov. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington for month of December, 1923," 31 Dec. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington, for month of January, 1924," 31 Jan. 1924, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, 3 Mar. 1924, 416:791 1/23-8/23, EC-CB, CE, RG 115; and H. J. Gault to F. Weymouth, 26 Mar. 1924, 416:791 1/23-8/23, EC-CB, CE, RG 115.

<sup>15</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 153.

<sup>16</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 138 and 145.

telegram read:

Referring to your telegram of today, Columbia Basin, Plan A Gravity 1,087,000 acres \$254.64 per acre. Stop. Plan B Gravity 1,425,000 acres \$241.38 per acre. Stop. Plan C Gravity 999,000 acres \$249.53 per acre. Stop. Plan D Gravity 1,406,000 acres \$231.40 per acre. Stop. Plan E Pumping 840,000 acres \$277.16 per acre. Stop. Plan F Pumping 1,133,000 acres \$246.58 per acre.<sup>17</sup>

Clearly, Weymouth viewed the cost estimates as the most valuable information in Gault's work. Gault also summarized the report as a series of cost per acre figures. "Table No. One—Summary of Results" in his report provided the same information as Weymouth's telegram. Similarly, Commissioner Mead and Assistant Secretary of the Interior John H. Edwards summarized Gault's work for Interior Secretary Hubert Work in a table which gave irrigable area, cost per acre, total estimated cost, and other cost data for one gravity and one pumping plan.<sup>18</sup>

The cost figures also drew more attention than any other part of the report. Gault estimated that irrigating the Columbia Basin using a gravity approach would be very expensive. Washington State's CBSC, General George Goethals, and Gault estimated that the cost per acre for a gravity project would be at least \$171.40, \$144.99, and \$231.40 respectively. Indeed, shocked at the price increases, Assistant Secretary Goodwin telegraphed Denver to confirm that Gault's estimates fell in the \$200 range rather than \$100. Responses to Gault's report focusing on his cost estimates proliferated. Following normal procedures, the chief engineer convened a board of engineers to review Gault's report. A. J. Wiley, James Munn, and John Savage devoted four and one-half of their eight and one-half page review to a discussion of the higher cost estimates. Gault's colleagues defended his work. Promoters of the gravity plan, on the other hand, chastised Gault's cost figures. Partly in response, newly appointed Commissioner Mead and Assistant Secretary of the Interior Francis Goodwin convened a second board of engineers

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<sup>17</sup> F. Weymouth to F. M. Goodwin, 11 April 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115.

<sup>18</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 1

to review Gault's work. Not counting summary and recommendations, half of the report of engineers Louis C. Hill, Joseph Jacobs, Charles H. Locher, Arthur J. Turner, Richard R. Lyman, and Osmer L. Waller constructed new designs and cost estimates for irrigating the Columbia Basin.<sup>19</sup>

Further, engineers involved with Gault's study defined cost estimates as an engineering task. Gault articulated his understanding of the content of his report most directly in the cover letter which accompanied the final copy of the report for the chief engineer. Gault stated:

Herewith is submitted a report on the engineering features of the Columbia Basin irrigation project in the State of Washington.... The report consists of a main part summarizing the results of the whole investigation, accompanied by three appendices treating the special subjects of soils, geology, and water supply in their relation to the project. Financial, economic, political, and legal questions concerning the project are not discussed in this report.<sup>20</sup>

Since Gault dealt with cost estimates at length, clearly he did not categorize them as "financial" or "economic" questions. The chief engineer stated this definition of cost estimates even more directly. Weymouth directed Gault to:

make your report cover strictly the technical engineering features; that is, your report should cover plans, estimates and cost of the project. I believe we will save ourselves much trouble if we do not attempt to suggest ways of financing the project or stating how soon the money can come back or how long it will take to settle it.<sup>21</sup>

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and 99.

<sup>19</sup> For the cost estimates, see: CBSC, *Columbia Basin Irrigation Project*, 9 and Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 88 and 99. On responses to Gault's report, see: F. M. Goodwin to F. Weymouth, 10 Apr. 1924, 416:791 1/23-8/23, EC-CB, CE, RG 115; CBIL, H. Lindley, and F. A. Adams, "Columbia Basin Irrigation Project. A Secondary Project," c. 1 June 1924, 416:791 1/23-8/23, EC-CB, CE, RG 115; and O. L. Waller to E. Mead, 26 July 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115. On the appointment of the second board of engineers to review Gault's technical work, see: F. M. Goodwin to E. Mead, telegram, 1 Aug. 1924, 512:301 23&25, Entry 7/19-29-CBP, WDC, RG 115 and F. M. Goodwin and E. Mead to H. Work, 21 Aug. 1924, 514:301 Hill, Entry 7/19-29-CBP, WDC, RG 115. For the board reports, see: Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 5-96.

<sup>20</sup> Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 97.

<sup>21</sup> F. Weymouth to H. J. Gault, 16 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115. See also: F. Weymouth to E. Mead, 2 Sept. 1924, 416:791 9/23-9/24, EC-CB, CE, RG 115; H. J. Gault to F. Weymouth, 13 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115; and Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 101-2. While Gault and Weymouth defined

Engineers also dealt with cost estimates in the same manner that they dealt with other technical work. The Denver office carefully controlled the assumptions that underlay both. For example, Gault felt “the unit costs and other assumptions should have final approval of your office before being used.”<sup>22</sup> Gault asked about: 1) an average amount of water loss from canals; 2) water requirements by month; 3) information on joints in steel pipes; 4) how much stress steel could stand; 5) how to calculate friction; 6) prices for excavating canals; and 7) prices for concrete lining for tunnels and canals. The Denver Office prepared an extensive reply to this laundry-list inquiry. A two-page discussion confirmed Gault’s figures for losses from concrete-lined canals and increased his figure for unlined canals. Another page supplied information on steel pipes and joints. The office recommended higher unit prices for excavation and instructed Gault to consult James Munn on unit costs for lining canals and tunnels. In early August, Chief Engineer Frank Weymouth and Engineers A. J. Wiley and James Munn visited Gault to review his work and consult further on engineering matters, including costs.<sup>23</sup>

Along with controlling assumptions, the Denver office provided Gault with specialized assistance on cost estimates, as well as with other technical matters. In the early 1920s, James Munn of the Denver office served as consultant on construction costs to studies of the Columbia Basin Project. He consulted with Gault, specifically. Munn also provided expertise on construction costs for the USBR review of the CBSC study of irrigating the Columbia Basin in 1920 and sat on the Board of Engineers that reviewed Gault’s report in the spring of 1924. Both of these boards discussed cost estimates at

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cost estimates as part of engineering, many other issues concerning money, such as a source of funds for irrigation and how the funds might be repaid, fell outside this category.

<sup>22</sup> H. J. Gault to F. Weymouth, 17 July 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115, 1.

<sup>23</sup> H. J. Gault to F. Weymouth, 27 July 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115. On the consulting trip see: F. M. Goodwin to F. Weymouth, 27 July 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; F. Weymouth, A. J. Wiley, J. Munn, and H.J. Gault to E. Mead and CBC, 9 Aug. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; and Acting Chief Engineer R. Walter, to H. J. Gault, 18 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115. For another example of an exchange over cost estimates see: H. J. Gault to F. Weymouth, 22 June 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115 and Acting Chief Engineer J. Munn, to H. J. Gault, 26 June 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115.

length. Likewise, design engineers in Denver provided Gault with special help. A. J. Wiley sketched basic designs for the dams on the gravity project when he, Weymouth, and Munn visited Gault in August 1923. Later that month, the designing section sent engineer C. H. Howell to Spokane to work with Gault on the designs of small dams and elected to prepare the designs and estimates for the Columbia River dam in Denver.<sup>24</sup>

Overall, finances played a central role in how USBR engineers assessed irrigation ventures in the 1920s. All the major USBR statements on irrigating the Columbia Basin rejected the possibility because of costs. Further, the way in which Homer Gault constructed and understood his study of irrigating the Columbia Basin demonstrated engineers' concerns with cost.

Of course, USBR engineers had good reason to be concerned with costs. USBR financing never worked as planned, and so the USBR had continuous trouble over money. Congress intended federal reclamation to be self-financing. Congress used seed money from the sale of public lands to establish a rotating "Reclamation Fund." In theory, the USBR drew on the fund to build irrigation works. In turn, farmers repaid the government for the structures that brought water. Payments from water users supplied the funds for the USBR to construct additional irrigation works. Frequently, however, farmers failed to make their payments.<sup>25</sup> In response, Congress and Interior Secretaries repeatedly tried to stabilize the financial situation of both the USBR and its farmers. Congress reduced farmers' payments and supplemented the Reclamation Fund. Ongoing problems also led to more punitive measures. Hydroelectric power stood out as a lone bright spot in an

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<sup>24</sup> On Munn, see: USRS, "Review of Report on the Columbia Basin Project Washington," 13 December 1920, Reports 10-55, ERC, RG 115; A. P. Davis to E. F. Blaine, 24 May 1922, 511:300.01, Entry 7/19-29-CBP, WDC, RG 115; and Senate Committee on Irrigation and Reclamation, *Commission, Boards, and Gault Reports*, 87-96. On aid with dam design see: H. J. Gault to F. Weymouth, 21 Sept. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115; J. Munn to H. J. Gault, 23 Aug. 1923, 416:791 1/23-8/23, EC-CB, CE, RG 115; H. J. Gault to F. Weymouth, "Report on Columbia Basin Project Investigations, Washington, for month of September, 1923," 2 Oct. 1923, 510:105.3, Entry 7/19-29-CBP, WDC, RG 115; H. J. Gault to F. Weymouth, 13 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115; F. Weymouth to H. J. Gault 17 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115; and H. J. Gault to F. Weymouth, 27 Nov. 1923, 416:791 9/23-9/24, EC-CB, CE, RG 115.



otherwise bleak financial picture.

The Reclamation Act of 1902 established federal investigation and construction of irrigation projects as a self-financing program. Money from public land sales in the sixteen states west of the 100th meridian went into the Reclamation Fund. Congress directed the Secretary of the Interior to use this fund<sup>25</sup> to investigate and construct irrigation projects in those states.<sup>26</sup> Farmers who used water from government irrigation works repaid the government. In theory, this income allowed the USBR to again spend money from the fund on constructing irrigation works. In fact, the Reclamation Fund revolved like a poorly weighted top—erratically, if at all.<sup>27</sup>

Individual financial problems caused farmers to default on their payments, at times with permission from Congress. Many farmers had high debts beyond those owed the government, while the USRS significantly underestimated development costs on many early projects. The modest income from small irrigation farms did not come close to covering all these expenses. In particularly brutal years, Congress even sanctioned non-payment. After World War I when prices for farm products dropped, Congress deferred the water users' payments for several years. Likewise, under similar circumstances, Congress granted blanket or individual moratoria for eight years in the 1930s.<sup>28</sup>

Congress repeatedly tried to stabilize USBR financing by fixing the repayment problem. Initially, the USRS collected project charges over a ten-year period. Congress extensively revised the payment plan three times before 1940. Each time the government lengthened the repayment period and decreased individual farmers' annual payments. In 1914, Congress extended the period from ten years to twenty, delayed payments until the fifth year of water delivery, and placed payments on an increasing scale to allow lower

<sup>25</sup> Warne, *Bureau of Reclamation*, 9-10 and 59-64.

<sup>26</sup>The original states in which the USRS operated were Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. Texas was added in 1906. Robinson, *Water for the West*, 17-18.

<sup>27</sup> "Reclamation Act of 1902," in *Reclamation Service*, by Brookings Institution, 104-7; Warne, *Bureau of Reclamation*, 9-10 and 59-64; and Robinson, *Water for the West*, 17-18.

payments in the early years. In the early 1920s, Congress revised farmers' payments based on income and wrote off construction charges for land unable to produce crops. The income-based repayment plan was given a forty-year maximum repayment period in 1926. In 1939, Congress again revised the repayment period: farmers had forty years to repay construction costs beginning ten years after first delivery of water to project lands.<sup>29</sup>

Congress also added to the Reclamation Fund. In 1906, Congress gave the USBR the authority to generate and sell hydroelectric power in conjunction with USBR projects. The income from electricity went into the Reclamation Fund and the project that generated it received credit toward the annual charge. In 1910, Congress loaned the Reclamation Fund \$20 million from the general treasury to complete existing projects. In 1911, Congress passed legislation allowing the USBR to sell water outside of its own irrigation projects. This income also went into the Reclamation Fund. In 1917, Congress turned over income from potassium sales and, in 1920, half the income from oil sales, mineral sales, and licensing of hydroelectric projects to the Reclamation Fund. In May 1933, the Reconstruction Finance Corporation loaned the Reclamation Fund \$5 million. Further, under the New Deal, Congress funded many USBR projects with public works funds. The final major additions to the Reclamation Fund before World War II came in 1938. Congress decided repayments for the New Deal projects funded out of the general budget would accrue to the Reclamation Fund. Congress also granted the Reclamation Fund half the proceeds from the sale of naval petroleum reserves.<sup>30</sup>

None of the efforts, however, solved the USRS's financial problems, and government authorities took harsher actions. The USBR endured hearings or external reviews in 1910, 1913, and 1923. Because of financial problems, Interior Secretary Lane demoted the USBR's first director, Frederick Newell, and placed a board in charge of the

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<sup>28</sup> Robinson, *Water for the West*, 37-40 and 57-59.

<sup>29</sup> Robinson, *Water for the West*, 42, 45-46, and 58-59.

<sup>30</sup> Brookings Institution, *Reclamation Service*, 107-124 and Robinson, *Water for the West*, 40-44 and 55-57.

USBR in 1914. Newell quit six months later. In 1923, Interior Secretary Hubert Work simply fired the second director, Arthur Davis, for the same problems.<sup>31</sup>

The USBR's experience with hydroelectric power, however, suggested an alternative to financial woes. Unlike farmers, electricity customers paid. The USBR began producing and selling electricity in its earliest years. For example, in 1904 and 1905, project engineer Louis Hill built a hydroelectric power canal at the Roosevelt Dam site in Arizona. The facility provided a power source for construction equipment. Although this effort did not initially succeed financially, the USRS later expanded the installation. As a permanent hydroelectricity power plant, the facility supplied electricity to commercial customers and to farmers who pumped irrigation water. This and similar developments became valuable sources of income in the USRS's first two decades. As of June 1917, income from electricity sales made up roughly one-quarter of total Reclamation Fund receipts. In the 1920s, Hoover Dam taught USBR engineers that electricity could pay for really big projects. While the financial plan for the project called for some income from water, Southern California cities and electric utilities signed contracts for electricity that alone could pay for the dam.<sup>32</sup>

By the 1920s, the experiences of USBR engineers had sensitized them to financial issues. The Reclamation Fund never worked well. Despite efforts to reduce farmers' payments and additions to the fund, the USRS needed help repeatedly. Help came at a price—outsiders investigated USBR activities and several respected leaders lost jobs. Only

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<sup>31</sup> Robinson, *Water for the West*, 40-45; Warne, *Bureau of Reclamation*, 27-9; and Brookings Institution, *Reclamation Service*, 23-24.

<sup>32</sup> Robinson, *Water for the West*, 27-29 and Warne, *Bureau of Reclamation*, 86-90 discuss electricity development by the USRS generally. See Brookings Institution, *Reclamation Service*, 126 for the financial figures. Jackson, *Building the Ultimate Dam*; Karen L. Smith, *The Magnificent Experiment: Building the Salt River Reclamation Project, 1890-1917* (Tucson, AZ: University of Arizona Press, 1986); and James, *Reclaiming the Arid West*, 65-85 provide longer discussions of the Salt River Project. Robinson, *Water for the West*, 51-55 and Warne, *Bureau of Reclamation*, 106-112 discuss the role of electricity sales in the Boulder Canyon Project. See also: Hundley, *Great Thirst*, 203-232 and Joseph E. Stevens, *Hoover Dam: An American Adventure* (Norman: University of Oklahoma Press, 1988). See the previous chapter for a longer discussion of the USRS's early experiences with hydroelectricity.

electricity sales offered hope. These financial problems produced an engineering culture that used cost as a major criterion for its work. In the 1920s, USBR engineers recommended against irrigating the Columbia Basin because the irrigation works would cost too much. Similarly, cost estimates played a central role in a major form of agency work—the preliminary investigation.

***The First 100 Days: An Electricity-Only, Low, Multiple-Arch Dam***

The first major USBR revision of Butler's approach to developing the Columbia River and Basin focused on cost but moved away from multiple purpose development. In the first 100 days of Franklin Roosevelt's presidency, politicians and engineers resurrected plans to build the Grand Coulee Dam. However, both the reborn designs and the world they came alive in had changed. The President was considering public works projects but favored ones smaller than Washington State's proposed \$400 million irrigation and hydroelectric development. USBR engineers displayed less confidence that electricity sales could meet their requirement that government investment be repaid. USBR engineers revised their plans for Grand Coulee Dam and an irrigation development for the Columbia Basin to better fit this new financial environment. Engineers proposed a two-stage development. Immediately, the government would construct only a small dam and small hydroelectric power plant. In the future, USBR engineers would expand the dam and power plant to Butler's specifications and add the irrigation works. This new approach realigned the project with the USBR's financial goals.

In 1933, USBR engineers faced four challenges as they tried to create a development plan for Columbia Basin that would repay their investment. First, negotiations with the administration established financial boundaries. Unlike Herbert Hoover, newly elected President Franklin Roosevelt and his advisors proposed government action as a response to the Depression. For planning Grand Coulee Dam, this new openness meant Washington development advocates and USBR engineers negotiated

an actual project with budget limits, rather than an ideal approach to development. Second, in 1933 no one even hoped for contracts that would guarantee the government repayment for Grand Coulee Dam. The severe Depression robbed USBR engineers of a mechanism for assuring that their financial plans would become reality. Third, uncertainty decreased engineers' willingness to rely on optimistic predictions of the future market for electricity. Fourth, the U.S. Department of Agriculture and Eastern congressmen still opposed developing new farmland.

Negotiations with President Roosevelt created the first new financial reality—a budget. Albert Goss, a member of Washington State's Columbia Basin Commission and State Grange Master, and Washington Senator Clarence C. Dill met with President Roosevelt on 17 April to lobby for Grand Coulee Dam. They went into the meeting hoping to get a Reconstruction Finance Corporation loan to fund state construction of Butler's project. Roosevelt did not agree but did not completely rebuff the men. He suggested a dam roughly one-third the cost of Butler's high dam, electricity, and irrigation development. In this exchange, Roosevelt set a financial constraint for the project: USBR engineers had a budget.<sup>33</sup>

Roosevelt probably saw this \$62 million price tag as financially conceivable—a price that could fit into the federal budget or other larger pictures. Others viewed the lower cost as easier to manage. Electric Bond and Share engineers and Senator Dill explicitly paired smaller budget with easier financing. Earlier, Electric Bond and Share engineers had proposed a \$42 million dam and irrigation project for the Columbia Basin because the lower cost would facilitate financing. Dill stated that a dam approximately one-third of the original price would be “easier to finance.”<sup>34</sup>

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<sup>33</sup> J. O'Sullivan to R. F. Walter, 20 Apr. 1933, 7:1, O'Sullivan MSS; C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; and E. Mead, “Memorandum for the Secretary. Re: Grand Coulee dam proposal,” 18 July 1933, 534:301.1 7/1/33-6/30/34. Entry 7/30-45-CBP, WDC, RG 115.

<sup>34</sup> Quote from: C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP,

In addition, Roosevelt may have thought a cheaper project would allow him to distribute public works money more evenly. Advocates of the dam certainly interpreted its cost in terms of competition for money. James O'Sullivan rationalized working for the smaller Grand Coulee Dam because it would cost roughly the same as Oregon's proposed Bonneville Dam. O'Sullivan felt price would be an important factor used to determine which of these two proposals received funding. Similarly, Walter Averill, editor of *Pacific Builder and Engineer*, thought about the distribution of relief money as a geographic competition. Averill advocated calculating Pacific Northwest eligibility for Public Works Administration (PWA) funds without counting Grand Coulee Dam, Bonneville Dam, and Montana's Fort Peck Dam.<sup>35</sup>

Second, lack of prospects for an assured repayment program made the USBR financially vulnerable. In the late 1920s and early 1930s, USBR engineers worked under a system that tied construction to a repayment plan. USBR engineers could not build dams or anything else without repayment contracts with water users or electricity contracts. Initially, USBR engineers expected this kind of arrangement for Grand Coulee Dam. Rapidly, however, lack of such a guarantee meant the USBR carried the financial responsibility for the dam.

Drawing on experiences in the 1920s, USBR engineers and Washington State supporters of Grand Coulee Dam anticipated repayment contracts would be a condition of construction. Following the Hoover Dam model, Commissioner Mead hoped to contract with electric utilities. James O'Sullivan suggested Washington State could contract for electricity. Using a different model of guaranteeing the government's investment, the President and others considered financing the dam through the Reconstruction Finance

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WDC, RG 115. See also: [Electric Bond & Share], "Columbia Basin Project Amended Plan 147 Ft. Head" [1933], 541:320 1/1/33-12/21/36, Entry 7/30-45-CBP, WDC, RG 115, 2-3 and 6.

<sup>35</sup> J. O'Sullivan to R. F. Walter, 20 Apr. 1933, 7:1, O'Sullivan MSS; J. O'Sullivan to W. Batcheller, 22 Apr. 1933, 7:1, O'Sullivan MSS; and "PWA and the West," *Pacific Builder & Engineer* 39 (2 December 1933): 17.

Corporation.<sup>36</sup>

In the early days of the New Deal, however, spending took priority over careful planning. Roosevelt informally promised funding for Grand Coulee Dam in late May. At that point, Roosevelt and his advisors had hardly suggested public works legislation. They certainly had not established a smooth process for managing large public works projects. Even after the administration set up its public works program, the financial arrangements for Grand Coulee Dam remained up in the air. The PWA did not make Grand Coulee Dam an official project until late July. Even after that, how the PWA would handle the Washington State dam remained unclear. In October, USBR engineers concluded that neither private utilities nor Washington State would contract for Grand Coulee's electricity. Finally, in November 1933, state and federal officials agreed on a plan. Grand Coulee Dam became a federal PWA project and the USBR constructed and managed it. Public Works Administrator and Interior Department Secretary Harold Ickes further decided that the government would recover its investment through electricity sales.<sup>37</sup>

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<sup>36</sup> J. O'Sullivan to R. F. Walter, 20 Apr. 1933, 7:1, O'Sullivan MSS; C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; J. O'Sullivan to L. Lawton, 6 May 1933, 7:2, O'Sullivan MSS; J. A. Ford to Spokane Chamber of Commerce, 8 May 1933, 7:2, O'Sullivan MSS; Frank Funkhouse, "Recent Developments in the Columbia Basin Project," Radio address delivered over KHQ, Spokane and KOMO, Seattle, 9 May 1933, 7:2, O'Sullivan MSS; and R. F. Walter to E. Mead, 13 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115.

<sup>37</sup> On the informal approval of the dam, see: J. O'Sullivan to R. F. Walter, 31 May 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115 and C. C. Dill to E. Mead, 31 May 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115. The Roosevelt Administration was just establishing PWA procedures in August. See: Mel Frey, "Stage Set to Speed Northwest Public Works Program: an Interview with Marshall N. Dana, District Adviser, Public Works Administration," *Pacific Builder and Engineer* 39 (5 August 1933): 18-9. On uncertainty about the status of the project in the summer of 1933, see: C. C. Dill to M. McIntyre, 6 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; E. Mead, "Memorandum for the Secretary. Re: Grand Coulee dam proposal," 18 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; and E. Mead, "Memorandum for Mr. Slattery," 20 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115. On the official adoption see: J. O'Sullivan to Acting Chief Engineer S. O. Harper, 29 July 1933, 14:7, CBC MSS and Harold L. Ickes, *The Secret Diary of Harold L. Ickes* (New York: Simon and Schuster, 1953), 1:72. On the continuing uncertainty on the financial arrangements, see: C. C. Dill to E. Mead, 4 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; H. M. Waite to E. Mead, 9 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; and E. Mead to R. F. Walter, 10 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115. On the USBR realization that no contracts for electricity would be forthcoming, see E. Mead to R. F. Walter, 25 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115 and L. McClellan, c. 25 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115. For the resolution of the dam's status see:

Without guaranteed income, the USBR carried the full weight of potential financial failure for Grand Coulee Dam. Ickes had set up a financial system much like that of early USBR projects, except that electricity replaced farmers as the source of income. The USBR would look for electricity customers after spending money to build the dam. These electricity contracts would be vital: they would be the only way to repay the government's investment. From the agency's first twenty years of experience, USBR leadership recognized the potential pitfalls of building projects today and working out financial plans tomorrow. As farmers' defaults showed, financial trouble with a project quickly became a headache for the USBR generally.

Third, the USBR engineers became more conservative in how they dealt with projections of future demands for electricity because of this shift in their repayment system. Without contracts, engineers relied on models of future markets for electricity to assure themselves that Grand Coulee Dam would be a financial success. With this new situation, USBR engineers preferred the smaller dam as a better match to the future market for electricity. Since Butler's plan proposed producing a great deal of electricity over a long period, this relative conservatism made sense.

Facing financial uncertainty, USBR engineers proclaimed the smaller dam a better match to the market for electricity. Denver office engineers recommended a low dam "to simplify the problem involved in finding a market for the power which would be made available."<sup>38</sup> Similarly, Commissioner Mead endorsed a low dam "to provide power for which there is a present market."<sup>39</sup>

The lengthy period over which Butler proposed to introduce large blocks of new electricity from Grand Coulee Dam should have made the USBR men nervous. This time frame did not fit with Butler's colleagues' opinions about the ability of engineers to predict

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Pitzer, *Grand Coulee*, 78.

<sup>38</sup> USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 1.

<sup>39</sup> E. Mead to H. Ickes, 23 May 1933, 533:301.1, Entry 7/30-45-CBP, WDC, RG 115.



markets for electricity. Army engineers confidently predicted markets for electricity in the near term only. In a companion report to Butler's, the North Pacific Division Engineer Colonel G. R. Lukesh and consulting engineer Barry Dibble opined: "In the electrical industry five years ahead is as far as plans can usually be prepared with any definiteness. A ten-year estimate is hazarded only with reservations."<sup>40</sup> Lukesh and Dibble expressed further uncertainty about electricity market predictions. They noted that growth in the market for electric power might fall considerably short of their predictions. They also warned that a new technology could replace electric power. In dramatic contrast to this shyness about long-term predictions, models of successful repayment of the government's investment in Butler's high dam required long-term sales of large amounts of electric power. The 1932 USBR model of the financial operation of a high Grand Coulee Dam proposed the following: marketing 720 million kW-hrs the first year after completion of the dam and marketing an additional 360 million kW-hrs annually until 8.32 billion kW-hrs was reached. After roughly ten years of construction, the plan required a market for a large new block of electricity each year for about twenty years. Building for thirty years of large growth in electricity demand when engineers confidently estimated that demand for only five to ten years in the future ought to have scared USBR men.<sup>41</sup>

The sheer magnitude of electricity that the high Grand Coulee Dam could produce should also have caused fear. In 1929, the region that engineers anticipated Grand Coulee Dam would serve used only 2.375 billion kW-hrs of electric power. In that year, Butler designed the high Grand Coulee Dam to produce 8.32 billion kW-hrs of electricity—three and one-half times the amount used in the entire region!<sup>42</sup>

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<sup>40</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 44.

<sup>41</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 44-47, 481-483, 520-522, 860-861, and 864-866 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 14.

<sup>42</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 38 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 14.

Fourth, opposition to new farmland endured, with cause. In 1932, Agriculture Secretary Arthur M. Hyde, Chief of the Army Corps of Engineers Major General Lytel Brown, and Pennsylvania Congressman Louis T. McFadden, for example, opposed Columbia Basin legislation. Similarly, New York Congressman Francis Culkin, Congressman Hope, and others spoke against Grand Coulee Dam in a House debate in August 1935. Farm conditions justified these positions. American farming entered its Great Depression in the wake of World War I. American farmers began increasing production during the war when they supplied much of Europe's food. Expansion continued after the war, even as European farmers reclaimed their home markets. Consequently, American food prices and farm income declined precipitously. In 1920, farmers made 15 percent of the national income; by 1929, they made only 9 percent. Many people left farming and many others lost their land through inability to pay debts. Dropping prices and hardship continued into the 1930s.<sup>43</sup>

In a very short period, the financial environment in which USBR engineers considered the construction of Grand Coulee Dam changed a great deal. President Roosevelt would fund a dam, but only a small one. This new dam lacked any guarantees that the government would recover its investment. This change in financial set-up encouraged USBR engineers to rely less on their ability to predict growth in markets for electricity and, therefore, favor a smaller dam. Opposition remained the same. Politicians connected to agriculture opposed new farms.

In the spring of 1933, USBR engineers redesigned Grand Coulee Dam to fit this new financial environment. Chief Engineer Walter and his staff split the dam in two and delayed the irrigation works. USBR engineers proposed building a 250-foot multiple-arch dam and a 520,000 kW electric power plant immediately. Later they could expand the dam

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<sup>43</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 4-5, 538-544; Committee on Irrigation and Reclamation, *Columbia Basin Project*, 229-244; *Congressional Record*, 74th Cong., 1st sess., 1935, Vol. 79, pt. 13, 13720-13730; Pitzer, *Grand Coulee*, 121-126; and Brinkley, *Unfinished Nation*, 634-5, and 678-9.

and hydroelectricity facilities to Butler's specifications and add the irrigation project.<sup>44</sup> A smaller dam and a smaller powerhouse fit well with the new financial environment. The lower cost of the multiple-arch dam and small electric power plant helped meet Roosevelt's budget. The lower cost and less electricity reduced reasons to fear a small electric power market. Postponing the irrigation project diffused agricultural opposition to the project. (See Appendix 2 for the USBR drawing of the multiple-arch dam for the Grand Coulee site.)

USBR engineers made a big step toward meeting the new budget by reducing the size of the dam and powerhouse. The engineers estimated that the high Grand Coulee Dam would cost \$126 million for the dam, \$43 million for the electric power plant, and \$18 million for interest during construction. The total cost of \$187 million exceeded the budget by \$125 million. In contrast, USBR men designed a low, multiple-arch dam that would cost \$40 million. The powerhouse and interest would only add \$19 million and \$3 million respectively. At \$62 million total, Roosevelt approved the plan.<sup>45</sup>

In a bold move, USBR engineers also changed the structural type of Grand Coulee Dam to meet the new budget. USBR engineers concluded a multiple-arch dam would be 3.5 percent cheaper than a gravity dam at this site. USBR engineers took, for them, a bold step by proposing a multiple-arch dam. "Structural tradition" dams were uncommon, in general, and the USBR had built few. In the early twentieth century, gravity dams of earth, stone, brick, or concrete were traditional technologies. People built few multiple-arch and other "structural dams," although the approach dates to the Roman period. The USBR completed fewer than ten. (See Appendix 2 for an illustration of an USBR multiple-arch dam.) The source of the idea to build Grand Coulee Dam as a multiple-arch

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<sup>44</sup> The Denver men first outlined this plan in: Acting Chief Engineer S. Haper to E. Mead, telegram, 29 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115. The fullest description was: USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115.

<sup>45</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 483 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest

structure explained this departure from standard procedures and emphasized the cost-saving feature of the choice. In an exchange with USBR engineers, colleagues at Electric Bond and Share suggested a multiple-arch dam for the Grand Coulee site to reduce costs. They wrote:

This type of dam would be favorable in this location, greatly reducing the volume of concrete and the cost as compared with a so-called gravity type dam.... The use of the modified multiple-arch dam...is merely suggested an account of the appreciable economy which its adoption would permit.<sup>46</sup>

Reducing the electric power plant addressed apprehension about the future market for electricity as well as budget problems. A small plant would produce less electricity and allow engineers to plan to market it quickly. Engineers designed the low dam to produce 2.2 billion kW-hrs of primary electricity annually—roughly one-quarter of the anticipated production from the high dam. While engineers anticipated marketing progressively more electricity from a high dam over a twenty-year period, the small dam demanded less. USBR engineers proposed the same marketing approach for the low dam as the high. The USBR would release 720 million kW-hrs of electricity the first year and add 360 million kW-hrs annually. However, with a low dam the engineers would market the dam's entire capacity in only four years. Even with a construction period, this period for electricity marketing fit better with engineers' preference for not predicting electricity markets more

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elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11.

<sup>46</sup>Quote from [Electric Bond & Share], "Columbia Basin Project Amended Plan 147 Ft. Head," [1933], 541:320 1/1/33-12/21/36, Entry 7/30-45-CBP, WDC, RG 115, 9. Jackson in his biography of dam designer John S. Eastwood stresses that multiple-arch dams were a *much* lower cost alternative dam technology. Jackson cites Eastwood's figures that multiple-arch dams could reduce construction costs 30% to 40% over other dams. Jackson, *Building the Ultimate Dam*, 2-3. USBR engineers did not understand these design options as that dramatically different. Engineers estimated a gravity dam at Grand Coulee Dam would require three times as much concrete as a multiple-arch dam. They, however, only anticipated a cost savings of 3.5%. USBR engineers proposed using concrete reinforced with metal rods for the multiple-arch dam, which was more expensive than the mass (un-reinforced) concrete of a gravity dam. Likewise, the wooden forms into which the concrete was poured would have been more complicated, and more expensive, for a multiple-arch dam. W. O. McMeen, "Summary of Multiple-Arch Dam Studies for Grand Coulee Project," 17 September 1934, 319:CB-510.00-CD-34-09-17 C-1, Reports 10-55, ERC, RG 115, 1 and 86. See also: Jackson, *Building the Ultimate Dam*, 13-40 and 192. Jackson understates the number of multiple-arch dams constructed by the USBR. According to the USBR, their engineers had built five multiple-arch dams by 1940. See: "Reclamation Engineering," 195.

than ten years in the future.<sup>47</sup>

A small and cheap dam producing less electricity was a better financial prospect. Modest electricity sales would pay for the low dam. On the other hand, paying off the high dam required substantial electricity sales. Further, if substantial electricity markets failed to develop, the high dam would fail financially. Modest electricity sales would not pay off a large structure. A small dam lowered the risk of having a dam that did not meet its financial goal.

Finally, engineers and politicians matched Grand Coulee Dam to the new financial conditions in two ways by limiting it to producing hydroelectric power. First, eliminating irrigation works reduced costs dramatically, which helped meet the budget. USBR engineers estimated that a high dam, hydroelectricity, and irrigation project would cost \$394 million. To reach \$62 million, engineers had to reduce costs by \$332 million. Cutting \$208 million for irrigation works produced almost two-thirds of this reduction.<sup>48</sup> Second, men in the capital felt that separating the irrigation features from the dam would greatly improve the latter's reception by Congress. Senator Dill neatly summarized the logic this way:

[I]t is the President's idea that we would not produce power for lifting water to the Grand Coulee Dam Reservoir, now. He would make this simply a power project for the present and try to sell the power to various users in the Northwest. He thinks this will take away much of the opposition in the House and Senate, that has developed because they are opposed to bringing any more land into cultivation.<sup>49</sup>

In 1933, USBR engineers proposed to meet a new set of financial requirements by building Grand Coulee Dam as a low, multiple-arch dam with a small powerhouse and no irrigation features. President Franklin Roosevelt set a specific and low budget for a Washington State dam. USBR engineers lost their guarantee of repayment and grew wary

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<sup>47</sup> USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11-14.

<sup>48</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 483.

<sup>49</sup> C. C. Dill to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115.

about the future demand for electricity. Eastern agriculturists continued to oppose the activities of the USBR. Smaller structures, a multiple-arch dam, and elimination of irrigation reduced costs to the specific budget. Lower costs and less electricity reduced demands on future electricity markets. Delaying the irrigation project also appeased the farm lobby.

### *Winter and Spring 1933-34: A Low, Gravity Dam*

In the winter and spring of 1933-34, USBR engineers again redesigned Grand Coulee Dam in an attempt to improve its financial prospects. During the summer of 1933, the financial environment in which the USBR men worked changed a second time. USBR engineers interpreted the construction of Bonneville Dam—a large hydroelectric dam on the Columbia River near Portland, Oregon—as the making of a competitor for electricity customers. At the same time, administration officials refused to consider anything but a small hydroelectric facility for the Grand Coulee site. With the prospect of competition, USBR engineers decided that building Grand Coulee Dam in two steps—constructing a 250-foot dam immediately and later expanding it into Butler’s 450-foot dam—should not increase the final cost. Toward this end, the engineers discarded the plan for a multiple-arch dam with a 520,000 kW powerhouse in favor of a small gravity dam with a minimal electricity installation. They also planned a structure downstream of the dam that would serve as both a temporary dam for drying the riverbed during the second stage of construction and the downstream edge of the high dam upon its completion. This gravity dam, minimal electric power plant, and “toe” of the high dam reduced transition costs in the following ways: 1) it used all the concrete poured for the first dam in the final structure; 2) it lowered construction costs; and 3) it cut costs for converting generating equipment.

Among many surprises during President Roosevelt's first 100 days in office, he approved two dams for the Columbia River. No one expected two dams. Major Butler, in the comprehensive plan for the Upper Columbia River, stressed a need for gradual

development. Butler expected electricity sales to pay for the dams. He cautioned, however, that constructing dams too rapidly would mean too much electricity. Some would go unsold and the dam's finances would suffer. Washingtonians, too, believed that the President would fund only one dam. When the PWA formally adopted Oregon's Bonneville Dam before Grand Coulee Dam, a Spokane newspaper pronounced Grand Coulee Dam dead and Senator Dill set out to investigate in the capital.<sup>50</sup>

Surprise turned to apprehension as USBR engineers realized that electricity from Bonneville Dam could cost less than that from Grand Coulee Dam. USBR engineers had three reasons to believe electricity from Bonneville Dam would be cheaper. First, electrical production capacity at Bonneville Dam would cost less than at Grand Coulee Dam. The \$59 million design for Bonneville Dam specified a 660,000 kW powerhouse. The multiple-arch dam for the Grand Coulee site had only a 525,000 kW installation, although it cost \$3 million more. Second, the additional uses of these dams would increase the cost of power from Grand Coulee Dam while decreasing it at Bonneville Dam. USBR engineers intended to set the rate for Grand Coulee Dam's electricity to produce surplus income to help pay for irrigation works. Bonneville Dam, in contrast, did not supply water for an irrigation project or support one through its electricity sales. In fact, the improvements that Bonneville Dam made to the navigability of the lower Columbia River had the potential to reduce the cost of its electricity. USBR engineers worried that the government would write off part of the investment in Bonneville Dam as an expenditure to improve navigation. Although USBR engineers did not mention this aspect, the relative locations of Bonneville and Grand Coulee Dams favored Bonneville Dam's electricity. The Army built Bonneville Dam near Portland, Oregon. Being closer to that city and Puget Sound than Grand Coulee Dam, Bonneville Dam's electricity could be delivered to market for less than Grand Coulee Dam's. To cap the bad news, USBR engineers expected

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<sup>50</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 2-3, 82-84, and 1064-1066 and Pitzer, *Grand Coulee*, 75.

Bonneville Dam to produce electricity before Grand Coulee Dam. The competitor beat Grand Coulee Dam in time as well as price.<sup>51</sup>

Working from these assumptions, USBR engineers concluded that electricity from Bonneville Dam would destroy the market for electricity from a low dam at the Grand Coulee site. USBR engineers directly expressed this dim view in the winter of 1933-34. Columbia Basin Commission Consulting Engineer Alvin Darland reported that both Chief Engineer Ray Walter and Leslie McClellan, the USBR's chief electrical engineer, worried that electricity from Bonneville Dam would eliminate a market for Grand Coulee Dam electricity. Likewise, Chief Designing Engineer Jack Savage explained that the threat of electricity from Bonneville Dam led the USBR to reconsider its plans for Grand Coulee Dam.<sup>52</sup>

Bonneville Dam's effect on regional markets for electricity made the two-step development of Grand Coulee Dam less attractive financially. In the spring of 1933, USBR engineers anticipated selling the electricity from a low dam for several years before constructing the high dam. This income allowed a low dam to reduce the added costs of building in two phases. Further, if the government waited long enough to complete Grand Coulee Dam, the low dam subsidized the high. However, if Bonneville Dam's electricity stopped the USBR from selling Grand Coulee Dam's, the low dam hurt the finances of the full development. Without electricity sales, building in two steps only increased the total cost of Butler's development.<sup>53</sup>

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<sup>51</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 14, and 481-5; USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 10-14; A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS; and Elwood Mead et al., "Report on Columbia Basin Project," 22 December 1934, 294, Reports 10-55, ERC, RG 115, 1-2, 9, and 13. The cost of transmission became an important issue later in establishing electricity rates for the federal dams in the Pacific Northwest, but I have found no evidence that USBR engineers worried about transmission costs at this time. See: Funigiello, *National Power Policy*, 174-225.

<sup>52</sup> A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS and "Minutes Columbia Basin Commission," 3 February 1924, 2:5-7, O'Sullivan MSS, 196.

<sup>53</sup> USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11-14.



While Bonneville Dam undercut USBR engineers' faith in a low dam, other administration officials remained unchanged in their views of Grand Coulee Dam. They insisted that USBR engineers work within the spirit of the original approval. Grand Coulee Dam would be a hydroelectricity facility costing \$62 million. Senator Dill reiterated this criteria in the winter of 1933-1934. At the urging of Senator Dill, Commissioner Mead cautioned Chief Engineer Walter:

[W]henever an opportunity presents itself, make it clear that we are proceeding in accordance with the allotment, which provides for a dam as high as possible, with the appropriation, but which will be a power dam exclusively.<sup>54</sup>

Dill also urged Washington State officials working with the federal government on the dam to be content with \$62 million and not request more.<sup>55</sup>

In the winter of 1934, USBR engineers re-designed Grand Coulee Dam in light of this new financial environment. Unable to replace the low dam with the high, USBR engineers proposed a plan that eliminated the financial penalties of building in two steps. The new design—a 250-foot gravity structure, the downstream toe of the high dam, and a smaller split powerhouse with different equipment—invested almost entirely in structures which would become part of the high dam. At the same time, many of these elements reduced costs to stay within the budget and spirit of the initial approval. (See Appendix 2 for the USBR's drawings of the low, gravity dam for the Grand Coulee site and an illustration that compares the high and low dam designs.)

Commissioner Mead, Chief Engineer Walter, and Columbia Basin Commission Consulting Engineer W. C. Morse all flagged the multiple-arch structure as an item which would increase costs. They anticipated that much of the concrete in this structure would not become part of the high dam. Engineers expected to incorporate the piers of the multiple-arch dam into a high, gravity dam but not the arches. This substantial material

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<sup>54</sup> Quote from: E. Mead to R. F. Walter, 9 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115. See also: C. C. Dill to E. Mead, 10 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115.

investment would be removed and discarded.<sup>56</sup>

USBR Chief Designing Engineer Jack Savage identified the need to divert the river twice—once for a low dam and later to expand the low dam into a high dam—as a second financial problem with the low dam. No one trivialized the difficulty and expense of redirecting the course of the Columbia River to expose the part of the riverbed where contractors would build the dam. The successful contractor for the low, gravity dam at the Grand Coulee site bid \$3.5 million of \$29 million (12 percent) for this task. Of the eighty-five items that made up the bid, only two items, placing concrete in the dam and excavating for the dam and powerhouse, exceeded diverting the river. Doing this work twice doubled this substantial expense.<sup>57</sup>

Columbia Basin Commission Consulting Engineer Alvin Darland highlighted yet a third item that would increase costs: two sets of hydroelectric equipment. USBR engineers wanted to use different equipment to generate electricity in the 250-foot dam and the 450-foot dam. With this approach, expansion meant replacing equipment and substantially reconstructing the powerhouse. Darland estimated that the cost of removing and disposing of generating equipment and rebuilding the powerhouse would be around \$15 million.<sup>58</sup>

By changing the structure of the low dam, USBR engineers eliminated the waste of discarding a large part of the low dam structure. USBR engineers exchanged the multiple-

<sup>55</sup> "Minutes Columbia Basin Commission," 8 Mar. 1934, 2:5-7, O'Sullivan MSS, 216 and 220.

<sup>56</sup> J. O'Sullivan to L. Lawton, 6 May 1933, 7:2, O'Sullivan MSS; "Minutes Columbia Basin Commission," 25 Nov. 1933, 2:5-7, O'Sullivan MSS, 135; R. F. Walter to J. O'Sullivan, 2 Dec. 1933, 14:7, CBC MSS; and W. C. Morse to CBC, 5 Feb. 1934, 13:1, CBC MSS.

<sup>57</sup> "Minutes Columbia Basin Commission," 3 February 1935, 2:5-7, O'Sullivan MSS, 199 and "Grand Coulee Dam and Power Plant, Columbia Basin Project: Bids Opened June 18, 1934, at Spokane, Wash., by the U.S. Bureau of Reclamation," *Pacific Builder and Engineer* 40 (7 July 1934): 26-7. See also: R. F. Walter to C. H. Paul, 14 May 1934, 533:301.1; Entry 7/30-45-CBP, WDC, RG115; "Preliminary Data on Design and Construction Features of Coulee Dam," *Pacific Builder and Engineer* 40 (14 April 1934): 22-3; "Brief Digest of Specifications for ...Grand Coulee Dam," *Pacific Builder and Engineer* 40 (5 May 1934): 23-5; James O'Sullivan, "Two Suggested Methods for... Diverting the Columbia River ...at Coulee Dam," *Pacific Builder and Engineer* 40 (9 June 1934): 29-30; and Frank Banks, "The Grand Coulee High Dam...And the Irrigation of the Columbia Basin," *Pacific Builder and Engineer* 40 (1 September 1934): 17-20.

<sup>58</sup> A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS, 5-7 and A. F. Darland to R. F. Walter, 16 Dec. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115.

arch dam for a gravity dam. A low, gravity dam allowed USBR engineers to construct the high, gravity dam by simply pouring more concrete on the existing structure. All of the low, gravity dam would become part of the high dam.<sup>59</sup>

Building the “toe” of the high dam along with the low dam addressed two problems. First, it reduced the cost of diverting the river a second time. The downstream face of each powerhouse and the furthest downstream segment of the high dam, with modest extensions, would block off the part of the river where contractors would expand the dam. The Columbia River would still be diverted twice. However, most of the structure for, and, consequently, the money spent on, the second diversion would directly contribute to the high dam.<sup>60</sup>

Second, the “toe” of the high dam helped the engineers maintain the spirit of Roosevelt’s original approval of a dam. As an unusual, and last minute, low-cost solution to the problem of river diversion, the toe helped USBR engineers to build a functional hydroelectric facility for \$62 million and still eliminate substantial transition costs. A number of the possibilities for the first stage of construction did not. Two proposals failed to complete a dam and power plant in the first phase. USBR engineers suggested building the base of the high dam as the first step of the project. Alternatively, Jack Savage proposed constructing part of the high dam on one bank of the river as the first stage. Both of these strategies required diverting the river only once but did not give Roosevelt a working hydroelectric facility. USBR engineers also considered building the base of the high dam up to average low water and finishing the initial construction with a small gravity

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<sup>59</sup> Harper announced the selection of the low, gravity dam: Acting Chief Engineer S. O. Harper to E. Mead, telegram, 16 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115. The detailed discussion of alternatives for the Grand Coulee site is: John Savage, “Alternate Plans and Estimates for Grand Coulee Dam,” 8 March 1934, 294, Reports 10-55, ERC, RG 115. For a brief description of the low dam that notes the lack of waste, see: Acting Chief Engineer S. O. Harper to J. O’Sullivan, 21 Feb. 1934, 13:2, CBC MSS. On the construction approach, see: J. O’Sullivan to R. F. Walter, telegram, 2 Feb. 1934, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115.

<sup>60</sup> Acting Chief Engineer S. O. Harper to E. Mead, telegram, 16 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; A. F. Darland to J. O’Sullivan, 7 Mar. 1934, 14:7, CBC MSS; and W. C. Morse to J. O’Sullivan, 13 Mar. 1934, 13:1, CBC MSS.

dam and power plant. This approach, however, cost a good bit more than \$62 million. The toe provided a neat low-cost solution to the diversion problem that, as a result, left enough for a working low dam and powerhouse.<sup>61</sup>

Changes to the powerhouse also helped USBR engineers build a working dam for \$62 million and reduced transition costs. USBR engineers split the powerhouse, constructed more of the final powerhouse, changed the hydraulic and electrical equipment, and substantially reduced the size of the facility. Splitting the powerhouse cut transition costs by contributing to the “toe” structure. Major Butler planned a single powerhouse for Grand Coulee Dam high dam and USBR engineers followed that approach for the multiple-arch dam powerhouse. However, as the men redesigned the low dam in the winter of 1933-34, they decided to build a powerhouse on each side of the river. Splitting the hydroelectric facility and incorporating the downstream wall into the “toe” structure extended this useful feature to both shores. As a bonus, splitting the powerhouse reduced the cost of the high dam by \$4.4 million.<sup>62</sup>

The revised powerhouse design for the low dam also contributed more to the high dam’s powerhouse. USBR designers called for the construction of all eighteen penstocks for the high dam through the low dam. These tunnels through the dam supplied the water to power the hydroelectric machinery. The multiple-arch dam design did not include the penstocks of the high dam.<sup>63</sup>

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<sup>61</sup> R. F. Walter to J. O’Sullivan, 2 Dec. 1933, 14:7, CBC MSS; A. F. Darland to E. F. Banker and J. O’Sullivan, 20 Jan. 1934, 13:1, CBC MSS; “Grand Coulee Dam and Power Plant Outline of Alternative Studies,” 24 Jan. 1934, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; “Minutes Columbia Basin Commission,” 3 February 1934, 2:5-7, O’Sullivan MSS, 197-7; and John Savage, “Alternate Plans and Estimates for Grand Coulee Dam,” 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115.

<sup>62</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 746-748; USBR, “Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085),” 24 May 1933, 294, Reports 10-55, ERC, RG 115, 10-11 and “preliminary estimate drawing,” A. F. Darland to J. O’Sullivan, 7 Mar. 1934, 14:7, CBC MSS; and John Savage, “Alternate Plans and Estimates for Grand Coulee Dam,” 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115, 2-8; W. C. Morse, A. F. Darland, D. C. Henny, and H. E. Smith to CBC, 31 Mar. 1934, 415:791 10/31-9/34, EC-CB, CE, RG 115.

<sup>63</sup> USBR, “Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085),” 24 May 1933, 294, Reports 10-55, ERC, RG 115, 10-11; Acting Chief

Changing hydroelectric equipment also reduced transition costs. In May 1933, USBR engineers designed equipment for the hydraulic conditions of the low dam. The new plan specified generators designed for the hydraulic conditions of the high dam but adapted to the low dam. USBR engineers estimated that each turbine and generator pair for the low, multiple-arch dam would cost \$1,020,000. CBSC Consulting Engineer Darland projected that machinery for the new plan—which would convert equipment for the high dam to temporary use in the low dam—would cost \$424,000 per unit. Modifying each turbine-generator pair then should have been \$596,000 cheaper than simply replacing them.<sup>64</sup>

Most dramatically, USBR engineers significantly reduced the capacity of the powerhouse to meet the low dam's budget. Spending and equipment changes combined to reduce the installation in the low dam from 520,000 kW to 102,900 kW. Engineers cut their allocation for generators and turbines from \$6.2 million to \$3.3 million. In addition, the cost of each generator-turbine pair increased from \$776,000 to \$1.1 million. This meant that USBR engineers had to cut the number of units from eight to three. Further, each new pair produced less electricity. In the low dam, the new equipment would produce 34,300 kW, whereas engineers had previously specified equipment rated at 65,000 kW.<sup>65</sup>

This reduction of the hydroelectric facilities kept the project on budget. With the multiple-arch dam design, USBR engineers planned to spend \$19 million on the powerhouse, \$40 million on the dam, and \$3 million on interest. The new program

Engineer S. O. Harper to F. Banks, 27 Feb. 1934, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; and John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115, 2-8.

<sup>64</sup>These figures do not include estimates for resale of removed equipment or modifications to the building to accommodate different sizes of equipment. A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS and John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115, 8-15 and 55-58.

<sup>65</sup>The price for high head units and low head runners actually appears to be for the 105,000 kW high dam turbine and generator pair, but it is the figure USBR engineers used to estimate their recommended low dam. John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115, 2-8 and Table 10 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294,

transferred \$5 million away from the hydroelectric facilities to pay for a more expensive low-dam structure. Further, other than the multiple-arch dam, only alternatives with a nominal or no immediate hydroelectric installation even came close to budget. USBR engineers estimated the costs for fifteen different approaches to the low dam in the spring of 1934. The hydroelectric facilities in these plans ranged from nothing to thirteen of the eighteen turbine-generator pairs planned for the high dam. The design that USBR engineers chose had the smallest electrical installation, without eliminating electricity production, of any of the plans.<sup>66</sup>

In the winter of 1933-34, USBR engineers stripped the low dam of most of its electricity-producing abilities to design a \$62 million project that could be expanded into Butler's high dam, hydroelectricity, and irrigation development without adding to the cost of that larger project. They also replaced the multiple-arch dam with a gravity dam, added the "toe," split the powerhouse, installed penstocks for the high dam, and changed the hydroelectric machinery. These actions accommodated the dam to a new financial environment—a \$62 million budget and anticipated competition from Bonneville Dam.

### *Summer, Fall and Winter 1934: Fighting for the High Dam*

During 1934, the USBR changed its position about the Washington State development for the last time. Financial concerns led the engineers to advocate immediate construction of Butler's multiple purpose project—a high dam, hydroelectricity, and irrigation design. While the smaller gravity dam reduced the financial penalties of building in two phases, it did not solve the basic problems of the approach. Reducing added costs actually increased the likelihood that electricity from Bonneville Dam would be cheaper than electricity from Grand Coulee Dam. In addition, USBR engineers decided that modified

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Reports 10-55, ERC, RG 115, 9–11.

<sup>66</sup> USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11 and John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115,

hydroelectricity equipment for the high dam would not serve in the low dam. Further, engineers identified a new problem aspect of the two-step project: joining the second concrete structure to the first. Fully aware of this dynamic, USBR engineers began pushing for the high dam, electricity, and irrigation before they even chose a contractor for the low, gravity dam. USBR engineers pushed for the high dam in a variety of ways. Officials published and presented arguments for immediately undertaking the full project. Privately, the engineers lobbied Interior Secretary Ickes for the high dam. They also encouraged and coached the activities of local boosters of the high dam.

Yet, how did a large multiple purpose dam seem better to USBR engineers than a smaller dam when it would cost more and produce more electricity for which there might be no market? Engineers thought an improved ability to sell electricity would fix the competition problem and cover the added cost. The high dam, hydroelectricity, and irrigation development had two advantages in respect to selling electricity. First, due to fixed costs, engineers anticipated a lower unit price for electricity from the high dam. Second, the irrigation project would complement electricity production just as electricity sales would greatly reduce charges to farmers. Irrigation farms and the communities that they supported would provide a market for Grand Coulee Dam electricity.

Although the USBR began construction of the low, gravity dam in June 1934, the engineers still worried about the financial prospects of the dam. They feared competition from Bonneville Dam, expenses connected to hydroelectric equipment, and the cost of pouring concrete at two different times. In December 1934, the USBR leaders made their clearest statements about the relationship between Bonneville and Grand Coulee Dams. They still feared that the lower cost of Bonneville Dam would mean its electricity would be cheaper. USBR engineers anticipated that only one-half of the cost of Bonneville Dam and two-thirds of the cost of its electric power plant would be reimbursed. Engineers also felt

the Grand Coulee site was not good for a low dam:

The damsite is not an economical site for a low-head power development. The depth to bedrock and the required length of dam are both too great in proportion to the head developed, and furthermore, too much cost is involved in the auxiliary features of the work such as the construction railroad, construction roads, highway bridge, camp, cofferdams and excavation work. All of these features will cost practically as much for the low dam as for the high dam.<sup>67</sup>

USBR engineers had hardly opened the bids for the low, gravity dam when they decided that they could not operate the low dam powerhouse with modified high dam equipment. While in Washington State for the opening of bids, Chief Engineer Ray Walter informed Washington State officials that hydroelectric equipment for the low dam would add significantly to the cost of the final development. Stating that USBR Chief Electrical Engineer Leslie McClellan had given up on the idea of converting equipment, Walter estimated that replacing low dam turbines and generators with equipment for the high dam would cost \$17 million. USBR engineers discussed hydroelectric equipment as a problem throughout 1934.<sup>68</sup>

In late 1934, USBR engineers began to discuss the joint between the low and high dams as a substantial expense. Yet, before this, USBR engineers did not view constructing the dam at two different times as a problem. In the spring of 1933, engineers endorsed the general idea of building a low dam immediately and later expanding the facility to Butler's specifications. For example, Chief Engineer Walter assured Commissioner Mead:

It is the consensus of opinion that it is entirely practical and feasible from an engineering standpoint to build a low dam for initial development, that can be subsequently raised to the full height of 370 ft if desired when conditions require, providing proper provision is made in the design for this purpose.<sup>69</sup>

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<sup>67</sup> Quote from Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115, 9. See also 1-2 and 13.

<sup>68</sup> On changing hydroelectric equipment, see: "Minutes Columbia Basin Commission," 18 June 1934, 2:5-7, O'Sullivan MSS, 345 and Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115, 10.

<sup>69</sup> R. F. Walter to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115.



When USBR engineers changed the structure from a multiple arch dam to a gravity dam, engineers likewise expressed no concern over the general idea of expanding the dam. For example, Chief Engineer Walter did not raise this issue in the major external review of the new design. Walter elected to appoint a board of consulting engineers for Grand Coulee Dam. This body met several times a year to review the project and provide advice to USBR engineers. To guide this process, Walter routinely presented the board with an agenda. The only time the board addressed an issue Walter did not suggest, it spoke on this construction plan. Although this action suggests controversy, the board heartily endorsed the approach, finding "no doubt whatever that the enlargement, as contemplated, is an entirely feasible engineering undertaking."<sup>70</sup>

In the fall of 1934, however, USBR engineers presented the joint between the low dam and high dam as a constellation of problems that boiled down to money. Engineers

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<sup>70</sup> Quote from: C. P. Berkey, W. F. Durand, J. Jacobs, and C. H. Paul to R. Walter, 31 Mar. 1934, Reports 10-55, ERC, RG 115, 4. See also: E. Mead to H. Ickes, 23 May 1933, 533:301.1, Entry 7/30-45-CBP, WDC, RG115; A. F. Darland to J. O'Sullivan, 7 Mar. 1934, 14:7, CBC MSS; Acting Chief Engineer S. O. Harper to E. Mead, 27 Feb. 1924, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; and R. F. Walter to C. H. Paul, C. P. Berkey, W. F. Durand, and J. Jacobs, 27 Mar. 1934, 438:791-D-1 3/34-9/34 f2, EC-CB, CE, RG 115.

Precisely when USBR engineers began to think about the joint in this fashion and began to work on a design for the joint is difficult to determine from existing sources. Such work may have begun in March 1934 or earlier. In a letter to John Butler, James O'Sullivan fleshed out an inquiry about feasibility of imposing the high dam on the low dam with questions about the bond between old and new concrete and water in the joint. I would guess a conversation with John Savage, Frank Banks, or one of the other USBR engineers alerted O'Sullivan to these as possible questions since USBR engineers pair these issues later. The CBC board raised a second aspect of the slope of the low dam as a potential problem. They found that unless the slope of the low dam matched the primary force vector in the dam the joint between the high and low dams would be vulnerable to sheering forces. But, because the USBR's design for the low dam basically met this condition, the CBC board pronounced that the "the dam designs...fully safeguard the subsequent completion of the work to the full height." There is however no indication of whether USBR engineers were working on a design for the joint at this time. I have no other record of O'Sullivan or anyone else raising the particular issue until September, at which time USBR engineers were apparently concerned with the issue. At a CBC meeting James O'Sullivan summarized a conversation with Savage in which Savage identified these aspects as problems and Banks stated the USBR engineers were working on the joint problem.

Quote from W. C. Morse, A. F. Darland, D. C. Henny, and H. E. Smith to CBC, 31 Mar. 1934, 415:791 10/31-9/34, EC-CB, CE, RG 115, 6. See also: J. O'Sullivan, "Memorandum for Board of Consulting Engineers," 13 Mar. 1934, 14:7, CBC MSS; J. O'Sullivan to J. S. Butler, 20 Mar. 1934, 1:43, O'Sullivan MSS; Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115, 9; and "Minutes Columbia Basin Commission," 8 Sept. 1934, 2:5-7, O'Sullivan MSS,

thought about the task of building the high dam on top of the low dam as one of joining the two parts so that they would respond to forces as one, while, at the same time, draining the connection to prevent hydrostatic forces in the dam. The men viewed this combination of goals as tricky. They could not use a standard approach to make the structure act as one and provide drainage. Specifically, the new concrete would shrink as it cooled and hardened, leaving gaps between the old and new structures. USBR engineers typically filled these gaps by grouting—pumping thin concrete into the gaps under pressure. However, they had no method for pumping grout into the joint under pressure and maintaining drainage for the joint. Still, USBR engineers thought they could construct a joint, but it would cost a lot. USBR engineers did not have a complete plan for constructing a joint between a low dam and high dam in December 1934. They considered a shaped concrete joint or extensive steel reinforcement. Both wooden forms, for pouring a shaped joint, and steel reinforcement were expensive. USBR engineers concluded:

The construction joint problem involved in the two stage construction of the low and high dams is of major importance and while it can no doubt be solved, it will involve a large additional cost which can be avoided if the whole dam is constructed in one stage.<sup>71</sup>

To address these financial concerns—the market for electricity, hydroelectric equipment, and the joint between the dams—USBR engineers mounted a campaign to begin immediate construction of the high dam. First, USBR officials spoke in favor of and published articles emphasizing the full high dam, hydroelectricity, and irrigation development. Second, they partially orchestrated local support for the high dam and irrigation project. Third, USBR leaders tailored internal reports to sell the full project to their administration superiors.

USBR engineers began their campaign for the high dam, hydroelectricity, and irrigation project with publicity. USBR officials spoke and wrote in professional and trade

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416-17.

<sup>71</sup> Quote from: Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-

forums. For example, B. E. Stoutmeyer, USBR District Counsel for the Pacific Northwest, spoke in favor of immediate adoption of the final project at the Pacific Northwest Planning Conference. Regional PWA officials convened this annual planning meeting. Similarly, Frank Banks, the USBR's head of the Grand Coulee Dam office, published a substantial article in *Civil Engineering*. For American Society of Civil Engineers members, Banks described USBR plans for developing the Columbia Basin almost entirely in terms of the final project.<sup>72</sup>

USBR officials also encouraged local supporters' activities promoting the high dam. Commissioner Mead, Chief Engineer Walter, and Construction Engineer Banks all urged Washington State officials to rally public support for the high dam. Mead also pushed Washington State Chamber of Commerce President S. H. Hedges to prepare a lobbying effort for President Roosevelt's visit to the Pacific Northwest in August 1934. Hedges organized a meeting of state political leaders who decided to have their best-placed member make a private appeal to Roosevelt.<sup>73</sup>

Most directly, USBR engineers prepared reports for their administration superiors, which pushed immediate adoption of the full project. When Roosevelt visited the Pacific Northwest in August 1934, USBR engineers prepared briefs for the President advocating the high dam. In December, USBR engineers prepared a major technical report recommending construction of the high dam and the first section of the irrigation project. The style of this document indicated USBR engineers really wanted to build Butler's dam.

55, ERC, RG 115, 10. See also: 9.

<sup>72</sup> Bernard E. Stoutmeyer, Address to Pacific Northwest Planning Conference, "Reclamation as a Fundamental Factor in Western Development and its Relationship to Other Developments," 5 March 1934, 2:Duplicates Coulee Dam, Woods MSS; Frank Banks, "Columbia Basin and Grand Coulee Projects," *Civil Engineering* 4 (September 1934): 456-9; and Banks, "Grand Coulee High Dam."

<sup>73</sup> "Minutes Columbia Basin Commission," 18 June 1934 and 10 October 1934, 2:5-7, O'Sullivan MSS, 344-7 and 479-481; S. H. Hedges to B. E. Stoutmeyer, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to C. D. Martin, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to E. Mead, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; C. C. Dill to S. H. Hedges, 24 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to C. C. Dill, 25 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and E. Mead to S. H. Hedges, 28 July 1934,

USBR technical reports typically traveled with cursory cover letters signed by an office director, usually Chief Engineer Walter or Commissioner Mead. In contrast, in the cover letter for this report, USBR leaders spent two pages summarizing the arguments for immediate construction. They tried to make the letter informal and compelling. Further, the engineers tried to move President Roosevelt and Interior Secretary Ickes with the weight of expert opinion. The top seven officials of the agency all signed the letter.<sup>74</sup>

Engineers campaigned for Butler's high dam, hydroelectricity, and an irrigation project as the solution to the financial problems of competing for electricity markets, changing electrical equipment, and physically expanding the low dam into a high dam. Building the full project immediately solved two-step construction cost problems simply; it eliminated two-step construction. Spending more money and producing more electricity solved the problem of a small market for electricity less obviously. USBR men thought they could break even financially by selling a lot of electricity for a low price, and an irrigation project would increase the market for electricity.

USBR engineers anticipated that a high dam and a large powerhouse would compete better financially with Bonneville Dam. Engineers designed a 1,890,000 kW powerhouse for the high dam and a 102,900 kW initial installation for the low. While the high dam project cost more, \$179 million as opposed to \$62 million, it did not cost proportionately more. Engineers thus hoped to establish lower unit prices for electricity from the high dam and compete with electricity from Bonneville Dam.<sup>75</sup>

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535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115.

<sup>74</sup> [Erdman Debler], "The Inland Empire," c. 1 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. B. Debler to E. Mead, 9 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to E. B. Debler, 13 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to B. E. Stoutmeyer, 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; Bernard E. Stoutmeyer, "Benefits Which Would Be Secured by the Early Construction of the Proposed Large Grand Coulee Dam," 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer to E. Mead, 18 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to B. E. Stoutmeyer, 26 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115.

<sup>75</sup> John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294,

USBR officials also emphasized that producing electricity with a high dam and building an irrigated farming community would work together: the irrigation development would provide a market for electricity from a dam. In March 1934, District Counsel Stoutmeyer argued:

if irrigation development should go hand in hand with the power development, our experience on other reclamation projects indicates that the project itself will to a large extent develop its own power market.<sup>76</sup>

After Stoutmeyer's talk, this argument figured consistently in USBR advocacy of the high dam, hydroelectricity, and irrigation project. Technical studies bore out this optimism to some extent. Denver office engineers estimated that the Columbia Basin Project would use one-quarter of the electricity from Grand Coulee Dam.<sup>77</sup>

Despite beginning construction of the low, gravity dam, USBR engineers remained dissatisfied with the financial prospects of this design. They still thought that electricity from Bonneville Dam would undercut electricity from a low dam. Further, they felt that building in two stages would increase the cost of the full development by requiring two sets of hydroelectric equipment and a complex joint in the high dam. USBR leaders concluded that only Butler's multiple purpose development would be financially sound. USBR engineers fought for the high dam in public talks and journals, by organizing local supporters, and through internal reports.

Although the USBR had settled on a multiple purpose design, a number of gradual steps, rather than a sharp turning point, led to such construction. In the spring of 1935, Congress passed legislation approving Grand Coulee Dam and numerous other public

Reports 10-55, ERC, RG 115, 6, 8, and 55 and Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115, 12-14.

<sup>76</sup> B. E. Stoutmeyer, Address to Pacific Northwest Planning Conference, "Reclamation as a Fundamental Factor in Western Development and its Relationship to Other Developments," 5 Mar. 1934, 2:Duplicates Coulee Dam, Woods MSS, 10

<sup>77</sup> [E. Debler], "Inland Empire," c. 1 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115, p.7; B. E. Stoutmeyer, "Benefits Which Would Be Secured by the Early Construction of the Proposed Large Grand Coulee Dam," 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55,

works projects. The sections concerning Grand Coulee Dam, however, did not specify a high or low dam. In June of that year, Ickes eliminated the smaller dam but did not authorize the high. He permitted the USBR to issue a change order which instructed the contractor to build as much of the high dam as possible—roughly to low water—with the \$62 million appropriation. At times, this structure was called the “foundation dam.” As contractors completed this work in 1937, Congress, at the President’s urging, passed an additional appropriation and USBR engineers set in motion their plans for completing the dam. Yet, even this was not the end. Engineers fought annually for funds until the early 1940s. As contractors finished the dam, the rationale of electricity production for the war effort finally converted congressional skeptics.<sup>78</sup>

### ***Conclusion***

In summary, between 1920 and 1934 USBR engineers changed their opinion on plans to develop the Columbia River and Basin repeatedly for financial reasons. Concerned with planning a financially successful project—which they defined as one that would repay government investment—engineers rejected both strictly irrigation and strictly electricity projects in favor of a combination. In the 1920s, USBR engineers rejected irrigation-only projects based on both gravity and pumping plans. Following the analysis of Army Corps of Engineer’s Major John Butler in 1932, USBR engineers endorsed a multiple purpose electricity and irrigation project based on a 450-foot dam. When President Roosevelt adopted the project, he, however, had different ideas. Limited to \$62 million and an electricity-only project, USBR engineers designed a much smaller, multiple-

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ERC, RG 115, 12-14.

<sup>78</sup> Senate Committee on Commerce, *Parker Dam on the Colorado River and Grand Coulee Dam on the Columbia River*, 74th Cong., 1st sess., 22 May 1935; “The Change Order at Grand Coulee Dam,” *Pacific Builder and Engineer* 41 (3 August 1935): 36; Charles H. Carter, “Change of Plan for Grand Coulee Dam,” *Reclamation Era* 25 (July 1935): 135; “Grand Coulee Dam Changed in Design: Power Now Omitted,” *Engineering News-Record* (13 June 1935): 861; Acting Commissioner John C. Page to Homer Bone, 19 May 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; and Pitzer, *Grand Coulee*, 119-126 and 157-174.

arch dam. Lack of pre-construction repayment contracts and the construction of Bonneville Dam spooked engineers back to favoring Butler's multiple purpose project. After conceptualizing an interim smaller, gravity dam designed to minimize conversion costs and a period when contractors worked on the foundation of the high dam without assurance of completion, the USBR and its contractors completed one of the first major dams conceptualized as a multiple purpose project.

In addition to serving as the second way in which federal engineers thought about dams that led them to multiple purpose building, cost concerns played a central role in the engineering culture of the USBR. Cost considerations shaped all the major design decisions USBR engineers made concerning Grand Coulee Dam. Further, the organization of Homer Gault's study of how to irrigate the Columbia Basin in 1923-24 showed cost to be a fundamental concern of the practice of conducting "preliminary investigations." USBR engineers even referred to cost estimates as engineering work.

The roles of concerns about cost in preliminary investigations and the design of Grand Coulee Dam undercuts a historical and historiographic separation of money from technique in the work of the USBR. The language of USBR engineers created this distinction. Engineers linguistically separated technical from financial concerns. They spoke of projects as "physically and financially feasible."<sup>79</sup> Two interpretations of the early federal USRS irrigation projects also constructed a clear distinction between financial planning and success and technical planning and success in the work of the USBR. Donald Worster and Marc Reisner wrote of projects as financial failures but technical successes. They show that the development of irrigated farmlands exceeded expected costs and that farmers failed to meet repayment schedules. At the same time, these writers described projects as "engineering marvels."<sup>80</sup> While agreeing with Worster and Reisner

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<sup>79</sup> Walter, "Report by the Bureau," 481.

<sup>80</sup> Reisner quoted in Jackson, "Engineering in the Progressive Era," 549 and Jackson, "Engineering in the Progressive Era", 549-551. See also: Worster, *Rivers of Empire* and Reisner, *Cadillac Desert*.

that early USBR irrigation projects failed financially, Donald Jackson revised their assessment of the engineering merit of the agency's work. He argued that, under the leadership of Frederic Haynes Newell and Arthur Powell Davis (1902-1923), the USRS produced no technical wonders either. In a case study of the Roosevelt Dam on the Salt River near Phoenix Arizona—one of the USBR's most notable early projects—Jackson argued that design choices, technical practitioners, and construction practices were at best ordinary and certainly not innovative.<sup>81</sup> Jackson, too, assessed financial and technical success separately. My argument that the engineering culture of the USBR had concern about cost as a fundamental focus denies this separation. If USBR engineers designed important structures using financing as one criterion and defined cost estimates as an engineering task, where was the boundary between technical and financial?

Finally, USBR engineers' concerns about cost did not directly translate into frugal design decisions. In the 1930s, USBR engineers chose more complicated projects and economies of scale over inexpensive structures. The design changes from the low, multiple-arch dam to the low, gravity dam to the high dam gave Grand Coulee Dam additional uses and made it more expensive. These decisions only made sense in terms of the return engineers anticipated from the government's investment.

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<sup>81</sup> Jackson, "Engineering in the Progressive Era," 554-574.



## Chapter 6—A New Deal Dam? Jobs, Electricity, and Conservation

Franklin Roosevelt and his top advisors moved Grand Coulee Dam out of its planning phase and into construction. More broadly, these men adopted dam building as an early and ongoing New Deal policy. They funded numerous dams. The reasons behind this policy shifted more than once between Roosevelt's assumption of office in 1933 and 1937, when Congress approved the completion of Grand Coulee Dam. Foremost, dams figured in relief, electricity, and conservation policy.

The experiences of President Roosevelt and Harold Ickes, his most important advisor on dams, predisposed them to build dams. Although Democrat and Republican respectively, both embraced political reform and admired former President Theodore Roosevelt. They followed his lead in supporting a utilitarian and managerial approach to natural resources policy. Further, as governor of New York, Roosevelt used public works to fight the Depression. He advocated government construction of hydroelectric facilities, especially on the St. Lawrence River. He practiced conservation in the management of his family home at Hyde Park. As Public Works Administrator and Interior Secretary, Harold Ickes funded and directed most New Deal water development. Long-time Chicagoan, political activist, and lawyer, Ickes had little direct experience with public works, conservation, or dams. He did, however, bring important experience as a champion of electrical industry reform to his posts in the Roosevelt administration. During the 1920s, Ickes helped form the Chicago's People's Traction League. This organization took on the city's utility barons, including electricity magnate Samuel Insull.<sup>1</sup> (See Appendix 2 for

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<sup>1</sup> Frank Freidel, *Franklin D. Roosevelt: A Rendezvous with Destiny* (Boston: Back Bay Books, Little, Brown and Company, 1990), 16-32 and 49-62 and Jeanne Nienaber Clarke, *Roosevelt's Warrior: Harold L. Ickes and the New Deal* (Baltimore: The Johns Hopkins University Press, 1996), 3-23. On Ickes see also: Harold L. Ickes, *The Autobiography of a Curmudgeon* (New York: Reynal & Hitchcock, 1943); Ickes, *Secret Diary*; Linda J. Lear, *Harold L. Ickes: The Aggressive Progressive, 1874-1933, Modern American History* (New York: Garland Publishing, 1981); Graham J. White and J. R. Maze, *Harold Ickes of the New Deal: His Private Life and Public Career* (Cambridge: Harvard University Press, 1985); and T. H. Watkins, *Righteous Pilgrim: The Life and Times of Harold L. Ickes, 1874- 1952* (New York: H. Holt,

pictures of President Roosevelt and Harold Ickes.)

While relief, electricity, and conservation all figured in Roosevelt and Ickes's support for Grand Coulee Dam, relief led, reform of the electrical industry came to the fore in 1935, and conservation provided an important secondary rationale throughout. The Roosevelt administration initially funded Grand Coulee Dam as part of its relief and recovery program. Building dams would put people to work and create structures of lasting value. In 1935, however, Roosevelt shifted the relief program away from major public works. By 1937, the regular Interior Department budget, rather than relief funds, paid for Grand Coulee Dam. Inversely, after dealing with immediate crises, Roosevelt and his Bull-Moose Republican supporters pursued a series of initiatives to spur electrical development and curtail the business excesses of the electrical industry. The electric-production ability of dams became an important part of such activity. The administration consistently pursued conservationist policies for the use of water resources.

### *Dams and Relief*

The Roosevelt administration began construction of Grand Coulee Dam and many others as relief and recovery initiatives, but Roosevelt rapidly moved away from building large public works for relief. This was because dams did not serve relief goals well. The U.S. Bureau of Reclamation (USBR)<sup>2</sup> for Grand Coulee Dam and Washington State officials tried to adapt the dam to fit relief agendas and had some initial success. However, the dam experienced many of the typical problems with spending relief funds quickly and in a targeted fashion. In 1935, Roosevelt shifted relief funds away from construction. While Grand Coulee Dam still received relief money that year, in 1937 Congress moved it into the regular Interior Department budget.

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1990).

<sup>2</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period

In 1933, Roosevelt and his top advisors began the construction of Grand Coulee Dam with relief funds. Washington Senator Clarence C. Dill and State Grange Master Albert Goss brought Grand Coulee Dam to the President's attention in April 1933. Roosevelt rejected their proposal—Major Butler's \$400 million high dam, hydroelectricity and irrigation development. However, Roosevelt indicated that a dam simply for electricity that cost approximately \$60 million might be funded through the nascent relief program. USBR engineers then proposed to build a \$62 million, multiple-arch dam as a first step in constructing Butler's Grand Coulee Dam and an irrigation development. Further appeals from Senator Dill also followed. The President responded positively. He directed Harold Ickes and his colleagues on the Special Board for Public Works to fund Grand Coulee Dam through the Public Works Administration (PWA) in July 1933. The PWA budgeted \$63 million dollars for the USBR to construct the dam.<sup>3</sup>

The Roosevelt administration began numerous dams with relief funds. In the Pacific Northwest alone, the PWA funded two large dams—Bonneville Dam near Portland, Oregon, and Fort Peck Dam in Montana—as well as Grand Coulee Dam. The PWA also provided the operating funds for the USBR. It allocated \$94 million to USBR activities in 1933 and 1934. In addition to Grand Coulee Dam, the USBR used relief funds to complete Hoover Dam on the lower Colorado River, to initiate work on the All-American Canal in California, and to support over thirty-five other projects and investigations.<sup>4</sup>

The relief effort included far more than building dams. Numerous agencies

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and general references.

<sup>3</sup> J. O'Sullivan to R. F. Walter, 20 Apr. 1933, 7:1, O'Sullivan MSS; C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115; C. C. Dill to M. McIntyre, 6 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; E. Mead, "Memorandum for the Secretary. Re: Grand Coulee dam proposal," 18 July 1933, 534:301.1 7/1/33-6/30/34. Entry 7/30-45-CBP, WDC, RG 115; "Grand Coulee First Big NRA Project for Pacific Northwest," *Pacific Builder and Engineer* 39 (5 August 1933): 19 and 37; Ickes, *Secret Diary*, 1:70; and Pitzer, *Grand Coulee*, 69-75.

<sup>4</sup> Walter A. Averill, "Northwest Construction Program Exceeds Half-Billion," *Pacific Builder and Engineer* 39 (4 November 1933): 16; "ERA Allotments to Bureau Reduced by \$20,000,000," *Reclamation Era* 25 (December 1935): 232, and W. F. Kubach, "Reclamation Projects Financed by Public Works

provided relief. Historian Lester Chandler divided these activities into three basic types: direct relief, public works, and work relief. Beginning in early 1933, the Federal Emergency Relief Agency, headed by Harry Hopkins, worked with state and local agencies to provide direct grants to people in need. The PWA began early as well. The National Industrial Recovery Act of June 1933 allocated \$3.3 billion for the PWA. Harold Ickes directed this program. It hired private contractors to employ skilled workers in building roads, schools, libraries, aircraft carriers, and other infrastructure. As the winter of 1933-34 approached, Hopkins convinced Roosevelt more aid would be necessary, and the President gave him permission to launch the third approach to relief—work relief. The short-lived Civil Works Administration (CWA) provided a variety of white-collar jobs to the unemployed without asking them to demonstrate need.<sup>5</sup>

Not all relief programs worked well. Dams, in particular, failed to meet relief agendas of targeting unemployed populations, putting large numbers of people to work quickly, and spending money primarily on salaries, rather than on materials. At Grand Coulee Dam, the organizers met relief goals in hiring their initial engineering staff. Further, engineers tried to rearrange the work to hire people quickly. This attempt, however, only partly succeeded. Overall, construction of the dam started slowly and directed too much money to materials.

Washington state officials and USBR engineers worked together to hire the initial engineering staff for Grand Coulee Dam and met relief goals better in this undertaking than in any other aspect of the construction of Grand Coulee Dam. Work on Grand Coulee Dam began under a \$377,000 grant from the Washington State Welfare Commission. A non-technical state commission oversaw the appropriation. This new Columbia Basin

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Allotments," *Reclamation Era* 25 (February 1935): 40-1.

<sup>5</sup> Lester V. Chandler, *America's Greatest Depression 1929-1941* (New York: Harper & Row, Publishers, 1970), 191-203; William E. Leuchtenburg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York: Harper & Row, Publishers, 1963), 120-124 and 133-4; and Arthur M. Schlesinger, *The Coming of the New Deal*, vol. 2 of *The Age of Roosevelt* (Boston: Houghton Mifflin Company, 1958), 99, 282-5, 287-8.

Commission (CBC) contracted with the USBR for the preparation of detailed drawings and other information required to solicit bids for the dam's construction. USBR Chief Engineer Walter placed Construction Engineer Frank Banks from the Owyhee Dam in Oregon in charge of studies at the Grand Coulee damsite. Banks and the CBC then worked together to hire the initial engineering staff: forty-three men to work at the site in Washington and ten junior engineers to draft and analyze designs in the USBR's Denver office.<sup>6</sup>

Banks and the CBC established and met local relief goals in their hiring. They decided to hire only Washington residents for the engineering staff. Banks acquired several Washington men familiar with USBR procedures when Chief Engineer Walter agreed to transfer them from the USBR's Cle Elum Dam near Yakima, Washington. Other Washington engineers came from the thousands of applicants reviewed by Banks and the CBC. In choosing engineers, they considered which part of the state men came from, which of the two major universities—University of Washington or Washington State University—they attended, and, for a very small number of positions, endorsement by representatives of organized labor. For example, on 2 September, the CBC rejected three engineers because they hailed from Seattle rather than Tacoma.<sup>7</sup>

More generally, organizers of PWA projects had two problems targeting hiring to meet relief goals. First, the PWA emphasized quality building over unemployment problems in choosing projects. Need for a facility or availability of relevant resources,

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<sup>6</sup> R. F. Walter to E. Mead, 24 July 1933, 478:101.03 CBP, Entry 7/30-45, WDC, RG 115; "Grand Coulee Dam - Columbia Basin Project. Active Personnel, Almira, Washington.," 25 Oct. 1933, 29:Personnel '33i, CBC MSS; "List of men employed at the Grand Coulee Dam, and being paid by the Columbia Basin Commission from state funds," c. 23 Feb. 1934, 29:Personnel '33ii, CBC MSS; and Pitzer, *Grand Coulee*, 67-8 and 72.

<sup>7</sup> "Minutes Columbia Basin Commission," 5 Apr. 1933, 22 Aug. 1933, and 1-2 Sep. 1933, 2:5-7, O'Sullivan MSS, 4-5, 40, and 53; R. F. Walter to T. W. Neil, 25 July 1933, 438:791-D-1 10/31 thru 2/34, EC-CB, CE, RG 115; E. Mead to T. W. Neill, 2 Aug. 1933, 438:791-D-1 10/31 thru 2/34, EC-CB, CE, RG 115; F. A. Banks to R. F. Walter, 18 Aug. 1933, 438:791-D-1 10/31 thru 2/34(2), EC-CB, CE, RG 115; F. A. Banks to J. Taylor, 5 Sep. 1933, 29:1, CBC MSS; F. A. Banks to J. O'Sullivan, 27 Sep. 1933, 29:1, CBC MSS; and F. A. Banks to E. Mead, 4 Oct. 1933, 438:791-D-1 10/31 thru 2/34(1), EC-CB, CE, RG 115.

rather than unemployment, influenced selection. Second, many of the jobs on PWA projects required experience in the construction trades. While many construction workers needed jobs, many of the unemployed did not have the necessary skills to work on PWA's projects.<sup>8</sup>

Timing also haunted the PWA. One of the initial goals of relief had been to spend funds quickly to get money to people in need. Critics lambasted Public Works Administrator Harold Ickes for a slow start in building. The PWA did get started slowly, and Ickes caused part of the delay. He diligently insured propriety and "efficiency" through lengthy investigation and approval processes. However, the nature of the work and legal problems also slowed the PWA. Public works required engineering plans and this work took time. Building a federal organization to oversee the activities and creating legal mechanisms for state and local governments to provide matching funds also slowed work.<sup>9</sup>

Like many PWA undertakings, the construction of Grand Coulee Dam dragged at the start. First, legal problems held up federal funds for the dam. The PWA did not release money until late September 1933—five months after serious discussion of building the dam began. During that period, the federal government and Washington State wangled over which would be responsible for the dam. The USBR's legal staff in the Pacific Northwest ultimately decided that the dam could not be financed through a PWA loan to Washington State and would be a federal PWA project. Washington's constitution limited the amount of debt that the state could assume. This decision resolved the major legal

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<sup>8</sup> Harold L. Ickes, "Spending Three Billions of Your Money," *American Magazine* (October 1933), Articles, Ickes MSS; Franklin Roosevelt, "President Roosevelt Enumerates Practical Principles in his Message to the 74th Congress," *Reclamation Era* 25 (February 1935): inside front cover; "Federal Emergency Administration of Public Works," *Reclamation Era* 25 (June 1935): 113; Leuchtenburg, *Roosevelt and the New Deal*, 70-71; and L. V. Chandler, *America's Greatest Depression*, 193.

<sup>9</sup> Ickes, "Spending Three Billions;" Ickes, "Spending \$3,300,000,000;" Harold L. Ickes, "Jobs versus Dole," *Today* (17 November 1934), Articles, Ickes MSS; Elwood Mead, "Reclamation Under the New Deal," *Reclamation Era* 25 (January 1935): 1-2; "Emergency Public Works;" and Schlesinger, *Coming of the New Deal*, 285-7.

roadblock.<sup>10</sup>

Second, USBR engineers failed to put large numbers of people to work quickly building Grand Coulee Dam, despite their efforts. To expedite employment, the men changed their preferred practice of handling all major excavation and concrete work through a single contractor. This effort, however, had little effect. People connected to the dam grew increasingly fretful over the slow start-up speed.

In the fall of 1933, USBR engineers altered their standard process for constructing dams in an effort to create jobs immediately at Grand Coulee Dam. Construction Engineer Banks wanted to begin construction with a bridge across the Columbia River and housing for the government staff. However, beginning excavation for the dam would put more people to work. By late October, Banks had started all three tasks.

Banks began construction on a bridge and a “camp” through standard USBR procedures. (The engineer’s “camp” grew into a full town called Engineers’ Town during the 1930s and is now the town of Coulee Dam.) When Senator Dill returned to Spokane to celebrate the approval of the dam in early August, Frank Banks approached him about money for a bridge across the Columbia River near the dam site and a camp for engineers. Commissioner Mead and Chief Engineer Walter concurred that a bridge and camp should be the next step and recommended funding to the PWA. The PWA released a million dollars to begin this work in mid-September.<sup>11</sup>

At the same time, USBR engineers changed their normal procedures and began

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<sup>10</sup> C. C. Dill to E. Mead, 4 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; R. F. Walter to E. Mead, 13 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; E. Mead to R. F. Walter, 25 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; L. McClellan, c. 25 Oct. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; J. O’Sullivan to C. D. Martin, 28 Oct. 1933, 27:1, CBC MSS; “Minutes Columbia Basin Commission,” 31 Oct. 1933, 2:5-7, O’Sullivan MSS, 109-14; and Pitzer, *Grand Coulee*, 76-78.

<sup>11</sup> On the communities surrounding Grand Coulee Dam, see Pitzer, *Grand Coulee*, 177-192. C. C. Dill to E. Mead, 4 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; E. Mead to C. C. Dill, 8 Aug. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; F. Banks to E. Mead, telegram, 11 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; F. Banks to R. Walter, telegram, 11 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; R. F. Walter to E. Mead, telegram, 13 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; and F. Banks to E. Mead, 4 Oct. 1933, 438:791-D-1

excavation to increase employment. At a meeting on 1 and 2 September, Senator Dill and the CBC pushed Construction Engineer Banks to put more people to work. In addition to a bridge and camp, the Construction Engineer suggested preliminary excavation of the dam site. Typically, the main construction contract for a dam included all the excavation. This standard procedure, however, would have delayed additional hiring. Banks estimated six months before the USBR could advertise the main contract. Actually, the USBR did not ask for bids until mid-April (seven and one-half months) and the major contractor began excavation in October 1934 (eleven months later). After consulting with John Savage, the USBR's Chief Designing Engineer, Chief Engineer Walter reluctantly endorsed an early excavation contract. By mid-October, the PWA had released a second million dollars, and engineers in Denver were working on specifications for an excavation contract.<sup>12</sup>

USBR engineers consistently discussed this excavation contract as an effort to increase jobs. Banks, Walter, and Savage all mention this rationale. For example, Banks introduced the idea to Walter as follows: "it might be possible to let a contract for the

10/31 thru 2/34(1), EC-CB, CE, RG 115.

<sup>12</sup> F. Banks to R. Walter, 6 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; F. Banks to R. Walter, telegram, 11 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; R. F. Walter to J. L. Savage, telegram, 29 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; J. L. Savage to R. F. Walter, telegram, 29 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; R. F. Walter to E. Mead, telegram, 29 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; E. Mead to R. F. Walter, telegram, 30 Sep. 1933, 438:791-D-1 10/31-2/34 f1, EC-CB, CE, RG 115; F. Banks to E. Mead, 4 Oct. 1933, 438:791-D-1 10/31 thru 2/34(1), EC-CB, CE, RG 115; F. A. Banks to E. Mead 13 Oct. 1933, 438:791-D-1 10/31-2/34 f1, EC-CB, CE, RG 115; R. F. Walter to E. Mead, 21 Oct. 1933, 534: 301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; "Preliminary Data," and USBR, "Columbia Basin Project," 1934, Entry 10, WDC, RG 115, 12 and 14.

Pitzer presents the appropriation for a camp and bridge and the appropriation for excavation as a single \$1 million appropriation in October. A letter from Banks to Mead that mentions official confirmation of an appropriation on September 22 and a memo from Banks to Walter on "Expenditure of \$1,000,000 fund on Grand Coulee Dam , Columbia Basin Project" describing preliminary work on a bridge and camp indicate that there was an appropriation in mid-September. Work on specifications for an excavation contract in late October suggest the appropriation documented by Pitzer was additional money for excavation. However, Pitzer dates the October appropriation through a Federal Emergency Administration of Public Works release number while Banks confirms an appropriation in September through "receipt of G. O. 635." Given these different sources of confirmation, there might only be one appropriation. In which case, the excavation work was simply added without additional money. Regardless, the addition of excavation underlies my point about the change of process.

Pitzer, *Grand Coulee*, 77 and 403 n. 85; F. Banks to E. Mead, 4 Oct. 1933, 438:791-D-1 10/31 thru 2/34(1), EC-CB, CE, RG 115; and F. Banks to R. F. Walter, 6 Oct. 1933, 438:791-D-1 10/31-2/34



roughing out of the foundation above the water line on both sides of the river which would give employment to a considerable number of men.”<sup>13</sup>

Despite this effort to provide employment immediately, in early 1934 and again at the end of that year men from both Washingtons worried about the failure to begin construction and employment in earnest. In January and February, local men such as Manly Haynes, vice-president of the Columbia River Development League, contacted state officials to urge quick action on the dam. State officials, in turn, made inquiries of the federal government. Likewise, the CBC asked its engineering consulting board for an analysis of the situation. The release of a design for the low dam and a call for bids, in March and April respectively, calmed this round of concern over speed. The issue, however, resurfaced at the end of the year. In November, the PWA sent an investigator to assess the status of the dam and make recommendations. Engineer Frederick Hall Fowler decided construction of the government camp and the bridge across the Columbia River were proceeding unnecessarily slowly. The general manager of the major contractor also expressed concerns about delays.<sup>14</sup>

Beyond the slow start-up issues, the PWA failed to put enough of its funds directly into salaries. Large construction projects cost much more per worker than other forms of relief. For example, to employ a single worker for one month, the PWA spent \$330 while the Works Progress Administration (WPA), a work relief program which emphasized low

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f2, EC-CB, CE, RG 115.

<sup>13</sup> F. Banks to R. Walter, 6 Sep. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115. See also the correspondence cited in the note 11.

<sup>14</sup> M. Hynes to H. Shepherd, 12 Jan. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; H. Shepard to F. Roosevelt, 17 Jan. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; W. C. Morse to CBC, 5 Feb. 1934, 13:1, CBC MSS; J. O'Sullivan to R. F. Walter, 16 Feb. 1934, 438:791-D-1 10/31-2/34 f1, EC-CB, CE, RG 115; A. F. Darland to J. O'Sullivan, 17 Feb. 1934, 13:1, CBC MSS; R. F. Walter to J. O'Sullivan, 22 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; "Brief Digest;" H. L. Ickes to E. Mead, 2 June 1934, , 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; F. H. Fowler to M. B. Fleming, 8 Nov. 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; H. L. Ickes to E. Mead, 22 Nov. 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to R. F. Walter and F. Banks, 24 Nov. 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to H. Ickes, 24 Nov. 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and H. L. Myer to F. A. Banks, 1 Dec.

capital projects and paid relief wages rather than prevailing industrial wages, spent only \$82. In general, 70 percent of PWA funds went to materials and only 30 percent to wages while almost the precise opposite was true of WPA—75 percent of WPA funds went to wages and 25 percent to materials.<sup>15</sup>

At Grand Coulee Dam, extensive mechanization of work processes reduced the portion of funds spent directly on labor. Descriptions of the work site indicated extensive mechanization and the writers' fascination with construction machinery. The CBC had a "contact man" at the construction site who reported weekly to CBC Secretary James O'Sullivan on the progress of the dam. Beyond listing the contractors and number of men employed each week, much of these reports detailed the installation and operation of equipment. For example, in the report of 29 December 1934, Ralph J. Kugelman described the machinery for placing the steel and wood that exposed the riverbed for construction and the conveyor system for removing topsoil from the dam site. He concluded with a comparison of dump trucks. Construction magazines also described the dam building equipment in detail. For example, *Pacific Engineer and Builder* ran a series of twelve articles that described or showed the excavation equipment. Spokane even held a parade of construction equipment to celebrate the first major contract for Grand Coulee Dam.<sup>16</sup>

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1934, 442:791-G slides thru 12/35, EC-CB, CE, RG 115.

<sup>15</sup> Ickes, "Spending Three Billions;" Roosevelt, "Practical Principles;" "Emergency Public Works;" Arthur M. Schlesinger, *The Politics of Upheaval*, vol. 3 of *The Age of Roosevelt* (Boston: Houghton Mifflin Company, 1960), 266 and 349; and L. V. Chandler, *America's Greatest Depression*, 193.

<sup>16</sup> R. Kugelman to J. O'Sullivan, 29 Dec. 1934, 13:1, CBC MSS; "Winter Contracts for Grand Coulee," *Pacific Builder and Engineer* 39 (4 November 1933): 20; Walter A. Averill, "Stripping of Overburden at Coulee Dam Six Weeks Ahead of Schedule," *Pacific Builder and Engineer* 40 (14 April 1934): 24-29; "Current Operations at Grand Coulee Dam...Shown in B. & E. Staff Photos," *Pacific Builder and Engineer* 40 (9 June 1934): 30-31; "Construction Start Soon on...Grand Coulee Dam," *Pacific Builder and Engineer* 40 (7 July 1934): 14, 16, and 27; Walter A. Averill, "Grand Coulee Low Dam," *Pacific Builder and Engineer* 40 (6 October 1934): 16-18; "Preliminary Construction at Grand Coulee Dam Speeds Ahead," *Pacific Builder and Engineer* 40 (3 November 1934): 26-7; "Scene Changes at Grand Coulee," *Pacific Builder and Engineer* 40 (1 December 1934): 23 and 26; Walter A. Averill, "Moving a Mountain a Mile...at Grand Coulee," *Pacific Builder and Engineer* 41 (12 October 1935): 28-38; "Excavating 15,000,000 Cubic Yards at Grand Coulee Dam," *Pacific Builder and Engineer* 41 (12 October 1935): 30-1; "Hauling Units Dump Through Grizzlies Into Apron Feeders," *Pacific Builder and Engineer* 41 (12 October

Overall, PWA construction projects, broadly, and Grand Coulee Dam, in particular, failed to meet several relief goals. Although building infrastructure seemed to promise to put people to work and create structures of lasting value, administration officials quickly concluded that the PWA did not spend its monies in the right places, fast enough, or on the right things. At Grand Coulee Dam, USBR engineers and Washington State officials succeeded in directing state relief funds for developing designs to a broad group of Washington residents. USBR men also rearranged their normal construction processes to try to speed hiring. However, despite an early contract for excavation, most of the construction, and with it the hiring of large numbers of laborers, started slowly. Once building began in earnest, Grand Coulee Dam exemplified another problem with using construction for relief. Too much money went to machinery and materials rather than directly into salaries.

Faced with these insights, President Roosevelt decided in late 1934 that the relief programs needed coordination and restructuring. In the revamping that followed, Harry Hopkins and work relief came to dominate administration programs. Fearing that direct grants would make recipients dependent and discourage work, Roosevelt ceased funding such programs. He also proposed a structure that he hoped would capture the virtues of his two main relief administrators—Hopkins and Ickes. The deliberative Ickes, who excelled at conducting works programs without graft or scandal, would oversee a body that selected projects. Ickes would also remain as the chief officer of the PWA. Hopkins, the enthusiastic spender, would run implementation for the new relief program. In the legislative process that set-up the new relief agency, however, Hopkins maneuvered the authority to initiate programs without review by Ickes's board. This ability gave him effective control over the new agency. Hopkins organized the WPA along the lines of the

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1935): 32-3; "World's Greatest Belt Conveyor 'Moves a Mountain A Mile'," *Pacific Builder and Engineer* 41 (12 October 1935): 34-5; "Conveyor Highlights," *Pacific Builder and Engineer* 41 (12 October 1935): 36; and "Spokane to Stage Celebration When Bids Are Opened on Grand Coulee Dam," *Pacific Builder and Engineer* 40 (9 June 1934): 47.

earlier CWA. It provided diverse jobs to the unemployed at higher than relief wages and without strict evaluation of need. Hopkins won another decided institutional victory over Ickes when Roosevelt designated only \$500 million of the \$4.8 billion slated for relief in 1935 to Ickes and the PWA.<sup>17</sup>

What, then, did this shift mean for Grand Coulee Dam and other dams? First, the administration rejected a proposal to expand Grand Coulee Dam under relief auspices. In July 1934, USBR engineers began asking for funds to build the high dam, hydroelectricity, and irrigation development rather than only the low dam. When President Roosevelt visited the construction site, USBR men argued that an expanded dam would fit into the relief program as a place to locate farmers displaced by Midwestern droughts. Roosevelt and Ickes, however, did not expand the project with relief money. The dam did receive PWA funds in 1935, but these were simply more of the \$62 million promised in 1933. Second, by 1937, the President moved dams out of his relief program. The regular Interior Department budget, rather than relief funds, provided the money for Grand Coulee Dam and other USBR projects.<sup>18</sup>

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<sup>17</sup> "Emergency Public Works;" "Administration of Four Billion Dollar Works Relief Appropriation," *Reclamation Era* 25 (May 1935): 97; Schlesinger, *Coming of the New Deal*, 296; Schlesinger, *Politics of Upheaval*, 264-8, and 343-51; Leuchtenburg, *Roosevelt and the New Deal*, 124-5; and L. V. Chandler, *America's Greatest Depression*, 203-5.

<sup>18</sup> [E. Debler], "The Inland Empire Realized—The Columbia Basin Project," c. 1 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to E. B. Debler, 13 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer, "Benefits Which Would Be Secured by the Early Construction of the Proposed Large Grand Coulee Dam," 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; "Minutes Columbia Basin Commission," 7 Nov. 1934, 2:5-7, O'Sullivan MSS, 539; E. Mead to H. Ickes, 27 Dec. 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115; E. Mead to H. Ickes, 11 May 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to F. R. McNinch, 31 May 1935, 437:791-D-1 5/35-9/35, EC-CB, CE, RG 115; E. Mead to F. A. Banks, 11 Oct. 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; "Reclamation Receives Additional Allotments," *Reclamation Era* 25 (September 1935): 173-4; "ERA Allotments Reduced"; "One Hundred Million Dollars Set Aside for Reclamation," *Reclamation Era* 25 (August 1935): 153; Acting Commissioner R. F. Walter to F. Steiwer, 11 Feb. 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; "We Will Win This Fight—Senator Lewis B. Schwellenbach," *Pacific Builder and Engineer* 42 (5 December 1936): 22; John C. Page, "Progress and Problems of Federal Reclamation," *Reclamation Era* 27 (October 1937): 230-1, 252; and Leuchtenburg, *Roosevelt and the New Deal*, 244.

### *Dams and Electricity*

While relief goals spurred the funding of Grand Coulee Dam in the first two years of the New Deal, the dam flourished in the context of several initiatives to reform electrification patterns in the United States around 1935. With the initial approval of a low dam in 1933, the administration framed the dam in terms of electricity development rather than irrigation. The tie between Grand Coulee Dam and electricity policy increased when Roosevelt launched additional initiatives to reform private utilities in 1935. Grand Coulee Dam came before Congress for approval in that year as an integral part of the reform agenda. In 1937, the government established a mechanism for selling electricity from Grand Coulee Dam and approved construction of the full high dam. By this time, however, the administration's electricity policy had lost some of its earlier ideological edge. Roosevelt and his advisors compromised to achieve some aspects of their goals while falling short of the radical initiatives of earlier years.

In 1933, the President agreed to fund Grand Coulee Dam to produce hydroelectricity for pragmatic reasons, rather than as part of a well-defined program to reform the electrical industry. In reformulating the dam to fit the relief budget, USBR engineers stripped it of all but its electricity features. Yet, this transformation served more than budgetary goals. Senator Dill emphasized that the reconfiguration would mute congressional opposition to a dam. USBR engineers signaled the pragmatic nature of this reformulation when they repeatedly called for a clear policy regarding the electric power produced by their dams.

In the spring of 1933, USBR engineers removed the irrigation features from the Columbia Basin Project to make it fit the relief budget. After over a decade of development studies, in January 1932 the Army Corps of Engineers (Army) and the USBR agreed that the upper Columbia River and the Columbia Basin should be developed with the combination of hydroelectricity and irrigation. They estimated that this would cost \$400 million. President Roosevelt, however, would only commit \$60 million of relief funds to

the dam. Given this budget, the USBR engineers redesigned Grand Coulee Dam as a 251-foot, multiple-arch dam. The power plant specified in this design contained eight units capable of generating 65,000 kilowatts each for a total installed capacity of 520,000 kilowatts. No pumps provided water for irrigation. Engineers also did not plan to manage the reservoir to improve navigation or to reduce floods. In March 1934, the USBR changed the structure of the dam from a multiple-arch dam to a gravity dam. This transformation significantly reduced the electricity which could be produced with \$62 million—from 520,000 kW to 102,900 kW and added no additional features.<sup>19</sup>

Supporters of the dam thought that recasting it as strictly for electricity would make it more politically palatable. Senator Dill spoke for the President: “this will take away much of the opposition in the House and Senate, that has developed because they are opposed to bringing any more land into cultivation.”<sup>20</sup> Indeed, throughout the 1920s and 1930s opponents of the development, such as Congressman Francis Culkin, criticized the plan to create new agricultural lands during a period in which over production was keeping farm prices devastatingly low.<sup>21</sup>

The fretfulness of USBR engineers over the lack of clarity in Roosevelt administration electricity policy emphasizes the pragmatic rather than programmatic quality of the emphasis on electricity in 1933. In late 1934 and early 1935, USBR engineers called repeatedly for a clear electricity policy. For example, Commissioner Mead told the National Reclamation Association: “we need a definite power policy.”<sup>22</sup> Similarly, an editorial in the USBR’s magazine *Reclamation Era* praised the formation of a committee to

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<sup>19</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*; USBR, “Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085),” 24 May 1933, 294, Reports 10-55, ERC, RG 115; and John Savage, “Alternate Plans and Estimates for Grand Coulee Dam,” 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115.

<sup>20</sup> C. C. Dill to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115. For views of the project as electricity-only, see also: E. Mead to R. F. Walter, 25 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115 and E. Mead to R. F. Walter, 9 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115.

<sup>21</sup> Committee on Irrigation and Reclamation, *The Columbia Basin Project*, 72nd Cong., 1st sess., 25, 27 May and 1, 2, 3, 13 June 1932, 229-244 and Pitzer, *Grand Coulee*, 69, 121, 124-5, 158, and 162-3.

establish an electricity policy and made several recommendations.<sup>23</sup>

In 1935, Grand Coulee Dam could more clearly be called part of a program to reform the electricity industry. In that year, President Roosevelt launched a series of initiatives: the Public Utilities Holding Company Act, the Rural Electrification Association (REA), and the National Electricity Policy Committee. These programs added to a momentum initiated with the Tennessee Valley Authority (TVA) and Hoover Dam. They committed the administration to a program of social transformation via cheap electricity. For unconnected reasons, the Grand Coulee Dam simultaneously faced the major legislative hurdle of congressional authorization. The dam won approval as one of the President's electricity initiatives.

The initiatives to reform the electricity industry in 1935 added to an expansion of federal involvement in electrical development that had started with the TVA and Hoover Dam. Hoover Dam substantially increased electricity production capacity of the federal government but did not use the new ability to influence the direction of the electricity industry. When completed in 1961, the dam added over 3 billion kW-hrs of electric power annually to the government's generating ability. With this new ability, the government faced two questions: To whom would it sell electricity? How would the electricity reach customers? Private utilities and advocates of government ownership of electrical companies fought bitterly over these issues in the early twentieth century. At Hoover Dam, the government chose very conservative options on both these questions in the late 1920s. At Hoover Dam, the Interior Secretary followed the USBR practice of selling electricity to a combination of state, local, and private entities. The USBR likewise had disposed of electricity from the Salt River, Minidoka, and other projects to a combination of public and private buyers. The Interior Secretary chose an even more conservative policy for distributing electricity. Companies aimed to restrict the government to producing electricity

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<sup>22</sup> Mead, "Reclamation Under the New Deal."

<sup>23</sup> "Power," *Reclamation Era* 25 (March 1935): 55.

and selling it wholesale to corporations at the site of production. In contrast, supporters of government initiatives wanted the government to take over the middleman role from utilities. Boosters hoped that, if the government owned transmission networks, towns, large industrial facilities, and companies that served residential and business customers would be able to buy directly from the government at lower cost. At Hoover Dam, however, the government did not even initially produce the electricity. The Interior Secretary allotted the potential electricity to a combination of private and municipal utilities and these bodies generated and transported the electricity. In contrast, the USBR already had transmission networks. For example, on the North Platte Project, the USBR had constructed 139 miles of transmission lines and sold electricity to towns, companies, and individuals all along this network.<sup>24</sup>

The TVA had more explicitly reformist aims than Hoover Dam; TVA directors pursued sale to local government electricity retailers, government-owned transmission lines, and rate reductions. With the President's blessing, TVA Director David Lilienthal set out to make TVA a "yardstick" with which to discipline the private electricity industry. Lilienthal had two aims. First, he wanted a "fair" rate for electricity. Lilienthal came to the TVA from a position on the Wisconsin Railroad Commission. This organization regulated railroad and electricity rates. As a member, Lilienthal learned that rate setting was an extremely difficult accounting problem. He hoped to monitor operations at TVA to determine the cost of producing electricity and use that figure to assess whether private utilities charged their customers fairly. Second, he wanted to increase the use of electricity in homes and farms. TVA tried to achieve these aims through setting up all government-owned electrical systems and charging low rates. First, TVA produced electricity with

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<sup>24</sup> "Power Development on the North Platte Irrigation Project," *New Reclamation Era* 17 (November 1926): 196; Clayton, "Commercial Power Minidoka;" "Power Development North Platte;" "Black Canyon Power and Pumping Plant, Boise Project, ID," *New Reclamation Era* 19 (February 1928): 30-3; McClellan, "Power Yuma Project;" McClellan, "Power Development;" "Boulder Dam Power Conference and Allocation of Power," *New Reclamation Era* 20 (November 1929): 170; Robinson, *Water for the West*, 27-9 and 53-5; and Tobey, *Technology as Freedom*, 40-61.



dams on the Tennessee River and its tributaries. Second, it built a government distribution grid in the region. Third, it encouraged the construction of municipal electricity systems and rural electric cooperatives to distribute the federal electricity. Then, TVA set wholesale rates for electricity as low as possible.<sup>25</sup>

In 1935, the Roosevelt administration further expanded its efforts to reform the electrical industry. A Public Utilities Holding Company Act placed regulations on electrical organizations and the REA expanded domestic electrification in rural areas. The Public Utilities Holding Company Act simplified the intricate interlocking corporate structures that dominated the electric power industry by the late 1920s. By the time Roosevelt took office, independent electricity companies served very few communities. Thirteen holding companies controlled 75 percent of private utilities, and three alone—United Corporation, Electric Bond and Share, and Insull—controlled 40 percent. Many levels of holding companies owned the typical utility. These corporations could connect geographically adjacent systems to make use of economies of scale. Some also provided valuable engineering expertise to their local utilities. Others were among the most notorious speculative financial schemes of the 1920s. For example, by 1933 a national holding company owned the local utility in Spokane. From the 1890s to 1928, Washington Water Power Company (WWP) independently produced electricity with hydroelectric plants and sold it in Eastern Washington and Northern Idaho. The company began operations in Spokane and expanded by buying smaller utilities in the area. In March 1928, the American Electricity and Light Company, part of the Electric Bond and Share group, bought WWP. Like TVA, the Public Utilities Holding Company Act stirred up controversy. It empowered the Securities and Exchange Commission to break up holding companies with more than two levels of ownership and to reorganize them on geographical

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<sup>25</sup> McCraw, *TVA and the Power Fight*, Hughes, *American Genesis*, 353-381, and Schlesinger, *Politics of Upheaval*, 362-376.

lines. Within three years, people dissolved the largest of these companies.<sup>26</sup>

Beyond reforming the corporate structure of the electrical industry, Roosevelt and his advisors wanted to increase the number of homes with electricity. The REA sought to extend electric service to all farms and rural homes. American farms electrified later than many businesses and homes. In 1935, only one in ten farms had electricity. Utilities often refused to extend service into rural areas because of the costs of building electricity lines that served few customers. Initially Engineer Morris Cooke directed the REA. Cooke studied electrification and advocated government ownership of electrical systems in Pennsylvania with Governor Gifford Pinchot and in New York with Governor Roosevelt in the 1920s. He also served on the federal body involved in constructing comprehensive plans for the Mississippi Valley in the first two years of the New Deal. Cooke set up the REA to organize farmers' cooperatives to build local electricity systems and to make them loans for the work. By 1941, four of ten farms had electricity, and, by 1950, nine of ten did.<sup>27</sup>

The administration pursued these initiatives hoping that cheap electricity would bring social progress. Roosevelt, Ickes, and their colleagues believed that cheap electricity would improve individual lives and entire regions. On an individual level, cheap electricity would allow all Americans to have the amenities of modern life, such as electric lighting, irons, refrigerators, and washing machines. More broadly, cheap electricity would spur industrial development and regional growth. Interior Secretary Ickes, TVA Director David Lilienthal, and USBR Commissioner John Page all voiced this vision of electricity development. These men followed a robust tradition of electrical utopianism in the United States. For example, in 1934 social critic Lewis Mumford identified electricity as one of a

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<sup>26</sup> Schlesinger, *Politics of Upheaval*, 302-324; Green, "Politics and Kilowatts," 13-15; Leuchtenburg, *Roosevelt and the New Deal*, 150 and 154-157; and Funigiello, *National Power Policy*, 32-97.

<sup>27</sup> Schlesinger, *Politics of Upheaval*, 379-384; Leuchtenburg, *Roosevelt and the New Deal*, 157-8; Layton, *Revolt of the Engineers*, 214-216; Deward Clayton Brown, *Electricity for Rural America: The Fight for the REA* (Westport: Greenwood Press, 1980); and Jean Christie, *Morris Llewellyn Cooke:*

small number of new technologies that would improve the failings of industrial society.<sup>28</sup>

In this ferment of reform activities, Grand Coulee Dam faced a difficult congressional approval vote. In 1935, the Supreme Court declared the PWA's Parker Dam, as well as other parts of the New Deal, illegal. In the spring, the court stopped work on this dam on the lower Colorado River because it had not been approved in the appropriate manner. Federal law required that Congress or the Chief of the Army Corps of Engineers approve river and harbor improvements. As Public Works Administrator, Ickes initiated work on over twenty projects, including Parker Dam, without either of these imprimaturs. Ickes argued that works not primarily for navigation did not fall under the river and harbor development rules. The Court decision on Parker Dam undercut this reasoning and left many PWA dams open to legal attack. In response, the administration sought explicit congressional approval for Parker Dam, Grand Coulee Dam, and numerous other dams. The Senate agreed with little debate. The House, however, fought about the provision for Grand Coulee Dam.<sup>29</sup>

Linking the dam to the administration's electricity program, advocates pushed the benefits of electricity development. Washington Congressman Samuel B. Hill led the defense of the dam. Hill opened: "This is not a reclamation project. This is a power dam and there is no reclamation in the program for its construction at this time."<sup>30</sup> Validating

*Progressive Engineer* (New York: Garland Publishing, 1983).

<sup>28</sup> Mumford, *Technics and Civilization*; Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115; Harold L. Ickes, "Saving the Good Earth: The Mississippi Valley Committee and Its Plan," *Survey Graphic* 23 (February 1934): 53-9, 91-3, Articles, Ickes MSS; Ickes, "Jobs versus Dole;" Page, "Problems of Federal Reclamation;" John C. Page, "The Challenge of the Drought," *Reclamation Era* 27 (November 1937): 253-5; Harold L. Ickes, "Federal Power," *The Christian Front* 3 (April 1938): 54-6, Articles, Ickes MSS; "Possibilities of Columbia River Development," *Reclamation Era* 28 (March 1938): 47; Schlesinger, *Politics of Upheaval*, 379-80; and Jordan A. Schwarz, *The New Dealers: Power Politics in the Age of Roosevelt* (New York: Vintage Books, a Division of Random House, Inc., 1994), 195-245.

<sup>29</sup> Committee on Commerce, *Parker and Grand Coulee Dam*; Committee on Flood Control, *Public Works Project for Controlling Floods, Improving Navigation, Regulating the Flow of Certain Streams, Etc.*, 74th Cong., 1st sess., 3 June 1935, Report No. 1089, 2-5; "Law Notes: Recent Legislation: Authorization, Parker and Grand Coulee Dams," *Reclamation Era* 25 (October 1935): 198; and Pitzer, *Grand Coulee*, 121-126.

<sup>30</sup> "Discussion of Amendments 71 and 72," *Congressional Record*, 74th Cong., 1st sess., 1935,

the appeal of electricity, opponents attacked the irrigation features. Members of the Senate opposed reclamation generally and irrigation farming in the Columbia Basin in particular because both promised to bring new land into cultivation. For example, Robert Rich and four other senators argued that the government should not simultaneously take land out of agricultural production and create new farmland in a subcommittee report on the authorization of Grand Coulee Dam. Similarly, congressmen spoke against Grand Coulee Dam during the floor debate by hammering at agricultural issues. Congressman Hope argued that “it will produce an immense amount of farm crops, thus adding to surpluses and undoing the effects of any reduction or control programs.”<sup>31</sup> Even when opponents attacked the electricity features, they linked them to irrigation. For example, Congressman Culkin argued there was no market for Grand Coulee Dam’s electricity and therefore the project must be a scheme for pumping irrigation water.<sup>32</sup>

The legislative successes of 1935 defined a high point in federal efforts to reform the electric industry, and the authorization of Grand Coulee Dam that summer linked it strongly to those activities. Yet, by 1937, the Roosevelt administration had to compromise over a hotly contested reform agenda. The administration and Congress separately resolved two major issues concerning Grand Coulee Dam in that year: the extent of immediate construction of the dam and how federal electricity in the Pacific Northwest would be sold. On size, Congress acted to complete the high dam. It appropriated the first funds beyond Roosevelt’s \$63 million for a low dam. Many people viewed this action as a commitment to the high dam and a great victory. Still, the dam required annual appropriations after 1937 for completion and Congress funded only part of the program that the USBR engineers pushed. In 1937, Congress also created the Bonneville Power Authority (BPA; Bonneville Power Administration later) to distribute electricity from

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Vol. 79, pt. 13, 13725. In addition, USBR engineers still presented this as a electricity-only project. See: E. Mead to G. R. Rowe, 22 Apr. 1935, 541:320 1/1/33-12/31/6, Entry 7/30-45-CBP, WDC, RG 115.

<sup>31</sup> "Discussion of Amendments," 13721.

<sup>32</sup> Committee on Flood Control, *Public Works Project*, 7-9 and "Discussion of Amendments,"

federal dams in the region. The BPA, too, embodied compromises.

In 1937, the government finally committed to building the high dam, although the process still left battles. Several events prefigured the financial commitment to build the high dam. USBR engineers decided as early as November 1933 that they preferred the high dam and irrigation development. In June 1935, Interior Secretary Ickes issued a change order that abandoned the low dam in favor of a foundation for the high dam. Neither of these actions, however, actually committed the government to completing the high dam during the 1930s and 1940s. On 9 August 1937, President Roosevelt signed the bill that provided the first money for the dam that exceeded the initial PWA appropriation of \$63 million. With this money in hand, the USBR solicited bids, chose a major contractor to complete the 450-foot structure, and began that work. Local boosters such as Rufus Woods rejoiced. Yet, the administration and Congress could have done more. Congress funded this extension through the regular Department of Interior budget and so had to make further appropriations annually. Further, the commitment to the high dam brought no similar funds for construction of the associated irrigation desired by engineers.<sup>33</sup>

Similarly, congressional coalitions and the administration created a compromise on the handling of federal electricity in the Pacific Northwest with the BPA. Nationally, the models for the disposition of electricity from federal dams varied from the government-dominated arrangement of the TVA to the corporate-dominated one of Hoover Dam. For the dams of the Columbia River, politicians and different groups of engineers backed arrangements modeled on both these alternatives. In the end, Congress passed middle-ground legislation for the Pacific Northwest that made BPA an important organization in the electricity field but gave it no other powers. Created to serve the soon-to-be-completed Bonneville Dam, the BPA would transmit and market the electricity from the Army's dam

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13727-9.

<sup>33</sup> "Minutes Columbia Basin Commission," 25 Nov. 1933, 2:5-7, O'Sullivan MSS, 134-5; Carter, "Change of Plan;" "We Will Win;" Sol E. Hutton, "New Contract Covers Completion of the Grand Coulee Dam," *Reclamation Era* 27 (December 1937): 277-280; and Pitzer, *Grand Coulee*, 160-174.

near Portland, Oregon and, later, all the federal dams on the Columbia River. As the USBR and Grand Coulee Dam supporters watched avidly, the debate on how to deal with electricity from Bonneville Dam determined the policy on electricity from Grand Coulee Dam.

Liberal Congressmen, such as Idaho's James Pope, sponsored legislation for a powerful federal body with a broad mandate to manage natural resources in the Pacific Northwest. The House and Senate both entertained such bills in 1935 and 1941. These bills would have created a structure similar to that of the TVA—an independent government corporation to manage water and other natural resources toward the “comprehensive” ends of navigation, flood control, irrigation, hydroelectricity, recreation, and other uses. In 1935, this approach received little attention because the two approaches I discuss below preempted it. In 1941, deep internal divisions among supporters of government participation in the electrical industry and a split between Washington and Oregon on this issue derailed the entire process of legislating.<sup>34</sup>

On the conservative side, the Army and Portland Chamber of Commerce members supported Army operation of Bonneville Dam in a manner similar to USBR operation of Hoover Dam. The Army would generate electricity and build a short transmission line to Portland or no line at all. The Federal Power Commission (FPC) would oversee the sale of electricity but would not set retail rates. Although the proposals indicated that local government bodies would have the first chance to buy electricity from BPA, many people assumed that, in actuality, electricity would be sold cheaply to large corporations—either industrial concerns or utilities. Congress debated this manner of organization in both 1935 and 1936.<sup>35</sup>

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<sup>34</sup> Ogden, "Development of Federal Power," 207-57; Herman C. Voeltz, "Genesis and Development of a Regional Power Agency in the Pacific Northwest, 1933-1943," *Pacific Northwest Quarterly* 53 (April 1962): 65-76; Funigiello, *National Power Policy*, 174-225; Bonneville Power Administration, *Columbia River Power for the People: A History of Policies of the Bonneville Power Administration* (Portland, OR: U.S. Department of Energy, 1981); and Pitzer, *Grand Coulee*, 233-245.

<sup>35</sup> See note 33.

The National Resources Board's Pacific Northwest Regional Planning Commission and the Committee on National Electricity Policy championed a compromise organization. In 1936 and 1937, these bodies proposed a government agency that would build a regional electricity grid, transmit electricity, market the electricity from all the federal dams in the Pacific Northwest, set uniform rates for electricity throughout the area, and sell first to local government utilities. This proposal represented a middle ground between the TVA and Hoover Dam models. The government would have substantial control of the development of electricity resources, unlike at Hoover Dam, but none of the broader resources and social management mandate of the TVA.<sup>36</sup>

The final legislation also contained more explicit compromises. Two compromises limited the BPA's authority with respect to the Army and the Interior Department. Washington Senator Homer Bone, an advocate of government participation in the electrical industry, authored a compromise between reformers and the Army that allowed the Army to retain control of the production of electricity at Bonneville Dam but gave the new organization the authority to distribute electricity and direct production. Bone made a concession to the Interior Department as well. Instead of setting up an independent agency like the TVA, he located the BPA in the Interior Department.<sup>37</sup>

Despite these concessions, the BPA had extensive authority in the area of electricity development. Roosevelt appointed James Dalmage Ross, former director of Seattle's very successful city utility, as the BPA's first administrator. Ross pursued a strong position for government electrification in the Pacific Northwest. He built a federal transmission grid linking the federal Columbia River dams, which extended the government into the business of electricity transmission in the Pacific Northwest. He also won a contentious debate on electricity rates. Ross wanted a "postage stamp" rate for electricity throughout the area served by the BPA. This single rate for electricity made low-priced government electricity

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<sup>36</sup> "Shall Northwest Have a CVA?," *Pacific Builder and Engineer* 41 (12 October 1935): 27. See also note 33.

equally available. Grand Coulee Dam supporters, among others, argued that electricity rates should reflect the cost of transmission. This approach would have made electricity cheaper around each dam. Men from the Columbia Basin hoped that such an economic geography would bring industries dependent on electricity to the basin. The BPA adopted “postage stamp” rates in 1938.<sup>38</sup>

In sum, electricity development played a critical role in underpinning administration support for Grand Coulee Dam throughout the 1930s, but peaked in importance in 1935. In 1933, Roosevelt and Ickes favored a hydroelectric dam over one that would be part of an irrigation development for pragmatic reasons—budget and political opposition to irrigation. In 1935, dams joined new initiatives—holding company legislation and the REA—to mark the high point of the Roosevelt administration's efforts to reform the patterns of electrification in the United States. By 1937, advocates of further reform had to compromise with more conservative congressmen and executive agencies. Such compromises included approval of the high dam but not irrigation and creation of a middle-road approach to selling federal electricity in the Pacific Northwest.

### *Dams and Conservation*

Conservation provided the most constant rationale behind the Roosevelt administration's dam-building program. Roosevelt and his advisors clearly valued conservation. They began several new programs, such as the Civilian Conservation Corps (CCC) and the Soil Conservation Service (SCS). Roosevelt also made clear that any dam on the Columbia River must contribute to the “comprehensive plan” for the river's development. At the same time, Roosevelt did not endorse conservation above all other considerations. His actions toward several of the more ambitious conservation plans—Ickes's Department of Conservation and George Norris's plan to replicate the TVA across the nation—illustrated this. Further, the plan for a low dam at the Grand Coulee site

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<sup>37</sup> See note 33.



failed to achieve many conservation goals.

Roosevelt and his advisors advanced the conservation agenda laid out by their Progressive Era predecessors. The administration sought technical experts to direct a policy that would allow heavy, but also long-term, use of natural resources. Roosevelt lent personal support to a variety of conservation programs beyond the water resources work of the USBR, Army, and the TVA. For example, with Roosevelt's urging, Congress created the CCC and the SCS. The CCC employed young men in rural areas to improve the national estate. At its peak in July 1935, over 500,000 eighteen-to twenty-four-year-old men worked for this agency. These men cleared land for reclamation reservoirs, restored historic battlefields, built wildlife shelters, and constructed forest roads and towers to aid fire fighters. Most importantly, they planted trees. The CCC, along with the Forest Service, implemented Roosevelt's idea to reduce the topsoil loss that created dust bowls in the 1930s. They planted a "shelter belt" of trees in a 100-mile wide strip from Canada to Texas. The SCS also worked to stop the topsoil loss dramatized by dust bowls. Ickes set up the Soil Erosion Service in the Interior Department. Its programs taught farmers physical conservation practices, such as terracing fields. In 1935, Roosevelt moved the Service into the Department of Agriculture and renamed it. Other conservation initiatives included the Taylor Grazing Act, the purchase of forestland, the creation of new national parks and monuments, and the establishment of bodies to coordinate conservation work, such as the Mississippi Valley Committee and the National Resources Board.<sup>39</sup>

This commitment to conservation extended to Grand Coulee Dam. Roosevelt and Ickes both wanted any dam at the Grand Coulee site to fit into conservation plans: They explicitly required that the dam fit into the "comprehensive plan" for development of the Columbia River. James O'Sullivan reported this requirement as the first of three conditions that Roosevelt set on approval of a dam.

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<sup>38</sup> See note 33.

<sup>39</sup> Schlesinger, *Politics of Upheaval*, 335-346 and 350-353 and Leuchtenburg, *Roosevelt and the*

The President wrote a letter to [Senator] Dill in which he said there was no reason why the R. F. C. should not finance the \$60,000,000 dam and electricity plant if three conditions were met:-The development should fit into comprehensive plans....<sup>40</sup>

Ickes then followed up on this requirement. Replying to a request for information, Commissioner Mead assured the Secretary that a low dam at Grand Coulee Dam, understood as the first step in building the high dam, could be incorporated into Major Butler's comprehensive plan for the upper Columbia River. The USBR engineers carried this conceptualization of the dam into their presentation of it. For example, Construction Engineer Frank Banks spoke of "comprehensive development."<sup>41</sup>

Despite this commitment to conservation, Roosevelt did not personally fight for all the conservation causes of the 1930s. Sometimes other considerations became more important to him than conservation. For example, Roosevelt only encouraged Harold Ickes and George Norris when they came to him with ideas for a Department of Conservation and replicating the TVA, respectively. He did not actively work for these programs.

Moralist and empire builder Harold Ickes sought to rearrange federal natural resource agencies from practically his first day as Interior Secretary. He sought to cleanse the Interior Department of its reputation for squandering public resources, to create institutional momentum for conservation policy, and to control important agencies by rearranging them. Toward these ends, Ickes coveted several resource agencies housed in the Agriculture Department, especially the Forest Service. In late 1934, Ickes and Agriculture Secretary Henry Wallace almost agreed to swap eight agencies, but Wallace decided against the plan. In 1935 and 1936, Ickes took this campaign public by introducing bills to change the name of the Interior Department to the Department of Conservation. While these attempts did not specify agency swaps, the bills gave the

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*New Deal*, 172-4.

<sup>40</sup> J. O'Sullivan to L. Lawton, 6 May 1933, 7:2, O'Sullivan MSS, 2.

<sup>41</sup> E. Mead to H. Ickes, 23 May 1933, 533:301.1, Entry 7/30-45-CBP, WDC, RG 115 and Frank Banks, Address before the National Reclamation Association, "The Grand Coulee Dam and the Columbia Basin Reclamation Project" (16 November 1935), 14:7, CBC MSS.

President the authority to rearrange agencies. The Agriculture Department and long-time defender of the Forest Service, Gifford Pinchot, strenuously objected. The President assured Ickes of his support for a unification of conservation activities, but he took no active part in the contest between his two strong-minded cabinet officers. In the end, Congress killed both the initiatives. Regardless of Roosevelt's specific reason for not strongly pursuing this reorganization, his lack of action demonstrated a limit to his devotion to conservation.<sup>42</sup>

Roosevelt similarly provided only token support for George Norris's attempt to expand the management of natural resources through government corporations modeled on the TVA. In early 1937, Roosevelt discussed with both the National Electricity Policy Committee and Nebraska Senator George Norris the division of the continental U.S. into seven regions and the creation of agencies similar to TVA for each region. These agencies would plan and implement resource and social-development projects. Roosevelt's discussions received a great deal of press attention. When Norris introduced such legislation in the early summer, House Rivers and Harbors Chairman Joseph Mansfield countered with a much weaker bill for planning boards that would simply suggest projects to existing federal agencies. Shocking Norris, the President endorsed only the broad concept of planning resource development. He did not indicate a preference between the bills. Agriculture Secretary Wallace, Interior Secretary Ickes, Secretary of War Harry Woodring, and the National Resources Committee all opposed Norris's bill because such bodies would overlap existing agencies. Wallace and Woodring even helped devise

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<sup>42</sup> Harold L. Ickes, "Those of Us Whose Memories....," *Review of Reviews*, Articles, Ickes MSS; "Change in Name of Department Proposed," *Reclamation Era* 25 (August 1935): 157; Harold L. Ickes, "Conservation," *Reclamation Era* 26 (July 1936): inside front cover; "New Building and Department Dedicated to Conservation," *Reclamation Era* 26 (May 1936): 105-9; Harold L. Ickes, "The Progress of Conservation and Public Works Under the Roosevelt Administration," 17 April 1936, Articles, Ickes MSS; Franklin Delano Roosevelt and Harold Ickes, "Messages to the Annual Meeting in Casper, Wyo., on October 12-13, of the National Reclamation Association, addressed to O. S. Warden, President," *Reclamation Era* 27 (October 1937): 229; Harold L. Ickes, "A Department of Conservation," *Reclamation Era* 27 (October 1937): 232-4; Harold L. Ickes, "Save Our Natural Resources," *The Democratic Digest* (April 1938): 21, 42-3, Articles, Ickes MSS; Schlesinger, *Politics of Upheaval*, 346-9; and Clarke,

Mansfield's counter proposal and orchestrated Roosevelt's openness to both options. Professional and booster groups connected to the USBR also opposed Norris's measure. Through the summer and fall, Roosevelt pressed for coordinating bodies but emphasized that their activities would be limited in scope. Like the Department of Conservation, Congress killed this proposal.<sup>43</sup>

The Roosevelt administration also did not always pursue the most direct conservation program for the Columbia River. Working in the conservation tradition established by Progressive Era federal scientists and engineers, Army Major John Butler designed the 450-foot dam for the head of the Grand Coulee. This design embodied several of the central conservationists' ideas about water development. It combined the maximum use of the waters of the Columbia River, a large reservoir to increase water resources, and the potential for government control of those resources. However, when Roosevelt funded the construction of Grand Coulee Dam, he gave USBR engineers only enough money for a low dam. Although USBR engineers planned an initial development that could be expanded into Butler's project, the low dam alone did not achieve conservationists' goals. The low dam plan foiled conservationists' goals in three interlocking ways. First, it significantly reduced the size of the reservoir. Second, the smaller reservoir meant less development of the entire river for hydroelectricity. Third, the reduction at Grand Coulee Dam had the potential to shift control of hydroelectricity to private corporations.

Discarding conservation goals of Butler's plan, the smaller dam and reservoir would not increase the usable water of the Columbia River or enhance the river's ability to produce electricity. Butler designed the high dam to store 5,028,000 acre-feet of water.

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*Roosevelt's Warrior*, 119-128.

<sup>43</sup> Harold L. Ickes, "To the Extent that the Federal Government...," *New York Times* (7 November 1937), Articles, Ickes MSS; "Reclamation Takes the Spotlight," *Pacific Builder and Engineer* 43 (6 November 1937): 30; Harold L. Ickes, "One Hundred and Fifty Years Ago...," *The New Democracy* (January 1938), Articles, Ickes MSS; and William E. Leuchtenburg, "Roosevelt, Norris, and the "Seven Little TVAs,"" in *The FDR Years: On Roosevelt and His Legacy* (New York: Columbia University Press,

Beyond directly increasing the water available for use, this storage increased engineers' ability to produce electricity at all dams downstream. Engineers could release stored water to raise the year-round water level of the river. With higher water levels, they could in turn produce more electricity. In contrast, USBR engineers designed the low dam to store only 250,000 acre-feet—5/100s of the volume of the high dam. In fact, the potential storage with a low dam was so insignificant that USBR engineers did not even design gates for the dam that would allow them to manipulate the amount of water in the reservoir. The low dam would not increase the usable water of the Columbia River or abilities to produce electricity. Further, engineers cared about storage and increasing their ability to produce electricity. The more "efficient" development of the waters of the Columbia River frequently appeared as an argument in favor of building the high dam.<sup>44</sup>

The smaller electricity installation in the low dam also discarded conservation agendas by leaving more of the future electricity market for private development. Engineers designed the low dam to produce 2.2 billion kW-hrs of primary electricity each year. In contrast, the high dam would produce 7 billion kW-hrs—over three times as many. In 1932, the USBR projected that annual energy requirements in the Pacific Northwest would increase by 12 billion kW-hrs between 1940 and 1955, the period over which the electricity from a dam at the Grand Coulee site would become available. A low dam would provide less than one-fifth of that increase. In contrast, with a high dam the government would produce roughly three-fifths of the increase.<sup>45</sup>

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1995), 159-195.

<sup>44</sup> USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115; E. Mead to E. B. Debler, 13 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer, "Benefits Which Would Be Secured by the Early Construction of the Proposed Large Grand Coulee Dam," 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; [E. Debler], "Inland Empire," c. 1 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. H. Kizer to E. Mead, 11 Apr. 1935, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and C. E. Magnusson, Radio show on KJR Seattle, "The Grand Coulee High Dam: The Key Structure in State Development," (14 April 1935), 17:2, O'Sullivan MSS.

<sup>45</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 521 and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest

The low dam also had the potential to more directly shift control of electric power from the government to private companies. The reservoir behind the 450-foot Grand Coulee Dam flooded three potential dam sites—Kettle Falls on the Columbia River and Fish Hawk and the Narrows on the Spokane River. In contrast, the low dam destroyed only the Fish Hawk site. The low dam, then, left two other sites for private developers. Indeed, WWP—the regional utility owned by Electric Bond and Share—actively considered building a hydroelectric facility at the Kettle Falls site in the 1920s and 1930s. The FPC granted WWP a preliminary permit for the site in 1922, and the company pursued permission to build at this location until the FPC decided that the high dam at the Grand Coulee site should take precedence. Kettle Falls had the potential for a 447,700 kW electrical installation. A WWP dam would have been a private dam almost as large as the government's 520,000 kW low dam. Two smaller dams, then, would have split electricity production between the government and a private utility.<sup>46</sup>

Overall, Roosevelt and his advisors valued conservation generally and sought conservationist options for Grand Coulee Dam. The Roosevelt administration began new conservation programs, such as the CCC and the SCS. Roosevelt also required that any development at the Grand Coulee Dam site fit into a conservation program. However, Roosevelt's commitment to conservation had limits. Roosevelt did not actively pursue either the Department of Conservation or George Norris's plan to replicate the TVA. For the Grand Coulee site, the low dam plan, in comparison to a high dam, failed to meet conservation goals by reducing resource use and shifting electricity development toward private companies.

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elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 7.

<sup>46</sup> House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 725, 820, and 747; USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 1; and Pitzer, *Grand Coulee*, 31, 71, and 160.

## *Conclusion*

The Roosevelt administration support for Grand Coulee Dam, and dams more generally, was no simple phenomenon. Dams figured in relief policy, efforts to reform the electrical industry, and conservation initiatives throughout the 1930s. However, the relative importance of these programs, and dams related to them, continually shifted. In 1933, Roosevelt turned to heavy construction, such as Grand Coulee Dam, as a way to put people to work. Construction projects had numerous problems serving relief aims and, by 1935, the administration was moving away from relief as a reason to build dams. The President also began funding dams as part of a program to moderate private utilities and expand electrification. In contrast to the role of dams in relief, Roosevelt's electricity program expanded and linkage to it helped Grand Coulee Dam in 1935. By 1937, however, conflict over these policies forced compromises on the way that the government sold electricity from dams on the Columbia River. Conservation goals held a more constant (if no less complicated) place in the administration's relationship with Grand Coulee Dam. Roosevelt and Interior Secretary Ickes both supported conservation initiatives broadly and with respect to the planning of Grand Coulee Dam. This support, however, was not all encompassing. Roosevelt gave no more than verbal support to some of the more radical conservation proposals of the 1930s, and the low dam plan met fewer conservation goals than the high dam.

In 1937, a new language for talking about dams, responsive to and strategic in this complexity, began to emerge. In the post-war era, the term "multiple purpose dam" would mark a coming-of-age of the style of water development that federal engineers began at Grand Coulee Dam and the other large dams of the 1920s and 1930s. In the late 1930s, this shorthand language collapsed contentious individual uses of dams—particularly producing hydroelectricity—into a representation that offered the blessing of the conservation logic of maximum development.

In its earliest usage, the descriptor "multiple purpose" served to downplay

electricity development and highlight the conservation characters of dams, such as Hoover and Grand Coulee. I have found three uses of the phrase “multiple purpose” in 1937. In all three, the writers introduced the term in a justification of federal dams that looked to conservation as the good achieved. Speaking before the Associated General Contractors of America, USBR Commissioner John Page justified the expense of Hoover Dam—which he identified as a “multiple-purpose development”—because of its many uses. He explained that “[b]y careful planning, Hoover Dam is made to conserve water for more different and diversified benefits and uses than any other similar dam so far constructed.”<sup>47</sup> USBR General Supervisor of Operation and Maintenance George O. Sanford and Interior Secretary Ickes also used the term “multiple-purpose dam” to justify federal electricity production. In the paper “Power Development on Federal Reclamation Projects,” Sanford described multiple-purpose dams as:

the type of project in which power generation is deliberately included as a major consideration, and in which the sale of power is expected to repay or to contribute largely to the repayment of the cost of construction. While projects in this class are dependent upon power generation and sale for their existence, since otherwise they could not be financed, they are not “power projects.” They are something more. In each case, power remains the by-product of the primary conservation objectives, water supply, flood control, and river regulation.<sup>48</sup>

Ickes wrote of multiple purpose dams while defending the concept of dividing the nation into seven regions and creating TVA-like organizations to oversee resource management. He emphasized the role of private utilities in attacking this proposal and then justified federal production of electricity by the following logic: the government has the right to build dams for navigation and flood control; the best use of the water is to develop electricity as well; and, therefore, the government can develop electricity.<sup>49</sup> In 1937, government officials introduced the term “multiple-purpose dam” to sidestep the controversial issues connected with federal electricity production in favor of the positive

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<sup>47</sup> John C. Page, “Water Conservation and Control,” *Reclamation Era* 27 (March 1937): 46-9, 48.

<sup>48</sup> George O. Sanford and B. E. Hayden, “Power Development on Federal Reclamation Projects,” *Reclamation Era* 27 (May 1937): 102-6, 103.



connotations of conservation.

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<sup>49</sup> Ickes, "To the Extent."



## **Chapter 7—Interactions: Engineers Leading, Cooperating, and Following**

Local boosters, federal engineers, the Roosevelt administration, and large construction firms came together in the 1930s to build the first dams explicitly conceived as multiple purpose. As much as new ways of thinking about dams and water development, relationships between these four groups stabilized the coalitions that built Grand Coulee Dam and the other large Depression Era dams. Federal engineers played important roles in nurturing these relationships and, yet, they fell into neither of the two stereotypical roles of engineers of public works. U.S. Bureau of Reclamation (USBR)<sup>1</sup> engineers were neither all-powerful technocrats nor pliant tools of special interest groups. In building Grand Coulee Dam, USBR engineers had dynamic relationships with local boosters, federal superiors, and contractors. To a remarkable extent, they followed, led, and compromised with all these groups.

On one extreme, scholars have interpreted professional engineers, especially Progressive Era engineers, as dictators of technical development. For example, Arthur Morgan and Donald Worster portrayed the U.S. Army Corps of Engineers (Army) and the USBR, respectively, in this manner. Morgan argued that Army engineers made water development decisions without considering local circumstances or conditions. Similarly, Worster presented the Western United States as a “hydraulic empire.” Through an alliance with the ruling class, technical professionals controlled development to benefit the well-to-do without considering nature or society’s lower classes. Bruno Latour provided a subtler version of this type of argument. Latour argued that successful technical professionalization is a social system in which “technoscientists” must be involved in particular processes. The professionals become “obligatory passage points.” In this view,

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<sup>1</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period

engineers do not baldly dictate, and yet they have absolute control.<sup>2</sup>

A separate strain of thinking about public works maintained the opposite: Local interest groups controlled development decisions and failed to consider long-term or broad-scope consequences. In the historical literature on water development, Donald Pisani approached this interpretation. He argued that local groups dominated irrigation development. Even federal irrigation under the USBR empowered local groups and further institutionalized a highly fractured process for water-resource management. Popular views of public works as “boondoggles” or “pork barrel” politics likewise depict these undertakings in terms of narrow local control.<sup>3</sup>

In this chapter, I will argue for a middle-ground interpretation of the role of federal engineers in the building of Grand Coulee Dam over either of these two extremes. Neither local groups, federal engineers, Presidential administrations, nor contractors dominated the planning and building of Grand Coulee Dam. Local groups contributed most to the initiation of the project. They fought for funds to study irrigation of the Columbia Basin repeatedly during the 1920s. Presidential administrations became most important when President Roosevelt chose to fund Grand Coulee Dam. Contractors entered the process last. USBR engineers chose the first major contractor in 1934. These companies selected certain construction techniques. Federal engineers played critical, but contested, roles throughout these processes. They conducted the early studies of irrigation championed by local boosters and authored later designs for the dam, but they also had to fight with local boosters for control of the studies and designs. Engineers provided President Roosevelt with development options but had to work within limits set by the administration. Finally, USBR engineers directed contractors to construct Grand Coulee Dam according to their

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and general references.

<sup>2</sup> Arthur E. Morgan, *Dams and Other Disasters: A Century of the Army Corps of Engineers in Civil Works* (Boston: Porter Sargent Publisher, 1971); Worster, *Rivers of Empire*; and Latour, *Science in Action*. See also: Layton, *Revolt of the Engineers* and Loren R. Graham, *What Have We Learned About Science and Technology from the Russian Experience?* (Stanford: Stanford University Press, 1998), 98-123.

<sup>3</sup> Pisani, *To Reclaim a Divided West*.

plans. Yet, they turned certain parts of the work over to their corporate partners.

As USBR engineers built Grand Coulee Dam and other early multiple purpose dams, they also learned important social skills for the perpetuation of this style of dam building. In successfully completing these dams through complex relationships with local boosters, administration superiors, and contractors, USBR men learned to nurture these kinds of relationships. They could use this skill as they replicated multiple purpose development across the American West after World War Two.

### *Local Supporters*

Federal engineers had a full spectrum of interactions with local supporters of Grand Coulee Dam. At different points, engineers directed, cooperated with, and followed local supporters. Local groups played their most important part in the initiation of Grand Coulee Dam. Washington men, not the USBR, pushed studies of irrigating the Columbia Basin. They also obtained the first funds to move the dam beyond the investigation stage. USBR engineers followed the lead of local boosters on these occasions. As the dam moved into construction, local boosters and USBR engineers had a short period of cooperation on technical matters when both groups had information to exchange. Engineers, however, quickly moved to take the lead in design and construction matters. Federal engineers cut local supporters out of design decision-making in the winter of 1933-4. In funding matters during the dam's construction, USBR engineers and local boosters worked closely together. National Reclamation Association meetings became a setting in which engineers and boosters exchanged information. Engineers also coached the lobbying efforts of local boosters. Overall, USBR engineers had considerable authority on all levels and yet not so much that local men did not attempt to participate in design as well as lobbying efforts.

Local boosters most obviously led and USBR engineers followed in the initiation of the dam. As I discussed in Chapter Three, during the 1920s local groups initiated studies of irrigating the Columbia Basin and federal engineers fought to maintain an independent voice in the activities. This pattern continued into the early 1930s. Washington State men,

not USBR engineers, placed the dam before President Roosevelt. Further, Washington State, not the federal government, made the contract that initiated construction.

In 1933, ferment to build Grand Coulee Dam as part of the relief program began in Washington State. In January, newly elected Democratic Governor Clarence Martin used his inaugural address to propose a commission to lobby for federal funds for a dam. The Washington legislature promptly passed appropriate measures and modest funding that created the Columbia Basin Commission (CBC). In the spring, the CBC sent one of its members, Albert Goss, to Washington, D. C., to help the state congressional delegation build support for the dam. Goss and Senator Clarence Dill pitched the dam to President Roosevelt in April. This meeting prompted a series of inquiries and decisions that made Grand Coulee Dam part of the administration's recovery program.<sup>4</sup>

Several of these inquiries elicited rapid responses, as USBR engineers followed the boosters' lead in endorsing the dam. The USBR men quickly affirmed that the dam could be built in two stages with the first part costing roughly \$60 million. First, Chief Engineer Walter endorsed the general idea and then the Denver Office leaders examined and endorsed the idea of two-step construction in a more substantial report.<sup>5</sup>

The Washington men also brought the USBR into the contracting process. The Washington State contracted with the USBR for designs, specifications, and preliminary investigations for the first stage of construction. Signed in July 1933, the contract provided \$377,000 for designs of a low dam for the Grand Coulee site, specifications that would form the basis for bids to construct that dam, and investigations of the geology at the

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<sup>4</sup> "Power Projects Proposed In Northwest," *Pacific Builder and Engineer* 39 (8 April 1933): 28-9; 33/4/20, O'Sullivan to Walter J. O'Sullivan to R. F. Walter, 20 Apr. 1933, 7:1, O'Sullivan MSS; C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; and Pitzer, *Grand Coulee*, 67-71.

<sup>5</sup> R. F. Walter to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to J. O'Sullivan, 24 Apr. 1933, 7:1, O'Sullivan MSS; E. Mead to C. C. Dill, 27 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; Acting Chief Engineer S. Haper to E. Mead, telegram, 29 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to C. C. Dill, 5 May 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24

dam site needed to complete the designs and specifications. Senator Dill and the CBC initiated this contract. The Washington men asked the USBR engineers to outline a plan for starting the dam and a budget. The senior men in Denver proposed designs and studies costing \$377,000. The two groups reached an agreement that created the first major contract for the dam.<sup>6</sup>

As the USBR began working on Grand Coulee Dam under this contract in the summer and fall of 1933, information flowed both directions during this period of cooperation. When USBR Construction Engineer Frank Banks turned to state and local bodies for information, they cooperated with his requests. Harry Bashore, the USBR engineer stationed in Spokane before Banks, directed Banks to materials he had given to the Columbia Basin Irrigation League. Banks also obtained information on the cost of highway bridges from Washington officials and tried to view the cores that the state had taken from the dam site in the early 1920s. These last, however, could not be located. Inversely, USBR engineers cooperated by providing the CBC with information. CBC Secretary O'Sullivan oversaw the process of applying for a Federal Power Commission permit to build Grand Coulee Dam. To write the application, Washington State contracted a couple of USBR engineers. Engineers in Washington, D. C., and Denver supplied O'Sullivan with important information, such as a copy of the Federal Power Commission application of the only major hydroelectric dam approved for the Columbia River's main stem. The USBR engineers also helped O'Sullivan collect maps and make drawings for the application.<sup>7</sup>

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May 1933, 294, Reports 10-55, ERC, RG 115.

<sup>6</sup> J. O'Sullivan to R. F. Walter, 31 May 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; C. C. Dill to E. Mead, 31 May 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to C. C. Dill, 8 June 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; "Contract of June 30, 1933 between USA and State of Washington," 14:4, CBC MSS; Acting Chief Engineer S. O. Harper to J. O'Sullivan, 14 July 1933, 33:1, CBC MSS; "Minutes Columbia Basin Commission," 29 June 1933, 2:5-7, O'Sullivan MSS, 22-24.

<sup>7</sup> On information flowing from Washington State to Banks, see: F. A. Banks to H. W. Bashore, 28 July 1933, 438:791-D-1 10/31-2/34(f2), EC-CB, CE, RG 115; F. A. Banks to R. F. Walter, 3 Aug. 1933, 791-D-1 10/31-2/34(f2), EC-CB, CE, RG 115; and F. Banks to E. Mead, 4 Oct. 1933, 438:791-D-1

As quickly as USBR engineers moved from following to cooperating, they moved again from cooperating to leading on design matters. USBR engineers in the Chief Engineer's Office removed everyone not in their office from design processes in the winter of 1933-4. During that period, USBR engineers changed the design for Grand Coulee Dam from a low, multiple-arch dam to a low, gravity dam. Engineers in Denver made this change by generating a set of possible designs, analyzing them, and choosing a "recommended plan." As this process re-opened decisions on the technical configuration of the dam, the USBR men strictly controlled participation in decision making. The engineers achieved this control despite the best efforts of local boosters to participate.

Chief Engineer Walter and his staff explicitly did not want outsiders participating in the design process, except as reviewers. Acting Chief Engineer Sinclair Harper, when truly harried about interactions between Denver, the CBC, and Frank Banks, stated his opinion that only USBR engineers should be involved with the design, saying: "Questions of this kind involving decisions on details of engineering and design, should be settled in our own organization, which in the end must assume all responsibility for results."<sup>8</sup> Chief Engineer Walter similarly expressed distaste at the prospect of working with a board of consulting engineers from Washington State. The CBC set up this board to monitor the activities of the USBR. Walter informed Construction Engineer Banks: "I do not look with favor on sending preliminary data to a consulting board at Spokane."<sup>9</sup> He further opined: "I am afraid they are going to be a nuisance."<sup>10</sup>

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10/31 thru 2/34(1), EC-CB, CE, RG 115. On the reverse, see: J. O'Sullivan to L. Lawton, 31 May 1933, 13:1, CBC MSS; C. C. Dill to E. Mead, 31 May 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; "Memorandum to the Chief Engineer," 2 June 1933, 438:791-D-1 10/31 thru 2/34(2), EC-CB, CE, RG 115; E. Mead to R. F. Walter, 8 June 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to C. C. Dill, 8 June 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; Acting Chief Engineer S. O. Harper to E. Mead, 15 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; and E. Mead to J. O'Sullivan, 27 July 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115.

<sup>8</sup> Acting Chief Engineer S. O. Harper to E. Mead, 26 Feb. 1934, 438:791-D-1 10/31 thru 2/34(2), EC-CB, CE, RG 115.

<sup>9</sup> R. Walter to F. Banks, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115.

<sup>10</sup> R. F. Walter, marginalia on J. O'Sullivan to R. F. Walter, 30 Oct. 1933, 438:791-D-1 10/31-



Despite repeated attempts by James O'Sullivan to obtain information about the design and participate in decision making, Ray Walter and his staff in the Chief Engineer's Office succeeded in providing the CBC with only minimal technical information until it was too late for them to make significant contributions. James O'Sullivan requested information on the design for the CBC's consulting engineers in late October. Walter pleaded that he could not provide information because the notebooks of several engineers contained the relevant material and the engineers had not yet collected it into a presentation version. Instead, he offered to send memoranda about the design as soon as the Denver Office chose one. USBR engineers proceeded to keep the CBC informed about the design. While on a visit to the site in late November, Mead informed them that engineers in Denver were considering replacing the low, multiple-arch design with a low, gravity one. In early December, Walter wrote James O'Sullivan of four construction scenarios under consideration. Briefly, these were: 1) to build a low, gravity dam; 2) to build a low, gravity dam and to complete excavation for the high dam abutments; 3) to build the high dam to low water and to superimpose a low dam; and 4) to build the high dam as high as money would permit. On a trip to the dam site in February, Chief Designing Engineer John Savage expanded the options to ten. These alternatives varied the amount of excavation, the number of electric generators, and the type of structure to be completed in the dam's first phase. Acting Chief Engineer Sinclair O. Harper informed the CBC of the recommended plan—a low, gravity dam and a “toe” for the high dam—in the third week of February. On 22 March, Walter mailed a report on alternative plans and a series of memoranda on aspects of the dam to the CBC in preparation for a joint meeting of the USBR and the CBC's Boards of Consulting Engineers. Overall, the Denver Office sent nothing more substantial than brief descriptions of the options until six days before the board meeting. This information came five months after James O'Sullivan first requested information; more than a month after the engineers chose a recommended plan; two weeks

after the Denver Office finished a report on the "recommended plan" and ten alternatives; and, in general, long after the CBC could have contributed to the process of designing Grand Coulee Dam.<sup>11</sup>

Beyond failing to provide the CBC with information, USBR engineers cut Washington State men out of the design process by ignoring the suggestions of CBC engineers and the opportunity to develop relationships with these men. For example, the engineers in Denver interacted politely with CBC Consulting Engineer Alvin Darland but failed to incorporate his ideas into the dam or to maintain a relationship with him. As a consultant for the CBC, Darland visited the USBR's Denver Office, the Washington Office, and the Allis-Chalmers Manufacturing Company of Milwaukee in late 1933. In Denver, the engineers received Darland politely. He toured USBR facilities and discussed the design of Grand Coulee Dam with the engineering staff. Commissioner Mead was not in Washington when Darland passed through, but he spoke briefly with Acting Commissioner Mae Schnurr. After Darland returned to Washington State, the USBR engineers did not incorporate Darland's efforts into their work. They did not use the information that Allis-Chalmers sent at Darland's request. In addition, they did not pursue a relationship with the CBC consultant. The Denver Office sent him follow-up information but requested nothing of him.<sup>12</sup>

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<sup>11</sup> F. Banks to R. Walter, 27 Oct. 1933, 438:791-D-1 10/31-3/34 (f2), EC-CB, CE, RG 115; J. O'Sullivan to R. F. Walter, 30 Oct. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. Walter to J. O'Sullivan, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. Walter to F. Banks, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. F. Walter to J. O'Sullivan, 11 Nov. 1933, 14:7, CBC MSS; R. F. Walter to F. Banks, 11 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; "Minutes Columbia Basin Commission," 25 Nov. 1933, 2:5-7, O'Sullivan MSS, 134-5; R. F. Walter to J. O'Sullivan, 2 Dec. 1933, 14:7, CBC MSS; R. F. Walter to J. O'Sullivan, 2 Feb. 1934, 14:7, CBC MSS; F. Banks to R. F. Walter, 9 Feb. 1934, 438:791-D-1 10/31-3/34 (f2), EC-CB, CE, RG 115; Acting Chief Engineer S. O. Harper to J. O'Sullivan, 21 Feb. 1934, 13:2, CBC MSS; R. F. Walter to F. A. Banks, telegram, 22 Mar. 1934, 438:791-D-1 3/34-9/34 Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to J. O'Sullivan, 22 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; and John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115.

<sup>12</sup> R. F. Walter to A. F. Darland, 7 Dec. 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; A. F. Darland to R. F. Walter, 16 Dec. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; and A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS.

Like the USBR's polite brush-off of Darland, the Chief Engineer and his staff demonstrated their authority in the design process by ignoring the CBC's board of consulting engineers and appointing their own. For major dams, the USBR typically appointed an external board of engineers to review plans and provide advice on any problems. For the Grand Coulee Dam, before the USBR men made their normal provision, the CBC appointed a consulting board of three Washington engineers: Alvin Darland, W. Chester Morse, and Horace Smith. The CBC wanted these men to review the designs developed by the USBR and to assure that any plan for a low dam could be expanded into a high dam. Although these men could have served as the sole review board, Walter appointed a separate USBR board. Further, Walter dismissed CBC Secretary O'Sullivan's suggestions about the staffing of this second board. O'Sullivan objected to Joseph Jacobs, a Seattle engineer, and endorsed Portland's David Henny for positions on the board. Despite these views, Walter followed his plans to appoint Jacobs but not Henny. Ultimately, Charles Paul, Charles Berkey, William F. Durand, and Joseph Jacobs served as the USBR's consulting board for Grand Coulee Dam.<sup>13</sup>

The Chief Engineer made one concession to the CBC's desire to review the designs, but this action held little importance for USBR authority. The USBR invited CBC Secretary O'Sullivan and the Washington consulting board to meet jointly with the USBR's board to review the design and specifications for the low, gravity dam in the spring of 1934. O'Sullivan jumped at the opportunity and even arrived in Denver early to review

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Darland, however, apparently impressed USBR engineers. Banks offered him the important position of field engineer in March 1934. Only the field engineer, office engineer, and chief clerk reported directly to Banks. See: J. O'Sullivan to A. F. Darland, 15 Mar. 1934, 14:7, CBC MSS and USBR, "Columbia Basin Project," 1934, Entry 10, WDC, RG 115, 181.

<sup>13</sup> "Minutes Columbia Basin Commission," 29 June and 20 Oct. 1933, 2:5-7, O'Sullivan MSS, 22-24 and 86; R. Walter to F. Banks, 8 Nov. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; E. Mead to J. O'Sullivan, 9 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; J. O'Sullivan to R. F. Walter, 13 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to J. O'Sullivan, 17 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; J. O'Sullivan to R. F. Walter, 20 Mar. 1934, 438:791-D-1 3/34-9/34, EC-CB, CE, RG 115; and J. O'Sullivan to W. Morse, H. Smith, A. Darland, D. Henny, 28 Mar. 1934, 438:791-D-1 3/34-9/34, EC-CB, CE, RG 115.

technical material about the design. The Washington board, however, had little impact on the design or specifications. While the USBR's board made numerous minor suggestions about revising the specifications, the Washington engineers' only substantial suggestion was that the USBR retain its planned profile rather than consider a narrower base.<sup>14</sup>

As the dam moved into construction, USBR engineers firmly controlled technical matters and their influence extended into political areas. USBR leaders worked closely with local boosters to maintain Roosevelt administration interest in Grand Coulee Dam. Engineers used National Reclamation Association meetings to coordinate with booster groups. At times of particular importance, engineers went as far as coaching the lobbying activities of local boosters. For example, in 1934, Commissioner Mead encouraged a local group to formulate an approach to President Roosevelt's visit and USBR engineers participated in devising a strategy. In 1937, Mead's successor, John Page, coached local boosters on both the timing and content of their congressional lobbying. Further, both of these cases demonstrated the leadership skills of USBR men. Engineers directed the activities of local boosters through suggestions and flattery rather than any direct power over them.

Federal engineers fostered cooperation with local boosters at National Reclamation Association meetings by making promotional presentations about their work and meeting with delegations from local groups. Founded in December 1932 at a meeting held in conjunction with an annual conference of Western governors, the National Reclamation Association sought to rally support for continuation of federal irrigation programs. During

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<sup>14</sup> E. Mead to J. O'Sullivan, 9 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; J. O'Sullivan to R. F. Walter, 15 Mar. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; J. O'Sullivan to R. F. Walter, 24 Mar. 1934, 438:791-D-1 3/34-9/34 (f2), EC-CB, CE, RG 115; R. F. Walter to C. H. Paul, C. P. Berkey, W. F. Durand, and J. Jacobs, 27 Mar. 1934, 438:791-D-1 3/34-9/34 f2, EC-CB, CE, RG 115; W. C. Morse, A. F. Darland, D. C. Henny, and H. E. Smith to CBC, 31 Mar. 1934, 415:791 10/31-9/34, EC-CB, CE, RG 115; C. P. Berkey, W. F. Durand, J. Jacobs, and C. H. Paul to R. Walter, 31 Mar. 1934, 289, Reports 10-55, ERC, RG 115; and "Miscellaneous Suggestions and Recommendations Resulting from a Reading of the Tentative Specifications," C. P. Berkey, W. F. Durand, J. Jacobs, and C. H. Paul to R. Walter, c. 31 Mar. 1934, 289, Reports 10-55, ERC, RG 115.

the 1930s, it met annually. Both USBR leaders and Grand Coulee Dam leaders attended these annual meetings. For example, at least eleven USBR men attended the December 1935 meeting including Chief Engineer Walter and Grand Coulee Dam Construction Engineer Banks. At these events, they promoted their work in presentations, such as Commissioner Mead's address on USBR goals in December 1934. USBR engineers also conducted business with local boosters at these meetings. For example in 1934, Commissioner Mead and Chief Engineer Walter met with CBC officials Banker and O'Sullivan. The activities paid off in expanding support for USBR activities. In 1937, the National Reclamation Association established an office in Washington, D.C. as a base for lobbying for USBR dams.<sup>15</sup>

During the summer of 1934, Commissioner Mead took a more direct leadership role by stimulating and directing local activities aimed at persuading President Roosevelt to expand the Grand Coulee Dam from a low dam to a high dam. In anticipation of Roosevelt's visit to the Grand Coulee Dam site in early August, Commissioner Mead encouraged Washington State Chamber of Commerce President Sam Hedges to organize a meeting of local supporters. A group of roughly twenty-five men met in Seattle on 19 July. The group included men from the State's CBC, as well as members of the Spokane-based Columbia Basin Irrigation League and the Almira-based Columbia River Development League, formerly antagonistic booster groups. USBR Construction Engineer Frank Banks and USBR District Counsel B. E. Stoutmeyer also attended. In consultation with these representatives of the USBR, the enthusiasts decided to present hopes for a high dam quietly. They charged CBC Chairman E. F. Banker to discuss the issue privately with

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<sup>15</sup> George H. Dern, "Problems Confronting the Western Section of the United States," *Reclamation Era* 24 (January 1933): 1-3, 11; "Salt Lake City Irrigation Conference," *Reclamation Era* 24 (January 1933): 6; "Minutes Columbia Basin Commission," 19 Dec. 1933 and 12-13 Dec. 1934, 2:5-7, O'Sullivan MSS, 144, 556-7, and 564; "Reclamation Organization Activities," *Reclamation Era* 25 (December 1935): 252; Banks, Address before the National Reclamation Association, "The Grand Coulee Dam and the Columbia Basin Reclamation Project," 16 Nov. 1935, 14:7, CBC MSS; Mead, "Reclamation Under the New Deal;" and Walter A. Averill, "Reclamationists Launch Fight For 1937 Congressional Appropriations," *Pacific Builder and Engineer* 42 (5 December 1936): 20-22.

the President. Mead endorsed this approach.<sup>16</sup>

In 1937, the dam needed skillful boosters even more. By the winter of 1936-7, USBR engineers had spent most of the initial funds allocated to the dam. With Harold Ickes's Public Works Administration eclipsed by Harry Hopkins's Works Progress Administration, the USBR sought further funds through the Interior Department's regular appropriation process. This approach meant congressional hearings on the dam—difficult hearings. In both 1935 and 1936, the dam faced hostility in the House. In 1935, congressmen hotly debated the Grand Coulee Dam before passing a belated official authorization. In 1936, opponents placed spending caps on the dam. This antagonistic atmosphere extended into the 1937 hearings.<sup>17</sup>

In this context, Commissioner Page molded enthusiast James O'Sullivan into a helpful congressional lobbyist. Page coached O'Sullivan on both the timing and content of his appeals. Page encouraged O'Sullivan to travel to Washington, D.C. and to testify at the congressional hearings on the USBR budget for the dam. Page also kept O'Sullivan apprised of the likely date of hearings so that the later could time such a trip. Further, Page specified electricity development as the central selling point of the dam. Although an irrigation enthusiast, O'Sullivan had a long record of insisting that electricity from Grand Coulee Dam would find a market and benefit the region. In preparation for the budget battle, O'Sullivan prepared a brief on the Pacific Northwest's future electric power market to shore up this selling point of the dam.<sup>18</sup>

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<sup>16</sup> S. H. Hedges to B. E. Stoutmeyer, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to C. D. Martin, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to E. Mead, 23 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; C. C. Dill to S. H. Hedges, 24 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; S. H. Hedges to C. C. Dill, 25 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to S. H. Hedges, 28 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and "Minutes Columbia Basin Commission," 8 Sep. 1934, 2:5-7, O'Sullivan MSS, 392.

<sup>17</sup> Pitzer, *Grand Coulee*, 115-126 and 157-174.

<sup>18</sup> J. O'Sullivan, "Statement in Favor of the Completion of the Grand Coulee Dam and Power Plant," 21 Jan. 1937, 535:301.1 1937, Entry 7/30-45-CBP, WDC, RG 115; J. Page to J. O'Sullivan, 29 Jan. 1937, 541:320 1/37-2/41, Entry 7/30-45, WDC, RG 115; J. O'Sullivan to J. Page, 2 Feb. 1937,

Overall, Washington State men played their most important independent roles as early advocates of regional development. Boosters initially led federal engineers into planning Grand Coulee Dam. In the 1930s, USBR men quickly began cooperating with local boosters and then took the lead in design matters. Although the USBR and CBC collaborated on the Federal Power Commission permit application, the Denver engineers cut all outsiders out of the debate over the design of Grand Coulee Dam during the winter of 1933-34. On political matters, USBR men and local boosters continued to work closely together although, at times, engineers led these activities too. National Reclamation Association meetings provided a forum for USBR men to interact with local boosters. Presidential visits and congressional hearings prompted USBR leaders to make sure that local boosters were not working toward different goals.

### *Federal Officials*

The relationship between USBR engineers and their superiors in the Roosevelt administration was no less complex than that with local boosters. Again, all shades of the spectrum from leading to cooperating to following characterized various interactions that Mead and his staff had with their direct boss, Harold Ickes, and the President. Through his influence with Congress, President Roosevelt's largest impact on Grand Coulee Dam came in the form of budgetary limits. President Roosevelt set a budget for the dam in 1933 and, although USBR leaders rapidly decided that the low dam would not meet financial requirements, the USBR had to follow that decision for four years. At the same time, the ultimately successful efforts of USBR men to persuade their executive branch superiors to complete the high dam in the 1930s, rather than the low dam, showed how USBR engineers used their position as experts to lead administration decisions. On other issues—most notably fitting the dam into relief and conservation programs—USBR men

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541:320 1/37-2/41, Entry 7/30-45, WDC, RG 115; J. Page to J. O'Sullivan, 10 Feb. 1937, 541:320 1/37-2/41, Entry 7/30-45, WDC, RG 115; J. O'Sullivan to Billy [Clapp], 31 May 1937, 1:2, O'Sullivan MSS; and Pitzer, *Grand Coulee*, 157-9, 161-163.

worked with Roosevelt and Ickes. Finally, USBR leaders and administration officials displayed another form of interaction, lack of communication. At times, USBR engineers and administration leaders simultaneously held contradictory ideas about the dam.

President Roosevelt most directly affected Grand Coulee Dam by setting its budget. Yet, over a period of years, USBR engineers used their position as experts to convince the President to substantially increase the dam's budget. In 1933, Roosevelt decided he would sanction a Washington State dam if it cost roughly \$60 million. Despite designs and a contract for a low dam, contractors completed the high dam in 1942 without any major breaks in construction.

Roosevelt and Ickes set and stuck to a \$60 million budget, despite immediate efforts by USBR leaders to open the budget to discussion. Chief Engineer Ray Walter tried to open the budget process to a more general assessment of what kind of dam should be built at the Grand Coulee site. Walter suggested that:

Additional studies involving comparative estimates of cost of say three dams of different heights, with corresponding hydrographic studies to determine the amount of firm and secondary power which would be possible with each dam, together with studies of the financial operation of each scheme, should be made in order to determine the most feasible scheme from an economic standpoint.<sup>19</sup>

The Denver Office reminded Mead of this suggestion twice. This attempt, however, failed and the \$60 million budget became an important constraint as engineers formulated the low, multiple-arch dam.<sup>20</sup>

Likewise, when engineers decided that the multiple-arch dam was unacceptable in late 1933, the administration still made the USBR stick to the original budget. Engineers delayed the process of redesigning the dam in the winter and spring of 1934 in hopes of getting more money. They, however, did not succeed. As issues grew tense, the

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<sup>19</sup> R. F. Walter to E. Mead, 14 Mar. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115.

<sup>20</sup> C. C. Dill to E. Mead, 21 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; and Acting Chief Engineer S. Haper to E. Mead, telegram, 29 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115. See Chapter 5 for a discussion of the relationship between the multiple-arch



Commissioner urged engineers in Denver and Washington State to emphasize that they were working within the confines of the original budget. In fact, engineers consistently recommended the low, gravity dam plan on the basis that it fit in the budget. For example, Acting Chief Engineer, Harper telegraphed Commissioner Mead: "setup for low dam and provisions for high dam all within \$63 million."<sup>21</sup>

A short time later, Roosevelt's reliance on the USBR gave the engineers an opportunity to encourage a change in this position. In the summer of 1934, Roosevelt visited Grand Coulee Dam while traveling in the Pacific Northwest. The USBR supplied the descriptions of the dam that briefed Roosevelt for the trip. During the month preceding the President's visit, Denver Office Hydraulic Engineer Erdman Debler and USBR District Counsel B. E. Stoutmeyer prepared information for the President. While Franklin Roosevelt had only funded a low hydroelectric dam, both constructed lengthy narratives describing Butler's full hydroelectricity and irrigation development. Both men also carefully constructed their documents to present the high dam in terms attractive to the President. They emphasized the utility of Grand Coulee Dam in providing homes for farmers displaced by drought or economic depression. They also stressed the conservation features of the project. These narratives carried the message that the high dam would be better dam than the low. The President's need for information provided the opportunity make this case.<sup>22</sup>

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design the budget for the low dam.

<sup>21</sup> Quote from: Acting Chief Engineer S. O. Harper to E. Mead, telegram, 16 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115. See also: "Second Report of the Columbia Basin Commission," 1934, 34:1, CBC MSS, 32-36; E. Mead to R. F. Walter, 9 Feb. 1934, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; A. F. Darland to J. O'Sullivan, 17 Feb. 1934, 13:1, CBC MSS; and John Savage, "Alternate Plans and Estimates for Grand Coulee Dam," 8 Mar. 1934, 294, Reports 10-55, ERC, RG 115, 2-4.

<sup>22</sup> [E. Debler], "The Inland Empire Realized—The Columbia Basin Project," c. 1 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. B. Debler to E. Mead, 9 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to E. B. Debler, 13 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer, "Benefits Which Would Be Secured by the Early Construction of the Proposed Large Grand Coulee Dam," 17 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer to E. Mead, 18 July 1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115; and E. Mead to B. E. Stoutmeyer, 26 July

As USBR engineers continued to appeal for the high dam, they relied further on their position as experts. In connection with the second major relief bill, USBR engineers prepared another presentation of Grand Coulee Dam for the President. This time, they emphasized engineering problems with the low dam as well as broad benefits of the high dam. In particular, USBR engineers identified the joint required to expand a low dam into a high dam and replacing hydroelectric machinery as problems. The joint, however, was less a clear physical obstacle to building the dam than a way that engineers used a technical issue to lead the development of the dam in a direction they preferred. The status of the joint as a technical problem changed with the engineers' assessment of the dam as a whole. Engineers identified the joint as a problem only after they identified broader flaws with the low dam. Further, although they the joint as a technical problem, the USBR men explicitly said that, with adequate funds, a joint could be made. Engineers also designed the literary form in which they brought attention to the issue of constructing a joint to persuade by virtue of expertise. Instead of giving only the name of the most senior engineer who worked on the report, USBR men made their consensus explicit. Commissioner Mead, Chief Engineer Walter, Chief Designing Engineer Savage, and four additional senior engineers from the Denver Office signed the letter to Secretary Ickes.<sup>23</sup>

Still, USBR engineers did not convince their bosses to devote more funds to Grand Coulee Dam until 1937, even after Ickes discarded the notion of building a low dam. In January 1935, Ickes tersely rejected the engineers' appeal for additional relief funds. By June, however, Ickes decided to compromise. He directed the USBR and its contractors to construct the foundation for the high dam rather than the low dam. For two years, the USBR worked on the foundation for the high dam or the "foundation dam," as Commissioner Page sometimes called the structure. The engineers repeatedly told people

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1934, 535:301.1 7/1/34-4/30/35, Entry 7/30-45-CBP, WDC, RG 115.

<sup>23</sup> "Minutes Columbia Basin Commission," 8 Sep. and 26 Oct. 1934, 2:5-7, O'Sullivan MSS, 416-20 and 502-4; J. O'Sullivan to R. Woods, 20 Oct. 1934, 8:1, O'Sullivan MSS; and Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115. See Chapter

that they were not building the high dam; rather they were simply constructing the first step. In 1936 Congress made the budget limit explicit by making it part of the Interior Department appropriation legislation. The “foundation dam” allowed construction on the high dam without increasing the budget. Repeated urging eventually convinced the President and Congress to lift the budget cap. Congress finally passed an appropriation to continue work on the high dam in the summer of 1937.<sup>24</sup>

Although the USBR and the Roosevelt administration struggled over funds for Grand Coulee Dam, they cooperated on important matters. USBR engineers worked with President Roosevelt to use dam building to put people back to work. USBR engineers normally had a single major contractor undertake the excavation and construction of their dams. However, to put more men to work during the winter of 1933-4, began excavation for Grand Coulee Dam early. With this action, USBR engineers helped, at least a little.<sup>25</sup>

Federal engineers and the President most consistently cooperated on conservation. During the 1920s, federal engineers drew on and developed the ideas of Progressive Era conservationists as they planned Grand Coulee Dam. In the 1930s, Roosevelt and Ickes supported similar policies broadly and in dam building. The independent commitment of USBR engineers and the Roosevelt administration to conservation converged and they eagerly worked together on this issue. For example, USBR engineers cooperated with other government conservation boards and officials. Commissioner Page placed the work of the USBR in the context of national planning bodies, such as various sub-committees of

Five for a longer discussion of the extension joint.

<sup>24</sup> H. Ickes to E. Mead, 8 Jan. 1935, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; H. Ickes to E. Mead, 15 May 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to H. Ickes, 23 May 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to M. Dana, telegram, 7 June 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; B. E. Stoutmeyer to C. J. Bartholet, 4 Jan. 1936, 436:791-D-1 11/36-2/37, EC-CB, CE, RG 115; Acting Commissioner R. F. Walter to F. Steiwer, 11 Feb. 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; Acting Commissioner John C. Page to Homer Bone, 19 May 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; J. Page to J. O'Sullivan, 28 Oct. 1936, 541:320 1/1/33-12/31/36, Entry 7/30-45-CBP, WDC, RG 115; and Pitzer, *Grand Coulee*, 157-174.

<sup>25</sup> For a longer discussion of this contract and its relationship to Administration relief goals see Chapter Six.

the National Resources Committee. Marshall Dana, the Portland, Oregon editor who held a series of New Deal appointments, kept in touch with USBR engineers. As District Adviser of the Public Works Administration in 1933 and chairman of the Pacific Northwest Planning Conference in 1934 and 1935, Dana corresponded with engineers Mead, Walter, and Banks.<sup>26</sup>

Finally, when USBR engineers ignored their executive branch superiors, odd disconnects arose in the rhetoric surrounding Grand Coulee Dam. Plans for selling the dam's electricity exemplified this dynamic. Ickes and Roosevelt intended to market the electricity from Grand Coulee Dam at low rates to serve as a "yardstick" for measuring the fairness of private electricity operations and to encourage development. To subsidize irrigation, USBR engineers, in contrast, wanted the highest rate that would undercut other forms of electricity. Therefore, Ickes spoke of the Grand Coulee Dam as an exemplar for electric industry reform while USBR engineers planned something quite different. In the end, multiple federal dams on the Columbia River made marketing electricity more complex than either anticipated.

Before the government decided how to market Grand Coulee Dam's electricity, Ickes talked all federal electricity in the Pacific Northwest as a single endeavor and about primarily in terms of the benefits of cheap electricity. Ickes thought cheap electricity would cure myriad individual and regional ills. Cheap electricity for homes and farms would

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<sup>26</sup> On Page's connection to the National Resources Committee, see: Page, "Water Conservation and Control" and John C. Page, "River Regulation In Our National Conservation Program," *Reclamation Era* 27 (June 1937): 121-2. On Marshall Dana, see: Frey, "Northwest Public Works;" M. Dana to F. Banks, 4 Dec. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; F. Banks to M. Dana, 6 Dec. 1933, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; Acting Chief Engineer S. O. Harper to M. Dana, 21 Feb. 1934, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; M. Dana and R. F. Bessey to R. F. Walter, c. 15 Feb. 1934, 438:791-D-1 10/31-2/34 f2, EC-CB, CE, RG 115; E. Mead to M. Dana, telegram, 7 June 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; Acting Chief Engineer S. Harper to M. Dana, 6 July 1935, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; Walter A. Averill, "Pacific Northwest Planning Conference," *Pacific Builder and Engineer* 41 (5 January 1935): 42-3; "Grand Coulee High Dam, with Reclamation and Power Development, Unqualifiedly Endorsed," *Pacific Builder and Engineer* 41 (5 January 1935): 43; "Planning Conference Recommendations," *Pacific Builder and Engineer* 41 (5 January 1935): 42. See also: Chapters Four and Six on Grand Coulee Dam and conservation.

lighten personal labor and provide modern amenities. For communities, cheap electricity would attract industries that provided good jobs. Ickes assumed that in the Pacific Northwest achieving this vision would mean coordinating the sale of electricity from Bonneville and Grand Coulee Dams; Competition between these federal dams certainly would have been no recipe for low electricity rates.<sup>27</sup>

USBR engineers, however, did not incorporate Ickes's ideas. While they saw the merits of electrification for both individuals and regions, the engineers strove to make the dam meet their financial criteria. Toward this end, they proposed electricity rates that would subsidize irrigation. Major Butler and his assistants first set out this formula. Barry Dibble, a consulting electrical engineer who had worked on the USBR's regular staff from 1909-1924, assisted Butler with this part of his report. Dibble borrowed estimates and logic from USBR plans for Hoover Dam. He proposed electricity rates for commercial electricity (as opposed to electricity used to pump irrigation water) of 2.5 mills per kilowatt-hour. This rate would undercut oil steam powered plants—the main competitor of hydroelectricity. While the precise assumptions about the financial set up of the dam changed with each re-analysis of developing the Columbia River and Basin, the logic behind proposed rates stayed constant. Engineers always named a rate that would subsidize irrigation and just undercutting competitors' rates. Set to generate income, these rates could by no means be considered “yardsticks” of cheap electricity rates.<sup>28</sup>

In respect to electricity rates, then, USBR engineers ignored their executive branch superiors and created conflicting currents in the rhetoric surrounding Grand Coulee Dam. Ickes's vision of cheap electricity clashed with engineers' approach of selecting the highest

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<sup>27</sup> H. Ickes to E. Mead, 31 Mar. 1934, 541:320 1/1/33-12/31/36, Entry 7/30-45-CBP, WDC, RG 115; Ickes, "Saving the Good Earth;" Ickes, "Jobs versus Dole;" Harold L. Ickes, "Thought for the Tomorrow," *Collier's* (12 December 1934), Articles, Ickes MSS; and Ickes, "Progress of Conservation."

<sup>28</sup> "Dibble, Barry," in *Who Was Who in America* (Chicago: Marquis Who's Who, ), 248; L. McClelland to R. Gill, 3 Feb. 1932, 1:B, Gill MSS; House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, 736-741, 852-856, and 1067; Walter, "Report by the Bureau," 522-535; USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11; and Mead et al., "Report on

competitive rates to subsidize irrigation. Ironically, the decision to market Grand Coulee Dam electricity through the Bonneville Power Administration resolved these cross-purposes by acting on another sentiment Denver Office engineers mostly ignored in their planning. Along with Ickes, a number of USBR engineers and upper-administration officials mentioned the need for a TVA-like body to market electricity from all the federal dams in the Pacific Northwest. However, Denver Office engineers continued to fret over competition from Bonneville's electricity and to calculate the financial prospects of each dam individually.<sup>29</sup>

Overall, the relationship between the Roosevelt administration and the USBR engineers was as dynamic as that between the engineers and the dam's local activists. The Roosevelt administration most directly influenced the development of Grand Coulee Dam by setting its budget. Despite objections, USBR engineers had to live with this funding for four years. During that time, however, they worked on getting more money. Eventually, they succeeded by leveraging their technical expertise. For example, they used briefs for the President and technical issues, like the joint between the high and low dams, to encourage the switch to a high dam. Engineers and the President also cooperated. For example, both wanted the dam to meet relief and conservation goals. Finally, when USBR men and their administration superiors failed to communicate odd contradictions appeared in the rhetoric surrounding Grand Coulee Dam.

### ***Corporate Contractors***

Along with local boosters and administration superiors, USBR engineers developed dynamic relationships with corporate contractors. To this point, contractors have played

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Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115, 4 and 16.

<sup>29</sup> A. F. Darland to E. F. Banker and J. O'Sullivan, 20 Jan. 1934, 13:1, CBC MSS; H. Ickes to E. Mead, 31 Mar. 1934, 541:320 1/1/33-12/31/36, Entry 7/30-45-CBP, WDC, RG 115; Mead et al., "Report on Columbia Basin Project," 22 Dec. 1934, 294, Reports 10-55, ERC, RG 115; Acting Commissioner R. F. Walter to F. Steiwer, 11 Feb. 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115; and Acting Commissioner John C. Page to Homer Bone, 19 May 1936, 535:301.1 5/35-12/36, Entry 7/30-45-CBP, WDC, RG 115.

little role in this history of Grand Coulee Dam. Historically, contractors did not participate significantly in the decisions and processes that I have discussed so far. However, during the 1920s and 1930s, the USBR constructed major dams by designing the structures in-house and then hiring firms, such as H. J. Kaiser or smaller construction firms, to build them. The USBR issued specifications for each contract and awarded the job to the lowest qualified bidder. The contracting firms planned the construction plant, purchased the materials, hired the laborers, and erected the dams.<sup>30</sup>

A broad range of contractors worked on Grand Coulee Dam. The two largest contractors built the dam's foundation and completed the dam. MWAK Company constructed the first part of the dam. For very large dams, construction firms frequently established one-time partnerships. Silas Mason Company of New York; Walsh Construction Company of Davenport, Iowa; and Atkinson-Kier Company of San Francisco joined to form MWAK. For the second contract, MWAK joined with several of the contractors they beat in the first bidding process. Consolidated Builders, Inc.—made up of MWAK plus Kaiser Construction Company of Seattle, Morrison Knudsen Company of Boise, Utah Construction Company of Ogden, J. F. Shea Company of San Francisco, Pacific Bridge Company of San Francisco, McDonald and Kahn of San Francisco, and General Construction Company of Seattle—completed the dam. Many of these firms

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<sup>30</sup> W. H. Nalder, "Submission of Data for Designs and Estimates," *New Reclamation Era* 19 (July 1928): 104-7 and F. A. Banks, "Problems in Handling Large Construction Work by Contract," *New Reclamation Era* 20 (December 1929): 182-5. For example, the two major specifications for Grand Coulee Dam were: U.S. Bureau of Reclamation, *Grand Coulee Dam and Power Plant, Schedule, Specifications, and Drawings, Specifications No. 570* ([Denver]: [U.S. Bureau of Reclamation], 1934) and U.S. Bureau of Reclamation, *Completion of Grand Coulee Dam, Left Powerhouse, and Foundation for Pumping Plant, Columbia Basin Project, Washington, Schedule, Specifications, and Drawings, Specifications, no. 757* (Denver: W. H. Kistler Stationery, 1937). For abstracts of these and descriptions of the bid openings see: A. Gilbert Darwin, "Grand Coulee Dam and Power Plant Specifications," *Western Construction News* 9 (April 1934): 103-114; "Brief Digest;" "Inland Empire Celebrates Opening of Bids on Grand Coulee Project," *Pacific Builder and Engineer* 40 (7 July 1934): 16-17; "Construction Start Soon;" "Bids Close December 10 for Completion of Coulee Dam," *Pacific Builder and Engineer* 43 (6 November 1937): 30-1, 53; "Plans for Completion of the Grand Coulee Dam," *Western Construction News* 12 (December 1937): 479-82; "Opening Of Bids For Contract To Complete Grand Coulee High Dam," *Reclamation Era* 28 (January 1938): 1; and "Consolidated Builders Tackle Work of Completing Coulee Dam," *Pacific Builder and Engineer* 44 (2 April 1938): 38-9. For an additional description of the variety of work that Grand

worked on numerous USBR dams. For example, six of the seven major contractors from Hoover Dam (Utah Construction Company, W. A. Bechtel and Kaiser, MacDonald and Kahn, J. F. Shea Company, Pacific Bridge Company, and Morrison Knudsen Company) also worked on Grand Coulee Dam. In addition to major construction contracts, the USBR hired firms to manufacture and install the mechanical and electrical equipment, such as turbines and generators. More local firms also obtained smaller contracts. For example, the early excavation contract went to the David H. Ryan Company, which subcontracted the work to the Goodfellow Brothers of Wenatchee and the Roland Construction Company of Seattle.<sup>31</sup>

Like the engineers' relationships with local supporters and federal superiors, the USBR engineers had a spectrum of interactions with their contractors. Simultaneously on different aspects of the work of dam building, USBR engineers led, delegated to, and cooperated with contractors. The USBR and their corporate partners could collaborate. For example, the initial low dam design came from informal discussions between USBR engineers and corporate colleagues. USBR engineers also conducted experiments to improve concrete mixers, although contractors owned and operated that construction equipment. Finally, USBR engineers delegated authority to the contractors. The most difficult planning task USBR engineers gave the contractors was diverting the river during construction. While the USBR did consult on this plan, the contractor had ultimate responsibility for design, implementation, and success. For the most part, the USBR men clearly led. The USBR designed the dam and kept close watch on the contractors' implementation of their plans.

Cooperation between USBR engineers and corporate engineers actually played an

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Coulee Dam's contractors undertook see: Averill, "Grand Coulee Low Dam."

<sup>31</sup> Acting Chief Engineer S. Harper to E. Mead, 23 Nov. 1933, 534:301.1 7/1/33-6/30/34, Entry 7/30-45-CBP, WDC, RG 115; "Opening of Bids;" "Construction Start Soon;" "Plans for Completion;" "Opening Of Bids;" "Consolidated Builders;" Fred K. Ross, "Western Pipe & Steel Start Work On Contract Involving...Nine Miles Of Welding," *Pacific Builder and Engineer* 44 (5 November 1938): 34-36; Warne, *Bureau of Reclamation*, 29-30; and Pitzer, *Grand Coulee*, 90, 99-100, 196-7, and 208.



important role in shaping the USBR engineers' first design of a low dam for the Grand Coulee site. The idea to build a 250-foot multiple-arch dam emerged from interactions between the engineers of Electric Bond and Share (EB&S) and the USBR. In early February 1933, Commissioner Mead met with engineers from EB&S and they gave him an eleven-page report that proposed a low, multiple-arch dam for the Columbia River location. Mead forwarded the report to Chief Engineer Walter who added that a low dam might later be expanded into the high dam endorsed by the USBR's January 1932 report. This exchange of ideas might have been insignificant except, a few months later, the USBR engineers formulated the plan to begin Grand Coulee Dam with \$62 million with the EB&S plan in mind. In April, when Walter initial endorsed a low dam, he referred explicitly to the corporate plan. In addition, the USBR men adopted the basic form for a low dam from the EB&S plan. The EB&S plan specified a 330-footlong multiple-arch dam that would stand 205 feet above the foundation. The powerhouse was to have thirteen generators that would each produce 65,000 kW of electricity for a total installed capacity of 845,000 kW. The USBR engineers in Denver proposed a very similar dam for inclusion in the relief program. They specified a slightly longer and higher dam—3420 feet and 251 feet respectively. Like the EB&S plan, USBR men called for a multiple-arch structure in the main section. The USBR engineers altered the EB&S design by proposing that the left third of the dam—the section that would abut the powerhouse and contain penstocks—be a gravity structure. Between the two proposals, the powerhouses differed the most. With eight 65,000-kilowatt generators, the USBR dam would have only a little more than three-fifths of the installed capacity of the EB&S dam.<sup>32</sup>

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<sup>32</sup> [Electric Bond & Share], "Columbia Basin Project Amended Plan 147 Ft. Head," [1933], 541:320 1/1/33-12/21/36, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to R. F. Walter, 8 Feb. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; R. F. Walter to E. Mead, 14 Mar. 1933, 438:791-D-1 10/31-2/34, EC-CB, CE, RG 115; E. Mead to D. Green, 21 Mar. 1933, 541:320 1/1/33-12/31/36, Entry 7/30-45-CBP, WDC, RG 115; D. Green to E. Mead, 22 Mar. 1933, 541:320 1/1/33-12/31/36, Entry 7/30-45-CBP, WDC, RG 115; E. Mead to R. Walter, 22 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; R. F. Walter to E. Mead, 24 Apr. 1933, 536:301.1 thru 6/33, Entry 7/30-45-CBP, WDC, RG 115; and USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development

USBR engineers cooperated with corporate partners more intentionally when they conducted research on concrete mixing at Grand Coulee Dam. MWAK and CBI manufactured all the concrete for Grand Coulee Dam on site. In the last step, large mixers combined gravel, sand, cement, and water. For this task, MWAK constructed two plants—Westmix and Eastmix—and equipped each with four mixers that could each hold four cubic yards. During the winter of 1936-7, USBR engineers and MWAK men collaborated on redesigning these mixers to increase mixing speed. MWAK built model mixers (one-thirteenth capacity) and gave them to the USBR testing laboratory at the Grand Coulee Dam site. The USBR engineers tested between fifty and sixty different arrangements of mixer blades seeking the shortest time to produce a uniform product. The best design reduced nine blades to three and reoriented them. These new arrangements shortened mix and discharge time by 16 percent. Since CBI had to mix 5,800,000 cubic yards of concrete thirty-two cubic yards at a time, this timesaving was substantial. Scientific work of USBR engineers improved the contractors' efficiency—truly cooperation.<sup>33</sup>

At the same time, USBR engineers delegated certain tasks entirely to the contractors and followed their lead in these areas. Most significantly, they left diversion of the river to the contractor. In order to build the dam, MWAK had to expose the rock foundation under the Columbia River. Diverting the Columbia River was no trivial task. The Columbia River contains a large and highly variable quantity of water. Engineers estimated its largest flood at 725,000 cubic feet per second. Further, they estimated a typical low flow of 17,500 cubic feet per second, a typical average of 109,000 cubic feet per second, and a typical high flood of 445,000 cubic feet per second. With this range, the height of the Columbia River varied about fifty feet at the head of the Grand Coulee over a year. The

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(low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115, 11.

<sup>33</sup> "Manufacturing 4,500,000 c. y. of Concrete for Coulee Dam," *Pacific Builder and Engineer* 42 (4 January 1936): 30-36 and Fred K. Ross, "Mixing Time Reduced at Grand Coulee: Reclamation Bureau Works out New Blading Arrangement for Mixers," *Pacific Builder and Engineer* 44 (5 November 1938): 28-

money spent to handle the river indicated the magnitude of the task. Before bidding, men in the construction industry estimated that the price for diversion would differentiate the bids. The item turned out to be the third largest in MWAK's bid after excavation and pouring the concrete in the main part of the dam. Diverting the river accounted for \$3,500,000 of the \$29,300,000 MWAK bid for building the low dam.<sup>34</sup>

USBR engineers only assisted with the plans for "diversion and care of the river." USBR engineers and the CBC suggested general concepts for diversion before the bid. The USBR convened their consulting board at the bid opening so that the board could review the diversion plan before the USBR accepted a bid. The USBR also reviewed the analysis of the stability of the temporary structure and, at the contractors' request, modeled the effect of part of the effort on the river's dynamics.<sup>35</sup>

The planning and responsibility lay with the contractor. MWAK's engineering staff—New York Consulting Engineer S. H. Woodard, Chief Engineer Francis Donaldson, Construction Engineer C. L. Riddle, Cofferdam Engineer R. L. Telford, and Designing Engineer James O. Foster—designed and approved the cofferdams. They decided to build the sides of the dam inside semicircular temporary dams on both sides of the river. Then, the company would de-water the middle by diverting the river over the west side of the in-process dam and connect the two ends. Unlike at Hoover Dam where the government agreed to bear the financial costs if the cofferdams failed, MWAK accepted full financial responsibility for the diversion. The contract between MWAK and the USBR provided that the company would only be paid for diversion when it had poured concrete to

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<sup>34</sup> O'Sullivan, "Diverting the Columbia River;" "Grand Coulee;" and O. G. F. Markus, "Diversion and Care of the River," *Reclamation Era* 25 (November 1935): 217-219.

<sup>35</sup> O'Sullivan, "Diverting the Columbia River;" R. F. Walter to C. H. Paul, 14 May 1934, 533:301.3 '30-'35; Entry 7/30-45-CBP, WDC, RG 115; F. Banks to R. Walter, 31 Aug. 1934, 438:791-D-1 3/34-9/34 (f1), EC-CB, CE, RG 115; H. L. Myer to F. A. Banks, 9 Nov. 1935, 437:791-D-1 10/35-12/35, EC-CB, CE, RG 115; F. Banks to R. Walter, 11 Nov. 1935, 437:791-D-1 10/35-12/35, EC-CB, CE, RG 115; J. E. Warnock to J. Savage, 9 Apr. 1936, 286, Reports 10-55, ERC, RG 115; and J. E. Warnock to J. Savage, 8 May 1936, 286, Reports 10-55, ERC, RG 115.

a specified height.<sup>36</sup>

While USBR engineers delegated certain tasks to the contractors, they kept tight control of the dam's design and of construction methods. The engineers had an elaborate system for communicating plans to contractors and monitoring their compliance. Drawings served to direct the work. Inspectors assured construction techniques.

USBR engineers directed MWAK and CBI's work primarily through hundreds of drawings. This process began with the materials that the USBR prepared for prospective contractors to aid them in making a bid. USBR engineers produced elaborate technical documents for all their major works that they published in a series *Schedule, Specifications, and Drawings*. These documents explained the work to be done with text and drawings and gave prospective bidders the forms for itemizing. For the two major contracts on Grand Coulee Dam, these documents contained fifty-six and 122 illustrations respectively. During the process of construction, USBR engineers in Denver made numerous detail drawings that superseded these preliminary ones. They sent these drawings to USBR Construction Engineer Frank Banks's site office, which in turn gave the drawings to the contractor. Nothing happened on the dam without the appropriate authorization from Denver that often came in the form of drawings. For example, in January 1936 MWAK and Banks negotiated with the Denver Office over the pouring schedule for a section of the downstream edge of the dam but could not go ahead without drawings from Denver. H. Leslie Myer, MWAK's general manager, worried that any delay in pouring this section would delay the entire dam. Correspondence only gradually brought agreement on a modified plan. Banks wrote several times requesting drawings to prevent delay before the Denver engineers approved a plan and sent the illustrated

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<sup>36</sup> "Brief Digest;" "Work Starts on Cofferdams on Coulee Project," *Pacific Builder and Engineer* 41 (5 January 1935): 39-41; and Walter A. Averill, "How Mason-Walsh-Akkinson-Kier Built World's Largest Cellular Cofferdam in 90 Days—Establishing a New Record," *Pacific Builder and Engineer* 41 (4 May 1935): 24-31.

guidelines.<sup>37</sup>

USBR guaranteed that contractors followed directions with an elaborate inspection system. The USBR engineers site office employed many inspectors who worked shifts along side the construction men. Inspectors primarily oversaw the pouring of concrete for the dam and the grouting of its foundation. (Foundation grouting was a procedure in which technicians pumped very thin cement into deep holes drilled into the bedrock under a dam to seal any cracks in the rock.) Inspectors verified the quality of these operations. For example, MWAK and CBI poured Grand Coulee Dam in blocks and engineers reviewed the set-up for each before pouring. The process for setting up a block included the following:

- 1) placing wood and metal forms to hold the concrete. Typical forms ranged from 265 cubic yards to 463 cubic yards. The largest were fifty feet by fifty feet by five feet.
- 2) installing hardware for the block. This included pipes for grout, metal sheets to manage the flow of grout in the structure, pipes to carry water to cool the concrete as it set, and pipes for drainage.
- 3) cleaning the concrete and metal surfaces. This step insured that the new block bonded to those surrounding it.

USBR inspectors checked the performance of all these tasks and issued an OK valid for

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<sup>37</sup> The specifications for Grand Coulee Dam are: USBR, *Grand Coulee Dam* and USBR, *Completion of Grand Coulee Dam*. The task of transmitting drawings was important and general enough to require instructions on performing it. See: R. Walter to All Field Offices, 7 Mar. 1934, 774:395.30 1/30-6/45, Entry 7/30-45, WDC, RG 115 and Office Memo No. 199, 7 Feb. 1940, 774:395.30 1/30-6/45, Entry 7/30-45, WDC, RG 115. Also, Commissioner Page resisted the idea of changing these procedures for Grand Coulee Dam. See: J. Page to H. J. Kaiser, 7 June 1938, 478:101.03 1930 thru, Entry 7/30-45-CBP, WDC, RG 115. On the episode where the lack of drawings threatened to delay construction, see: H. L. Myer to F. A. Banks, 6 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; F. A. Banks to R. Walter, 14 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; F. A. Banks to R. Walter, telegram, 15 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; F. A. Banks to R. Walter, 15 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; R. Walter to F. Banks, telegram, 17 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; R. Walter to F. Banks, telegram, 20 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; F. Banks to R. Walter, 23 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; Acting Chief Engineer S. Harper to F. Banks, 24 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115; and Acting Chief Engineer S. Harper to F. Banks, telegram, 24 Jan. 1936, 444:791-I 1936, EC-CB, CE, RG 115.

three hours. If the contractor did not pour in that time, USBR men had to re-inspect.<sup>38</sup>

USBR engineers' authority to direct design and construction extended to rejecting the contractors' construction plans. For example, in the winter of 1938-9, USBR engineers rejected a proposal from CBI to speed pouring. CBI formulated several plans for faster construction of the dam. The Denver leadership rejected these plans because of fears that such changes might decrease the safety of the dam. The engineers attempted to accommodate some of the contractors' requests but they vetoed the overall plan.<sup>39</sup>

Like relationships with local boosters and the Roosevelt administration, the USBR had a broad spectrum of interactions with its contractors. At times, USBR engineers and their corporate partners collaborated. Discussions between USBR and EB&S engineers inspired the initial design for the low, multiple-arch dam at the Grand Coulee site and cooperative experiments on cement mixers reduced mixing time. The USBR also delegated the lead to the contractor for certain tasks. At Grand Coulee Dam, the largest and most intellectually demanding task given to the contractors was diversion of the river. For the main construction activities, however, USBR engineers retained tight control. With the design of the dam and its implementation through drawings and inspecting, the USBR men directed the contractors' activities. USBR engineers also had the authority to block the contractors' plans as they did when CBI wanted to speed concrete pouring in the winter of 1938-9.

### **Conclusion**

The construction of Grand Coulee Dam happened through a complicated web of

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<sup>38</sup> F. A. Banks, "Significance of Grand Coulee Dam," *The Reclamation Era* 26 (December 1936): 278-9 and "Handling Concrete...In the Blocks at Coulee," *Pacific Builder and Engineer* 45 (5 August 1939): 26, 27, 65.

<sup>39</sup> J. Savage to R. Walter, 1 Dec. 1938, 535:301.1 1938, Entry 7/30-45-CBP, WDC, RG 115; CBI, "Grand Coulee Dam. Fast Concrete Placing. Program No. 4," 4 Dec. 1938, 535:301.1 1938, Entry 7/30-45-CBP, WDC, RG 115; CBI, "Grand Coulee Dam. Contract Program," 6 Dec. 1938, 535:301.1 1938, Entry 7/30-45-CBP, WDC, RG 115; R. Walter, F. Banks, J. Savage, L. McClellan, and J. Hammond to J. Page, 12 Dec. 1938, 433:791-D-1 11/38-1/39, EC-CB, CE, RG 115; and J. Page to H. Ickes, 14 Dec. 1938, 433:791-D-1 11/38-1/39, EC-CB, CE, RG 115.

relationships between four important groups: local boosters, USBR engineers, the Roosevelt administration, and corporate contractors. At points, one particular group dominated. Local boosters carried the hope for development through the early planning. Roosevelt and his advisors influenced the dam most directly by setting a budget. USBR engineers delegated tasks, such as diverting the river, to contractors. The USBR men vigilantly controlled the technical design of the dam. Yet, the groups all also followed one another and had genuine moments of collaboration.

Throughout building Grand Coulee Dam, USBR engineers had a special, and yet still contested, role in this web of relationships. The other three groups interacted much more with USBR engineers than with each other. USBR engineers also wielded considerable power in both the technical and political decision making about Grand Coulee Dam. However, they could not act without the support of the other three groups. Further, local boosters and the Roosevelt administration both challenged the engineers' authority. The engineers' power was by no means absolute.

This ambiguous position held by USBR engineers and the range of the relationships between engineers and the other groups involved with the dam, and especially cooperation, makes an important historiographic point. USBR engineers were neither the absolute leaders nor the technical toadies often-portrayed in interpretations of engineers of public works and, particularly, water development projects. USBR engineers did not have the authority to develop the Columbia River without regard to the wishes of others. Neither did local interest groups control the engineers. The relationships among the groups around Grand Coulee Dam constantly shifted. At any point, engineers, local boosters, contractors, or administration leaders could lead, follow, or collaborate.

This ambiguous position of USBR engineers and the complicated relationships between the groups involved in building Grand Coulee Dam also points to an important feature of establishing "multiple purpose" dams as the paradigm for American river development and water resources management. This transition took more than interested

parties, good ideas, and technical knowledge. It also took experts at social interactions. USBR learned to be in and cultivate complex relationships with local boosters, administration superiors, and contractors as they built Grand Coulee Dam and the other large projects of the 1920s and 1930s. After World War Two, they used these skills as they built many more such projects.



## Chapter 8—Conclusion

Somewhat later than mechanical engineers who followed Frederick W. Taylor's approach to "rationalizing" factories, engineers of the U.S. Bureau of Reclamation (USBR)<sup>1</sup> and their colleagues in the Army Corps of Engineers (Army) created "one best way" to "rationalize" rivers. Starting from a Progressive reform heritage, engineers of the USBR, especially, evolved a set of technical practices, values guiding their work, and skills at interacting with development enthusiasts and their government superiors. This system quite reliably led engineers to think that American rivers should be developed with multiple purpose dams. Federal engineers created this system as they made Grand Coulee Dam and the other large dams of the 1920s and 1930s into multiple purpose dams. They used it to transform the American waterscape after World War Two.

Grand Coulee Dam, one of the dams that taught federal engineers multiple purpose dam building, started as a local initiative. In 1917, development enthusiasts from Spokane, Washington, and small towns in and around the arid region southwest of the city known as the Columbia Basin began lobbying for irrigation farms. Each group, however, wanted a different technology. Businessmen from Spokane with a well-financed lobbying organization backed a "gravity plan." They imagined dramatically scaling up a traditional approach to irrigation. Engineers would divert water from a river at a higher elevation than the lands to be irrigated and let gravity bring the water to the land through a series of canals, tunnels, and lakes connected into a single waterway. In this case, the Pend Oreille River, a tributary to the Columbia River, would provide the water for the lands of the Columbia Basin. James O'Sullivan and his small town lawyer friends had another idea. They envisioned a really big dam on the Columbia River itself. The dam would provide

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<sup>1</sup> This agency was the U.S. Reclamation Service (USRS) from 1902-1923. In 1923, the Secretary of Interior changed its name to the U.S. Bureau of Reclamation as part of an administrative reorganization. Throughout this dissertation I will use the name U.S. Reclamation Service when events under discussion fall in the 1902-1923 period. I will use the name U.S. Bureau of Reclamation for events in the later period and general references.

electricity to pump water out of the Columbia's gorge, and the water would irrigate the Columbia Basin. Additional electric power would be sold commercially to attract industry to central Washington State and subsidize irrigation farming. These two groups carried their ambitions to the Washington State government. This action led to the formation of a third local group. State officials—both men in Washington State government positions and the Washington State federal congressional delegation—began lobbying for development of the Columbia River and Basin. All three groups asked for money for studies, permission to build, and, finally, construction funds from both the state and federal governments.

During the 1920s, successful appeals to the federal government brought federal engineers from the USBR, Army, and Federal Power Commission (FPC) into the process of planning the development of the Columbia River and Basin. These engineers both resisted participation in the activities of the Washington boosters and dominated the intellectual construction of the Grand Coulee Dam and the Columbia Basin Project. The staid professional engineers of the USBR particularly did not want to irrigate the Columbia Basin. The fighting between men from Spokane and small town boosters repelled the engineers. In addition, the USBR did not want responsibility for an enormous new irrigation area when they already had many farmers with ongoing financial troubles. Engineers from the FPC and Army might study water development, but they would not push for federal construction. The FPC only regulated and conducted studies on which to base its decisions. In the 1920s, the Army officially favored federal construction of dams only for navigation and, reluctantly, flood control. The FPC, however, needed information on the Columbia River because of the river's vast potential to produce electricity. The Army did not object to working with the FPC, which had no internal engineering staff, in constructing plans.

Once involved, federal engineers applied ideas about water development advocated by Progressive conservationists and produced a development plan for the Columbia River and Basin. FPC, Army, and USBR engineers all studied the Columbia River and Basin in

the 1920s. They analyzed the area with the goal of developing water in as many ways as possible and using reservoirs to increase water resources. This “comprehensive planning” perspective meant balancing irrigation, navigation, flood control, and hydroelectric production. Through these activities, federal engineers developed plans for pumping projects to irrigate the Columbia Basin that complemented state plans for gravity projects. They also selected a pumping approach. They decided that the region ought to have a large multiple purpose dam at the head of the Grand Coulee, extensive hydroelectric power facilities, and an irrigated farming region in the Columbia Basin.

In 1933, Franklin Roosevelt approved a different project for the Grand Coulee damsite. USBR engineers, in turn, focusing on a development project that would meet their financial criteria, changed the design three times before finally re-establishing the late 1920s plan for a combination dam, hydroelectricity, and irrigation project. Initially, President Roosevelt approved a two-step approach to developing the Columbia River and Basin. In the mid-1930s, USBR engineers would build a 250-foot multiple-arch dam with a 520,000 kW powerhouse. Later, they would double the size of the dam and add the irrigation project. However, when Roosevelt approved this project, he also authorized the Army to build Bonneville Dam on the Columbia River near Portland, Oregon. USBR engineers rapidly decided that in this competitive environment the two-step project would not succeed financially.

USBR engineers had a very particular financial goal for their dams: recover the government’s investment. In the Reclamation Act of 1902, Congress required that farmers on federally irrigated land repay the money spent on irrigation works. Although by 1933 farmers had failed repeatedly to meet their obligations, USBR engineers still sought to design developments that would meet this demand. They looked to a new source for repayment, however. Positive experiences selling hydroelectricity, especially the willingness of Southern Californian cities and utilities to contract for enough electricity from Hoover Dam to entirely pay for the enormous structure, made electricity customers

the prime new candidates.

In Washington State, USBR engineers feared that cheaper electricity from Bonneville Dam would fill the regional needs and Grand Coulee Dam would be left without electricity customers. To address this problem, they changed the design of Grand Coulee Dam several more times. First, they abandoned the multiple-arch structure to a low, gravity dam to reduce the costs of building in two-steps. Yet, this did not resolve the underlying problem. As soon as the USBR began constructing the low dam, the leaders started a campaign for the high dam and irrigation project. USBR engineers hoped building the full project immediately would solve the competition problem by both reducing the cost of electricity from Grand Coulee Dam and increasing electricity demand. Congress and the administration debated the merit of this more expensive undertaking for several years but ultimately allowed the USBR to build the high dam without any break.

Relief, electricity, and conservation intertwined as the reasons the Roosevelt administration sponsored dam building. At first, Roosevelt funded major public works projects, such as Grand Coulee Dam, as part of his relief program. Quickly, however, dams proved to be poor relief projects. Engineers took too long to spend money and, when they did, they spent too much on materials rather than people. By 1935, dams figured more in electricity policy than relief. In that year, Roosevelt and his advisors launched a series of programs to reform the electric power industry. Enabling the federal government to produce electricity, dams took a place alongside holding company legislation, the Rural Electrification Administration, household electrification, and other programs to curb the excesses and remedy the weakness of American electrification. Alongside relief and electrical reform, conservation motivated New Dealers to support dam building. Franklin Roosevelt followed his uncle and earlier President Theodore Roosevelt in guiding natural resources policy toward management by federal scientists for long-term heavy use of resources. Franklin Roosevelt made Grand Coulee Dam part of this conservation agenda by stipulating that any dam on the Columbia River be part of a

“comprehensive plan.”

These three groups and the ways they thought about dams came together in a complex set of relationships that enabled the construction of Grand Coulee Dam as a multiple purpose project. At various times, each of the three groups led, each followed, and, at times, they cooperated. The areas that each group dominated differed, however. Washington State boosters provided the initial push to plan irrigation for the Columbia Basin. Federal engineers selected the method of development and managed construction. The Roosevelt administration set boundaries, such as the budget of \$62 million that the engineers operated under for four years.

Although local boosters, the Roosevelt administration, and federal engineers all played vital roles in the processes that ended with the construction of Grand Coulee Dam, federal engineers and the engineering culture within the USBR had special influence over the form of Grand Coulee Dam. Five aspects of the culture of engineering of the USBR in the 1920s and 1930s had particular importance: a Progressive heritage, an ethic of professional autonomy, commitment to conservationist water development, concern with cost, and complex relationship skills.

USBR engineers had strong connections to Progressive Era reform traditions. Reformer politicians and engineers—Theodore Roosevelt, Nevada Senator Francis Newlands, and Frederick Newell—led the legislative effort to establish a federal irrigation program. Subsequently, reformer engineers Frederick Newell and Arthur Powell Davis headed the new USRS from 1903 to 1923. Many of the engineering leaders of the USBR during the 1920s and 1930s learned engineering and reform directly from Newell and Davis as junior engineers in the USRS. For example, Construction Engineer Frank Banks, the USBR engineer in charge of the site office for Grand Coulee Dam, began working for the USRS in 1906 and devoted fifty-one years to the organization.

This Progressive heritage encouraged a strong sense of professional autonomy. USBR engineers initially resisted working on plans to irrigate the Columbia Basin because

of a political division in Washington State and the efforts of two groups to manipulate the organization. Once drawn into working on studies and later the dam, USBR engineers tried and generally succeeded in keeping local boosters out of what they considered technical decisions. For example, USBR engineers obtained control of an investigation of irrigation options in the mid-1920s and prevented James O'Sullivan and Washington State consulting engineers from influencing design decisions as they planned the "low," gravity dam in 1933-4.

This independence, combined with other conservationist water development ideas of their Progressive heritage, directed USBR engineers toward multiple purpose dam building. USBR engineers believed that their expertise could best guide resource development and acted accordingly. They also thought that reservoirs would solve many water development problems. USBR experience with the development of hydroelectricity in conjunction with irrigation at Hoover Dam in the 1920s convinced USBR engineers of the merits of another basic idea advocated by Progressive conservationists: comprehensive planning. In planning the development of the Columbia River and Basin, USBR engineers drew on all three of these ideas. First, they repeatedly maneuvered for control of decision-making processes. Second, they endorsed a development plan that evaluated the potential of the upper Columbia River in terms of navigation, flood control, irrigation, and hydroelectric development and combined hydroelectricity and irrigation. Further, the 450-foot dam at the head of the Grand Coulee created an enormous reservoir that increased the potential of the Columbia River to generate hydroelectricity.

A strong commitment to a particular financial outcome also underpinned the rise of multiple purpose dam building. USBR engineers designed and re-designed Grand Coulee Dam to create a development project that they thought would repay the government's investment. In the end, the USBR engineers decided that only a combination project including substantial hydroelectricity would meet their financial goals. The USBR's financial failures in its first two decades, and the processes of investigation and

retrenchment that resulted, sensitized USBR engineers to financial issues.

Finally, relationship skills developed in building Grand Coulee Dam and the other projects of the 1920s and 1930s encouraged further multiple purpose building. USBR engineers negotiated a complicated web of relationships with dam enthusiasts, federal superiors, and contractors to build dams. Engineers wielded considerable power with both technical and political decision processes. Yet, the other groups still challenged them, and they could not build dams without the support of local boosters and presidential administrations. In this situation, engineers combined leading, following, cooperating, and ignoring all the other groups as needed to build the dams of the 1930s. They repeated this complicated dance to build more multiple purpose dams.





## Appendix 1—Quantitative Data on the USBR

Fiscal Year	USBR dollars available for expenditure	USBR full-time employees	Dams completed by USBR
1903	\$856,903	nr*	2
1904	\$18,201,904	nr	nr
1905	\$8,759,905	nr	nr
1906	\$-9,709,267	2998	1
1907	\$16,213,314	6563	0
1908	\$10,013,673	4245	5
1909	\$10,380,859	4864	2
1910	\$8,505,960	5423	6
1911	\$24,724,701	8275	4
1912	\$7,287,912	6468	2
1913	\$6,230,913	6611	3
1914	\$9,766,080	8170	1
1915	\$11,743,957	8373	4
1916	\$13,531,916	5410	1
1917	\$8,904,474	6483	1
1918	\$8,539,131	5288	1
1919	\$9,842,196	3819	1
1920	\$7,850,197	3783	4
1921	\$9,126,098	4507	1
1922	\$20,603,793	3667	0
1923	\$15,361,453	nr	1
1924	\$12,565,991	nr	3
1925	\$13,642,734	nr	1
1926	\$12,365,166	nr	1
1927	\$7,558,247	nr	4
1928	\$12,205,728	nr	1
1929	\$14,445,329	nr	1
1930	\$8,744,930	nr	1
1931	\$20,243,931	nr	2
1932	\$22,372,932	nr	2
1933	\$25,868,886	nr	1
1934	\$98,663,367	nr	0
1935	\$31,702,472	nr	1
1936	\$52,368,782	nr	2
1937	\$58,092,899	5651	4
1938	\$73,509,053	6052	7
1939	\$47,789,193	6270	5
1940	\$80,882,572	7150	1
1941	\$74,549,055	7636	2

1942	\$102,802,797	8016	2
1943	\$91,665,613	6543	1
1944	\$41,612,519	6513	0
1945	\$27,435,945	7033	2
1946	\$120,945,596	14362	4
1947	\$119,633,035	16250	2
1948	\$143,186,986	nr	4
1949	\$266,774,495	15653	10
1950	\$358,310,460	18962	3
Dams under construction in 1950.			19

\* The USBR did not report these figures every year. "nr" means not reported.

This table was compiled from the annual reports of the USBR. These documents appeared annually from 1902 (first)-1932 (thirty-first). The report appeared within the *Annual Report of the Secretary of the Interior* after 1933.<sup>1</sup>

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<sup>1</sup> "Annual Report 1902"- "Annual Report 1950".

## Appendix 2—Illustrations

- Illustration 1: "The completed Grand Coulee Dam, minus the third powerhouse." Pitzer, *Grand Coulee*, 246.
- Illustration 2: "Hail Columbia Country." Sundborg, *Hail Columbia*, inside front cover.
- Illustration 3: "James O'Sullivan." Pitzer, *Grand Coulee*, 290.
- Illustration 4: "Rufus Woods." Pitzer, *Grand Coulee*, 156.
- Illustration 5: "Roy Gill." Pitzer, *Grand Coulee*, 48b.
- Illustration 6: "Senator C. C. Dill." Billington, *People, Politics, and Public Power*, 428.
- Illustration 7: "O. L. Waller, Vice President." Enoch Albert Bryan, *Historical Sketch of the State College of Washington, 1890-1925*. Spokane, WA: The Alumni and the Associated Students, 1928), 327.
- Illustration 8: "The Reclamation Commission [Includes A. P. Davis and F. H. Newell.]" *Reclamation Record* 5 (January 1914): 16.
- Illustration 9: "Theodore Roosevelt and Gifford Pinchot...." William Manners, *TR and Will: A Friendship That Split the Republican Party* (New York: Harcourt, Brace & World, Inc., 1969), 146h.
- Illustration 10: "Senator Newlands addresses the crowd...." Rowley, *Reclaiming the Arid West*, 117.
- Illustration 11: "Dr. Elwood Mead." *Reclamation Era* 26 (February 1936): front cover.
- Illustration 12: "John C. Page." *Reclamation Era* 27 (February 1937): front cover.
- Illustration 13: "Commissioner [David W.] Davis (right) and Chief Engineer Weymouth...." *Reclamation Record* 14 (November-December 1923): 331.
- Illustration 14: "Raymond F. Walter." *Western Construction News* 9 (April 1934): 103.
- Illustration 15: "John Lucian Savage." *Reclamation Era* 27 (April 1937): 82.
- Illustration 16: "Who's Who on Grand Coulee Dam, Washington." *Reclamation Era* 30 (November 1940): 309.
- Illustration 17: "Charles H. Paul et al." *Western Construction News* 9 (April 1934): 112.
- Illustration 18: "Grand Coulee—Power Site, High Dam, Plan and Elevation." House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, plate 57.
- Illustration 19: "Grand Coulee—Power Site, High Dam, Sections of Dam, Power House." House Committee on Rivers and Harbors, *Columbia River and Minor Tributaries*, plate 58.

Illustration 20: "Columbia River Dam, Low Multiple Arch." USBR, "Preliminary Estimate and Design: Columbia River Dam and Power Development (low-dam crest elevation 1085)," 24 May 1933, 294, Reports 10-55, ERC, RG 115.

Illustration 21: "Bartlett Dam...." Jackson, *Building the Ultimate Dam*, 192.

Illustration 22: Grand Coulee (low) Dam, Plan and Sections. USBR, *Grand Coulee Dam*, Drawings 8 and 12.

Illustration 23: "Change Order." *Pacific Builder and Engineer* 41 (3 August 1935): 36.

Illustration 24: "President Roosevelt views Grand Coulee Dam...." *Reclamation Era* 27 (November 1937): 259.

Illustration 25: "Secretary Ickes and Commissioner Page...." *Reclamation Era* 28 (November 1938): 219.



The completed Grand Coulee Dam, minus the third powerhouse. *Courtesy Wenatchee World.*



IDAHO

COLUMBIA

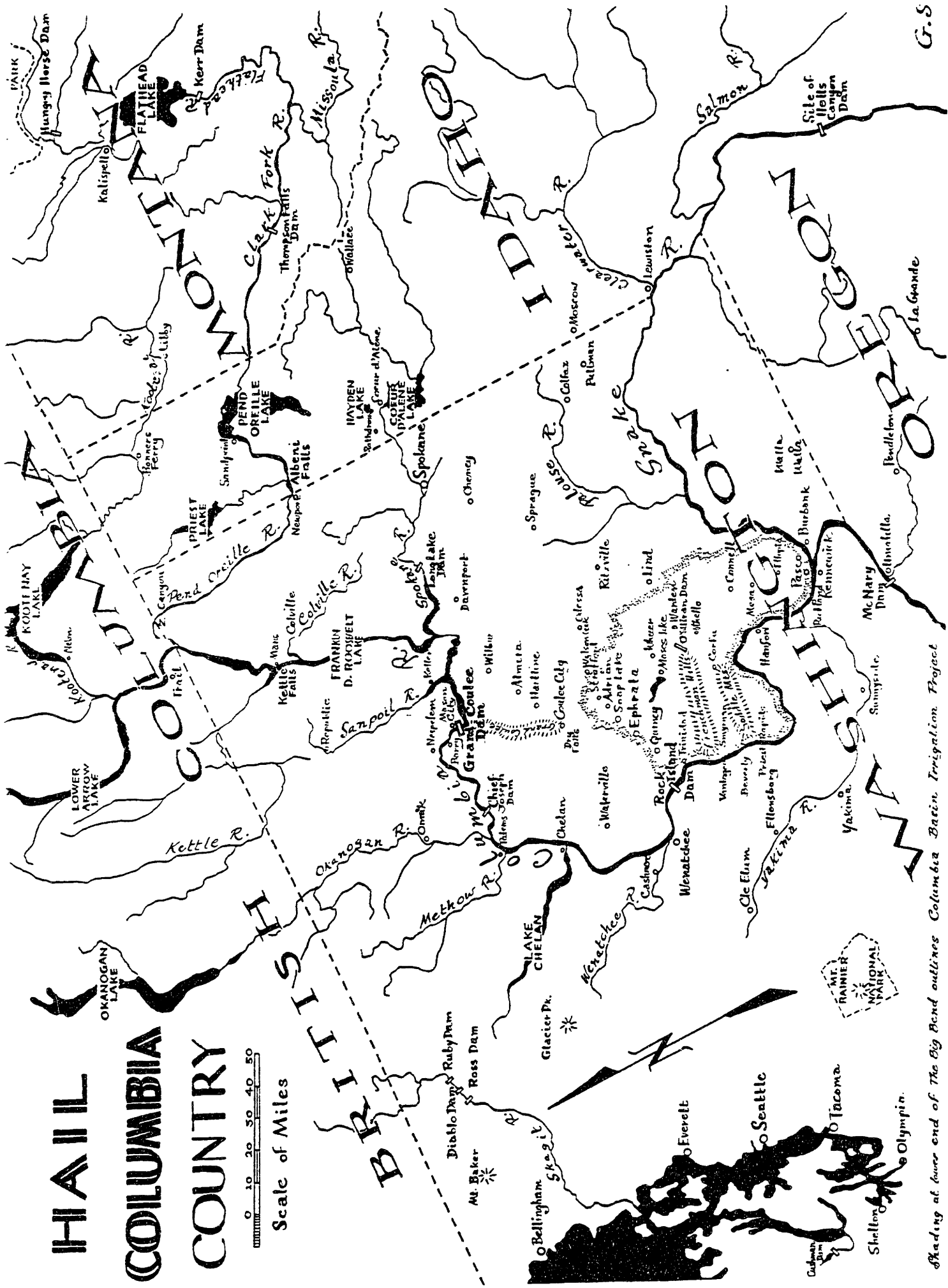
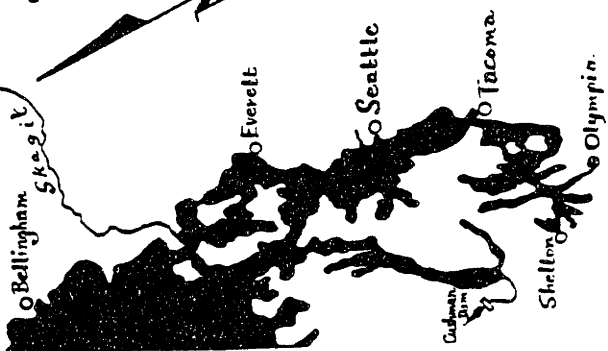
COUNTRY



Scale of Miles

BRITISH

DIABLO DAM & RUBY DAM  
ROSS DAM  
Mt. Baker  
Glacier Pt.



Shading at lower end of The Big Bend outlines Columbia Basin Irrigation Project







James O'Sullivan. *Courtesy Bureau of Reclamation.*





Rufus Woods. *Courtesy Bureau of Reclamation.*





Roy Gill. *Courtesy Eastern Washington State Historical Society, no. 83-32.*



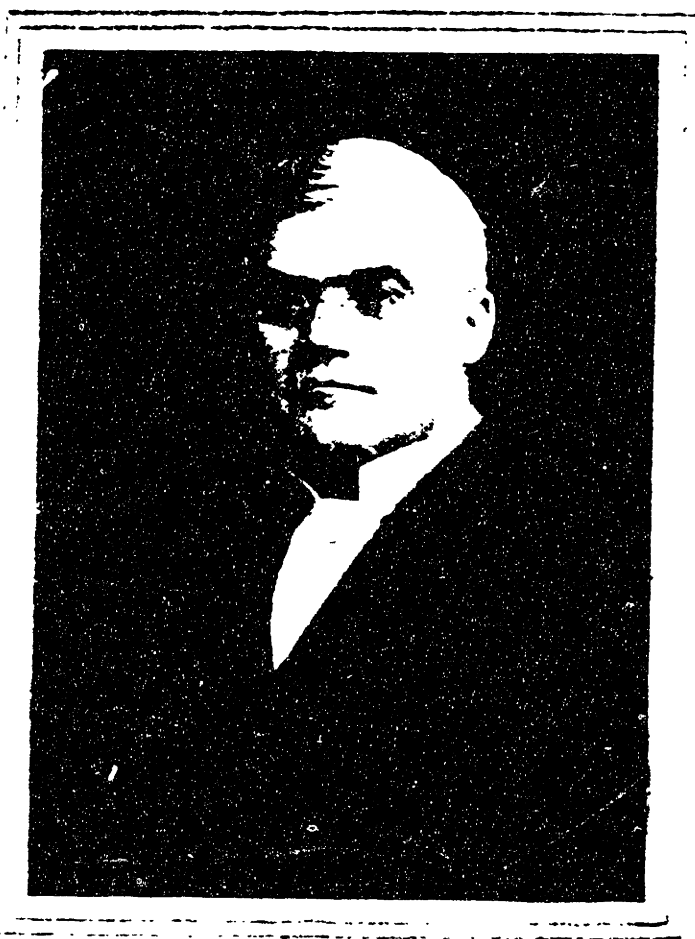


SENATOR C. C. DILL

*Courtesy BPA*







O. L. WALLER, *Vice President*





THE RECLAMATION COMMISSION  
From left to right: W. A. RYAN, Comptroller; J. D. O'DONNELL, Supervisor of Irrigation; A. P. DAVIS, Chief Engineer; W. R. KISS, Chief Counsel;  
F. H. NEWELL, Director; FRANKLIN K. JANI, Secretary of the Interior





UNDERWOOD & UNDERWOOD

Theodore Roosevelt and Gifford Pinchot on a trip of the Inland Waterways Commission down the Mississippi River, October, 1907





5. Senator Newlands addresses the crowd at the opening of Derby Dam, east of Reno on the Truckee River. This ceremony occurred on June 17, 1905, three years to the day after the passage of the National Reclamation Act of 1902. Photograph courtesy of the Nevada Historical Society. Used by permission.





# THE RECLAMATION ERA

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# THE RECLAMATION ERA

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VOL. 27, NO. 2



FEBRUARY 1937



JOHN C. PAGE  
NEWLY APPOINTED COMMISSIONER OF RECLAMATION





Commissioner Davis (right) and Chief Engineer  
Weymouth on Columbia Basin project.





Raymond F. Walter  
Chief Engineer







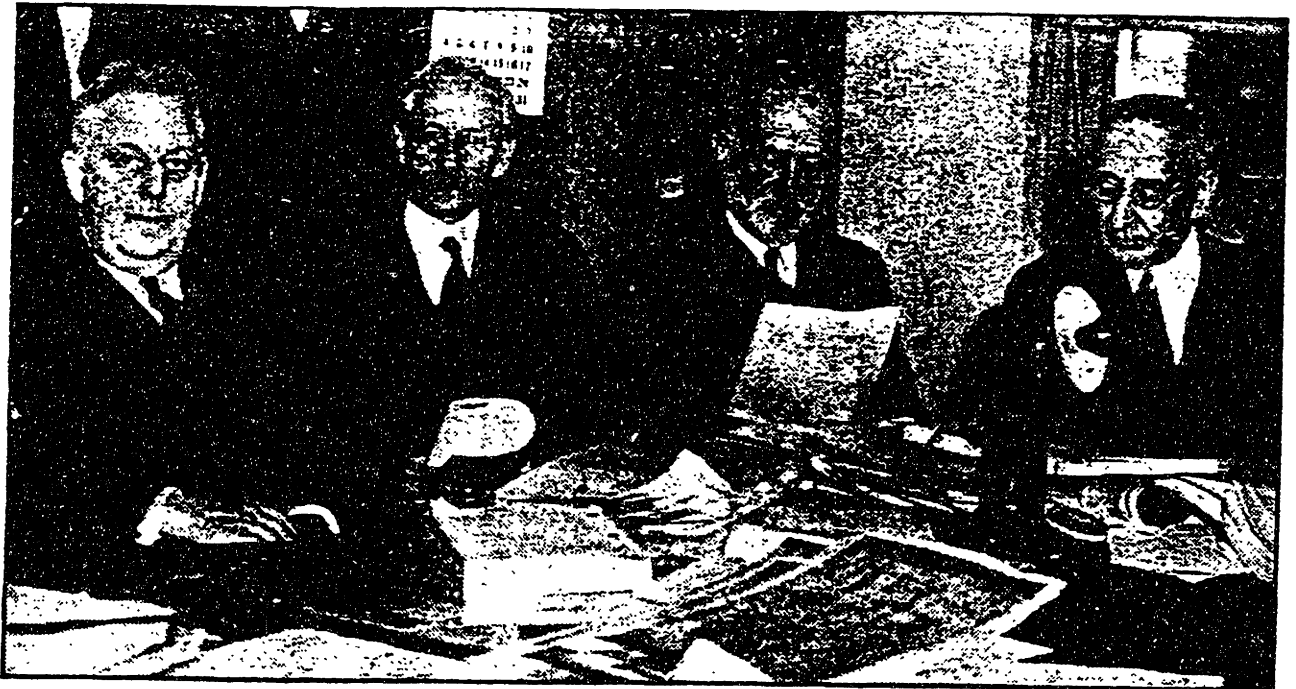
JOHN LUCIAN SAVAGE.



Who's Who on Grand Coulee Dam, Washington. *Left to right:* A. F. Darland, Construction Engineer; F. A. Banks, Supervising Engineer; Bert Hall, Chief Inspector; J. H. Miner, Assistant Supervising Engineer

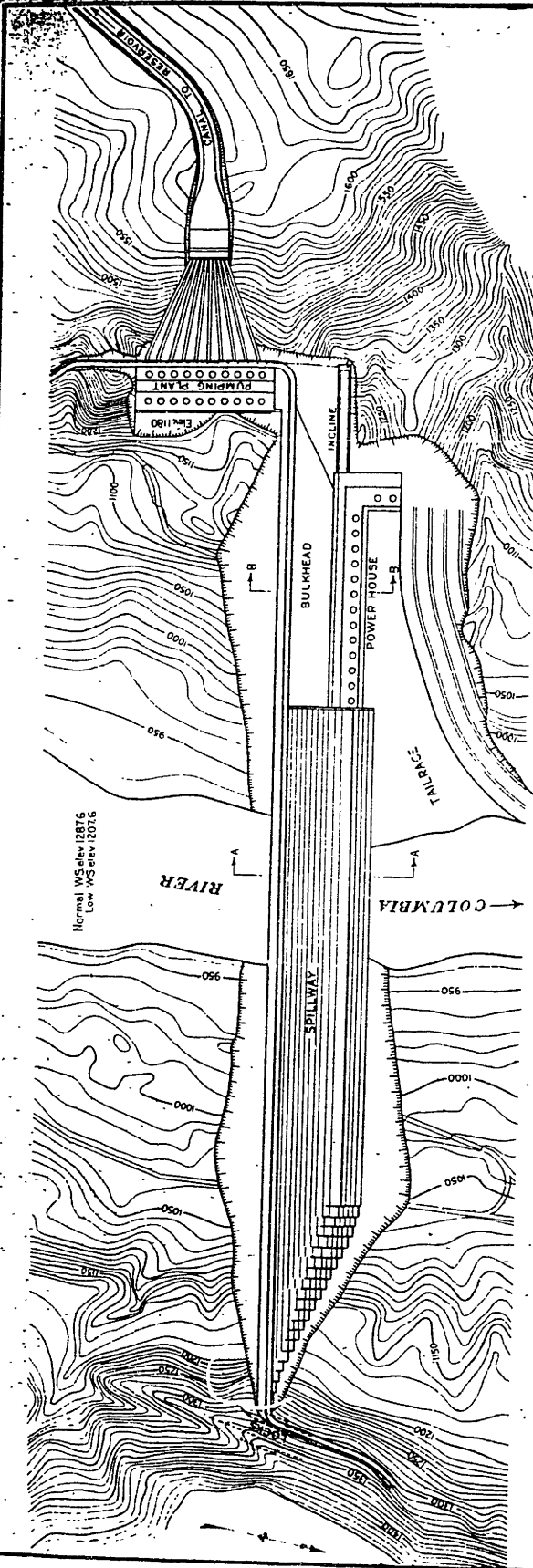




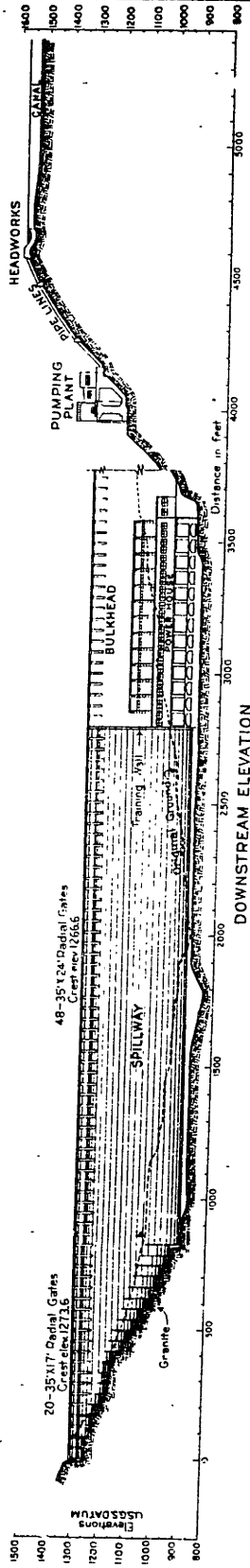


(Left to Right) Charles H. Paul, Dayton, Chairman; Charles P. Berkey, New York City; W. F. Durand, Stanford University; and Joseph Jacobs, Seattle; Members Bureau of Reclamation Consulting Board of Engineers on the Columbia Basin Irrigation and Power Project





GENERAL PLAN



DOWNSTREAM ELEVATION

**GRAND COULÉE - POWER SITE  
HIGH DAM  
PLAN AND ELEVATION**

In 1 Sheet Scale As shown

U.S. Engineer Office, Seattle, Wash., July 31, 1931  
Approved by the Chief of Engineers  
Checked by the District Engineer  
Designed by the District Engineer  
Drawn by the District Engineer  
FILE NO. 1041 (200)

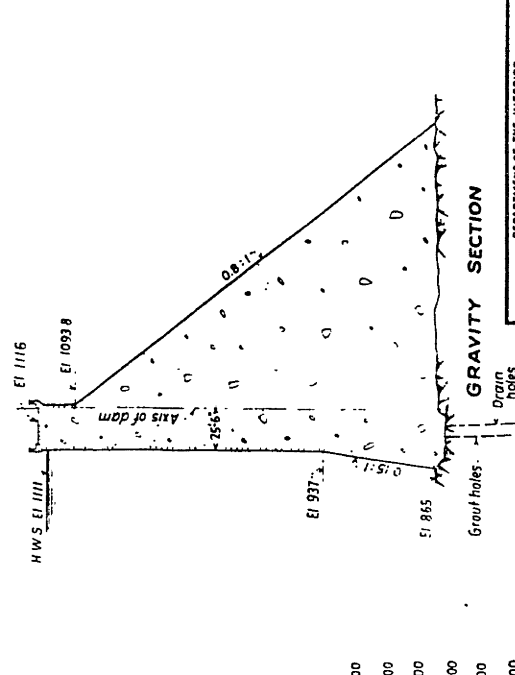
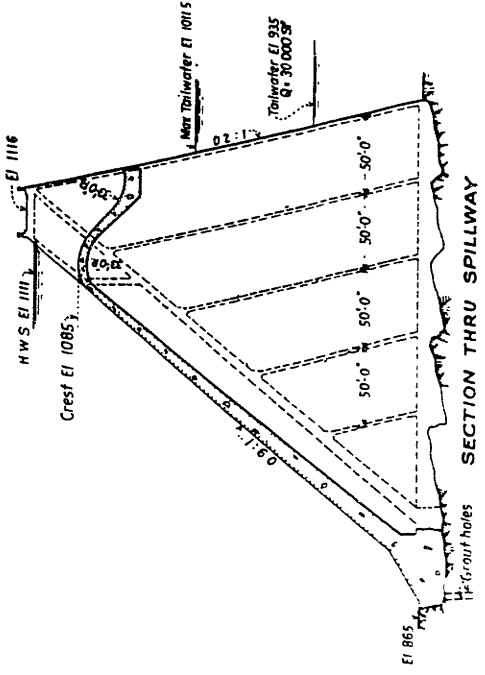
U.S. GOVERNMENT PRINTING OFFICE: 1928



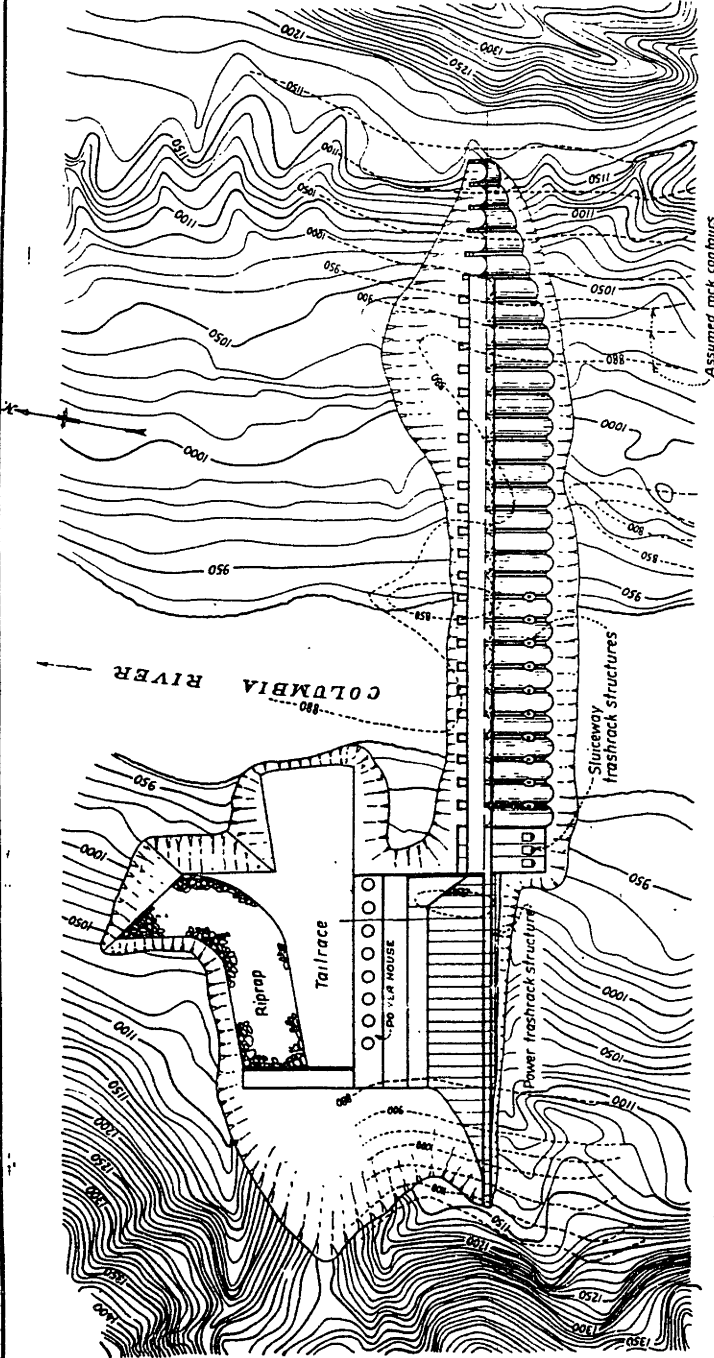




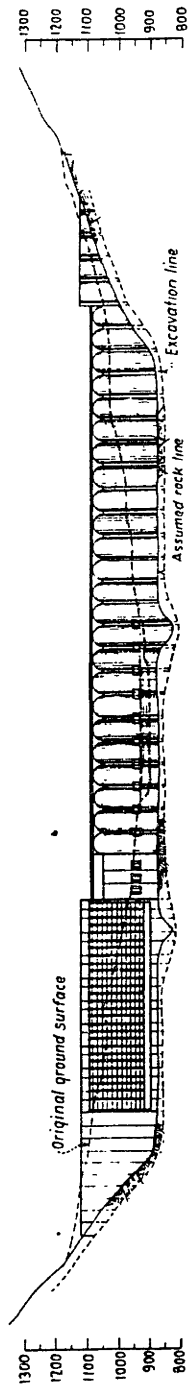
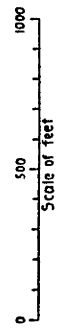




DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 COLUMBIA BASIN PROJECT - WASHINGTON  
**COLUMBIA RIVER DAM  
 LOW MULTIPLE ARCH**  
 PRELIMINARY ESTIMATE DRAWING  
 DRAWN BY: E. A. ...  
 CHECKED BY: R. M. ...  
 APPROVED BY: ...  
 DATE: MAY 11 1933  
 222-D-1



**PLAN**



**UPSTREAM ELEVATION**





8.9 *Bartlett Dam, north of Phoenix, Arizona, completed in 1939. This double-walled, hollow buttress structure was the only major multiple arch dam ever built by the Bureau of Reclamation. (Salt River Project Archives)*

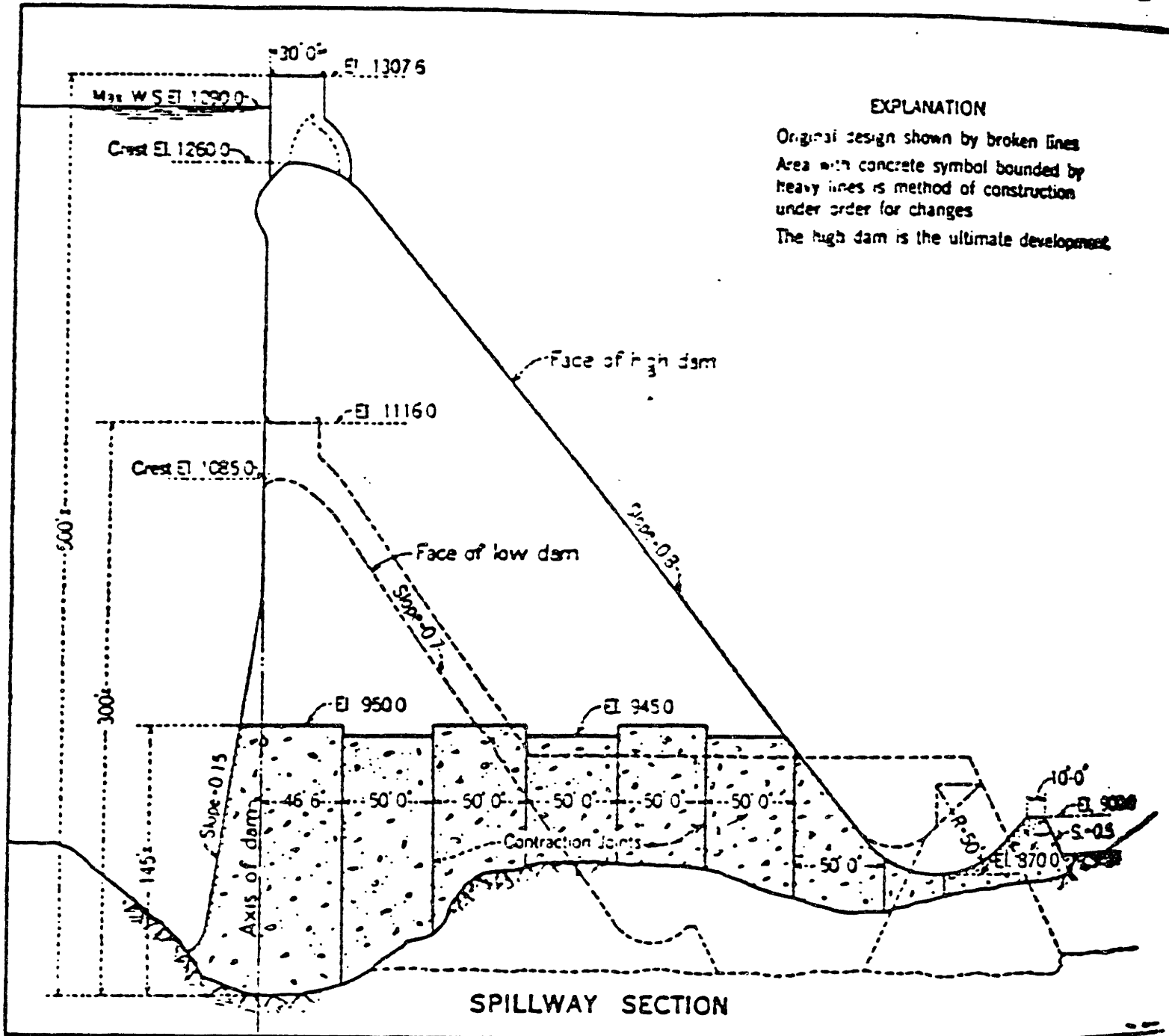








# The Change Order at Grand Coulee Dam



The illustration pictures a cross section of the Grand Coulee Dam showing the original design or low dam, and the ultimate development or high dam including the 177 foot complete foundation for a 500-foot dam as provided in the change order announced June 7 by Secretary of the Interior Harold L. Ickes.

Present progress by Mason-Walsh-Atkinson Kier Co., the contractors, indicates completion of the foundation excavation by September. Preparation for concreting operations have started. Removal of overburden from gravel pits as well as the initial work at pumping station and aggregate handling plant is well under way.





*President Roosevelt views Grand Coulee Dam from Observation Point with Construction Engineer Banks.*



Secretary Ickes and Commissioner Page meet in the West to travel together on an inspection trip in Federal reclamation territory





### Appendix 3—Sources for tables on engineers

Men Included in Tabulation			
Commissioners	Denver Leaders, 20s	Denver Leaders	Grand Coulee Dam Leaders
Davis, Arthur Powell	Gaylord, J. M.	Day, Charles M.	Banks, Frank Arthur
Davis, David William	Hinds, Julian	Debler, Erdman B.	Cole, Clarence M.
Mead, Elwood	Munn, James	Harper, Sinclair Ollason	Darland, Alvin F.
Page, John Chatfield	Weymouth, Frank Elwin	Houk, Ivan	Miner, James Henry
	Williams, Charles Page	Keener, Kenneth Bixby	Parker, Horace A.
		McClellan, Leslie Newman	Sharkey, F. J.
		McPhail, Harvey Franklin	Smith, Charles B
		Monroe, Robert Ansley	
		Nalder, William H.	
		Preston, Porter Johnstone	
		Savage, John Lucian	
		Steele, Byram W.	
		Walter, Raymond Fowler	
4	5	13	7

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## Abbreviations

<b>Banks MSS</b>	<b>Frank Arthur Banks Papers, 1913-1957, Washington State University, Manuscripts, Archives, and Special Collections, Pullman, Washington</b>
<b>Batcheller MSS</b>	<b>Willis T. Batcheller Papers (Acc. #195, 2497, 2497-2), University of Washington Libraries, Seattle, Washington</b>
<b>CBC MSS</b>	<b>Columbia Basin Commission Papers, Washington State Archives, Olympia, Washington</b>
<b>CBSC MSS</b>	<b>Columbia Basin Survey Commission Papers, Washington State Archives, Olympia, Washington</b>
<b>CCF 07-36</b>	<b>Central Classified Files 1907-1936, Office of the Secretary, RG 48</b>
<b>CCF 37-53</b>	<b>Central Classified Files 1937-1953, Office of the Secretary, RG 48</b>
<b>CE</b>	<b>Office of the Chief Engineer, Denver, Colorado, RG 115</b>
<b>CF</b>	<b>Clipping Files, Eastern Washington State Historical Society, Spokane, Washington</b>
<b>Dill MSS</b>	<b>Clarence C. Dill Collection, Eastern Washington State Historical Society, Spokane, Washington</b>
<b>EC-CB</b>	<b>General Correspondence Files 1902-42 (Engineering), Columbia Basin, CE, RG 115</b>
<b>Entry 10</b>	<b>Entry 10 Project Histories, Feature Histories, and Reports 1902-1932, WDC, RG 115</b>
<b>Entry 35</b>	<b>Entry 35 Correspondence Relating to Federal Projects, 1934-41, Projects Control Division, RG 135</b>
<b>Entry 39</b>	<b>Entry 39 Records Concerning Reclamation Projects, 1933-35, Projects Control Division, RG 135</b>
<b>Entry 42</b>	<b>Entry 42 Records Relating to the Justification of Projects 1933-35, Projects Control Division, RG 135</b>
<b>Entry 7/19-29-CBP</b>	<b>Project Correspondence File 1919-1929, Columbia Basin Project, Entry 7 General Administrative and Project Records 1919-1945, WDC, RG 115</b>
<b>Entry 7/30-45</b>	<b>Project Correspondence File 1930-1945, Entry 7 General Administrative and Project Records 1919-1945, WDC, RG 115</b>
<b>Entry 7/30-45-CBP</b>	<b>Project Correspondence File 1930-1945, Columbia Basin Project, Entry 7 General Administrative and Project Records 1919-1945, WDC, RG 115</b>
<b>Entry 748</b>	<b>Entry 748 Index to the Central Classified Files 1907-53, General Records, Post 1907 Records, RG 48</b>
<b>Entry 765</b>	<b>Entry 765 Office File 1923-28, Records of Secretary Hubert Work, Records of Interior Department Officials, Post 1907 Records, RG 48</b>

Entry 766	Entry 766 General Subject File 1933-42, Records of Secretary Harold L. Ickes, Records of Interior Department Officials, Post 1907 Records, RG 48
Entry 768	Entry 768 Office Files, Secretary of the Interior Oscar Chapman 1933-53, Records of Interior Department Officials, Post 1907 Records, RG 48
Entry 810	Entry 810 General Correspondence and Other Records 1937-58, Records of the Office of the Solicitor, Post 1907 Records, RG 48
Entry 811	Entry 811 Subject Files of the Associate Solicitor 1928-1948, Records of the Office of the Solicitor, Post 1907 Records, RG 48
ERC	Engineering and Research Center, RG 115
GCD Exh.	Grand Coulee Dam and Columbia Basin Project Exhibit, Eastern Washington State Historical Society, Spokane, Washington
Gill MSS	Roy R. Gill Papers, 1921-1942, Washington State University, Manuscripts, Archives, and Special Collections, Pullman, Washington
Harding MSS	Bruce Charles Harding Papers, 1921-1951, Washington State University, Manuscripts, Archives, and Special Collections, Pullman, Washington
Histories	Project Histories 1911-1991, ERC, RG 115
Hutton MSS	Sol Elwood Hutton Papers (Acc. #773, P32/10-7f), University of Washington Libraries, Seattle, Washington
Ickes MSS	Harold L. Ickes Papers, Manuscript Division, Library of Congress, Washington, D. C.
Leg 05-36	Legislation 1905-1936, Office of the Secretary, RG 48
MWAK MSS	Mason-Walsh-Atkinson-Kier Company Records, 1934-35, Cowles Rare Book Library, Special Collections, Foley Center, Gonzaga University, Spokane, Washington
O'Sullivan MSS	James Edwards O'Sullivan Papers, 1903-1983, Cowles Rare Book Library, Special Collections, Foley Center, Gonzaga University, Spokane, Washington
Personnel	General Correspondence 'Personnel' 1906-42, CE, RG 115
Reports 10-55	Project Reports 1910-1955, ERC, RG 115
Reports 99-78	Studies, Reports, & Projects 1899-1978, ERC, RG 115
RG 115	Records of the Bureau of Reclamation, Record Group 115, National Archives—Rocky Mountain Region, Denver, Colorado
RG 135	Records of the Public Works Administration, Record Group 135, National Archives, Washington, D. C.
RG 48	Records of the Department of the Interior, Record Group 48, National Archives, Washington, D. C.

SLD MSS	Seattle Lighting Department Records (Acc. #33-1. loc TO363a), University of Washington Libraries, Seattle, Washington
Straights	General Correspondence Files (Straights), CE, RG 115
Waller MSS	Osmer Lysander Waller Papers, 1897-1935, Washington State University, Manuscripts, Archives, and Special Collections, Pullman, Washington
WDC	Office of the Commissioner, Washington, D. C., RG 115
Woods MSS	Rufus Woods Papers (P13/115c), University of Washington Libraries, Seattle, Washington

Citations to collections may include box number, box and folder numbers, or box number and file name. This information will come after the document information and prior to the collection information. It will be abbreviated *box number:file designation* (e.g., 3 or 3:21 or 3:Monthly Reports).



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