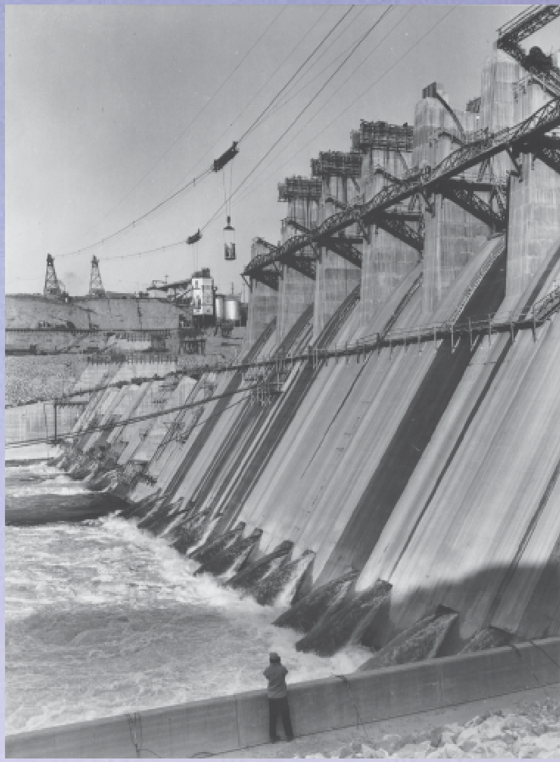
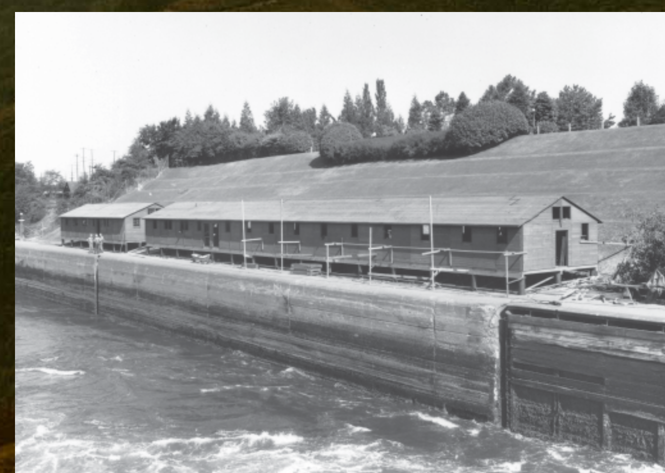


Northwest Passages:

History of the Seattle District
U.S. Army Corps of Engineers
Volume II
1920-1970



-The picture in the center of the cover is Mount Rainier.
-The picture on top left hand of the cover shows Chief Joseph Dam 5 Nov 1953.
-The picture on the bottom left hand of the cover shows the Alaska Highway Construction in 1942.
-The picture on top right hand of the cover shows flood-fighting on the Kootenai River on 5 June 1961.
-The picture on the bottom right hand of the cover shows the Lake Washington Ship Canal on 14 AUG 1943.

Northwest Passages:

A History of the Seattle District
U.S. Army Corps of Engineers, Volume II
1920-1970

Written by William F. Willingham, Ph.D.

2006

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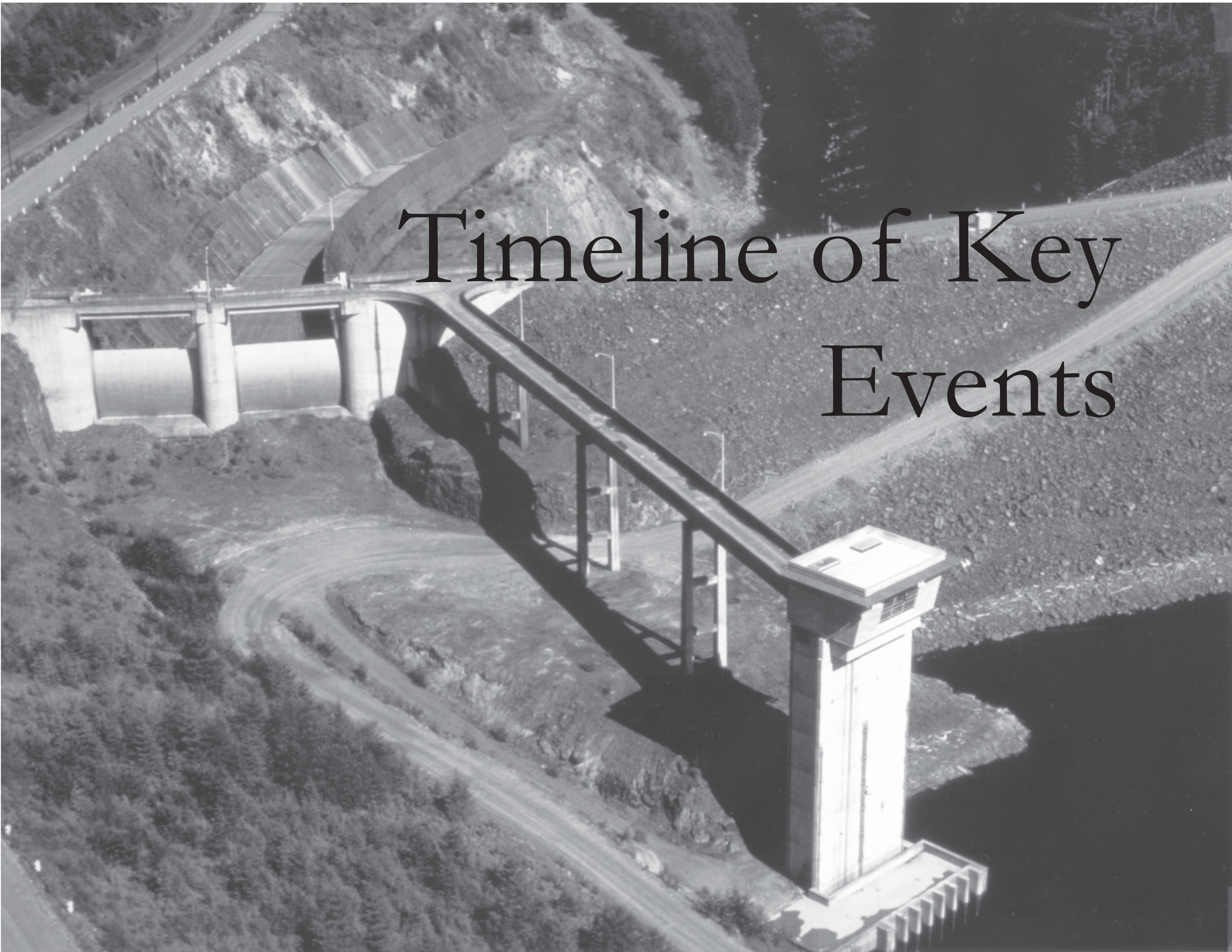
William F. Willingham,
PhD

Timeline of Key Events



1920 – Seattle District began dredging, snagging, and constructing dikes from the entrance bar in Willapa Bay to Raymond, Washington.

1920's – Congress authorized Seattle District to increase the dimensions of the channel between the Locks and Puget Sound by dredging and making other and structural additions to the Lake Washington Ship Canal.

1921 - The Corps reassigned the Alaska civil works projects to the newly created Alaska District based in Juneau.

1925 – Congress authorized enlarging and deepening the Duwamish waterway.

1928 - Senator Wesley Jones initiated a campaign to have the Columbia basin irrigation development studied as a part of the 308 investigations.

1929 - The Corps had the machinery and deckhouse removed from the *Swinomish* and placed on the *W. T. Preston*.

1930 - Congress authorized the Corps to complete the Hylebos project and take over maintenance of the entire Tacoma Waterfront and the Puyallup and Wapato channels.

1930 – Congress accepted the Corps' report favoring expansion and authorized an extension of the channel harbor known as Squalicum Creek waterway.

1930 – Congress adopted Major Butler's plan for the Duwamish channel expansion.

1930s – Congress approved the construction of the Umatilla and the Snake River Dams.

1930 – Congress authorized increasing the Chehalis River channel depth to 16 feet.

1930 – Major Butler and Commissioner Mead held a conference in Wenatchee, Washington, that paved the way for better cooperation between the Corps and the Bureau of Reclamation.

1930s - Construction of McChord Field began.

1932 – The Corps closed the Juneau office and the civil works projects were reassigned to Seattle District.

1933 – 308 Report was published as the House of Representatives document 103.

1935 – Congress authorized reconstruction of the north and south jetties of Grays Harbor and adopted revised bar, harbor and river dimensions.

1935 – Congress further modified the Willapa River and Harbor project to include maintenance of the bar channel to a depth of 26 feet.

1935 – Seattle District implemented a 44-hour work week and made employment practices subject to civil service requirements.

1935 - The Rivers and Harbors Act of 1935 allowed the Corps to assume maintenance of the completed Wapato waterway and abandon the Puyallup waterway.

1936 - Congress recognized that flood control was a proper activity of the federal government, adopted the Flood Control Act of 1936 and designated the Corps as its agent.

1936 - The Corps' flood control undertakings provided further injections of money and jobs for Washington's economy.

1937 - Colonel H. J. Wild concluded that there was no cost-effective method in existence for solving the sedimentation problem caused by the Snohomish River.

1939 – The Preston's wooden hull was replaced with a welded steel hull and a new wood frame deckhouse.

1939 – Work began on Mud Mountain Dam.

1940s - Seattle District's biggest military construction project occurred at Fort Lewis.

19421 - After 1 May 1942, authority for the Alaska construction projects went through a series of command changes.

1942 – General Groves decided that the production facilities for the Manhattan Project needed to be in an isolated area. Colonel Matthias recommended a track of land between the towns of Hanford and Richland.

1942 – Seattle District organized a camouflage section within its Engineering Division. The Boeing plant and airfield received highest priority.

1944 - In the Flood Control Act of 1944, congress ordered the Corps and the Department of Interior to consult with each other when planning their studies and to share data from their investigations.

1945 - President Truman proposed a fundamental revamping of the federal water policy in the Columbia River basin.

1945 – The Hanford project started to deliver plutonium to Los Alamos, NM.

1946 – Alaska District was reestablished with its headquarters in Anchorage.

1946 – The Columbia Basin Inter-Agency Committee was created by the Federal Inter-agency River Basins Planning Board to discuss inter-agency issues.

1948 – Mud Mountain Dam construction completed.

1949 – Congress provided the first construction funds for Foster Creek project that was renamed the Chief Joseph Dam.

1949 – Mud Mountain Dam was completed.

1950 - Congress authorized the Albeni Falls Dam in the Flood Control Act of 1950.

1950 - Congress authorized the construction of Libby Dam.

1950 – Congress authorized the Howard Hanson Dam in the Flood Control Act of May 1950.

1950's - Seattle District was involved in revising the Corps's HD 531 Report which culminated in the effort to build Libby Dam.

1951 – The construction of Albeni Falls Dam began.

1955 Congress passed Public Law 84-99 which authorized the Corps to engage in a broad range of emergency flood control measures.

1957 – The Corps completed Albeni Falls Dam.

1957 – The Corps completed Chief Joseph Dam.

1958 – Seattle District began developing Atlas sites near Fairchild Air Force Base in Spokane to house ICBM missiles.

1961 – The United States and Canada concluded their negotiations over the Columbia River development and agreed to sign a treaty which would allow Canada to build 3 dams and the US to build Libby Dam.

1962 – Congress approved the Wynooche Dam project in the Flood control Act of 1962.

1962 – Howard Hanson Dam was completed.

1970 – Seattle District's military responsibilities were transferred to Sacramento District due to a Corps reorganization.

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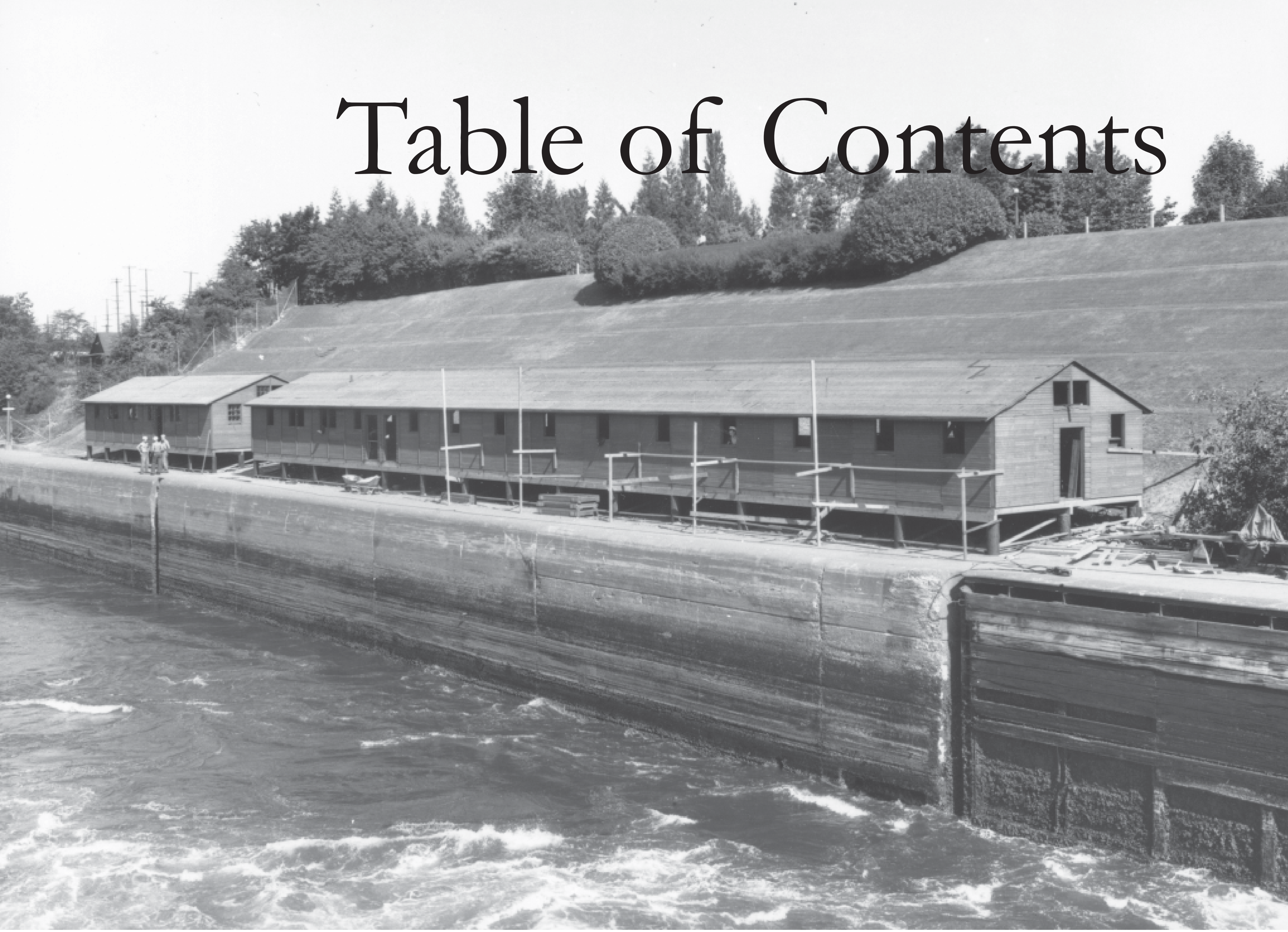
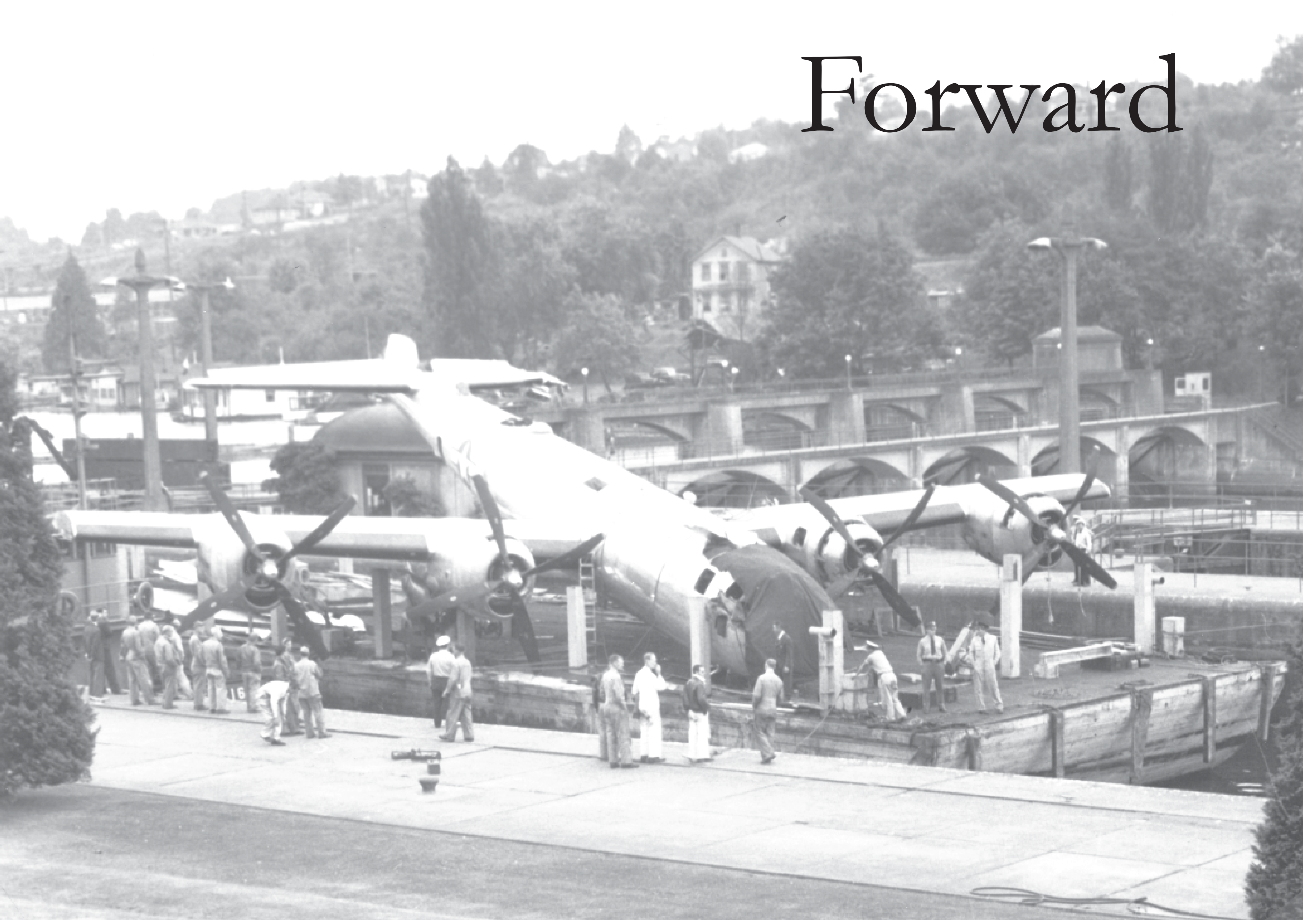


Forward



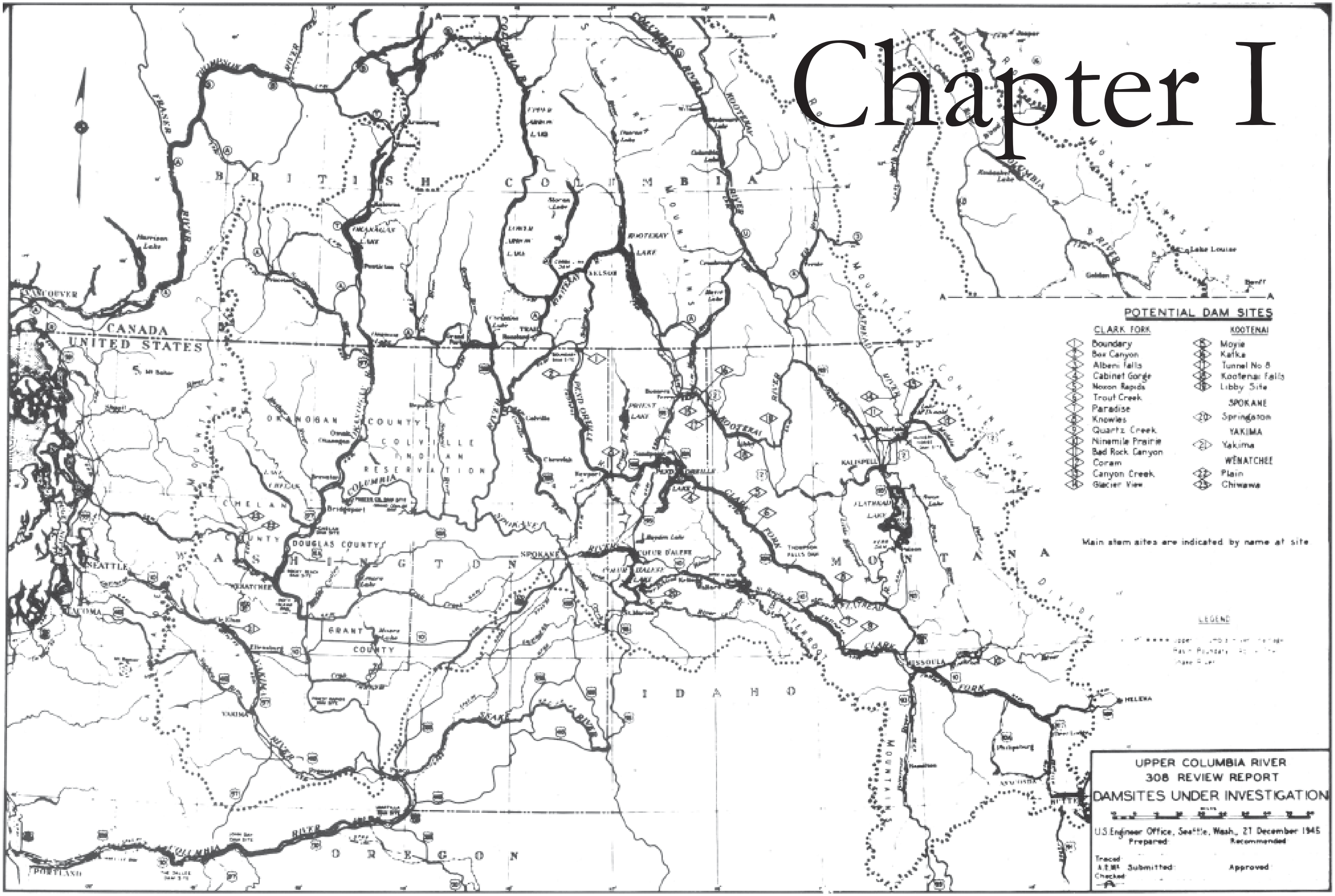
The United States Army Corps of Engineers continues to be the preeminent public engineering organization in the world. The Seattle District, US Army Corps of Engineers, has capably served the Nation and the Pacific Northwest since 1896. In 1992 we published the first volume of our history under the title "Northwest Passages: A History of the Seattle District U.S. Army Corps of Engineers, 1896-1920." Now, we are pleased to present the second volume of this important series that covers the period 1920-1970.

This volume covers a very dynamic and productive era for the Seattle District. It highlights the increasing importance of coordinating work with other Districts and with other Federal agencies. It recounts the challenges of managing the rivers of the Pacific Northwest to support the economic prosperity of the nation and coping with the ensuing cultural and environmental issues. This volume denotes the contributions of the District toward the nation's efforts in World War II and explains the involvement with civil projects in the post-war era.

This volume has pictures of many facilities that are the end products of the District's work over this 50-year period. It also pays tribute to the creativity, determination, and commitment to service of the men and women of the District whose energy made that period a particularly dynamic one.

DEBRA M. LEWIS
Colonel, Corps of Engineers
District Commander

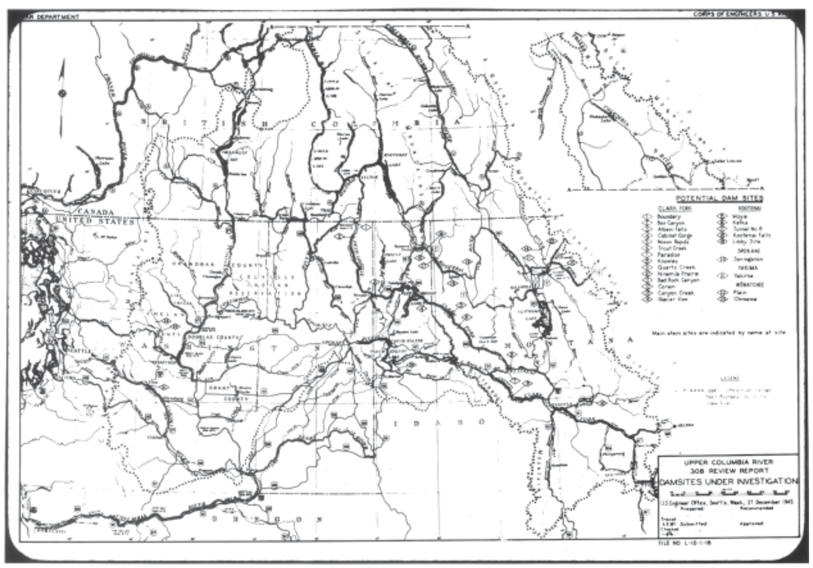
Chapter I


BRITISH COLUMBIA
CANADA
UNITED STATES
WASHINGTON
IDAHO
MONTANA
OREGON
SPOKANE
SEATTLE
KALISPELL
MISSOULA
HELENA
Lake Louise
Banff
POTENTIAL DAM SITES
CLARK FORK
Boundary
Box Canyon
Albeni Falls
Cabinet Gorge
Noxon Rapids
Trout Creek
Paradise
Knowles
Quartz Creek
Ninemile Prairie
Bad Rock Canyon
Coram
Canyon Creek
Glacier View
KOOTENAI
Moyie
Kafka
Tunnel No 8
Kootenai Falls
Libby Site
SPOKANE
Springston
YAKIMA
Yakima
WENATCHEE
Plain
Chiwawa
Main stem sites are indicated by name at site
UPPER COLUMBIA RIVER
308 REVIEW REPORT
DAMSITES UNDER INVESTIGATION
U.S. Engineer Office, Seattle, Wash., 21 December 1945
Prepared:
Recommended:
Traced:
Submitted:
Approved:
Checked:

MULTIPURPOSE WATER RESOURCES DEVELOPMENT AND THE 308 REPORT

During the 1920s, the Corps of Engineers began to move from single purpose water resources projects to multipurpose water development. Congress pushed this transition in 1925 when it authorized the Corps and the Federal Power Commission to prepare cost estimates for surveys of those navigable streams and tributaries "whereon power development appears feasible and practicable." The goal was to have the two agencies develop plans to improve stream navigation "in combination with the most efficient development of the potential water power, the control of floods, and the needs of irrigation." In April 1926, the Corps submitted to Congress a list of over 200 rivers in 24 groups that justified detailed study at an estimated cost of $7.3 million. In the following year, Congress appropriated the funds for the recommended investigations; and the Corps initiated its unprecedented series of comprehensive river surveys. The Columbia River and its tributaries would figure prominently in the river basin studies.[1]

The finished studies became the now famous "308 Reports," named after the House of Representative document containing the Corps original



308 Report

survey estimates. These reports became the basic planning guides for federal multipurpose water resources projects undertaken over the next 50 years. In 1935, Congress directed the Corps to periodically update the 308 Reports to reflect important changes in economic factors, additional streamflow records, or other pertinent data. With this authority, the Corps had broad responsibility to undertake continuing river basin planning for navigation, hydropower, and flood control.[2]

The concept of multipurpose river basin development by the federal government was not a new one in the 1920s. It had originated in two aspects of the Progressive Era conservation movement, especially strong between 1900 and 1940. One source of the approach stemmed from the progressive belief in applying technical and scientific solutions to solving human problems, in this case the wise use of natural resources such as water for irrigation, human consumption, and hydropower. The other source arose from the progressive faith in the government's ability to efficiently manage resources for the benefit of all and not allow their exploitation by private enterprise for the few. Careful planning and development by government experts could ensure the preservation and wise use of the nation's water resources. The Army Corps of Engineers would fill the role of engineering and scientific experts in the large scale, multipurpose development of water resources.[3]

Congressional water resources legislation between 1900 and 1920 increasingly pointed in the direction of broader development considerations rather than just the traditional navigation interests that had previously been the focus of federal concern. For example, the 1899 Refuse Act strengthened the ability of the Corps to protect the nation's navigable waterways from indiscriminate dumping of refuse or placing obstructions to navigation. The General Dam Acts of 1906 and 1910 established a set of conditions for authorizing nonfederal projects on interstate waterways, including issues focused on waterpower development. The Rivers and Harbors Acts of 1910 and 1912 permitted the Corps to consider factors other than purely navigation matters in its surveys and investigations of rivers.[4]

President Theodore Roosevelt, in establishing the Inland Waters Commission in 1907, summed up the case for comprehensive development of the nation's waterways: "We cannot afford needlessly to sacrifice power to irrigation, or irrigation to domestic water supply when by taking thought we may have all three. Further, every river from its headwaters to its mouth is a single unit and should be treated as such." Efforts to create a new government agency to fully coordinate federal planning and development for the nation's waterways, however, foundered over congressional concerns that the federal government lacked constitutional authority to construct projects solely for flood control or hydropower. In addition, the Corps resisted surrendering its authority over navigation to another federal agency.[5]

While the Corps' civil works activities in the Pacific Northwest during the first quarter of the 20th century continued to focus on traditional, single purpose navigation projects, its district engineers were aware of increasing interest in other uses of the Columbia river system. These other uses consisted of regional reclamation and power projects. Local interest in the upper Columbia basin, in particular, assiduously promoted a major irrigation project. The State of Washington sponsored hydrologic surveys, newspapers demanded action, and state and federal election campaigns featured the issue throughout the 1920s. Rival development plans, high costs, and policy matters, however, prevented movement on any specific project. Proponents of power developments on the Columbia and Snake rivers were stymied in their efforts by the lack of sufficient power markets in the Pacific Northwest. While providing survey information to the various interest groups, the Corps warily worked to safeguard its mandate over navigation rights. In this effort, it received the support of another regional special interest group, the Open River Association, based in eastern Oregon.[6]

During the 1920s, two rival plans emerged that proposed to bring water to the Columbia basin for agriculture. The first, promoted chiefly by Spokane interests, called for construction of a dam at Albeni Falls on Pend Oreille River on the Idaho-Washington border. From there, a main gravity canal would extend into the basin country to the southwest, where water would be delivered to irrigators through supplementary works. Between 1.2 and 1.7 million acres, depending upon different versions of the scheme, would be irrigated. The gravity plan stood to bring enormous benefits to bankers, realtors, and contractors in Spokane.[7]

Wenatchee interests, located in north-central Washington, countered with a proposal to store water behind a dam on the Columbia at Grand Coulee and pump it through a system of canals branching off from the southern end of the Coulee. A key feature of this plan was its hydroelectric component, necessary to produce power for operation of the pumping equipment and subsidize the cost of construction. The Wenatchee-area Grand Coulee advocates anticipated the same financial benefits that Spokane would realize, if water were brought to the plain from Albeni Falls.

At first, the gravity plan appeared most likely to succeed. Initial studies by the State of Washington in the early 1920s favored the gravity

Columbia Basin Illustration

plan, but its high cost—$300 million—delayed immediate action. The gravity plan backers looked to the federal government for assistance, but the Bureau of Reclamation expressed considerable skepticism about the plan. It questioned the quality and objectivity of the state studies supporting the gravity plan and undertook investigations of its own. These studies, culminating in reports submitted in 1924 and 1925, found that use of the upper Columbia for irrigation was feasible and generally favored the gravity system approach. Nevertheless, the Bureau recommended that a specific federal plan of development was premature because of high costs and the lack of experience with projects of such complexity.[8]

An independent study conducted in the early 1920s for the Federal Power Commission by Colonel James Cavanaugh, North Pacific Division Engineer, also investigated all possible uses of the water from the upper Columbia. After careful study of existing information, Colonel Cavanaugh concluded that regional irrigation and power development were inevitable and that in the case of irrigation, either the gravity or pumping plan was feasible. He did urge, however, that more detailed study would be needed to make a sound choice between the two alternatives. Colonel Cavanaugh also noted that the continued expansion of the electricity market in the Pacific Northwest would possibly favor the pumping plan at some time in the future. This point further supported the notion that circumstances dictated delay in moving forward with any immediate plan of development.[9]

Washington State officials and the state's congressional delegation continued to push the gravity plan. Private power companies, especially the Spokane-based Washington Water Power Company, opposed the pumping plan with its hydroelectric dam, which would produce competing electricity. Surplus gravity canal water, moreover, could be diverted to the Spokane River to supply the existing private dams with an additional supply of water for power production. While the gravity plan had the initial advantage, backers of the pumping approach gained support over time. They had a strong argument that power sales revenue could offset the costs of construction of the irrigation system on a piece-by-piece basis. In contrast, the gravity plan would produce no revenues until the entire system of canals, tunnels, and siphons had been finished. Also, Idaho, the source of much of the gravity plan's water, objected to releasing its water for another state's benefit. A dam at Grand Coulee, on the other hand would confine the effects of the pumping plan within the bounds of Washington.

By the late 1920s, Washington Senators Wesley Jones and Clarence Dill began to question the viability of the gravity plan and called for a thorough investigation of the pumping plan. When Senator Jones failed in 1928 to win congressional approval for such a study by the Bureau of Reclamation as part of a broader look at federal reclamation of the Columbia basin, he turned to the Corps of Engineers. He initiated a campaign to have the Columbia basin irrigation development studied as a part of the 308 investigations. Senator Jones hoped that by having the Corps include reclamation of the Columbia basin in its studies, he would finally get the thorough and objective investigation needed to move the irrigation plan forward. Indeed, by the time the 308 Reports came out in the early 1930s, the nation's deteriorating economic conditions assured that sound water resources development proposals would get a sympathetic hearing when federal projects were selected to provide economic relief.

The 308 Reports proved a massive undertaking for the Corps. The experience of the Seattle District offers a good example of the complicated nature of the study process. Initially, the Chief of Engineers assigned the Columbia River survey to the Portland District of the Corps. The Chief reasoned that since the Portland District had played the greatest role in past federal improvement of the river, efficiency and economy dictated that it should continue in that role for the 308 studies. Colonel William J. Barden, Seattle District Engineer, lodged an immediate protest against this decision.

Colonel W.J. Barden, Seattle District Engineer
19 June 1923 to 10 June 1927

He pointed out that "the improvement of the [upper] Columbia River and its tributaries has been in that district [Seattle] for many years and all data and records are on file therein and all personnel familiar therewith are attached hereto." At Barden's urging, the Corps reorganized the study according to district boundaries, the mouth of the Snake serving as the dividing point. Seattle District thus had responsibility for the upper reaches of the river to the Canadian boarder, while the lower section to the Pacific Ocean went to

Portland. The North Pacific Division had overall responsibility for coordinating the final report.[10]

For reasons of time and cost, the initial 308 Report focused on the main stem of the Columbia River and its minor tributaries; the Snake and Willamette River reports came later. Major topics for coverage included navigation, flood control, hydroelectric power development, irrigation, hydrology, rainfall, evaporation, stream flow, runoff, silt content, and municipal water supply. Gathering existing data from other agencies and conducting the required field work to generate new data proved a frustrating, time-consuming, and expensive task. The whole process had institutional consequences for the Corps. In the past, most decision-making had taken place at the district level, with the division exercising only nominal authority. During the 1920s, in fact, the office of the North Pacific Division Engineer was delegated in alternating fashion to the district engineers in Seattle and Portland. Between 1923 and 1927, for example, Colonel Barden headed both the Seattle District and the North Pacific Division. Divided responsibility for the management and execution of the Columbia River studies ultimately required separation of the district and division roles in Portland.[11]

Colonel Barden's defense of his district turf did not mean that the Seattle District intended to focus solely on the Columbia River. Even before the District's abandonment of navigation work in 1917, the Columbia had been peripheral to the District's main western Washington concerns. In initially assigning priorities to the rivers examined under the 308 studies, Colonel Barden's successor, Major John S. Butler, gave first importance to the Skagit River. District personnel stationed in Seattle could more conveniently study it, and it presented less complex problems of development than the Columbia River. In later defending his original prioritization of work, Major Butler pointed out that "the Columbia River report was placed last because of magnitude and importance, and because additional stream flow records were desired for the purposes of the report. It was expected that one or two years would be required for the completion of a satisfactory report for the Columbia River." Moreover, as the 308 investigations got underway, Congress was still considering Senator Jones' bill authorizing the Bureau of Reclamation to study the Columbia basin irrigation project, so Major Butler thought Columbia basin irrigation studies might be the responsibility of the Bureau of Reclamation.[12]

Major Butler initially proposed to exclude irrigation from his study of the Columbia. He noted to the Chief of Engineers, Major General Edgar Jadwin, that "in view of the present bill now pending before Congress, it seems that the Bureau of Reclamation will be called upon to make the surveys and to have charge of the work involved." He questioned, therefore, the propriety of the Corps of Engineers becoming involved with a subject "which . . . pertains largely to work to be done by another department of the Government." Noting that Congress had authorized comprehensive surveys under House Document 308, the Chief of Engineers overruled Butler. While the Jones legislation calling for a Bureau of Reclamation survey was pending, that agency expressed little interest in the task. General Jadwin curtly observed that "the prospect of early legislative action on the Columbia Basin project is not known. The possibility of such action in the future should not divert the district engineer from the prosecution of studies assigned to him."[13]

Major John S. Butler
Seattle District Engineer
20 July 1927 to 20 August 1931

Accordingly, Major Butler's final plan of study envisioned a wide-ranging investigation. For example, he projected an elaborate series of gauging stations to measure accurately streamflow on the Columbia and its tributaries. He targeted a dozen dam sites on the river system—including Little Dalles, Kettle Falls, Grand Coulee, Foster Creek, Rock Island, and Priest Rapids on the main stream—for thorough analysis. Most importantly, he was determined to carry out a detailed examination of the rival irrigation schemes for the Columbia basin. "Beyond question," observed the major, "the most important single item in connection with a comprehensive study . . . is the proposed Columbia Basin Irrigation project."[14]

To accomplish his ambitious and wide-ranging plan of study, Major Butler recommended expending $2.5 million—a third of this sum for the irrigation studies. Some embarrassment resulted when the Portland District submitted an estimate of $370,000 for its investigation below the mouth of the Snake. Chagrined over this “wide divergence,” Colonel Gustave Lukesh, head of both the Portland District and the North Pacific Division, confessed to the Chief of Engineers, General Jadwin, that the complications of his dual role had prevented him from properly supervising Butler. The colonel explained that “while coordinating the work of the two districts . . .” he had “purposely” avoided any attempt “to influence the District Engineer, Seattle District, in the preparation of his estimates of cost.” Colonel Lukesh thought “it to be better that the District Engineer submit his own estimates which, with the comments of the Division Engineer, would reach the Chief of Engineers for consideration.”[15]

Major Butler’s figures were, in the view of the Corps’ headquarters officials, “very excessive.” The Chief of Engineers ordered Butler to prepare general rather than detailed plans for construction of dams on the main river, to abandon plans to study the tributaries, and to make full use of all existing federal, state, and private studies. Under separate cover, an unhappy Chief of Engineers reminded Colonel Lukash that “Orders and Regulations . . . prescribe that he shall supervise the execution of works assigned to Engineer districts in his division . . . [and see that such work] is executed . . . economically, efficiently, and in conformity with law and regulation.” Noting that Major Butler had been ordered to submit new estimates, the Chief directed that “the division engineer will actually supervise the execution of this work in accordance with the spirit of existing orders, regulations and instructions.”[16]

Acting upon these instructions, Major Butler sharply reduced his estimates. It would now require, he reported in May 1929, only $270,000 to carry out the circumscribed survey. Major Butler was able to refine his estimates after studying all the published reports and visiting the Bureau of Reclamation office in Denver. There he examined the published and file drawings and other data relating to the Columbia Basin project compiled by the Bureau’s engineers. The State of Washington officials also simplified Butler’s work by making available unpublished survey data relating to the project in their records.[17]

By the spring of 1929, the Corps’ 308 study was rapidly becoming the key-planning document for the subsequent development of the Columbia basin. Irrigation was still regarded as the focus of that development on the upper Columbia River, but the Bureau of Reclamation remained equivocal about its role in such development. While publicly backing a Columbia basin irrigation project, the agency secretly expressed little interest in pursuing it. By this time, the Bureau was heavily involved in the Boulder Project and doubted its ability to carry out two major construction projects at the same time.[18]

Washington Senator Wesley Jones, as noted above, turned in early 1929 to the Corps of Engineers as the surest route to approval of the long-delayed irrigation project. “Two or three years ago,” he informed a constituent, “we adopted in the river and harbor bill a provision authorizing the appropriation of something over $7,000,000 to carry on a survey over the country, not only of river and harbor matters, but dealing with flood control, power development, and reclamation.” Under this authorization, the Columbia River was “being earnestly and actively taken up” by the Corps of Engineers. While admitting that his bill for a Reclamation Bureau survey probably was doomed, he, nevertheless, thought that the irrigation “survey is actually going on and we will probably get a report through the army service sooner than we might otherwise get it.” [19]

Senator Jones met with the Chief of Engineers on several occasions during January and February of 1929 to urge the importance of focusing on the Columbia River portion of the 308 study. Since Jones was a senior legislator, chairing first the Senate commerce committee and later the appropriations committee, the Corps of Engineers was anxious to promise cooperation. The Columbia survey, the Chief’s office assured Jones, would be “prosecuted with a vigor commensurate with its importance.” The Chief of Engineers ordered Major Butler to give top priority to the Columbia River in his plan of study. In this fashion, the senator helped transform the regional importance of the 308 Report, and made the Army engineers the key to future water resources development in the Columbia basin.[20]

The stock market crash of October 1929 and subsequent economic contraction known as the Great Depression provided the economic and political backdrop for the 308 survey and for the initial response to its recommendations on the future development of the Columbia River basin. When the stock market collapsed, Major Butler already had a force of 25 assistants at work in newly rented space in the District’s office at the Burke Building in downtown Seattle. Several survey parties were also in the field at Grand Coulee and other potential dam sites on the Columbia.

While office and field work proceeded, so many individuals interested in Columbia basin development descended on the Seattle office

Burke Building, Seattle, Washington

that the Major ordered documents locked away for security reasons. Delegation after delegation insisted that irrigation be accorded primacy in the study and that a definitive choice be made between the gravity and pumping plans. The press and the Washington congressional delegation kept up the pressure on the Corps, urging the utmost speed so that a report would be ready for Congress as soon as possible. Corps officials, while maintaining a sympathetic public front, privately criticized the methods and goals of reclamation boosters. "I am impressed with the fact," wrote one military officer in the Seattle office, "that the Pacific Northwest not only grows big trees, but also gentlemen very open handed with other people's monies." While conventional irrigation schemes, continued this observer, "have dipped into the treasury with anything from a spoon to a small scoop shovel, this scheme will utilize at least a 5 yard steam shovel."[21]

In response to the continued pressure, the new Chief of Engineers, Major General Lytle Brown wrote in late October to Colonel Lukesh "it is desired that the survey of the Columbia River . . . be pushed to completion at the earliest possible date . . . . All the essential engineering and economic data for the final determination of the problems involved must be secured, particularly with reference to the Columbia Basin irrigation project, but it must be kept in mind that Congress expects vigorous action and nothing should be left undone that will expedite the work." The Chief went on to order the Division Engineer to "submit an early report stating what steps have been taken to comply with the above instructions . . . and giving your revised estimate as to the earliest date complete report may be expected." Colonel Lukesh responded that he would send the requested report as soon as he conferred with the Seattle District Engineer.[22]

In his report to the Chief on 25 November 1929, Colonel Lukesh voiced considerable exasperation over the pressure from eastern Washington irrigation interests. The Columbia basin project, he noted, was "the cherished hope of a small and active group who have apparently no direct personal concern in its consummation beyond the expectation of increased commercial activity for their communities." In his view, there existed no "great general public interest in reclamation of the large irrigable areas above the Snake." In fact, beyond certain portions of eastern Washington, Lukesh detected little enthusiasm for the Columbia basin project. Lukesh was adamant that no single element should control the choice of data or completion date for the entire report. As he stated it, "the so called Columbia Basin Project . . . is merely a part of the irrigation study which in turn is but a part of the comprehensive study." "It will receive," he concluded, " its full measure of attention" but not be allowed to

Major General Lytle Brown

dictate the timing of the entire report. Because there were so many special interests promoting their own irrigation, power, and flood control schemes, he was determined to secure data "independent of partisan sources of information." Finally, Colonel Lukesh conceded that while he and Major Butler agreed that 31 October 1931 was their preferred date for submitting the 308 report, they would defer to the Chief of Engineers and move the completion date up to 1 July 1931.[23]


Colonel Gustave R. Lukesh

Senator Wesley Jones of Washington kept pressing the Corps to produce a report on the irrigation component of the larger study as soon as possible. On 16 December 1929, Senator Jones wrote to the Chief of Engineers, "will you kindly write me just what the status is [of the irrigation studies] . . . so that I can send it to the people who are very much interested?"

The Acting Chief of Engineers, Brigadier General Herbert Deakyne, responded, based on a status report supplied by Colonel Lukesh, "that good progress is being made on this work" and quoted Lukesh to the effect that the Columbia River Basin project "in extent of superficial area . . . takes first rank of the areas in this section under study for irrigation." General Deakyne, however, omitted the Colonel's following sentence: "In other respects it is not the most important."[24]

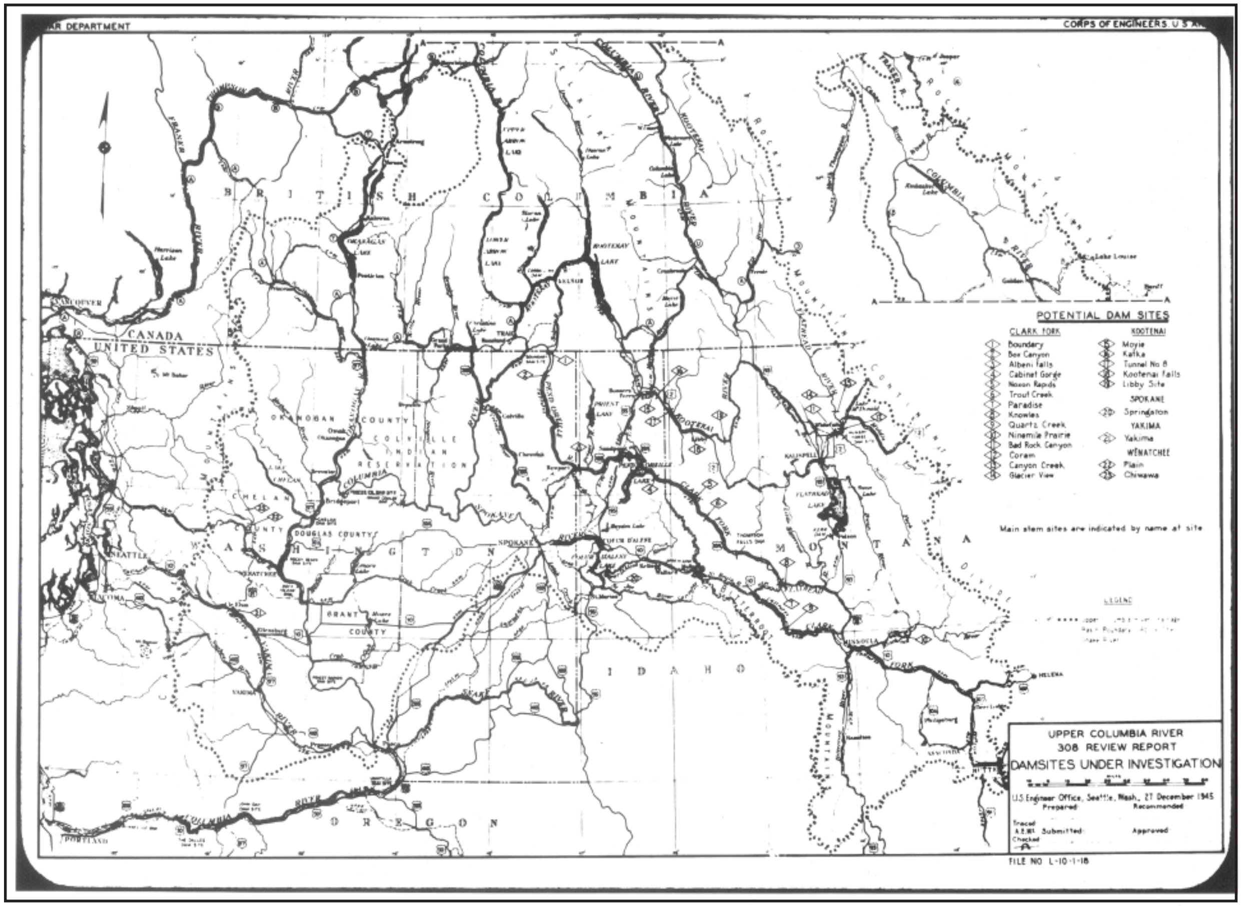
Of the four elements that were the focus of the 308 report—flood control, navigation, power, and irrigation—two clearly had less importance for the future development of the upper Columbia. Flooding, while a persistent and serious problem on many tributaries, was confined largely to tidewater sections of the Columbia below the Cascade Mountains. The lack of steamboat traffic on the upper Columbia after 1920, militated against a major study of this river use. Power and irrigation, therefore became the principal factors in river basin development. Major Butler reorganized his staff, separating the 308 effort from the regular rivers and harbors work. He assured Colonel Lukesh "that I am going to push this 308 work with all possible speed and in accordance with your views as far as possible."[25]

Major Butler's staff spent much time attempting to determine the future growth in power demand. The Seattle District hired outside consultants to study past trends and develop predictions of anticipated expansion. Industries thought to be prime customers for Columbia River hydroelectricity, especially mining and forest products, were examined in detail. Because the dams would be built far from potential markets, cost of transmission had to be taken into account. The long-term effects of the Great Depression on power consumption could only be guessed at, reducing the most careful estimates to what one engineer termed the level of prophecies. A major focus of debate concerned whether 15 or 25 years would be required to fully utilize power from a dam at Grand Coulee.[26]

Irrigation, though, required the most attention of the Seattle District engineers, since regional interests appeared to be successful in making it seem the most beneficial use of water from the upper Columbia. The Seattle District combined its own work with data from state and other federal agencies to prepare accurate basin-wide precipitation and soil quality information. Although previous reports were examined, the Seattle District developed its own data to evaluate objectively the gravity and pumping plans for getting water to the Columbia basin. Concern over damages from an excessive rise in the elevation of Pend Oreille Lake from the gravity plan caused the engineers to inspect supplementary storage sites at Priest, Couer d'Alene, and Flathead lakes.[27]

Following the Chief of Engineers instructions, however, attention centered on the main-stem Columbia River. Using Corps funds, the U.S. Geological Survey prepared a two-inch-to-the-mile chart of the river from the Canadian border to the mouth of the Snake River. That agency also cooperated by monitoring the gauging stations established by the Seattle District. Survey parties made core drillings to test foundation conditions at six dam sites on the Columbia: Grand Coulee, Foster Creek, Wells, Chelan, Rocky Reach, and Vantage. Seattle District geologists and consulting geologists also conducted studies to verify water tightness of a reservoir at Grand Coulee.[28]

Developing preliminary plans for a dam, powerhouse, and pumping components at the Grand Coulee site proved challenging because of the size of the proposed facility. As initially conceived, the dam would reach a height of 220 feet and would back the river up to Washington Water Power's



308 Report

permit for the Washington Water Power's proposed installation at Kettle Falls and any other application for a power license until he submitted the 308 Report and it was acted upon. Of course, supporters of the pumping plan applauded Butler's request.[29]

Once the engineers established the dam's height, a host of other technical issues had to be resolved. The Grand Coulee spillway, for example had to be designed to withstand the force of water falling from nearly the height of the Washington Monument. Answering the questions necessary to produce feasible preliminary plans for a high dam at Grand Coulee, led the engineers to settle on the pumping concept as the best means of irrigating the Columbia basin. Major Butler's analysis indicated that the sale of electricity from Grand Coulee would repay the cost of the irrigation project faster than would the gravity plan. Major Butler wrote to Colonel Lukesh "our studies show that the pumping plan, in connection with the power development at Grand Coulee, is the more economical plan." The Corps' 308 studies finally resolved the long fought controversy over the rival

proposed Kettle Falls project on the upper Columbia River. This soon changed because the engineers determined that the Columbia would have to impound water to the international boundary in order to be sure of supplying the irrigation works in low water months. To do this, the Seattle District engineers envisioned a "high dam" of 330 feet or more. A dam at Kettle Falls, by reducing the height of Grand Coulee, also would have limited Grand Coulee's electrical output and adversely affected its ability to financially support the irrigation project. Major Butler found it necessary to intercede with the Federal Power Commission to postpone action on the

plans to irrigate the upper Columbia River basin.[30]

That the Corps of Engineers made the key recommendation concerning the best method for irrigating the Columbia basin caused some consternation at the Bureau of Reclamation. From the beginning, recalled Colonel Lukesh in late 1930, he feared that the Corps was "treading on dangerous ground" in the matter. Lukesh thought that while most 308 studies carried out by other districts were not "productive of irritation to other Federal agencies, there is a strong possibility of such feeling as to streams where the irrigation feature is a factor." On the Columbia River, for example, the Corps "might be considered to be an interloper into the functions of the Bureau of Reclamation." It did not matter that the Corps acted upon the directive of Congress.[31]

The Seattle District's work on Columbia basin irrigation did raise the potential for conflict with the Bureau of Reclamation. Most historians, without thoroughly investigating the matter, assumed that a fierce rivalry arose between the two agencies over the development of upper Columbia River irrigation. For example, Paul Pitzer in his study of Grand Coulee Dam, asserted (while admitting that he had not fully researched the issue) that "for years the Army Corps of Engineers and the Bureau had jealously competed for turf, and neither wanted to yield any ground to the other." The historical record, however, does not sustain such a view as far as the Columbia River is concerned. Mary Reed, who has written a fine history of the Corps of Engineers' North Pacific Division and who perhaps has investigated the controversy most thoroughly, is skeptical that an adversarial relationship ever existed. After a careful examination of the record, she concluded, "in many respects . . . those outside the two agencies played important, if not decisive, roles in defining the issues and/or influencing the agencies."[32]

In fact, the existing agency records, press accounts, and correspondence of the outside interests involved indicate that while the Corps and the Bureau made a sincere attempt at cooperation, others kept the pot stirred. For example, two members of Congress decried the Corps' alleged usurping of the Bureau's rightful responsibilities in the field of irrigation in the Columbia basin. In a like vein, eastern Washington irrigation interests challenged the professional capability of the Corps to do irrigation studies. An agitated Secretary of the Interior complained to the Secretary of War in May 1929 that the Corps' 308 studies would encroach on work traditionally carried out by bureaus of the Interior Department. Despite minor misunderstandings and irritations, however, the Corps and the Bureau worked out the differences over their relative responsibilities for irrigation development and dam construction and operation with a minimum of disagreement. Certainly multipurpose planning blurred the line separating the missions of the two agencies. By the late 1920s, the Bureau had begun to focus on large-scale reclamation undertakings, such as the Boulder Project in Nevada, that required a massive dam for both hydroelectric and irrigation purposes. As a result of its 308 Reports, the Corps was prepared to undertake large multipurpose dams, combining power production with navigation and/or irrigation features. The Corps, in fact, increasingly assumed this role as congressionally authorized, Depression-era public works relief projects got underway.[33]

For its part, the Corps always acknowledged that the Bureau would construct the Columbia basin project, even while maintaining that it was in the best position to conduct objectively the studies necessary to determine which approach—the gravity or pumping plan—was superior. Despite congressional sniping and sporadic complaints by Elwood Mead, Commissioner of the Bureau of Reclamation, that the Corps was poaching on the Bureau's preserve, relations between the Corps and the Bureau at the regional level proceeded relatively smoothly. Even Mead admitted that there were no real conflicts between his agency and the Corps. Each was acting on similar, though potentially conflicting, legislative directives.

At the beginning of the 308 studies, both Major Butler and Colonel Lukesh tried to have the responsibility for the irrigation study of the Columbia basin assigned to the Bureau but had been overruled by the Chief of Engineers' office. Then, at the Chief's direction, Major Butler visited the Denver regional office of the Bureau in March 1929 to examine maps and other irrigation data to avoid duplication of effort. Upon Major Butler's request, much of this material was loaned to the Seattle District for the duration of its survey. Major Butler also requested the temporary services of A. J. Wiley, an experienced reclamation engineer, to evaluate the Seattle District's 308 Report irrigation studies. He noted that Wiley was "an outstanding engineer who has gained the confidence of Dr. Mead and other officials of the Bureau of Reclamation . . . [and his assistance] will be a benefit in coordinating the work of the two departments." In spite of the Corps' efforts at cooperation, Columbia basin project partisans and Bureau of Reclamation supporters continued to question the Corps' right to perform irrigation studies.[34]

When Congressman Louis Crampton complained in May 1929 that the Corps' 308 studies of the irrigation potential of the Columbia basin encroached on the Bureau of Reclamation's traditional turf, the Secretary of War, James Good, bluntly responded that the 308 studies were congressionally authorized. He added that the Corps of Engineers, though, was willing to cooperate with the Reclamation Service and assured Crampton that "the War Department has no desire to take over the functions of the Interior Department." In response to the controversy, Colonel Lukesh even suggested to Major Butler that he consider asking the Bureau to perform appropriate field and office work for the 308 irrigation studies, "the funds to be provided by the Engineer Department."[35]

In August 1930, Butler and Commissioner Mead held a conference in eastern Washington that paved the way for fuller cooperation and data sharing between the two agencies. At first, Major Butler declined to meet with Mead, citing the press of business. Mead, however, persisted and Butler arranged to attend a smoker given in honor of Mead on 2 August 1930 in Wenatchee, Washington. After a frank exchange of views concerning Mead's previous criticism of the Corps' intrusion into the Bureau's irrigation activities, both agreed to cooperate fully in all studies related to the Columbia basin project. In his summary of the meeting for the Chief of Engineers, Butler also strongly argued against the growing agitation by Columbia Basin project partisans for a joint irrigation report by the Corps and the Bureau. "It is believed," Butler wrote, "that this office has gone too far with its present studies to be diverted in its main purpose by a joint report with another branch of the Government." The issue arose after Congress in 1930 appropriated $50,000 for a separate Reclamation Bureau study of Columbia basin irrigation and supporters of irrigation in the region tried to force a joint study. Major Butler speculated that the push for a joint report indicated "that the Bureau of Reclamation sees the possibilities in the pumping plan for taking care of the cost of the dam and power house by the sale of commercial power, and hence the present agitation in the press by Dr. Mead and his party."[36]

Colonel Lukesh, in his endorsement of Major Butler's letter to the Chief, agreed with Major Butler that a joint report was inadvisable because the Corps was attempting "to produce a balanced plan for the utilization and control of the waters of the entire Columbia" and not just for the element of irrigation. Lukesh added that "Major Butler is to be commended for the way in which he represented the Engineer Department during the recent visit of Dr. Mead to the Columbia Basin project area, and for his excellent talk before the assemblage at Wenatchee on August 2." The Chief's office concurred that the Corps would issue its own 308 Report but also decided that the Bureau would be offered a chance to review and comment on the irrigation portion and have its remarks appended to the main report. In addition, the Chief ordered that there be "free interchange of plans" and "full information exchanged" between the two agencies, with "no overlapping in work" or "duplication of effort."[37]

Immediately after the meeting between Commissioner Mead and Major Butler, Mead assigned one of his top engineers, H. W. Bashore, as his personal representative for the Columbia basin project studies. Bashore quickly set up an office at Spokane, Washington, and proceeded to review all existing surveys and reports related to the Columbia basin irrigation proposals. To accommodate Bashore's mission and build good relations with the Bureau, Colonel Lukesh recommended to the Chief of Engineers that Major Butler be instructed to fully cooperate with Bashore, "asking in return that the source of original data obtained by the Engineer Department be acknowledged in Mr. Bashore's report." The Chief's office concurred with this suggestion.[38]

Major Butler's and Colonel Lukesh's main concern was that the Corps be able to carry out an objective survey of the irrigation potential of the Upper Columbia without being tainted by either the pumping or gravity plan proposals. As Major Butler told the Chief of Engineers in November 1930, he sought to convince all parties to the irrigation controversy "that the Corps of Engineers is approaching this problem with an open mind, with a desire to arrive at the truth, and to treat all alike." The political pressure for interagency cooperation and a joint report, however, never completely died out. As the time neared to draft the 308 Report, the Corps took further steps to placate the Bureau. To calm Mead's concern about the Corps intentions, the Chief of Engineers offered to let Mead review the completed irrigation studies before their final adoption by the Corps. A sanguine Mead reported to the Secretary of the Interior that he and the Chief of Engineers had an understanding that would avert "all danger of injurious controversy over conclusions" contained in the final 308 Report concerning irrigation. In Mead's view, any differences remaining were the result of meddling by others intent upon playing the Corps off against the Bureau for their own ends. Still, Mead could not resist adding that "nevertheless, the carrying out of separate and independent studies by two different branches of the Government, is a wasteful and undesirable procedure."[39]

For his part, Major Butler continued to work at establishing a rapport with his counterparts in the Bureau, and the informal exchange of data between them proceeded without major disruption or the need for a formal protocol. As Butler optimistically indicated to the Chief of Engineers in the fall of 1930, "the engineers of the Bureau of Reclamation have always shown a very commendable spirit of cooperation and it is thought that Mr. Bashore will be no exception." In a confidential memorandum to Colonel Lukesh, Major Butler promised "to cooperate fully with the Reclamation Service when called on" regardless of whether or not Bashore fully reciprocated. In fact, Butler thought Commissioner Mead was being truthful when he told the Chief of Engineers that Bashore was "not in a position to afford any actual cooperation to the Engineer Department." Apparently, Bashore's assignment required him simply to gather and evaluate information that would enable him to review the Corps' work on irrigation once it was completed. Commissioner Mead emphatically stated to the Columbia Basin Irrigation League that Bashore would make a detailed study of the Columbia Basin project and that the Bureau would draw "no conclusions . . . until Mr. Bashore has completed his investigation." Mead also informed the Chief of Engineers that Bashore would undertake no surveys himself but simply review existing studies."[40]

After initial difficulties, Butler and Bashore managed to work out their differences so that the Corps kept its investigations on track. As evidence that the engineers within the Bureau of Reclamation approved of his work, Major Butler quoted from the report of A. J. Wiley on Butler's irrigation work:

> "The study now being made under your direction impresses me as being a perfectly unbiased attempt to present all the factors needed to decide upon the best method of using the water of the Columbia and its tributaries for the reclamation of the Columbia basin tract. . . . I think that the work is being done in a very efficient way. So far as I can see nothing is being overlooked and nothing unnecessary is being done. I like the way the investigation is being handled and can suggest no changes in the methods you are using."

Major Butler kept his superiors closely informed of his efforts at cooperation with the Bureau of Reclamation in general and Bashore in particular.[41]

When an article in the 9 October 1930 issue of the *Engineering News Record* suggested the potential of separate and conflicting reports by the Corps and Bureau on the controversial Columbia basin project, Colonel Lukesh attempted to downplay the matter. Writing to Brigadier General G. B. Pillsbury, Assistant Chief of Engineers, he stated "there has been and is absolutely no friction so far as I know, and I believe myself to be well informed." Colonel Lukesh continued to favor full cooperation with the Bureau but was determined to produce a balanced final report that placed irrigation within the broader context of a full consideration of other water uses along the entire Columbia River. Privately, Colonel Lukesh fretted to Major Butler that Mead was attempting to cast doubt on the quality of the Corps' irrigation studies so that the Bureau of Reclamation could "not only take all glory and credit, but crush the ED [Engineer Department] into the mire."[42]

Realizing the significance of what his final report would propose as a plan of development for the Columbia River and the scrutiny it would receive, Colonel Lukesh was determined that his proposal would be "the best plan of improvement for all purposes" and firmly grounded in the assembled data. To accomplish this goal, Lukesh issued a set of instructions to the Seattle and Portland district engineers to insure that they carried out their economic analysis using the same cost assumptions. The "best plan" must give "full weight . . . to all economic factors." Lukesh noted that

Although a plan as a whole may be wholly feasible from an engineering construction point of view, or from the point of view of meeting the requirements as to full utilization of the river's resources and potentialities, yet, unless the plan is economically feasible, it can not be recommended.

This meant that all cost elements of an undertaking must be considered regardless of whom was paying them. Colonel Lukesh also reminded the two district engineers that their reports were but "a part of a report on the river as a whole." He hoped that by having them use the same approach in the treatment of economics and keeping the bigger picture in mind, he would not be placed in the position of having "to reconcile conflicting statements" when he drafted his report.[43]

As the 308 Report neared completion, the Corps sent Mead a draft for his review. Faced with a manuscript of 2,500 pages, an exasperated Mead responded that he lacked the means to review the document and that the Corps should submit the report without the Bureau's comments. When the North Pacific Division forwarded the 308 Report in July 1931 for higher level review within the Corps, it also agreed to a meeting with the Reclamation Board of Engineers to present its findings and, hopefully, to gain Reclamation's concurrence. By the time Major Butler had finished his portion of the 308 Report, he had completed his Seattle District tour of duty and had been reassigned to the Corps' office in Omaha, Nebraska. His knowledge, however, was essential and at the Bureau of Reclamation's request the Chief of Engineers included Butler in the joint review team. After reviewing the data and records and touring the potential dam sites, the Bureau representatives expressed their satisfaction with the report and the Seattle District agreed to assign an engineer to assist in revising the cost estimates for the irrigation project. The Bureau acquiesced in the Corps' recommendation for a power dam and for pumping water from a reservoir at Grand Coulee into canals.[44]

The Bureau's representatives at the meeting noted the Corps' continued cooperation, stating that the Corps had "manifested a willingness and desire to cooperate in any reasonable way to secure further data or make available any information which they had gathered." In a letter reprinted in the published Columbia River and Tributaries 308 Report, Mead stated "that there is a complete agreement between engineers of the War Department and those of this Bureau regarding the plans which should be adopted for irrigation and power development and estimates of cost." Commissioner Mead later acknowledged that the Bureau's subsequent report, which sought congressional authorization for a Columbia basin reclamation project, was based on the Corps' 308 Report. Mead praised the skill, thoroughness, and cooperative nature of the Corps' personnel in preparing the 308 Report.[45]

Published in 1933 as House of Representatives Document 103, the two-volume 308 Report comprised 1,848 closely printed pages. The report sought, according to Colonel Lukesh, to present a comprehensive approach to the development and control of the Columbia River. As Major Butler stated in his portion of the report, "an effort was made to combine the different features into a harmonious plan for the fullest possible use of the natural resources of the region; a plan which, if followed, would insure the ultimate complete use of those resources for the most beneficial purposes and without unnecessary waste." Although altered circumstances in the future would inevitably require changes in emphasis, added Major Butler, "it is confidently expected that the plan suggested will be a safe guide."[46]

The Seattle District's portion of the Columbia River and Tributaries 308 Report demonstrated that the development of power sites and irrigation on the upper portion of the Columbia was feasible, while improvements for navigation and flood control were not. As Colonel Lukesh pointed out, "only by canalization can through navigation over the upper river be made possible." There existed, in contrast—according to the Portland District part of the 308 Report—some likelihood of river transport being restored by multipurpose works along the middle Columbia and lower Snake. All Army engineers involved with the 308 studies agreed, however, that overall development could not be justified with navigation as the prime purpose.[47]

With respect to the control of flooding, the upper Columbia River's well-defined and deep channel generally limited even modest damages on the upper river to a once-in-400 year's occurrence. Major Butler, therefore, included no funds for flood protection in his cost estimates for the Army plan. Below the Snake River, the question of damages on the Columbia's tidal portion was "a matter of concern" to Colonel Lukesh. But since there was no need for a federal role, controlling works, such as levee raises, came within the capabilities of the states of Washington and Oregon. The situation, according to Lukesh, was not analogous to the Mississippi Valley, where a river passed through many states and protective works of one local jurisdiction often only transferred the damage to another.[48]

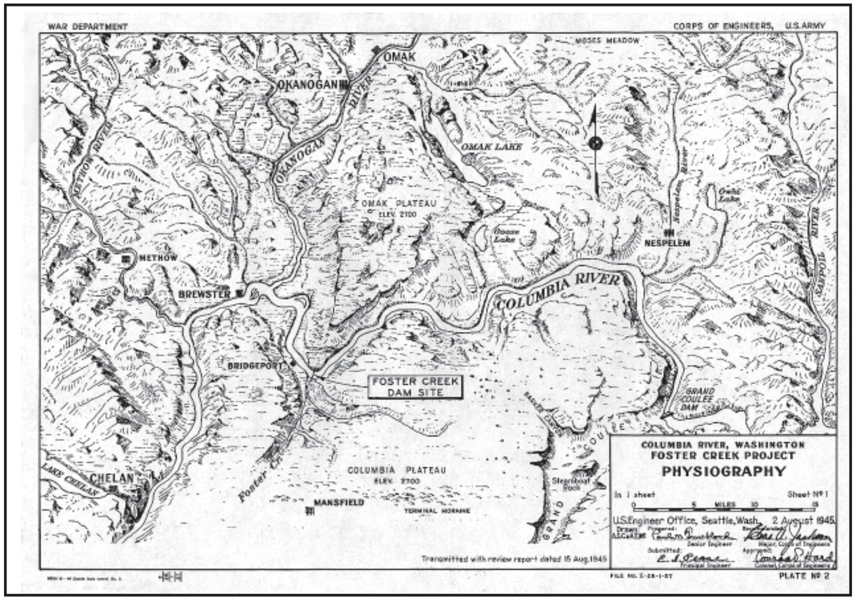
The 308 Report identified irrigation above the mouth of the Snake as a major consideration for future development, while finding no major irrigation program appeared warranted on the lower Columbia. Careful calculations led key determinations about the Columbia Basin project. The "existence of land and a nearby source of water," observed Colonel Lukesh, "do not alone warrant irrigation." Available capital, soil and climatic conditions, and the willingness of experienced farmers to take up land had to be considered. As Major Butler wrote in his section of the report, "Obtaining qualified settlers for development of the land is a problem, fully as essential to success as the construction work of the project." These factors, however, were deemed policy questions best left to Congress.[49]

Of the two rival plans for irrigating the Columbia basin, the pumping plan proved the most economical. Based on his investigations, Major Butler concluded that the gravity project, while feasible, would require an expenditure of $750 million. The estimated cost of the pumping alternative, however, came to only $341 million, a figure that could be substantially reduced through sale of Grand Coulee power. The Seattle District's examination, moreover, affirmed the Coulee's suitability for reservoir purposes. Butler calculated that with a subsidy from the dam, settlement at a rate of 25,000 acres per year would enable repayment of construction costs over a 68-year period. The 308 Report's projections of population growth in the Northwest suggested that future demand for food justified a staged development, with the power portion begun before construction of irrigation works.[50]

The Seattle District's part of the 308 Report thus provided official recognition of the superiority of the pumping plan based upon a power dam at Grand Coulee. At the same time, the overall survey displaced irrigation as the principal beneficial usage of the Columbia. Viewed from a Canadian border-to-the-Pacific Ocean perspective, electrical generation served as the primary focus of future development. Even above the Snake, the feasibility of moving water onto the dry plain depended upon the production and marketing of power. As Colonel Lukesh noted, power development "may be considered the basis of the report."[51]

To facilitate maximum utilization for production of electricity, the combined reports of the Seattle and Portland Districts proposed the construction of eight of the ten dams ultimately recommended by the Corps'

Board of Engineers, including the private power project then underway at Rock Island. Together, these structures would use 92 percent of the river's normal flow. Colonel Lukesh reported that "with one exception, each dam as planned will back water practically up to the dam next above, thus making available for power production about all the head that can be obtained at each site without interference with the next." The exception involved the 75 feet of slope between the foot of Priest Rapids and the mouth of the Snake. The lack of a suitable dam site combined with the need to avoid flooding the town of Pasco, meant that this stretch of the Columbia would be left in an undeveloped state.[52]



Foster Creek Project

Six of the proposed dams—Grand Coulee, Foster Creek, Chelan, Rocky Reach, Rock Island, and Priest Rapids—were above the Snake. The Seattle District engineers prepared preliminary cost estimates and construction plans for each dam, although the published report contained only the Grand Coulee plans. The geomorphology of the Columbia River presented a common problem. As Major Butler observed, "it is noteworthy that at only a few places, and then for short distances only, does the river flow directly upon the bedrock." Uncertain foundation conditions ultimately forced shifting the Chelan and Warrendale dam sites a few miles upstream from where originally recommended.[53]

The proposed Grand Coulee Dam comprised the most imposing of the recommended undertakings. Uncertain as to whether a low or a high dam represented the proper course, the Seattle District prepared plans for both. The smaller structure had a height of 360 feet from its foundation and cost $114 million. The larger dam reached 490 feet in height and extended from bluff to bluff for 4,290 feet. It required an expenditure of $181 million. Both plans called for a 15 unit powerhouse that would be installed in stages between the projected completion date of 1941 and the early 1950s. Ten pumping units were needed to lift water into the Coulee storage reservoir. The river itself would be impounded for 151 miles northeast to the Canadian border.[54]

Of the remaining proposed dams on the upper Columbia, the largest was at Foster Creek Rapids, 53 miles downstream from Grand Coulee. The Seattle District's plans called for a structure 225 feet high, requiring $48 million for construction. Engineers set the installed capacity at 691,000 kilowatts or 40 percent of that at the high Grand Coulee dam. The powerhouse design provided for a maximum of 12 generating units. At Foster Creek, projected damages were estimated at only $50,000 because of the "valueless" nature of the adjacent canon lands. In contrast, construction of Grand Coulee dam would cause damages to property of an estimated $6.6 million and a high dam at The Dalles would result in an estimated $71.3 million in damages.[55]

Because the dams proposed by the Seattle District were in remote locations, the manner and cost of distributing power became a major issue. As Colonel Lukesh pointed out, "some industries may find it economical to locate close to the generating stations, but the bulk of the energy will require long-distance transmission for delivery to the points at which it can be used most conveniently." The existing transmission technology and the concentration of population in the Puget Sound and the Willamette Valley of the Pacific Northwest made those the likely points. According to the Army engineers' calculations, it would cost approximately $10 million to construct the necessary initial 250-mile network of transmission lines.[56]

Clearly, the economic feasibility of the dams and transmission network rested on the existence of a large market. As Colonel Lukesh stated, "the primary element of power study is the amount of hydroelectric power that can at present and within a reasonable future be utilized in the Northwest." Accordingly, nearly a fifth of the Columbia River 308 Report focused on current and prospective power consumption. The Corps' studies revealed the short-term effects of the Great Depression on electrical consumption in the Pacific Northwest. While industrial usage declined by 8 percent in 1930, residential consumption increased by 13 percent. Based on this pattern, the Corps expected the overall upward trend of the preceding decade to continue, especially if prosperity returned. Power output in the Pacific Northwest had mounted at an average yearly rate of 9.5 percent since 1920. Taking a conservative view of future demand, Colonel Lukesh postulated that "the rate of increase of production will gradually decrease following a smooth curve." From this perspective, and recognizing the inherent uncertainties involved in such projections, the Corps anticipated that all of the power dams recommended would ultimately be needed, especially since the Army engineers proposed a gradual implementation of its plan.[57]

Federal construction of the proposed dams, though, was not a necessity. Past experience suggested that projects of such enormous size and funding as the Corps recommended exceeded the financial capabilities of private utility companies. Many years would have to pass before charges to customers enabled recovery of construction costs. But Colonel Lukesh believed that ever-expanding demand, as projected in the Corps' report, altered this situation: "the productive capacity of the larger power sites is now more quickly absorbed than it would have been in an earlier period." Thus private firms conceivably could undertake such projects with reasonable expectation of early profitable return. In their review of the Columbia River 308 Report, the Board of Engineers of the Corps, moreover, denied that Boulder Dam established a precedent for public construction and asserted that the hydropower potential of the Columbia should be developed "on a purely business basis."[58]

The 308 Report detailed an undertaking of awesome proportions. General Lytle Brown, the Chief of Engineers, wrote in his endorsement of Colonel Lukesh's report that "the structures contemplated in the scheme for power development are all on a large scale, some on a grand scale, and the conditions at some of them as to foundations and flood discharge over the dams are without precedent." Even so, General Brown had no doubt that the engineering problems were capable of resolution. Under the plan sent forward by the Corps, the Columbia River would be transformed into "the greatest system for water power to be found anywhere in the United States." Only one major obstacle remained. The dams alone, from Grand Coulee on the upper Columbia to Warrendale (later Bonneville) on the lower Columbia, would cost a startling $711 million.[59]

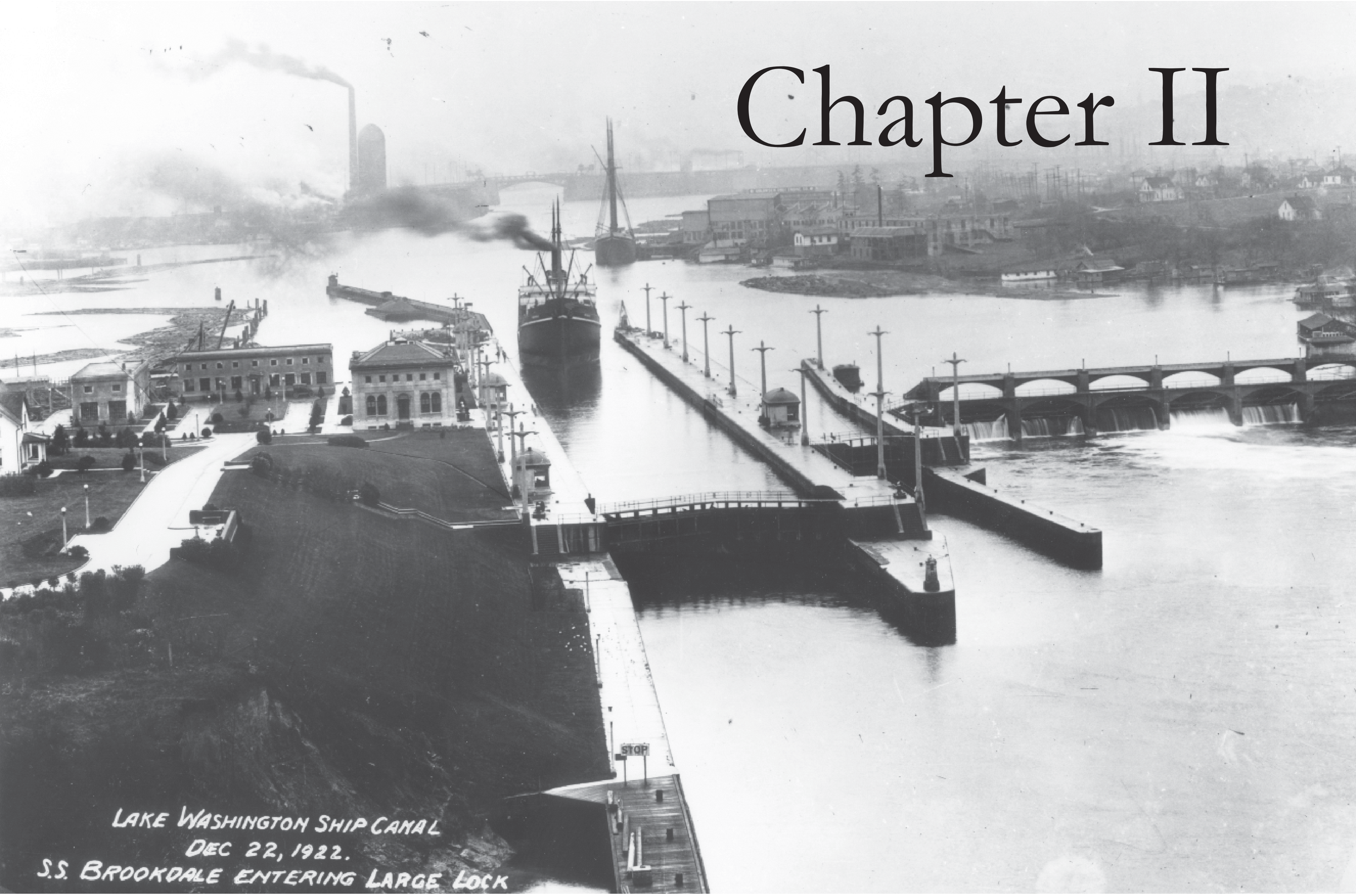
The cost factor proved especially daunting to the Hoover Administration stuck in the depths of the Great Depression, and it accounted for the anticlimactic recommendations of the Corps' higher authority. After completing its review, the Board of Engineers advised that the United States "would not be justified at the present time in making any improvement of the [Columbia] River other than as authorized by existing projects, nor would it be justified in participating in the cost of any portion of the comprehensive plan." The forecasts of Major Butler and Colonel Lukesh as to growth in power demand, the Board found, were "unduly optimistic." All that the Chief of Engineers ultimately recommended in his analysis was that permits be issued only for those private dam projects corresponding in general with the 308 Report plan and provision be made for incorporating navigation facilities as designed by the Corps. For their part, both Colonel Lukesh and Major Butler had been careful to state in their official 308 Report that they were simply laying out a comprehensive plan as a guide for the future development of the Columbia River. The actual level of any federal involvement in projects undertaken to carry out the plan was left to higher political authority in the President's administration and in Congress to decide.[60]

Despite this less than bold advice, the 308 Report of Colonel Lukesh and Major Butler soon emerged as a major document of Pacific Northwest history. The new administration of Franklin D. Roosevelt, moreover, proved more receptive to the notion of massive water resource projects providing work relief. The plan laid out in the 308 Report for the Columbia River presented a thoughtful blueprint for combining infrastructure creation with unemployment relief. Adroit political maneuvering by the Oregon and Washington congressional delegations won the new President's commitment for two federal dams on the Columbia River. In the year of the 308 Report's publication, construction started on Grand Coulee and Bonneville, two of the three dams selected by the Corps as prime for initially developing the Columbia River. The Corps built Bonneville Dam, while the Bureau constructed Grand Coulee Dam. Fortuitously, these structures were completed in time to provide power for the Hanford atomic works and the new aluminum and airplane industries of the Pacific Northwest, helping to win World War II. After the war, Congress ordered new studies, based on the original 308 Report, to guide further development of the Columbia River.

For fifty years, the 308 Report served as the basic plan for water resources work on the Columbia River.[61]

Major Butler and Colonel Lukesh deserve recognition as major figures in the history of the Pacific Northwest. Methodically and objectively, these Army engineers fearlessly investigated, analyzed, and ultimately produced a plan that was at once bold and yet feasible. Both men patiently resisted the pressures of special interests to bend the Corps' studies to their own ends and stood their ground within the federal bureaucracy to defend the results of their efforts. Their plan pointed the way to the future economic development of the region through multipurpose water resource projects, even if the command structure of the Corps of Engineers initially was reluctant to carry it out. Major Butler also laid out the future path of the Seattle District as it moved from traditional single purpose rivers and harbor work to multipurpose projects involving hydropower and flood control.

Chapter II


LAKE WASHINGTON SHIP CANAL
DEC 22, 1922.
S.S. BROOKDALE ENTERING LARGE LOCK
STOP

CIVIL WORKS PROJECTS DURING THE INTERWAR YEARS

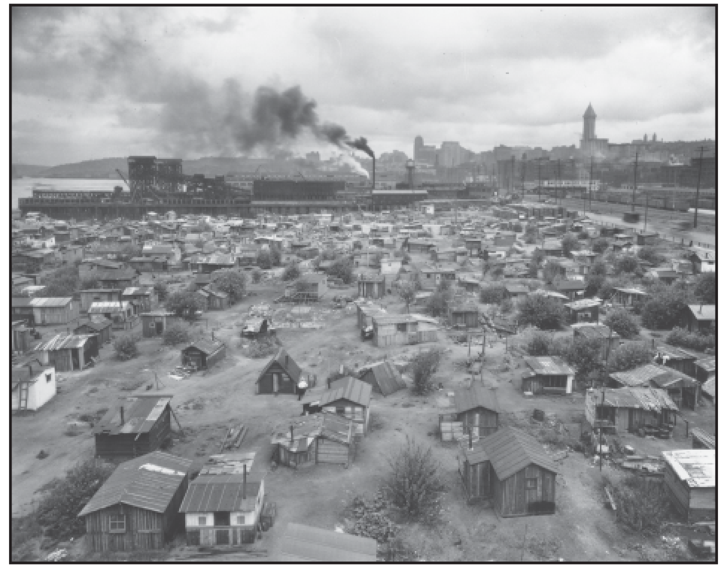
Following completion of the Lake Washington Ship Canal in 1917 (see volume one), civil works activity in the Seattle District entered a quiet period that continued through much of the 1920s. Traditional rivers and harbors work that focused on western Washington proceeded mostly in a low-key maintenance mode. The loss of responsibility for Alaska projects when the Corps established the Alaska District Office in Juneau in 1921 further cut the Seattle District workload. This reduced level of activity changed with the new attention given eastern Washington as a result of the Congressionally-mandated 308 Report studies initiated in late 1928. Despite the impression that the Columbia River basin development investigations captured most of the Seattle District's attention during the 1930s, important new and continuing Corps navigation and flood control work occurred on the Puget Sound drainage and elsewhere along the Pacific coast.

The 1920s and 1930s in Washington

Between the world wars, extractive industries such as forestry, agriculture, and fisheries dominated the economy of Washington. Along the state's Pacific coastline, lumber companies rapidly harvested and milled huge old growth forests of Douglas firs and fisherman trolled the rich coastal waters for salmon and other valuable fish. The coastal region was isolated from the rest of Washington by difficult, mountainous terrain and limited transportation facilities. Few hard surfaced roads or railroads connected the region with the major urban population centers of Seattle and Tacoma. In fact, as late as 1940, the entire Pacific Northwest had only 12,000 miles of all weather roads. Waterborne transportation proved the most efficient means to carry commerce and people to and from the coastal region.[1]

In the late 19th and early 20th centuries, settlements had sprung up at natural harbors along the Washington coast where lumbermen had built sawmills and docks and fishermen had constructed fish processing stations, boatyards, and canneries. Some general freight also passed through the coastal harbors. In their natural state, these harbors often were too shallow or subject to dangerous bar conditions, severely limiting the possibilities for extensive commercial and industrial development. Large-scale fishing and lumbering operations demanded safe and commodious harbors to process and ship their products to outside markets. Consequently, throughout the interwar years, coastal settlements and their various business interests sought federal help through the Corps of Engineers to improve the navigability of their harbors and waterways.

While the natural resource-based economy of the Pacific Northwest had never really boomed in the 1920s, the Depression of the 1930s crippled



Hooverville
March, 1933

it, causing mortgage foreclosures, delinquent taxes, bankruptcies, and rising unemployment. Seattle had its "Hooverville" (a shantytown for the unemployed and down-and-out) on the waterfront and high unemployment among its longshoreman and other maritime workers. The situation was no better in the forest products industry, which accounted for half of the wage earners in Washington. The bottom fell out the lumber market after 1929; and by 1932, eighty percent of the lumber mills in the Pacific Northwest had closed. Between 1929 and 1932, the state's annual lumber production dropped from 7.3 billion feet to 2.2 billion feet. The Depression also had a devastating effect on the fishing and maritime industries. The loss of markets led to laid up boats and their crews to the unemployment line. Business at Pacific coast docks and terminals slowed dramatically. Labor strife was endemic in the lumber and maritime industries along the Pacific coast in the mid-1930s.

Federal assistance through President Franklin Roosevelt's New Deal programs brought relief, jobs, and a source of capital to the beleaguered Pacific Northwest. The public works programs of the federal agencies, such as the Public Works Administration and the Federal Emergency Relief Administration, and the new flood control and multipurpose projects of the Corps helped to stem the tide of economic decline in the region. The Corps also provided economic relief in more traditional ways as well. In addition to the regular congressional appropriations for its rivers and harbor program, the Corps also applied relief money from other federal agencies to expand the scope or speed up the work on its navigation projects. After 1936, the Corps' flood control undertakings provided further injections of money and jobs for the Washington economy.

During either good or bad economic times, the adoption of a rivers and harbors project by the Corps' resulted from a fairly standardized political and engineering process. A Corps' project usually had its beginning in a request by local interests through their Congressional representative for federal assistance to improve the navigability of a waterway. Congress would request that the local Corps district office prepare a preliminary examination to determine if there existed sufficient present or future potential growth of commerce or shipping to justify a federal navigation project.

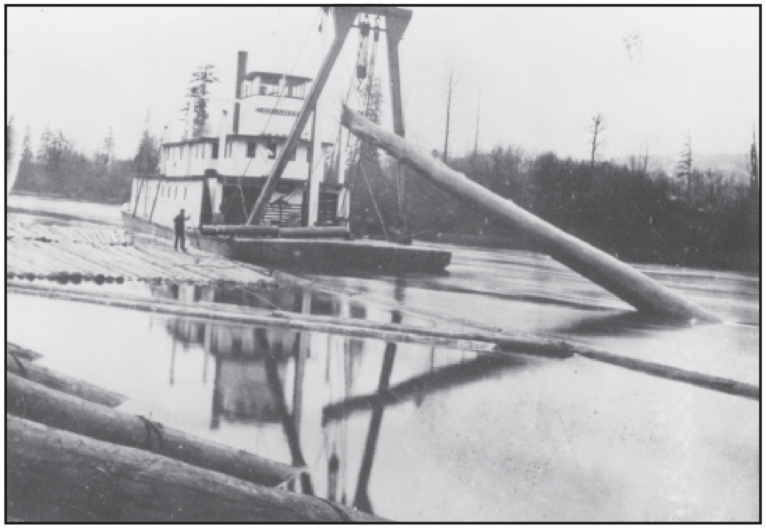
If the Corps, based on its preliminary examination, recommended against a project, that usually ended the process for a time. If, on the other hand, the Corps found sufficient economic justification for a federal undertaking, it would recommend to Congress that it be allowed to conduct a survey to develop a detailed engineering plan and cost estimate for a rivers and harbors project. If Congress then authorized and funded such a survey, the Corps would carry out the detailed study, develop a feasibility report, and again report back to Congress. Before its final submittal to Congress, the project worked up by a Corps' district would undergo rigorous review by the agency's division office, an engineering review board at the Corps' headquarters, and the Office of the Chief of Engineers. Some projects never survived this internal review process. Once a project reached Congress, however, it would then be up to the local interests desiring the proposal to lobby Congress to actually authorize and appropriate funds so that the Corps could carry out the recommended plan. From beginning to completion, the path of a Corps' water resources project was strewn with many potential technical, financial, and political hurdles. What follows are specific examples of the Seattle Districts' rivers and harbors projects and their results during the 1920s and 1930s.

Puget Sound Project

At the beginning of the 1920s, the Seattle District had responsibility for 20 rivers and harbors projects, including 18 in Washington and 2 in Alaska. Of the Washington improvements assigned to the Seattle District, all except the upper Columbia River navigation channel were located along the coasts or on the Puget Sound and its tributaries. From the Nooksak River on the north to the Nisqually River on the south, the streams tributary to Puget Sound were dangerously obstructed by snags and other debris brought down by the annual freshets. Shallow draft steamers could navigate only at the highest stages of tide, and towing log rafts and floating timber—the other main commercial uses of the rivers—proved uncertain much of the time. To overcome these difficulties, the Corps, beginning in 1882, engaged in annual snagging and dredging operations. By 1920, the Corps had expended $594,000 on new and continuing Puget Sound operations, averaging about $20,000 a year.[2]

To carry out its navigation improvements on the rivers tributary to Puget Sound during the 1920s, the Seattle District used the *Swinomish*, a stern wheel snag boat and clamshell bucket dredge built in 1915. It replaced the snag boat *Skagit*, originally built in 1883 and rebuilt in 1896. The snagging and dredging produced no lasting results because annual freshets quickly washed debris back into the stream channels. Some critics questioned these efforts at rivers and harbors improvements on the Puget Sound because river borne commerce in the coastal region was on the decline by the 1920s. Improved roads permitted freight and log trucks to provide an economical alternative to river steamers and log drives, the main river usage. The Seattle District Engineer admitted in his Annual Report for 1920 that, for all the Corps' efforts at dredging and snagging, "no permanent results are obtainable, but the maintenance of existing channels requires continuous operation of the snag boat." In that same annual report, the Seattle District Engineer also recorded that the snagboat *Swinomish* removed 2,270 snags, 29 trees, 113 piles, and 14,161 cubic yards of material from the rivers and sloughs emptying into Puget Sound. Between 1920 and 1930, Seattle District spent an average of $19,477 on annual maintenance on the Puget Sound project.[3]

During the 1920s, the annual snagging and dredging work of the 161- by 32-foot *Swinomish* required a crew of 16. These men lived on board while the riverboat operated seven days a week on the rivers and sloughs of the Sound. The captain had complete authority to hire and fire his crew; and the deckhands, if they stayed and showed suitable aptitude, could work their



Skagit

way up to mate or even captain in time. It was not unusual for crew members to spend a lifetime on the snagboat and, upon retirement, to be succeeded by sons or other close family members. Work on the snagboat was arduous and often dangerous. When not surveying for and removing snags and other debris from the waterways of the Sound, deckhands spent their time repairing tools, such as the sounding and pike pole, peavey, pickeroon, swamp hook, axes, and saws.[4]

The *Swinomish's* clamshell dredging bucket had a two cubic-yard capacity, and its A-frame with swinging boom could lift 75 tons. The crew conducted sweeping operations with skifts and floating lines to locate and mark snags for removal, using mechanically operated hooks and dynamite. The snagging and dredging operations took their toll on the *Swinomish*. After sinking twice and receiving numerous overhauls during the 1920s, the boat began to show its age. Finally, in 1929, the *Swinomish* had its machinery and deckhouse removed and reinstalled on a new wooden hull. The Corps renamed the boat the *W. T. Preston* in honor of the only civilian district engineer to serve the Seattle District. This occurred during World War I, when there was a shortage of regular army engineer officers.[5]

The *W. T. Preston* served ably during the 1930s, although changes in operations occurred. In 1935, the District instituted a 44-hour workweek and made employment practices subject to civil service requirements. In the following year, after 31 years of service, Captain Frederick Siegel retired from the *W. T. Preston*. He also had served as the captain of the snagboat *Skagit*, predecessor of the *Swinomish*, as well as on the *Swinomish* and the *W. T. Preston.* His son-in-law, who had started his career in 1925 as an engineer on the Swinomish, replaced him as captain. Deterioration of the *Preston's* shallow-draft wood hull led to its replacement in 1939 with a welded steel hull and a new wood frame deckhouse. The machinery, wheel, lifting gear, and various furnishings, originally from the *Swinomish*, were retained on the rebuilt *W. T. Preston*.[6]

Seattle District Engineers became frustrated by their inability to achieve lasting benefits from their navigation maintenance operations on Puget Sound but were unwilling to recommend abandoning them. Declining commercial use of the rivers on the Sound also added pressure for change. In 1928, the Seattle District proposed modifying the existing project by using a government-owned pipeline dredge to remove shoals blocking river navigation. A pipeline dredge had the advantage of depositing material away from channel banks, where as the existing clamshell dredge could only dump its material along the shoreline where freshets soon washed it back in the waterway. Nothing came of this proposal and during the 1930s, annual Puget Sound project maintenance costs for snagging and dredging averaged $24,168.[7]

Willapa Harbor

In general, the Seattle District projects on the Washington coast called for improving and maintaining navigation channels to a certain depth and width to support transportation by ships entering coastal harbors or to assist shallow-depth steamers attempting to travel short distances up a coastal river. Local interests constantly lobbied Congress to authorize such navigation projects. The Corps' project at Willapa Bay, Washington, initiated in 1892 and modified several times thereafter, exhibited typical features of such work.

Willapa Harbor was an inlet 30 miles north of the Columbia River at the mouth of the Willapa River. Under natural conditions, a series of shoals limited the navigable depth within the Willapa Harbor, and snags clogged the Willapa River. By 1920, the Corps' project for the Willapa River and Harbor called for a channel 24 feet deep and 200 feet wide from the entrance bar in Willapa Bay to Raymond, Washington. From that point, the Corps maintained a channel 24 feet deep and 150 feet wide up the North and South Fork for a short distance. After local cooperation requirements were

Willapa Bay

met in 1920, the Seattle District began dredging, snagging, and constructing dikes and achieved the full project dimensions in 1924. Elements of local cooperation included a cash contribution of $71,775 towards project costs estimated at $819,170 and the provision of dumping grounds for dredged material. In 1927, Congress modified the project to include maintenance of the bar channel to a depth of 23 feet. This navigation improvement supported trade generated by nine sawmills and two general freight wharves in Willapa Harbor and resulted in the development of a lumber export trade not previously possible. Annual project maintenance costs averaged $10,358 during the 1920s.[8]

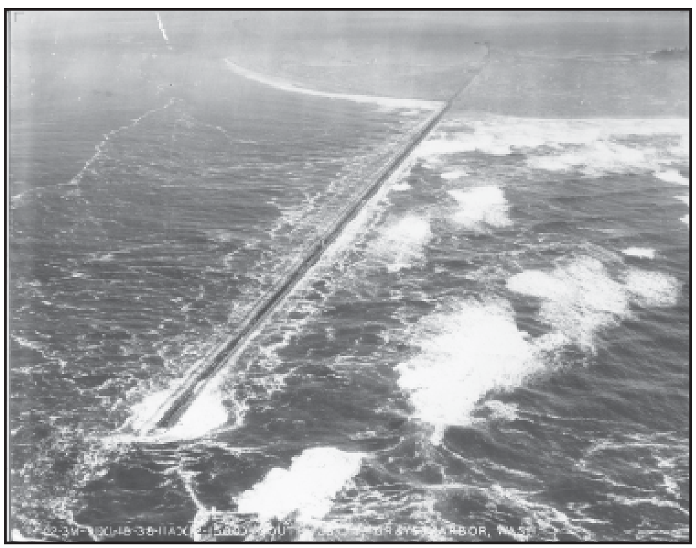
In 1935, Congress further modified the Willapa River and Harbor project to increase the maintained depth over the bar to 26 feet, to create a cut-off channel at the Narrows, and to increase the maintenance depth of the harbor channel to 26 feet. These changes greatly increased the annual maintenance costs of the project. Depression-era public works funds, however, also became available to supplement the Corps' regular appropriations for the Willapa River and Harbor project. During the 1930s, the annual maintenance costs averaged $104,098—ten times the figure for the 1920s. Expenditures for new work amounted to $192,134 for the decade.[9]

Grays Harbor

Grays Harbor, at the mouth of the Chehalis River on the southwestern Washington coast, represented a major Seattle District navigation project. Between 1896 and 1920, the Corps had constructed two massive jetties to secure a 24-foot channel over the bar. The Seattle District completed the south jetty in 1902 and the north jetty in 1915. Over time the jetties had deteriorated under the incessant pounding of the ocean, and the actual prevailing depth was only 19 feet. The project, which by 1920 had cost $2.6 million to construct and $654,572 to maintain, supported thriving lumbering operations located in Grays Harbor. Commerce clearing the bar in 1920 amounted to 636,571 tons valued at $14.4 million; by 1929 traffic over the bar amounted to 2.2 million tons worth $29 million. Concerned that large ships could not operate economically as the bar shoaled, local interest sought not only the authorized depth, which was only 80 per cent complete by 1920, but also an increase to 40 feet. Average annual maintenance costs, mostly for dredging, during the 1920s amounted to $135,000.[10]

The Corps also had a project to provide a 200 foot-wide, 18 foot-deep channel in Grays Harbor between the bar entrance and Aberdeen at the mouth of the Chelalis River, a distance of 15 miles. The undertaking then called for a channel 150 feet wide, six feet deep, and 8.5 miles long up the Chehalis River to Montesano. The work, begun in 1907 and completed in 1910, required dredging, diking, and snagging. The initial project dredging removed 1.8 million cubic yards, but by 1920 another 1.3 million cubic yards of maintenance dredging was necessary. As of 1920, the Seattle District had spent $507,555 on the project, including $156,233 in maintenance dredging. The port of Grays Harbor Commission assumed the annual maintenance in 1920. At times during the 1920s, the Seattle District used its sea going hopper dredge, the *Culebra*, to dredge shoals in the inner harbor. The Corps required the Grays Harbor Port Commission to pay the cost of fuel and lubricants used for such dredging and, in certain instances, the total cost of such operations. In 1930, Congress authorized increasing the Chehalis River channel depth to 16 feet.[11]

Annual maintenance dredging of the bar at Grays Harbor continued unabated during the 1930s. In 1932, the Corps recommended combining the existing bar and inner harbor projects and increasing their dimensions. The new plan, referred to as Grays Harbor and Chehalis River, called for deepening the bar channel to 30 feet with a minimum width of 600 feet by



Grays Harbor, South Jetty

extending the jetties and by increased dredging. The inner harbor would have a channel 26 feet deep and 350 feet wide from the bar to Aberdeen, and a channel 16 feet deep and 150 feet wide in the Chehalis River from Cosmopolis to Montesano. Annual maintenance dredging on the combined project during the 1930s averaged $191,362.[12]

By the early 1930s, both the Grays Harbor commercial interests and the Corps agreed that jetty reconstruction was the best approach to maintaining the bar depth. Within the Corps, however, opinions differed over whether both jetties should be rehabilitated and /or extended. Ultimately, the Chief of Engineers, following the advice of Colonel Thomas Robins, the North Pacific Division Engineer, recommended reconstructing both jetties without extensions. In 1935, Congress authorized reconstructing the north and south jetties and adopted revised bar, harbor, and river dimensions as recommended in the combined project of the Corps.[13]

During the 1930s, the local port commission struggled to pay for its portion of maintaining channel depths and pushed unsuccessfully to have the federal government assume the entire cost. Some Depression-era public works funds were used on both the new work and continuing maintenance operations. The Seattle District began reconstructing the south jetty in 1936, but inadequate funding delayed progress on the project. The work remained uncompleted in 1940, when national war preparedness priorities cut off further funding. No rebuilding of the north jetty took place before World War II. By June 1940, the total cost of the Grays Harbor combined project had reached $12.4 million.[14]

Tacoma Harbor

To improve the commercial possibilities of Tacoma on Commencement Bay 30 miles south of Seattle, various public and private entities had attempted to deepen two channels in the waterway. Prior to 1902, when Congress authorized a Corps project, local interests had dredged a channel 200 feet wide, 25 feet deep, and 4,000 feet long known as the city waterway. It connected the public and private terminals at Tacoma's 11th street bridge with deep water. The Corps' navigation project involved extending the existing city waterway another 4,500 feet, with depths between 15 feet and 18 feet; and reviving the failed effort to establish a channel 500 feet wide, 3,650 feet long, and 28 feet deep in the so-called Puyallup waterway. The Seattle District completed work on the city waterway in 1905 and provided annual maintenance for it.[15]

Puyallup waterway construction, however, proved difficult because of the annual freshet on the Puyallup River. The Seattle District started work on the Puyallup waterway in 1908 and by 1910 had removed 1.8 million cubic yards of material. In November 1909, a flood in the Puyallup River completely filled the waterway with silt. Following that unfortunate event, the Rivers and Harbors Act of 1910 suspended all Corps work on the Puyallup waterway until local interests agreed to divert the Puyallup River from the waterway. Tacoma civic leaders, however, refused to assume that expensive burden. Although by 1920, the Corps had spent $337,233 on the Tacoma harbor project, local interests still had not undertaken a diversion of the Puyallup River. The main city waterway adequately served Tacoma's extensive harbor facilities and ocean-going commercial traffic. The Seattle District removed shoals in the city waterway in 1917, 1924, 1928, and 1931; otherwise, little maintenance work proved necessary.[16]

Although overtaken by Seattle as the premier commercial city of Puget Sound in the early years of the 20th century, Tacoma continued as a major port at the southern end of the Sound. Its principal exports consisted of lumber products, flour, and copper. In 1929, the port shipped 3 million tons of general cargo (excluding floating timbers) valued at $171 million. By comparison, the Port of Seattle shipped 7.5 million tons of goods (excluding floating timbers) worth $757 million. The Depression of the 1930s hit Tacoma's lumber industry hard, but the long-term economic trend appeared favorable.[17]

During the 1920s, Tacoma commercial interests had expanded the Tacoma harbor by improving the Hylebos waterway and the Wapato waterway. In 1930, Congress authorized the Corps to complete the Hylebos waterway project and to take over maintenance of the entire Tacoma waterfront, from the city waterway on the west through the Puyallup and Wapato channels in the center to the Hylebos waterway on the east. The Seattle District established and maintained a channel 200 feet wide and 30 feet deep from Commencement Bay to Lincoln Avenue (10,000 feet in length) and then a channel 150 feet wide and 26 feet deep for another 3,000 feet to the end of the waterway. The cost of deepening the Hylebos waterway came to $124,085, with the project completed in 1931.[18]

In 1933, the Corps recommended modifying the existing Tacoma Harbor project by abandoning any improvement of the Puyallup waterway; constructing two, 700 foot long training walls at the mouth of the Puyallup River; and providing federal maintenance of the entire Wapato waterway after local interests deepened it to 34 feet. Using federal emergency public works funds, the Seattle District built the two training walls in 1934 at a cost of $51,609. The Rivers and Harbors Act of 1935 allowed the Corps to drop the Puyallup waterway and to assume the maintenance of the completed Wapato waterway. In 1936, the Corps recommended adding a turning basin to the Hylebos waterway, and Congress approved the work in 1937. The Seattle District completed the turning basin in January 1939 at a cost of $88,416. In spite of the fact that Seattle had five times the population of Tacoma and a more commercially valuable port, the Corps spent over 30 percent more on improving the latter's harbor than on bettering the former. By 1940, the improvements and maintenance costs at Tacoma came to $701,427 but only $483,301 at Seattle.[19]

Seattle Harbor

Seattle served as the chief commercial harbor on Puget Sound. Its main anchorage encompassed Elliott Bay, an arm of Puget Sound that extended two miles in width and four miles in length. Between 1894 and 1910, local interests had attempted to expand the waterway by dredging to the east and west of the mouth of the Duwamish River, a tributary at the southern end of Elliott Bay. The river emptied into the bay across extensive shallow tidal flats with no discernible channel. As available commercial space on Seattle's waterfront became scarce, developers had looked to the Duwamish drainage, with its broad and flat expanse of buildable land and excellent rail service, as a logical place to expand the city's harbor facilities. In 1910, the local improvement district, working to deepen the Duwamish River for a distance of four miles upstream, attempted to involve the Corps in the project. The Seattle District Engineer advised against federal action because of the limited commercial development along the Duwamish waterway up to that time. As Captain Arthur Williams of the Seattle District wrote in 1910, Corps involvement would "place the United States in the position of improving a river to create a traffic instead of to accommodate a commerce already existing."[20]

The Duwamish waterway soon underwent a major expansion by the newly established local port district, the Port of Seattle. Authorized by the state legislature in 1911, the Port of Seattle set about improving the city's waterfront. Private investors spent millions on constructing wharves, terminals, and shipyards along the newly expanded Seattle waterfront. In 1919, the Seattle District recommended and Congress approved the Corps' assumption of maintenance of the completed East and West waterways, which extended about 2 miles and had an authorized depth of 34 feet. The legislation also authorized the Corps to provide maintenance on the Duwamish waterway once the state and King County finished dredging it. The Duwamish channel, when completed, would extend 3.2 miles, have a width of 150 feet, and a depth of 20 feet.[21]

Local interests finally finished the Duwamish waterway in 1924; and in the following year, Congress, at the Corps' urging, authorized enlarging the waterway by deepening the lower portion to 30 feet and the upper section to between 15 and 20 feet. Colonel Edward Schulz, Seattle District Engineer, had stated as early as June 1922 "there can be no doubt that this waterway [Duwamish] will be a valuable future asset to the United States" and urged the enlargement of the project dimensions. The Corps' Board of Engineers at first demurred but upon reconsideration agreed the project for enlarging the Duwamish waterway should be approved. In reaching its conclusion, the Board cited the commercial importance of Seattle and the sizeable investment in harbor improvements already undertaken by local interests. The legislation authorizing the new project required local interests to pay half of the cost of the new work; and once that obligation was met, the Seattle District completed the undertaking in 1929. By 1930, state and local government bodies had spent a total of $6.3 million on improving the East, West, and Duwamish waterways; and the Seattle District had expended $158,252 on the harbor work. Commerce in the Seattle harbor grew from 5.5 million tons in 1919 to 10.5 million tons in 1929.[22]

In response to renewed lobbying by local shipping and port interests, Major Butler conducted another study of the adequacy of the existing project. As a result of his examination, he recommended in 1929 that the Corps extend the Duwamish channel a distance of 1.4 miles with dimension of 15 by 150 feet. The Division Engineer, Colonel Gustave Lukesh, disagreed with this proposal, pointing out the current lack of commercial activity along that portion of the waterway proposed for enlargement. Colonel Lukesh argued that the "extension appears to be one that should entirely . . . be made by those immediately interested." The Corps' Board of Engineers, though, endorsed Major Butler's plan, noting that the United States had spent a "comparatively insignificant" sum of money on the Duwamish waterway, considering that "Seattle Harbor is one of the most important Pacific coast ports."[23]

Congress accepted the Corps' recommendation and adopted the waterway expansion in 1930; local interests, however, had difficulty raising their half of the project cost ($150,000) and the work was slow to get underway. Ultimately, the Seattle District had to omit part of the project—a settling basin—because the local funding match was lacking. It did not complete the remaining work until December 1931. In 1932, the Corps recommended that Congress authorize additional maintenance dredging in the East waterway. Congress failed to act on this advice until 1935, when it finally approved the new maintenance work.[24]

Ever-persistent local interests sought to have the Corps enlarge and lengthen the upstream portion of the Duwamish waterway again in 1936. This time, all levels of the Corps responded negatively, noting that Seattle's commerce had not yet recovered to its pre-Depression era level. As the Corps' Board of Engineers noted, the tonnage of Seattle's harbor had dropped from 10 million in 1929 to 6 million in 1933 and had rebounded only slightly in 1934 to 6.8 million. Lieutenant Colonel Wild, the Seattle District Engineer, bluntly stated the Corps' view: "Further improvement of Duwamish Waterway is not necessary to accommodate present or reasonably prospective commerce." Although reluctant in the late 1930s to modify the existing Seattle harbor project, the Corps' past work had established a precedent for future waterway expansion when justified by growing levels of commerce. The Seattle District moreover, had taken over full channel maintenance from the Seattle port commission. By 1940, the Seattle District had spent $483,301 on its project for improving and maintaining the Seattle harbor.[25]

Lake Washington Ship Canal

The other possible location for expansion of Seattle's harbor facilities existed to the north at Salmon Bay and along the shores of Lake Washington. The construction of the Lake Washington Ship Canal by the Corps made expansion in this direction possible. Built between 1910 and 1916, the Lake Washington Ship Canal represented the largest undertaking of the Seattle District in its first thirty years. When completed, the canal extended from Puget Sound through Shilshole Bay, Salmon Bay, Lake Union, and Union Bay to Lake Washington—a distance of eight miles. To establish the connection between Puget Sound and Lake Washington, the Seattle District built a concrete double lock and fixed dam at the entrance to Salmon Bay and a 30 foot deep by 150 foot wide channel from the locks to Puget Sound. Local interests excavated a channel 25 feet deep and 75 feet wide from the locks to Lake Washington. The locks and dam cost the federal government $2.3 million, and local governments spent $1 million on excavation and revetment work. By 1920, the Seattle District had spent $3 million building and maintaining the Lake Washington Ship Canal.[26]

During the 1920s, Congress authorized the Seattle District to increase the dimensions of the channel between the locks and Puget Sound by dredging, to carry out extensive revetment work, and to make other plant

Lake Washington Ship Canal
June 11, 1923

and structural additions to the Lake Washington Ship Canal project. By 1930, the Seattle District had expended an additional $800,000 on new work and $98,000 on maintenance of the project. In addition, the actual operation and maintenance of the locks, dam, buildings, and grounds of the project were covered under a separate annual appropriation, totaling $1.1 million by 1930. The Seattle District completed the last of the canal's revetment work in 1932 and considered the entire project finished at that time. Total construction cost came to $3.3 million and another $110,201 was required for maintenance. Using public works funds in the mid-1930s, the Seattle District dredged a 30-foot channel between the locks and Lake Washington. By 1940 total project costs came to $6.3 million.[27]

Unfortunately, the Lake Washington Ship Canal failed to live up to its projectors commercial hopes. The expected commercial traffic developed very slowly and consisted mostly of log rafts and bulk commodities, such as sand and gravel, coal, and mineral oil. In time, recreation boating became the main use of the ship canal. Still, it remained one of the prized, large-scale projects of the Seattle District.

Everett Harbor

The Seattle District also had a diking and dredging project on the Snohomish River, which emptied into Puget Sound via a system of sloughs at Everett, Washington. The 21-mile long Snohomish River was formed by the junction of the Snoqualmie and Skykomish rivers. The Corps' navigation improvement, begun in 1894 and consisting of diking and dredging, was modified in 1902 and 1910. It was supposed to establish a navigable channel 75 feet wide, 8 feet deep, and 5.5 miles long from deep water in the Everett harbor to the head of Steamboat Slough and the lower Snohomish River. Severe siltation from the Snohomish, however, continued to frustrate the Corps. The project had cost $643,527 by 1920, but the Seattle District Engineer noted in his Annual Report "extensive shoaling has taken place in the dredged channel and only 50 percent of the original cut remained." The waterway was used chiefly for towing logs. The Seattle District performed little maintenance on this project during the 1920s; and, in 1930, Major Butler noted that the work up to that time had achieved "no material increase in available depths."[28]

During the 1930s, the Corps undertook several efforts to improve project results by diverting more river-borne sediment directly into Puget Sound. In 1931 and 1932, the Seattle District raised the existing dike in Everett Harbor, widening the opening at the outlet of the Snohomish River, and carried out maintenance dredging in the eight-foot channel. This effort finally achieved authorized project dimensions; and the Corps did no further work on the project until 1937, when additional maintenance dredging became necessary. In 1939, with an allotment of $28,000, the Seattle District dredged a settling basin in another attempt to better control the siltation problem in the harbor. In a study by the Seattle District in 1937, Colonel H. J. Wild reassessed the Everett Harbor project and candidly admitted that no cost-effective method existed for solving the sedimentation problem caused by the Snohomish River, given the low level of Everett's commercial traffic. By 1940, total costs of the Everett Harbor project had reached $855,556.[29]

Bellingham Harbor

At Bellingham Bay, an extension of Puget Sound 100 miles north of Seattle, the Corps undertook a project to deepen the channel serving Bellingham harbor. The burgeoning timber and fishing industries in this area justified navigation improvements at this location. With congressional authorization in 1902, the Seattle District dredged a passage 363 feet wide with depths ranging from 18 to 26 feet for a distance of 5,100 feet through obstructing tidal flats. The Seattle District completed the work in 1913, but shoaling soon reoccurred, requiring periodic maintenance dredging. By 1920, the Corps had expended $158,250 on the project to support commerce consisting mainly of logs, lumber, and paper. The project required little maintenance work during the 1920s.[30]

In the early 1920s, local interests sought expansion of the existing Bellingham harbor project and the Seattle District Engineer supported this request; but in February 1924, the Chief of Engineers rejected this advice, believing that the current level of commerce did not require any changes. The local port commission, however, kept up the pressure for more work; and the Corps finally recommended a limited expansion of the existing project. In 1930, Congress accepted the Corps' favorable report and authorized an extension of the channel within the harbor known as the Squalicum Creek waterway, provided local interests maintained a portion of it. The Seattle District obtained the necessary local cooperation and accomplished the new dredging during 1931 at a cost of $30,000. Although local interests continued to press for further improvements during the 1930s, the Corps refused to go along, arguing that the existing project adequately served the locale. The Bellingham harbor project required little maintenance dredging during the remainder of the decade. By 1940, the Bellingham Harbor costs amounted to $226,496.[31]

Other Rivers and Harbors Projects

To provide a low-water navigation channel at the mouth of the Skagit River, the Seattle District constructed training and closing dikes and carried out dredging under a project authorized by Congress in 1910. The Corps had conducted snagging operations on the Skagit River, 50 miles north of Seattle, since 1882 under the appropriation for Puget Sound and Tributaries. By 1920, the Seattle District had spent $104,806 on the Skagit River project. Since local interests failed to comply with legally required elements of cooperation, the Seattle District did little further work on the project during the 1920s. In 1930, the District Engineer admitted, "the desired results have not been secured" by the Skagit River project. The Corps officially closed the project in 1932. In another early project (begun in 1893), the Corps carried out dredging and diking on the Swinomish Slough at La Conner, Washington to provide a channel 100 feet wide and 4 feet deep, serving mainly log tows and farm products. This project had cost $219,090 by 1920. The Seattle District performed little or no work on this project during the 1920s, but between 1935 and 1937 it enlarged the channel to a depth of 12 feet. By 1940, the Corps' work on the Swinomish Slough project had cost $652,847.[32]

In 1919, Congress authorized the deepening of a channel known as Cap Sante Waterway in Anacortes harbor in the northern portion of Puget Sound. Delays in arranging the local cooperation requirements prevented work on the project until 1930. At that time, Seattle District established the deeper channel by dredging 168,816 cubic yards of material at a federal cost of $46,376. Commerce in the harbor consisted chiefly of floated logs, lumber products, and canned fish. Although local interests pushed for further harbor improvements, Major Butler, in December 1930, argued against a new project: "Anacortes is a comparatively small community and no great increase in the amount of its commerce, nor any saving in freight rates can be foreseen as a result of the proposed improvement." The Corps carried out no further work on the Anacortes project until 1939, when it spent $6,882 on maintenance dredging.[33]

While tending to the navigation needs of the rivers and harbors of the Washington coast between the two World Wars, the Seattle District had to devote some of its limited resources to studying a plan for building a 120-mile waterway to connect Puget Sound with the Columbia River. In the early 1930s, the state of Washington had developed a plan for a series of shallow-draft canals to link the two points. The waterway would start at the southern end of Puget Sound in Budd Inlet and extend to Grays Harbor via the Black and Chehalis river valleys, a distance of 58 miles. Two sea-level canals would then join Grays Harbor with Baker Bay on the Columbia River, using Willapa Bay as the intermediate connection. A land cut of 5 miles would be needed to connect Baker Bay with Willapa Bay, while another cut of 12 miles in length would unite Willapa Bay with Grays Harbor.[34]

In the section from Puget Sound to Grays Harbor, the state-sponsored plan called for a lock canal with dimension of 90 feet by 16.5 feet and having nine locks, each with chambers of 60 by 600 feet and a depth of 14 feet. The lock system would provide a lift of 90 feet. As proposed by the state, the sea level canals would be 120 feet wide and 14 feet deep over the remainder of the distance. The waterway would make as much use as possible of the existing navigation channels already established by the Corps in Grays Harbor and Willapa Bay. The state plan intended the canal system to accommodate light draft sea-going ships and was estimated to cost $30,485,200.

According to the Washington State Canal Commission, the immediate justification for the canal was to provide employment "for those on or near relief" and to promote development of the timber and fishery resources of the Washington rain coast. As the Commission wrote in their report of June 1933, "The construction and use of the system of canals hereby recommended would result in the rehabilitation of industry, the widening of markets and promotion of commerce, the enhancement in value of the resources, national, state and private, connecting the harbor system upon

Puget Sound, Grays Harbor, Willapa Bay and Columbia River." The Commission also noted the waterways value for national defense, allowing the movement of destroyers and small naval craft away from exposed ocean routes.[35]

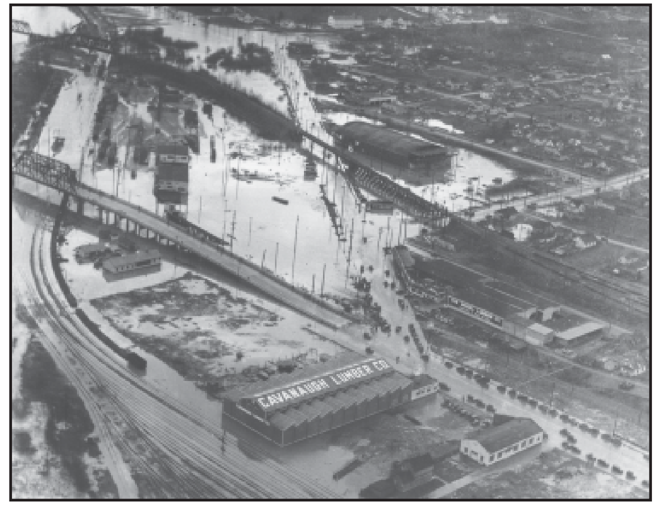
At Congress's request, the Corps reviewed the state's current plan for an intercoastal waterway connecting Puget Sound with the Columbia River and previous Corps' reports on the subject. The Seattle District Engineer, Colonel C. L. Sturdevant concluded that the cost of such a major engineering effort far exceeded any anticipated benefits to commerce. He thought that the Commission overestimated the extent of proposed commerce and had recommended a canal depth greater than would be required for the vessels likely to use the waterway. He argued that commercial barge traffic, rather than ocean-going ships would utilize the canal. The Corps upper echelons concurred in Colonel Sturdevant's findings. The state canal supporters unsuccessfully tried to get around the Corps' opposition by seeking public works funds to carry out the project.[36]

Flood Control Mission

In 1936, the Army Corps of Engineers received a new mission. In addition to its responsibilities for improving and maintaining navigable channels in the nation's waterways, Congress assigned to the Corps the job of providing flood control across the nation. In the Flood Control Act of 1936, Congress recognized that flood control was a proper activity of the federal government, and the Corps was designated as its agent in accomplishing this new federal undertaking. In response to this new charge, the Seattle District quickly launched a number of studies that led to flood control work on rivers draining into the Puget Sound.[37]

Flooding along the lower reaches of the tidal rivers of the Puget Sound region stemmed from the particular climatic conditions of the Pacific Northwest rain coast. All of the rivers draining into the Sound originated on the upper, western slopes of the Cascade Mountains. They flowed down through steep, narrow canyons and, then spread out upon the broad flatlands near tidewater. Eighty percent of Puget Sound's annual precipitation took place between October and April. Periodic, rapid snow melts caused by warm, moist air off the Pacific Ocean often resulted in flooding in downstream valleys in the late winter or early spring. Damages to farms and small towns could be devastating, if not catastrophic.

The Seattle District studied flooding on the Skagit, Puyallup, Stillaguamish, Green, and Nooksack rivers before 1936 but lacked authority to do anything about the problem. As long as the flood damages were localized and their effects on navigation minimal, no federal involvement could be justified. Public and private efforts at flood control were limited and haphazard. Dikes erected to protect farmland were discontinuous and not part of any coordinated plan. The most efficient but costly solution to flood control appeared to be storage in upstream reservoirs. The relatively small average annual damages to property from flooding, however, seemed to preclude that approach.[38]



Tacoma Flood
11 December 1933

The Flood Control Act of 1936 adopted three projects in the Seattle District; these included undertakings on the Puyallup, Stillaguamish, and Skagit rivers. The new federal flood control policy imposed stiff local cooperation requirements; and the difficulty local governments had in complying with these obligations often delayed the Corps in undertaking a project. Under the terms of the 1936 flood control law, local government entities had to supply all lands, easements, and rights-of-way necessary for construction. In addition, the responsible local entity had to indemnify the federal government for any construction damages and agree to maintain and operate the completed works. Subsequent legislation in 1938 and 1941 significantly eased some of these local cooperation requirements.[39]

The Skagit River flood control project involved a major river diversion, called the Avon Bypass, together with widening and reveting the banks of the river. The Avon Bypass included concrete control works at the head of the cutoff and a concrete weir at the outlet. The estimated cost of the project stood at $3.1 million for construction and $1.8 million for lands and damages. The chronic inability of the local sponsor to comply with the terms of cooperation led to the eventual deauthorization of the project.[40]

The Stillaguamish River flood control project covered the area between Arlington and the head of Hat Slough, Washington. The work provided flood protection by snagging, constructing a bank revetment and two cutoff channels, and closing an auxiliary slough. The Seattle District began work in September 1937, using both Corps and emergency relief funds, and completed the project by 1939 at a cost of $217,184.[41]

Mud Mountain Dam

The major pre-World War II flood control effort by the Seattle District involved the Puyallup River and the associated construction of a reservoir at a site known as Mud Mountain on the upper White River, a tributary of the Puyallup. Both rivers had their source in glaciers on the flanks of Mt. Rainier. In 1906, a state authorized, local flood control commission had diverted the White River from the Duwamish River to the Puyallup River near Auburn, Washington. The Seattle District had studied the flooding problem on the lower Puyallup River in the mid-1920s, but recommended against a flood control project at that time. Colonel W. J. Barden, the Seattle District Engineer, stated that "the Federal interest involved in the improvement and the national benefits that might result there from are insufficient to justify the United States in undertaking the improvement desired by local interest." Further studies as a part of the 308 Report examinations failed to alter that negative judgment about the federal government's possible role in a local flood control project and Congress took no action. Within two years, however, the situation changed.[42]

Massive flooding in December 1933 caused almost a $1 million in damages in the Puyallup River Valley and Tacoma. Congress then ordered the Corps to reexamine its previously unfavorable flood control report. In response, the Seattle District prepared a plan for controlling runoff in the White-Puyallup drainage. The Corps proposed constructing a flood control reservoir at Mud Mountain, building flood channels on the upper Puyallup River, and enlargement and revetment of the river through Tacoma. The plan generally conformed to the desires of local interests. The estimated first cost of the entire project was $4.8 million, with the Mud Mountain Dam accounting for most of the expenditure ($3.2 million). Writing in January 1936—well before the flood control act of that year—the District Engineer recognized that the federal government had little direct interest in the Puyallup basin's flood problem, but believed that "if the present national policy of assisting local communities in the construction of public works is to continue and is to include flood control works, this project should have priority." He also thought that local interest should pay as much as two-thirds of the projects costs.[43]

Mud Mountain Dam
Spillway Basket

The Division Engineer concurred with the District Engineer's recommendations except that he thought that local interests should have to contribute only one-half of the cost of the project and furnish rights-of-way, and assume all maintenance. The Board of Engineers, however, recommended against the project, citing once again the small direct federal interest in the project. The Board noted that the "direct Federal interest in the plans is confined to the possible reduction in maintenance dredging of waterways in Tacoma Harbor" as a result of the proposed channel enlargement and flood control reservoir at Mud Mountain.[44]

Within a few months, the Corps' reluctance to undertake the

Mud Mountain Dam - Canyon Damsite
15 May 1940

Puyallup River project became moot with the passage of the landmark Flood Control Act of 1936. In fact, this measure specifically authorized the work in question. Using emergency relief funds, the Works Progress Administration completed the bank protection on the upper Puyallup River in 1936. The Corps, at the same time and with funds from the same source, began preparing plans for Mud Mountain Dam. This initial work also included conducting surveys and carrying out foundation explorations. Preliminary studies continued for the next three years, and during that time the Seattle District completed some permanent work such as constructing a 2.5-mile road to connect the dam site with an existing highway and erecting quarters for construction workers.[45]

The initial design for Mud Mountain Dam called for a $3.1 million concrete arch dam 400-foot high. Since the solid rock walls of the canyon at the dam site barely exceeded 200 feet and the remaining 200 feet consisted of glacial till, questions soon arose over the structure's stability. Captain Arthur Trudeau, Seattle District Deputy Engineer, later remarked that the name "Mud Mountain Dam is not something that assures you a feeling of safety." Subsequent studies indicated that serious foundation problems existed that would require a redesign of the dam. The new design proposed a rolled earth fill and quarry rock faced dam, raising 425 feet above bedrock and extending 700 feet at crest elevation. The width at the dam's base was 2,200 feet and tapered to 50 feet at the crest. The reservoir had a storage capacity of 106,000 acre feet. The cost for the dam had increased to an estimated $5.4 million.[46]

In addition to the design issues, the North Pacific Division office raised concerns about the lack of provision for fish passage. This omission, cautioned the Division office, would cause the various state and federal fisheries agencies to argue against building the dam. The Corps eventually added a fish trapping and hauling facility to insure fish migration above the dam. As workers began to place the fill material for the embankment core in early 1940, the dam's contractor, the Guy F. Atkinson Company, warned that the earth fill structure might fail. The Seattle District immediately conducted additional tests, which indicated that because of the moisture content of the fill, the embankment could indeed fail. A hurried redesign added rock fill sections of stone, graded from fine to coarse, over the earth fill core. The design changes raised the estimated project cost to $10 million.[47]

Work on Mud Mountain Dam had begun in August 1939, and by the end of June 1941 the project was 76 percent complete. At that point, the Corps had spent almost $8.5 million on construction. The engineers encountered a novel technical problem in constructing the earth and rock fill dam, involving work during the wet season. Normally, water must be added to obtain compaction of the core material, but in this case the winter rains made the clay core materials too wet. The contractor solved the problem by first drying the clay in a rotary kiln and then redampening it to the proper degree before placing it in the core. The contractor carried out this procedure underneath an enormous canvas covering (328 by 196 feet) designed to keep out additional moisture during the rainy season. In 1942, the Seattle District had to halt further work because of wartime shortages of men and material and the press of other national spending priorities. The unfinished project posed some danger as an exceptional flood could have overtopped the embankment and destroyed the existing structure. Fortunately, the Seattle District avoided such a disaster and resumed construction in 1947. At the time of its completion in 1948, Mud Mountain Dam was the highest earth and rock fill dam in the world. The final cost of construction came to $13 million.[48]

Although the Seattle District concentrated its flood control work in western Washington, it did examine flooding problems in the eastern portion of the state as well. Examinations of the Yakima, Spokane, and St. Joe rivers led to projects authorized in the Flood Control Act of 1938. The work typically called for levees and collateral structures along river banks to protect urban areas in the cities of Yakima and Spokane, Washington, and St. Maries, Idaho. Construction on these small-scale projects did not get underway until 1940 and was largely completed by 1942. The Seattle District also carried out a flood control project for Coeur d'Alene, Idaho. This undertaking called for a concrete floodwall, earthen levees, and a steel sheet pile wall along the lake and river shore for a distance of one and one-half miles. The Corps completed this project between 1940 and 1942, at a cost of about $175,000.[49]

Alaska Projects

Prior to World War II, the Seattle District had an on again/off again responsibility for Corps of Engineers work in Alaska. From 1896 to 1905 and 1909 to 1921, the District carried out engineering projects in Alaska. These included improving the mouth of the Yukon River, Nome Harbor, and the St. Michael Canal. In 1912, the Seattle District commenced a project to provide a navigation channel through tidal flats that constricted passage through the Apoon Mouth of the Yukon River. By 1913, the Corps had dredged 119,545 cubic yards of material to create a channel 250 to 350 feet wide and 6 feet deep for a distance of 7 miles. The project cost $131,049 by 1920. At Nome Harbor, a portion of Norton Sound 115 miles north of the mouth of the Yukon River, the Seattle District undertook another channel deepening project in 1917. At this location, the district built two parallel timber and concrete jetties, 400-feet long at the mouth of the Snake River and dredged a channel 8 feet deep for 1,500 feet. By 1920, the project was 60 percent complete at an expenditure of $138,316. Between 1908 and 1912, the Corps spent $391,000 deepening and straightening the channel between St. Michael and Norton Sound.[50]

In 1921, the Corps reassigned the Alaska civil works projects to the newly created Juneau District. Then, as an economy measure, the Corps closed the Juneau office in 1932 and once again placed Seattle District in charge of the Alaska work. As the Corps' Alaska undertakings expanded in the late 1930s, the Seattle District, for greater efficiency, established an area office at Anchorage to oversee the flood control and rivers and harbors work in the territory. Lieutenant Alvin C. Welling served as the Area Engineer for Alaska from 1939 until January 1941, when Major Benjamin B. Talley took over the post. By that time, war in Europe and the danger of war in the Pacific had heightened the strategic importance of Alaska; and the Corps turned its attention from civil to military projects in the territory.[51]

Fort Lawton, Seattle, Washington

Between 1933 and 1940, Congress greatly expanded the Corps' civil works program in Alaska. It approved projects for seven locations and authorized 20 additional examinations and surveys. These new examinations led to improvement projects at the harbors of Sitka, Cordova, Petersburg, and Kodiak. This work involved constructing jetties, dredging waterways, and sometimes removing submerged rocks. Other new work included snagging in the Stikine River; constructing a dike on the Salmon River at Hyder; channel clearing at Iliuliuk, between Bristol Bay and Shelikof Strait; and removal of boulders from the Egegik River. In addition, the Seattle District continued periodic maintenance and undertook some new work on completed projects at Wrangell Narrows, Seward Harbor, Nome, Lowell Creek, and Ketchikan Harbor. In the late 1930s, the District carried out flood control work at Fairbanks by constructing a dike along the Tanana River. Among the last civil works carried out by the Seattle District in Alaska was the Lowell Creek Diversion Tunnel at Seward. This flood control project, begun in 1941 and completed in 1945, involved building a 400 foot-long diversion dam and horseshoe-shaped tunnel through Bear Mountain to divert Lowell Creek away from the center of Seward. In 1946, the Corps established the Alaska District with its headquarters in Anchorage.[52]

Seattle District Organization

The relatively light workload of the 1920s made for a small Seattle District workforce. Only about a dozen clerks and engineers, located in the Burke Building in downtown Seattle, were needed to conduct the preliminary examinations and surveys and provide the project and plant oversight for the rivers and harbors work assigned to the District. The comprehensive studies necessary to produce the 308 Reports required an expansion of the District workforce in the late 1920s. By 1931, the Seattle office of the Corps had grown to about 70 people. The completion of the multipurpose water resources studies and the Depression era-driven personnel cutbacks of the Hoover administration, however, resulted in a momentary decline in the District office staff.[53]

The advent of a massive public works program under President Franklin Roosevelt, which utilized in part the Corps' projects and management oversight, soon led to an expansion of the District workload and personnel. In addition, the new flood control mission—especially the work associated with Mud Mountain Dam—further increased the need for an expansion of the District staff. The workforce grew from about 36 in 1933 to almost 200 by December 1939. In the fall of 1939, the Seattle District had four office divisions: engineering, civil works construction, military construction, and administration. These divisions were further subdivided into 34 branches and sections. Additionally, the Area Engineer for Alaska also reported to the Seattle District Engineer.[54]

By the end of 1940, the American military buildup in anticipation of war led to a further expansion of the District workload. The District now oversaw a major military construction effort, with over 700 persons engaged in a $16 million building program. This work included new airbases in Alaska and Washington, expansion of existing Army posts in both states, the ongoing civil works program, and a $750,000 Works Progress Administration construction program under District supervision. To accomplish this workload, field and office employees grew from 900 in December 1940 to 2,800 by February 1941. District employment peaked at 10,243 in September 1942. A long-serving Corps employee, Sherman Green, later recalled the pressures District personnel experienced as they strived to get the work done in the context of wartime emergencies:

> A day's work generally ran 12 or more hours. Neither holidays nor weekends interrupted the drive to prevent "work completed" bars on the Control Division's ubiquitous and tyrannous progress charts from trespassing on the allotted "deadlines." Pay for overtime was yet to be enacted into law, and compensatory time was recorded but seldom if ever possible to use. It seemed that the only limits were physical endurance.[55]

Conclusion

While the Seattle District's extensive work on the 308 Report absorbed much of its energies during the interwar years, the District also carried on its traditional rivers and harbors program without much fanfare. The District's total number of authorized projects showed little change between 1920 and 1940, but the location and type of undertakings did shift slightly during the 1930s. In 1920, for example, the Seattle District had responsibility for 18 rivers and harbors projects, 17 at coastal or Puget Sound locations and 1 on the upper Columbia River. The Annual Report for 1930 showed that while the total number of projects still stood at 18, the upper Columbia navigation project was no longer listed. Congress had deauthorized it in 1923 because no commerce moved any longer on that portion of the river. On the other hand, the 1930 Annual Report now listed a new coastal project.

In the 1930s, more dramatic changes in project type occurred. During the decade, Congress deauthorized or combined seven coastal or Puget Sound projects and added several flood control undertakings to the District's responsibilities. Thus, while on the eve of World War II, the Seattle District had charge of only one less project than it had in 1920, the mix and geographic distribution were very different. Now it had 11 river and harbor projects on the coast and 6 flood control works scattered throughout the District.

The dollar value of the Seattle District program also grew somewhat between 1920 and 1940. From the District's founding in 1895 to 1920, it had expended almost $9.9 million on navigation improvements and maintenance. Over the next 20 years, it spent another $14.6 million on new work and continuing maintenance on existing navigation projects. Two undertakings—Grays Harbor and the Lake Washington Ship Canal—accounted for much of the District's total rivers and harbors program. Those two projects alone represented $18.6 million or 76 percent of the Seattle District's navigation program costs between 1895 and 1940. The new flood control mission amounted to only $3.5 by 1940. The Mud Mountain Dam project accounted for $3.2 million or 91 percent of the District's flood control work on the eve of World War II. The combined total of the District's navigation and flood control expenditures by 1940 came to almost $28 million. Most of the Seattle District's civil works program would be placed on hold as the Corps strived to meet urgent wartime needs from 1941 to 1945.

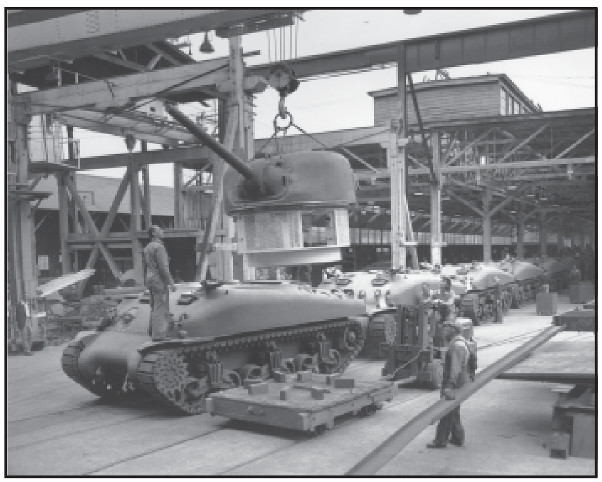
Chapter III

WORLD WAR II AND MILITARY CONSTRUCTION

While the attack on Pearl Harbor formally thrust the United States into World War II, the Seattle District was not unaware of the potential for involvement in the expanding world conflict that began in 1939. In fact, from 1940 on, the Seattle District became increasingly involved in the United States defense mobilization effort. Beginning in 1940, Army engineers started constructing airfields and railways in Alaska at a rapid pace. The transfer of the construction and real estate responsibility of the Army Quartermaster Corps to the Corps of Engineers one week before Pearl Harbor further added to the defense workload of the Seattle District.

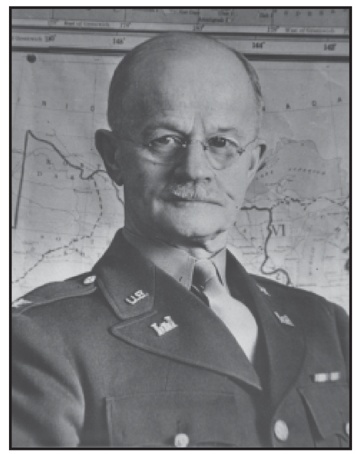
Early Preparedness

With America's declaration of war on Japan, the Seattle District immediately went on a war footing. Regular Army personnel in the district, customarily wearing peacetime civilian clothes, now exchanged them for military uniforms. The magnitude of the war related work shouldered by the Seattle District between 1941 and 1943 was indicated by the fact that it employed over 37,000 persons, with the high point at any one time of close to 10,000. In order to find enough employees, the District had to send 13 recruiting teams around the country. These recruiters competed with private firms also searching for workers need to support the war effort. The rapid personnel buildup proved a management nightmare. The District leadership had to cope not only with the rapid employment of thousands but also with high turnover rates and cumbersome bureaucratic regulations under the Civil Service system. To administer the District's war related work required a major expansion of its military officer component. At the height of military activity in the fall of 1943, the District had 32 military officers on staff.[1]



Wartime Buildup

The District's war effort involved myriad undertakings, ranging from straightforward military construction projects such as designing and building airfields, aircraft warning stations, harbor facilities, and supply depots to procuring and delivering supplies for construction and troops operations in Alaska and the Pacific. The Seattle District also supported the super secret Manhattan Project and the Alaska Highway construction and carried out novel camouflage operations for domestic defense plants. Another unusual responsibility occurred in early 1942, when the Seattle District was ordered to build facilities at a state fairgrounds and a racetrack for processing interned Japanese Americans being removed from the West Coast by presidential order. They ultimately were sent to detention centers in Idaho and Utah for the remainder of the war.



Colonel Richard Park
Seattle District Engineer
Dec 1942 - Nov 1943

The Seattle District's wartime responsibilities included both its own directly assigned projects and those it received as construction agent for the Western Defense Command and other Army entities. District employees often expressed confusion as to the correct chain-of-command on specific jobs. More command complexity followed Japan's mid-1942 attack on the Aleutians Islands. In response to this military threat to the West Coast, the Corps of Engineers promptly relocated the North Pacific Division—renamed the Pacific Division—inland to Salt Lake City, but kept the Corps' district offices in Seattle and Portland. On 1 December 1942, Colonel Richard Park of the old North Pacific Division became the new Seattle District Engineer. He arrived in Seattle with seven handpicked members from his previous division staff. Colonel Park's appointment helped to strengthen the leadership of the District at a time of great crisis. As Hanford Thayer, the new Assistant Chief of Engineering under Colonel Park later recalled, “We literally . . . moved the [existing] Seattle District Engineer out of his office and his assistant, and his executive officer, and chief of the construction division, and replaced them with our . . . people.”[2]

The changing command responsibility for the massive and urgent military construction program in Alaska caused the most chain-of-command uncertainty for the Seattle District. After 1 May 1942, authority for the Alaska construction projects went through a series of command changes. At first, the Western Defense Command or its delegated agency, the Alaska Defense Command, assumed jurisdiction over the Alaska military construction program from the Seattle District; but ultimately, military authority passed to the Alaskan Department in November 1943. As one historian later noted, “such shifts in authority not only confused the commands involved, but simply could not be followed strictly by the men working at remote stations from which correspondence with any command headquarters might take a month or two by air, sea, or dogsled. . . . Sometimes that was a blessing. They could skip the paper work, get on with the real work, and let whoever thought he had the authority at the moment come to see what was done; or, receiving conflicting orders, they could act on those best meeting their own sense of necessities.” Through all the changes, however, Seattle District continued to act as a service agency to get the work done. It designed structures and facilities, procured construction materials, recruited engineers and labors, and transported the men and materials to the work sites as requested.[3]

The construction workload immediately after Pearl Harbor became so great that the district office had to quickly establish area offices around the State of Washington, in such places as Everett, Spokane, Fort Lewis, Yakima, and Port Townsend. When the Seattle District gained responsibility for all military construction in Montana, it created an area office at Great Falls to manage the work. The crush of work soon led to a decentralization of authority for field offices. The various area offices received full responsibility for prosecution of their projects, with the district office chiefly acting as a reviewing center. After May 1943, when much of the fieldwork had been completed, a reverse process took place. The district office gradually took back much of the previously delegated authority.[4]

To design the temporary and permanent buildings and support facilities for the Army and the Air Force bases, the Seattle District engineering staff used standard drawings from the Corps’ headquarters and then site-adapted them. In carrying out the actual construction projects, the Corps relied heavily on civilian contractors, working on fixed price contracts under the supervision of Corps’ personnel. For security reasons, the Corps dispensed with advertising for bids and instead directly negotiated contracts with civilian companies. This process speeded up initiating the work and assured better utilization of a wide spectrum of qualified contractors. In May 1944, the Corps resumed competitive bidding with award to the lowest bidder, but public advertising was still not allowed.[5]

At the beginning of the war, the military focused on the state of harbor defenses along the Pacific Coast—especially the Strait of Juan de Fuca, the sea entrance to Puget Sound. The existing fortifications on the Sound—Forts Worden, Case, Flagler, and Lawton—dated to the Spanish American War and were useless against the weapons of World War II. While the facilities at these bases were useful as training and staging sites for troops, Army brass had bigger plans for the forts. The commander of the harbor defenses of Puget Sound ordered the installation of the Navy’s biggest guns—16-inch naval rifles—mounted underground in the bluffs at Cape Flattery overlooking the Strait of Juan de Fuca and Striped Peak.[6]

The Seattle District received the job of designing and supervising the construction of the enhanced gun emplacements. The work required excavating and tunneling in Striped Peak to provide living quarters, ammunition magazines, and gun emplacements. Just as all of the installation was completed and one gun mounted, the Army suspended the project as fear of a Japanese naval attack passed. Construction for Cape Flattery battery was not as advanced when the order arrived to terminate the work. At that location, roads, utilities, and deep excavation had been completed but no concrete had been poured. Construction crews were not sorry to leave the Cape’s perpetual rain and damp.[7]

Wartime Camouflage

One of the more novel features of the Seattle District’s wartime activities involved the development of elaborate camouflage measures for vital defense industries. Defense authorities deemed Puget Sound shipbuilding and Boeing Company airplane factories essential to restore the nation’s military effectiveness. Protective concealment of these operations from aerial attack became a high priority concern of the Seattle District. In January 1942, when air attack seemed imminent, the district organized a camouflage section within its Engineering Division. Personnel assigned to this task soon increased from an initial four to thirty-eight. These included architects, commercial artists, landscape architects, engineers, and an agronomist. Camouflage to protect from air attack was a comparatively new measure, so efforts during the first year focused on training and experiments to develop the best techniques. While a few members of the district team attended the Corps' Camouflage School at Fort Belvoir, Virginia, most participated in a 10-week course run by the Office of Civilian Defense at the University of Washington.[8]

The Boeing plant and airfield received the highest priority in camouflage. The sheer size of the undertaking caused the District Engineer to maintain that complete concealment was impossible and that only a "tone down" be attempted. While awaiting a decision from higher authority on this approach, the camouflage section began preliminary studies by creating a scale model of the Boeing plant. At this juncture, two Hollywood art directors, Captains John Detlie and Malcom Brown, with backgrounds in visual deception and professional degrees in engineering and architecture, joined the camouflage unit. Eventually this team developed workable plans, not only for the Boeing plant but also for eleven other airfields and numerous other military installations. Hanford Thayer had some involvement in the Boeing effort and recalled "the camouflage plan was to build a fake town across the Boeing plant itself and across Boeing Field. The artificial picture would be made up of asphalt, lumber, wood chips, feathers, fake trees and bushes. It was a good blind, and possibly gave us some protection." The treatment for airfields consisted of a texture made of finely crushed rock rolled into a bitumal adhesive and applied to the runways and then painted with disguising colors and outlines. The deception proved so effective that incoming pilots expressed frustration in locating the runway at camouflaged Boeing Field.[9]

Other Military Construction

The Seattle District's biggest military construction project in Washington occurred at Fort Lewis, a 91,000 acre Army training center originally opened near Tacoma in World War I. Between 1940 and 1945, the Army spent $26 million constructing housing, much of it temporary, for 46,000 soldiers. Facilities at the Fort Lewis post hospital became so strained in the first months of the war that supplies were stored in the base theater and other temporary locations. The Seattle District eventually built dozens of storage facilities on the base.[10]

On swampy ground adjacent to Fort Lewis, the Seattle District, in the late 1930s, began construction of McChord Field with funds diverted from New Deal relief agencies. By mid-1942, several million dollars had been spent on runways, lighting systems and cantonment buildings. McChord was the best known of many installations built for the Army Air Forces across the Pacific Northwest, which included 49 airfields and 36 radio communication and warning stations.[11]

The Alaska Theater

A key chapter in the Seattle District's wartime mission took place to the north in Alaska. Except for the period between 1921 and 1932, the Seattle District had responsibility for all Alaska civil works prior to World War II. The various Alaska projects provided the Seattle District with valuable information about the region's special circumstances when it received responsibility for the massive Alaskan military construction program in January 1941. At that time, the Seattle District Engineer named Major Benjamin B. Talley as Area Engineer, Alaska, with his office in Anchorage. In May 1942, when jurisdiction for Alaska switched from the Corps to the Western Defense Command, Talley was designated as Officer in Charge, Alaska Construction. As historian Lisa Mighetto has written, "Talley proved to be a capable, energetic, enthusiastic leader of the Alaska Engineers. Under his supervision, the engineers completed the airfield garrisons for Alaska's defense, expedited the transportation of supplies and equipment by sea and rail, and built the bases from which the United States launched offensive strikes against Japan."[12]

While the Seattle District's work in the north picked up as a result of the Roosevelt Administration's late 1930s early 1940s mobilization program, the pace increased at a frantic rate after 7 December 1941. Alaska's huge size, remoteness, lack of roads, and extreme weather made construction very difficult. The air distance across Alaska from Ketchikan to Attu stretched 2,700 miles, accessible only by air or water transport. Moving men, material, and equipment to distant work sites was only the first hurdle. The weather and terrain made working conditions especially rigorous. Short summer construction seasons encompassed by months of winter darkness and bitter cold that froze men's skin and extremities, solidified lubricants in machinery, or turned motor fuel to jelly made labor impossible much of the time. Cyclonic storms or "Williwaws" along the Aleutian chain and rain, ice, snow, and fog along the coast, all coupled with alternatively permafrost or boggy conditions inland made dependable construction or travel throughout Alaska very problematic. Designing structures for such conditions required much trial and error at the time of actual construction. With men confined for long periods at isolated sites under such harsh conditions, worker morale proved difficult to maintain. Under such trying conditions, Seattle District found it a daunting task to supply men and material for the Alaska military construction effort.[13]

Major Talley's reports on working in wartime Alaska revealed the Corps' challenges in completing projects. He noted, for example, at Fort Richardson near Anchorage, "there is scarcely a building under construction . . . that is not handicapped by the absence of some material or other." He also complained of a chronic shortage of personnel for all projects. In addition, work proceeded at a frantic pace. Major Talley reminisced about the construction of a mess hall at Yakutat Field during Thanksgiving time: "When the cooks were preparing [the food] in one end of the building, the troops were putting the roof on the other." Talley accomplished his mission by working directly in the field and focusing aggressively on solving the problems at hand with a strong sense of urgency. He was not afraid to experiment or even risk his own life to get the job done.[14]

Since most construction supplies had to be shipped to Alaska from Seattle by sea and Alaska itself lacked a land-based transportation system, the Corps had to quickly assemble a transportation infrastructure of harbor facilities, airports, railroads, and highways. The Corps initially focused on constructing improved harbor facilities from Kechikan in the southeastern Alaska to Dutch Harbor in the far western Aleutian Islands. Because airplanes provided the chief method of travel over Alaska's vast and rugged terrain, the Corps constructed 68 airfields, including such major bases as Elmendorf at Anchorage and Ladd at Fairbanks, as well as many remote landing strips scattered throughout the Alaskan bush. These airfields made possible the transfer of thousands of warplanes to the Soviet Union under the wartime Lend Lease program. This effort hastened the defeat of German forces on the eastern front. To support the air transportation network and provide warning of enemy aircraft, the Corps located sites for and built 20 radar and radio communication stations in Alaska.[15]

To improve the handling capacity of the overtaxed Alaska railroad, which extended from Seward on the southern coast to Fairbanks in the northern interior, the Corps enlarged the Seward harbor facilities and built a second entry point at Whittier on Kenai Peninsula. The Corps also constructed extensive defensive works (Fort Raymond) at Seward, making it the most fortified city on the Alaska coast. The work at Whittier required boring a railroad tunnel 14,000 feet long, constructing a dock and terminal facility, and building a second tunnel of 5,000 feet at Portage. The Corps also had to build almost 1,200 miles of new roads to connect the various projects with harbors, railheads, or existing roads.[16]

As the Corps pushed military construction in Alaska, the Seattle District had to assemble a fleet of vessels to maintain the flow of men, supplies, and equipment to the project sites. To that end, the district leased or purchased more than 350 small craft, tugs, barges, fishing tenders, scows, and old sailing ships. In addition, the Corps operated numerous military transports and seagoing barges between Seattle and Alaska ports. The Seattle District effort to assemble an Alaska support fleet was under the direction of Richard Davies, an engineer with 35 years of rivers and harbor experience. To maintain this miscellaneous supply fleet, the district relied on its moorings at the Lake Washington Ship Canal and Locks or contracted with civilian yards on the Puget Sound.[17]

To meet the needs of the Alaska supply effort, the Seattle District even constructed new vessels, using innovative designs. These included 4 seagoing tugboats, 3 crane barges, and 66 power scows or barges. These new vessels were built largely of readily available northwest woods, since this saved critical materials needed elsewhere in the war effort. The tugs and barges served as the backbone of the sea transport system up the Inland Passage and into the Gulf of Alaska. In addition to the usual weather and ice challenges of navigating in Alaska waters, ship crews faced the constant danger of attack by Japanese submarines and warplanes. One ship, the *Klihyam*, was bombed 9 times in 22 days on one Aleutian voyage. In April 1943, the Army transferred most of the Seattle District Alaska fleet to the newly organized Army Transport Service. The district kept only the snagboat, *Preston*, the survey boat, *Mamala*, and the inspection boat, *San Juan*, to continue its civil works functions.[18]

Perhaps the most famous of the Corps' wartime projects in Alaska was the Alaska or ALCAN Highway. This project grew out of the military need to reduce dependence on sea transport. After Pearl Harbor, the sea-lane between Seattle and Alaskan ports was vulnerable to Japanese naval and air attack. To alleviate this weakness, the War Department, in February 1942, ordered the Corps to come up with a plan for an overland route to Alaska. The Assistant Chief of Engineers, Brigadier General Clarence L. Studevant (a former Seattle District Engineer), put together a plan in five days that called for a basic 1,543-mile gravel or pioneer road between Dawson Creek, British Columbia, and Big Delta, Alaska. A rail line passed through Dawson Creek and existing roads extended southeastward from Dawson Creek to the United States border in Montana, a distance of 477 miles. The chosen route for the ALCAN Highway linked the critical airfields that formed the northwest air ferry route that supplied military forces defending Alaska. Canada agreed to the highway project in March 1942.[19]

Alaska Canada Highway Construction, 1942

The Army engineers, under Colonel William Hoge and Colonel James O'Connor, built this path-breaking gravel road in two phases. After the engineer troops completed a rough, minimum road in one short season, private contractors subsequently improved it. The Seattle District assisted this massive project by supplying men, materials, and equipment. The Corps used 10,000 soldiers in seven engineer regiments as the road-building work force. One-third of those soldiers were African American. Between 13 March 1942 and 20 November 1942, the Army engineers—working under punishing conditions—pushed a gravel road across muskeg and permafrost, along glaciers and lakes, through high mountain passes, and over numerous streams and rivers, all at a cost of approximately $135 million. As one writer flying the route at the time noted, most knowledgeable observers doubted the Corps could complete its pioneer road-building task in one season: "Old-timers in Fairbanks had said that the Army would do well to complete a survey in 1942; not a cut would be made before 1943. Looking down upon that lonely world of tangled northern forest, it struck me that they probably were right." The completed, odds-defying road immediately assisted the war effort by relieving the transportation burden on the Alaska ports and the Alaska Railroad.[20]

The Seattle District also assisted in other potential transportation projects during World War II. In later 1942 and early 1943, the Seattle District received orders to survey a possible railroad across Alaska. One part of the line would have connected Prince George, British Columbia, with Fairbanks. Another section would have stretched from Fairbanks to the Seward Peninsula on the Bering Strait. The route would have been part of the effort to supply the Soviet Union in its struggle with Germany. Seattle District personnel conducted some of the surveys under considerable hardship because of poor weather conditions and difficult terrain. The railroad project proved stillborn because of its high cost and Alaska's reduced strategic importance after 1943.[21]

The Manhattan Project

Aware of the German research into the military implications of atomic energy, President Roosevelt authorized the top secret Manhattan Project to produce an American atomic bomb. The Secretary of War and top Army commanders selected the Corps of Engineers to head up the project. The Corps quickly set up a new engineer organization, the Manhattan District, initially under Colonel James Marshall and then Brigadier General Leslie Groves, to carry out the project on an expedited basis. In December 1942, General Groves decided that production facilities for the fissionable material needed to be located at an isolated, inland area for both safety and security reasons, have a climate suitable for year-round construction, abundant clean water and electric power supply, and geological characteristics capable of supporting heavy concrete structures.[22]

General Groves sent his top assistant, Colonel Norman Matthias to scout potential locations in the West. Based on information supplied by the Seattle District Engineer and his own personal reconnaissance, Colonel Matthias recommended, on 31 December 1942, a 670 square mile, sparsely populated tract along the Columbia River between the tiny towns of Hanford and Richland. Not only did the location meet all of the basic site criteria, but it also had easy access to a major railroad and sat next to a switching station for a 230 Kv transmission line linking Grand Coulee and Bonneville dams. General Groves concurred and site acquisition and project planning began on 7 January 1943. Colonel Matthias became Area Engineer in charge at Hanford.

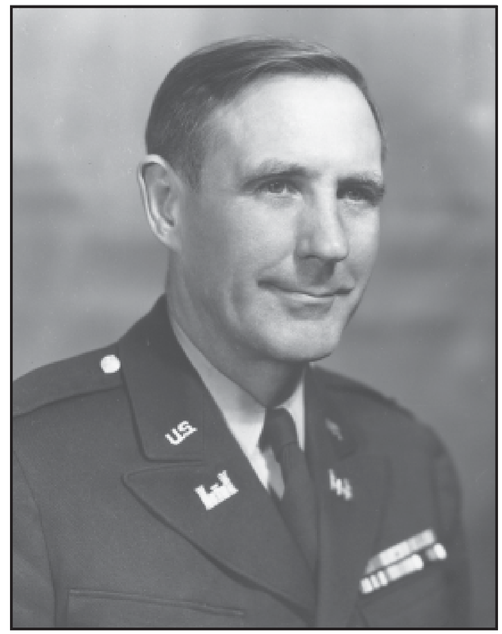
The remoteness of the site did cause Colonel Matthias problems as he started construction at Hanford. In particular, he encountered difficulties in labor recruitment and transport, in housing and feeding the construction force and operating personnel, and in maintaining morale over time. The crash program to set up the Hanford works and its nuclear reactors was truly daunting. As Colonel Matthias later noted "activities of basic research, development and engineering had to progress simultaneously and routines established to focus all activities towards engineering design, construction and operation. Engineering under these conditions and production of equipment presented problems that were probably as difficult and demanding as the scientific effort."[23]

The government initiated condemnation proceedings against the owners of the approximately two-thirds of the Hanford site land in private ownership. Federal authorities also ordered the 1,550 farmers, ranchers, and townspeople on the project lands to vacate their property within 30 days. Some of the condemnation lawsuits were not settled until after the war. The Seattle District speedily conducted sub-surface investigations that confirmed the site had excellent foundation conditions. Between March 1943 and August 1945, the Hanford Engineer Works of the Manhattan Engineer District built 554 industrial structures, 386 miles of roads, 52 miles of electrical transmission lines, 158 miles of railroads, and hundreds of miles of fencing. The production facilities included three unprecedented nuclear reactor complexes, three huge chemical separation plants, and a building to manufacture uranium fuel elements.

The entire effort used immense quantities of materials. For example, construction required 780,000 cubic yards of concrete, 40,000 tons of structural steel, and 11,000 electric light poles. The quantity of concrete used was equivalent to a 390-mile long highway, 20 feet wide and 6 inches thick. The steel equaled the displacement of a battle ship, while the number of power poles was sufficient to build a single pole line from Chicago to St. Louis. The entire Hanford project cost $350 million to produce the plutonium delivered to Los Alamos starting in January 1945.

To carry out the immense construction project, the Corps had to set up a construction camp, which in a few months grew to contain 45,000 skilled and semi-skilled workers. Barracks housed 39,000 of the laborers, while an on-site trailer camp accommodated most of the rest. To operate the production plant, the Corps built a new city, Richland, housing 17,500 employees and their families. The community contained modern utilities, commercial facilities, churches, and schools. Colonel Matthias found managing this construction project very challenging: "With construction areas four to eight miles apart, the 'center of gravity' of construction areas some ten miles from the construction camp, with one major construction job located about 20 miles from the center of gravity and village of Richland about 25 miles from the main group, the problem of central control of the construction operations was exceedingly complex."[24]

Colonel Matthias faced other challenges as he and his staff raced to produce the raw material for making an atomic bomb. Recruiting and maintaining the highly skilled workforce necessary to build and operate the plutonium production plant required "extensive effort," as he later wrote, because it was "at a time when labor was in short supply, food and gasoline were rationed, and most building materials were critical under [the] war economy." He noted that the frequent dust storms at Hanford had a particularly depressing effect on the workers and "that the day after one storm 500 workers quit." In all, about 130,000 men and women were employed at Hanford during the war.[25]

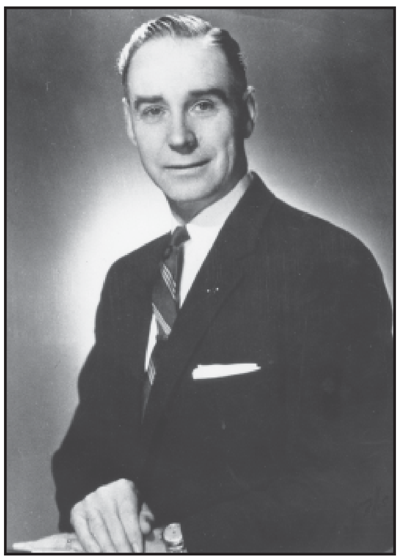


Colonel Norman A. Matthias
Seattle District Engineer
July 1952 - June 1956

The basic research, design, and construction of the production facilities all took place simultaneously at great speed and under the tightest possible secrecy. Only a few top engineers knew what was being made at Hanford. Colonel Matthias later recalled that he "was expressly forbidden to divulge the purpose of the project to anyone, military or civilian, who did not require that knowledge to further the project. This made it impossible to enlist aid from any agency on the basis of logical explanation of need." The cover story put out by Colonel Matthias was that a new high-powered explosive known as RDX was under development at Hanford.[26]

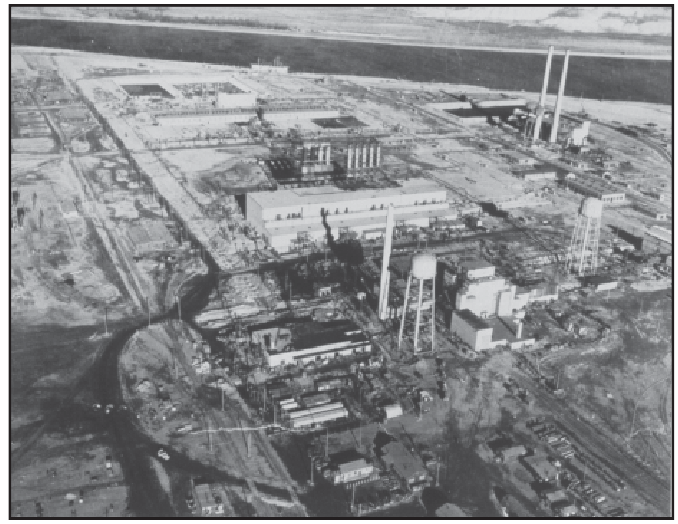
In spite of all the difficulties, Colonel Matthias later proudly noted, "the construction of Hanford was done under a real crash program telescoped into and dependent upon basic research, development and engineering programs running concurrently. The construction of Hanford, from start of site selection to completion of three reactors, two chemical separation plants and all supporting facilities, was less than 26 months." Colonel Matthias attributed part of his success to the assistance provided by various Corps of Engineer offices. He wrote, "we were continually appealing to the Seattle District, the Portland District, [and] the North Pacific Division at Portland . . . for help with respect to local problems. Wholehearted assistance was given in all cases. . . . I felt, throughout my service at Hanford, that I could not have received better help if I had been running a normal Corps of Engineer project under the normal Corps of Engineers organization."[27]

The scientific problems inherent in producing an atomic bomb were enormous. Basic research on possible consequences of radiation generated by the atomic piles (reactors) led to a direct connection with the Seattle District. Colonel Matthias requested that Hanford Thayer, the district's Assistant Chief of Engineering and also experienced in fisheries matters, aid the Manhattan District in conducting a project to determine the biological effects of gamma radiation on fish and on the water used to cool the reactors. The ultimate object was to learn what effects the radiation might have on humans. Because of the stringent secrecy surrounding the Manhattan Project, Thayer's contract with the University of Washington for radiation research was officially referred to as study of X-rays in the treatment of fungous infections in salmonid fishes. This served as a cover for the research project until the end of the war. The scientists involved in the research thought the work was to help servicemen suffering fungal infections in the tropics and Alaska.[28]



Hanford Thayer

Because of Thayer's considerable knowledge about the hydrologic characteristics of the Columbia River, Colonel Matthias called upon him for advice throughout the construction and operation of the Hanford Works. In particular, Thayer recalled, "My background on the Columbia River with regard to high water, low water, floods, and temperatures, and so forth, was very valuable to the design team on the intake and outlet works" for the water used to cool the reactors. He also established and oversaw the operation of an onsite fish facility and research program at Hanford. Thayer marveled at the extraordinary authority he had in connection with his Manhattan Project responsibilities: "I was able to secure travel orders, order supplies, requisition equipment, divert constructions material, and labor for Hanford, secure assistance in the office as required, and to obtain a car and driver whenever I wished. I had a blank check to use, but not to misuse, and not to reveal the purpose of my being so secret about everything."[29]



Hanford Project

At one point during early construction at Hanford, Colonel Matthias asked Thayer to find a supply of telephone wire. After a frenzied search, Thayer "located wire intended for the ALCAN Highway project and diverted the entire amount to Hanford, exercising the highest priority held under executive order of the President." On another occasion, Thayer diverted a shipload of workers bound for Alaska to the labor-short Hanford Works. He later recounted that "as workers were received in Seattle they were sent to the Alaska labor camp nearby, then, according to my instructions, sent to Hanford with their parkas, tools, and mukluks."[30]

The intense security surrounding Thayer's work for the Manhattan Project gave him a special, if occasionally, uncomfortable notoriety in the Seattle District office. Thayer always refused to tell his co-workers, civilian or military, about his secret job, and when one military officer persisted, Thayer arranged for his transfer to the South Pacific. Thayer's mail arrived by special courier marked top secret or confidential and was not opened by the mailroom personnel. Security personnel constantly escorted him as he went about his Manhattan Project duties. "At one point," Thayer later recalled, "a new Colonel in the Seattle District office asked me to come to his office and advise him of the project that I was working on that was so secret. I could not tell him, and I told him that I could not. He became irate and stood up with his fist on the desk and said, 'Mr. Thayer, you are my employee and I demand to know what you are doing.' I said, 'I'm sorry, sir, I cannot do that.'" The Colonel persisted and ultimately it took a call from Colonel Matthias to mollify the frustrated commander. Thayer also carried on his normal Seattle District responsibilities while assisting the Manhattan Project.[31]

Supply Mission

The supply mission formed the core of the Seattle District's wartime undertakings, whether in support of military construction in Alaska, the ALCAN Highway, or the Manhattan Project. Between 1941 and 1943, the district spent over $131 million on 1,517,000 tons of supplies for the Alaska military construction program. Items procured and shipped included everything necessary to sustain workers in remote settings with climatic extremes, as well as the materials, tools, and other equipment needed for heavy construction projects. At its peak in 1942-1943, the supply organization of the Seattle District numbered 1,200 employees. The core of the operation functioned through 40 buyers and 80 inspectors.[32]

Prior to the national defense buildup starting in 1940, the Seattle District procurement operation was a minor activity, focused on purchases of office supplies and materials for the district floating plant, civil works projects, and the Puget Sound fortifications. Such work required only five employees. The transfer of all Air Corps field construction from the Quartermaster Corps to the Corps of Engineers in December 1940 and the assignment of all Army Quartermaster construction to the Army engineers brought increased supply responsibilities and an influx of Quartermaster personnel into the Corps. Supply mission tasks grew in complexity with the growth in defense workload.

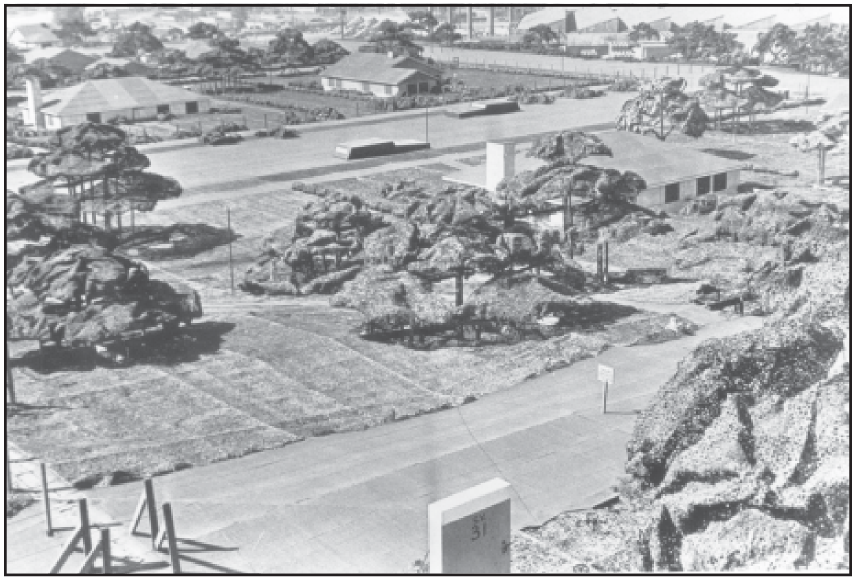
The basic procurement process required inspection of all purchased material and equipment for compliance with specification, either at the point of manufacture or upon arrival at the receiving end. Once the items were received, they usually needed temporary storage and proper packaging for shipment on to their ultimate destination. As the workload expanded, the Seattle District supply mission outgrew its storage facilities on the Seattle waterfront several times. Ultimately, the district built a large, modern warehouse at 4th Avenue South and Lander Street to house its supply operation. The supply division also stockpiled large quantities of lumber and heavy equipment at other locations. One such storage site, the Argo Yard, in south Seattle became a massive salvage, repair, and redistribution operation. To aid in the operation of the Argo Yard, the Seattle District used 400 German prisoners of war. They were quartered at Fort Lawton and transported by bus on a daily basis and under heavy guard to work in the Argo Yard.

Seattle's location adjacent to the great forests of the Pacific Northwest made it a principal source of supply for lumber shipped to war theaters throughout the world. The Seattle District supply operation developed a number of designs for prefabricated, portable buildings, which were suitable for all extremes of weather and simple to set up. Thousands of these buildings were produced at Seattle and shipped to troop locations around the world.

Summary of Military Work

The Seattle District's wartime activities embraced a broad array of actions from design and construction to management and supply. It also included assistance to the Corps' North Pacific Division real estate office, as it acquired privately owned land and buildings necessary to carry out the war effort. One unusual action occurred when the Army acquired the New Richmond Hotel in Seattle and Hanford Thayer was given the responsibility for remodeling it into a hospital to care for soldiers injured in the Aleutian campaign against the Japanese. Barely a year later, after the Japanese withdrew from Alaska, Thayer received orders to convert the hospital back to a hotel.33

Over all, the Seattle District compiled an impressive wartime record in Alaska and the Pacific Northwest. One informed source has estimated that the district carried out over 280 major construction projects at some 300



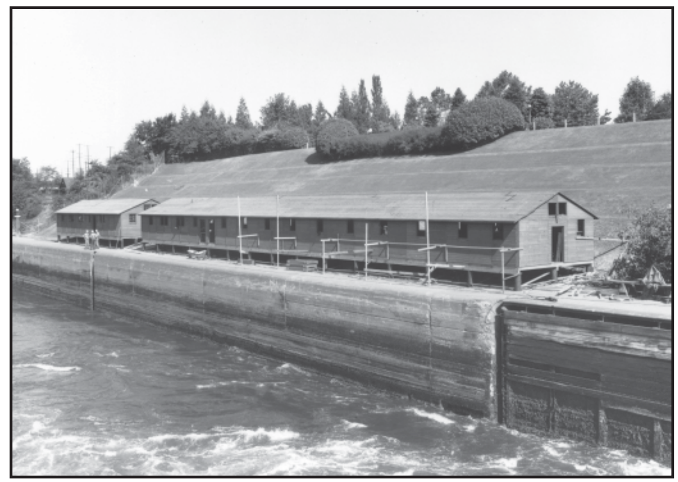
Camoflage

separate locations in Alaska, Canada, and the northwestern United States. These included airfields, aircraft warning stations, port complexes, training camps, hospitals, bombing ranges, military housing projects, ammunitions depots, harbor defense forts, and numerous other special facilities. Since some of these projects included numerous components, literally thousands of discrete undertakings were involved in the total war effort by the District. With the end of hostilities in sight by early 1945, the Seattle District began to make preparations for an orderly transition from wartime to a peacetime economy. In July 1945, the district established a Contract Termination Unit to close out and reimburse contractors and suppliers on 250 military contracts and purchase orders with an original face value of approximately $2 million. Seattle District employment plummeted to a more normal peacetime level of around 600 and staffers with seniority scrambled to keep positions at the expense of less-experienced personnel.[34]

Post-World War II Pacific Northwest

World War II transformed the economy and society of the Pacific Northwest. On the eve of the war, forestry and agriculture provided the economic mainstays of the region. According to the National Resources Planning Board, three of every four workers gained their livelihoods from those two sources of economic activity. Little other heavy industry existed in the region. At the beginning of the war, for example, the Boeing Company employed 4,000 people in the nascent aircraft industry, and shipyard employment on the Puget Sound and Columbia River consisted of about 1,800 laborers. The sudden availability of vast amounts of electrical power from Bonneville and Grand Coulee Dams, together with the voracious war production demands of the United States caused a dramatic change in the economic landscape. The Pacific Northwest Regional Planning Commission reported in 1943, "low-cost power from the Columbia is having a revolutionary effect upon the industrial development of the region."[35]

The federal government played a key role in the economic transformation of the Pacific Northwest. It expended $40 billion in the West during the war, producing enormous change. Seattle companies alone received war contracts worth $5.6 billion. Between 1940 and 1942 alone, 200,000 Americans migrated to the Pacific Northwest to work in defense



Lake Washington Ship Canal
14 Aug 1943

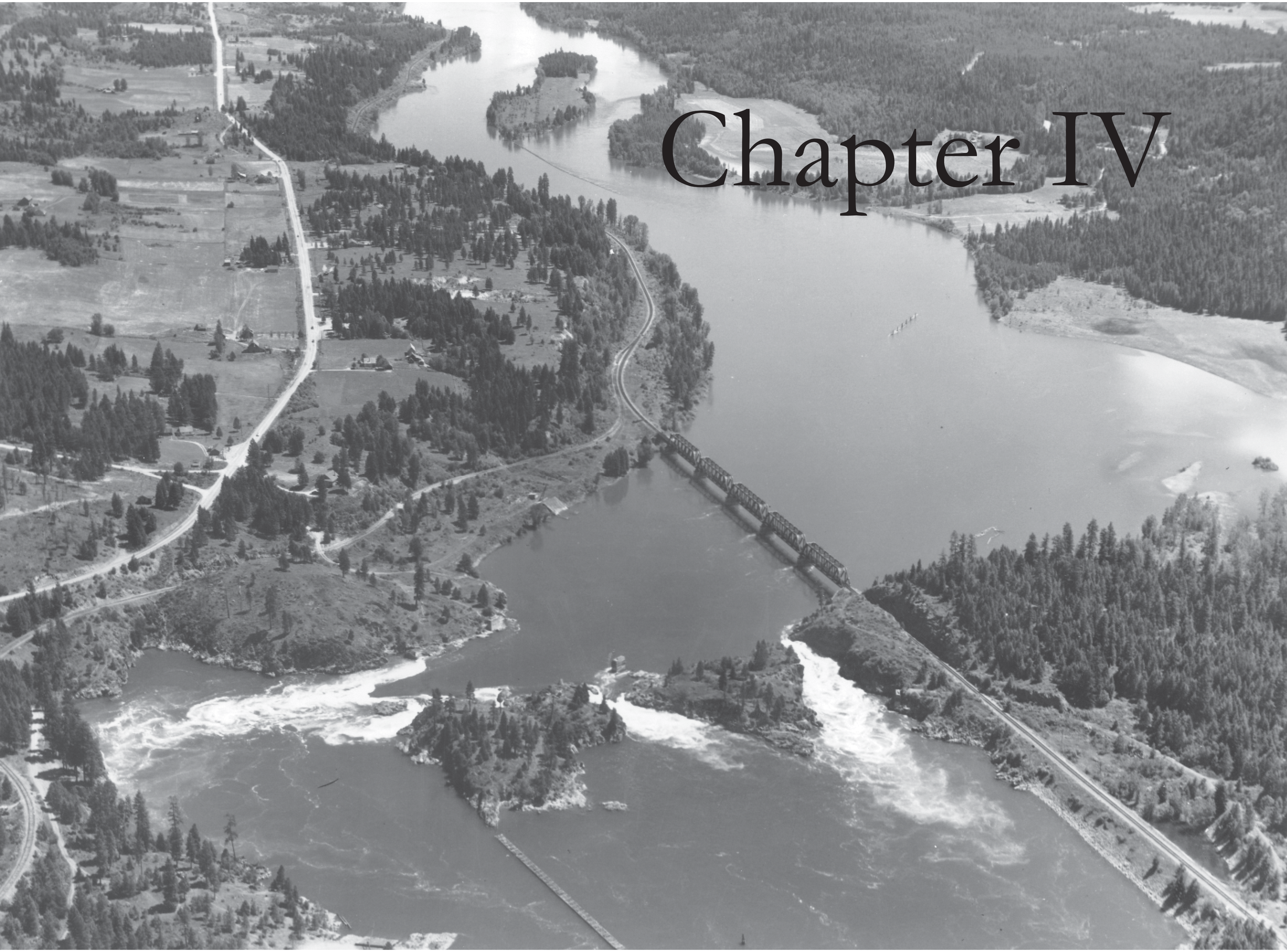
industries. Seattle saw the number of its manufacturing employees double between 1940 and 1942. At its peak during the war, the Boeing Company employed 50,000 workers; while Seattle and Portland shipbuilders gave jobs to 220,000 laborers. The acute shortage of workers caused wages to soar. While the population in the Pacific Northwest increased by a fifth in the wartime years, personal income rose by 162 percent.[36]

Cheap and abundant hydropower enabled the region to begin escaping its dependent status as an extractive economy that sent its raw materials elsewhere for processing. The sudden emergence of the Pacific Northwest as a major producer of aluminum provided a case in point. National output of the strategic metal increased from 163,000 tons in 1939 to a record 920,000 tons in 1943. In those same years, the federal government financed the building of five aluminum plants in Washington and Oregon. At the war's end, these factories produced almost 45 percent of the nation's supply of aluminum. The Columbia River's cheap power led the federal government to locate the aluminum plants in the Pacific Northwest, since the production process required enormous amounts of energy. The inexpensive power more than offset the high cost of transporting bauxite, the principal raw material in making aluminum, from distant mines located in the southeastern United States.[37]

Because of its light weight, high strength, and resistance to corrosion, aluminum was vital in making airplanes. The new aluminum plants in the Pacific Northwest made the region a center of the aircraft industry. By the end of the war, Boeing had built almost 8,200 bombers in its Seattle area plants. In 1944, at its peak of production, the Boeing Company produced $600 million worth of aircraft for the war effort. By contrast, the total output of all Seattle manufacturers in 1939 came to a mere $70 million.[38]

Observers of the regional scene at the end of the war wondered what all these changes in the economy portended for the future. Predictions made during the 1930s had assumed decades would pass before the power from Grand Coulee and Bonneville Dams would be fully absorbed. A mere half-decade of war production demolished those notions. New concerns arose, though, as many economists predicted a severe postwar economic downturn. The slump, however, failed to materialize, as forced wartime savings fed the pent-up demand for consumer goods and housing after 1945. In view of the transformed Pacific Northwest economy and the potential for further hydropower development on the Columbia River system, the Corps of Engineers ordered a review and updating of the old 308 Report. This post-war review and planning exercise would lay the foundation for the Seattle District's civil works program for the next 25 years.[39]

Chapter IV



MAIN CONTROL PLAN PROJECTS

The Seattle District civil works projects in the postwar years embraced a wide spectrum of undertakings. On the planning side, the update of the 308 Report for the Columbia River and Tributaries proved a major effort during the late 1940s; while planning, designing, and construction of Chief Joseph Dam fully engaged all aspects of the district's engineering expertise. The revision of the 308 Report culminated in the House Document (HD) 531 Report, also known as the main control plan. Traditional rivers and harbor work on the Puget Sound and at Gray's Harbor, as well as emergency flood response work also required the regular attention of the district. By the mid-1950s, the Seattle District was involved in revising the Corps' HD 531 Report, culminating in the major water plan and the effort to build Libby Dam. This chapter will focus on the Seattle District's part in preparing the HD 531 Report and in building Chief Joseph Dam. Chapter V will discuss the development of the major water plan and other significant civil works projects constructed during the 1950s and 1960s.

HD 531 Report

The rapid development of aluminum, aircraft, and atomic works increased the energy requirements of the Pacific Northwest. Informed observers believed that these industrial activities argued for the ultimate development of the water resources of the Columbia River basin as first set forth in the 308 Report. The Bonneville Power Administration (BPA) recommended, in addition to increased generating capacity at Grand Coulee, Rock Island, and Bonneville dams, construction of a $59 million dam at Foster Creek Rapids on the upper Columbia. Although the uncertainty concerning the effects of postwar demobilization on the Pacific Northwest economy bothered many observers, the Seattle and Portland Districts of the Corps conservatively estimated that a major new hydroelectric dam would be needed by the mid-1950s.[1]

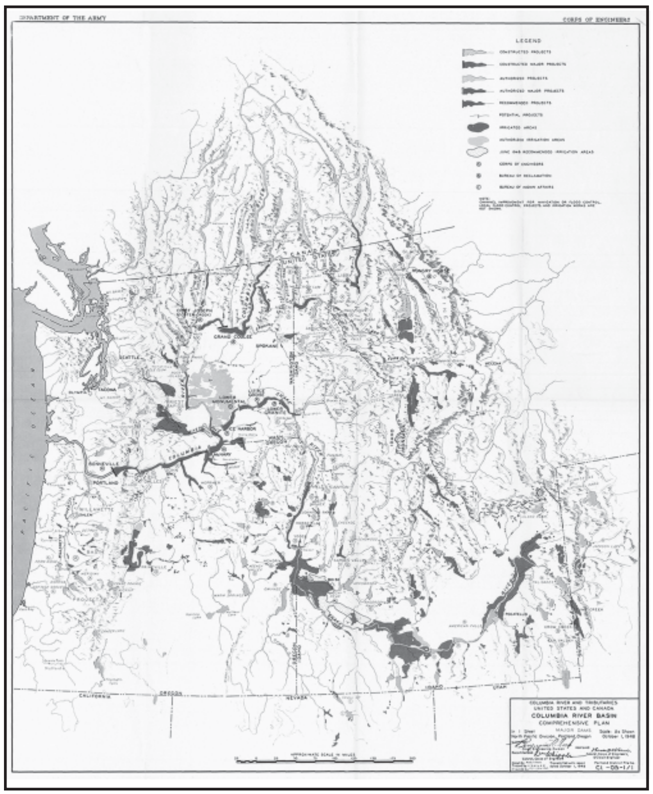
Throughout the war, the Corps used what resources it had available to continue planning for postwar hydroelectric development on the Columbia River. In November 1943, the Seattle and Portland Districts held a joint planning meeting to discuss the best division of responsibility for conducting a comprehensive review of the 308 Report. The questions chiefly focused on which projects should be built and who should build them. The Umatilla Dam (later renamed McNary) on the lower Columbia and Foster Creek (later renamed Chief Joseph) on the upper Columbia emerged as the mostly likely initial candidates for construction. Both had strong regional support from various interest groups and had backing from the Corps' leadership.[2]

The Corps also had to fend off the ambitious efforts of the Bureau of Reclamation to have the Chief Joseph project assigned to that agency. In 1942, the North Pacific Division Engineer, Colonel Richard Park, pointed out to the Chief of Engineers that the Corps must carry out, as expeditiously as possible, comprehensive planning for future power production "in order that the Corps of Engineers may retain leadership and control in the field of hydroelectric power and water resources planning in the Pacific Northwest where this subject is one of outstanding importance and where the control of it will likely, therefore, be sought by other agencies." Colonel Park noted that while basic plans existed for main stem projects, much work needed to be done for power projects on the tributaries.[3]

The Board of Engineers for Rivers and Harbors agreed with Colonel Park's recommendation for comprehensive planning and the Chief of Engineers concurred. Before the resource-strapped Corps had proceeded very far in the initial review, the investigations were subsumed into a comprehensive survey and report of the Columbia River and Tributaries authorized by the Committee on Commerce of the U. S. Senate in September 1943. While the field investigations carried out by the Seattle and Portland District personnel were kept at a minimum level until the war ended, the studies did ensure the Corps' leadership role in postwar economic planning in the Pacific Northwest and laid the basis for an expanded civil works program.[4]

Postwar planning also involved other federal agencies besides the Corps. The Bureau of Reclamation promoted irrigation and flood control projects on the Columbia's tributaries throughout the Northwest, while the BPA focused on expanding its power transmission facilities and marketing efforts. After Congress abolished the National Resources Planning Board in 1943, the Roosevelt Administration struggled to keep a semblance of central planning alive. The President ordered federal construction agencies such as the Corps to report all long-range planning to the Bureau of the Budget on an annual basis, and he continued to push the idea of river basin-wide planning commissions. In 1943, the Departments of War, Agriculture, and Interior as well as the Federal Power Commission agreed to establish the Federal Inter-Agency River Basins Commission (FIARBC) to encourage cooperation among federal water resources agencies. The FIARBC was an outgrowth of an earlier tripartite interagency agreement established in 1939 to foster cooperation within the federal water resources bureaucracies. Congress also added its voice to those urging greater coordination between water resources agencies. In the Flood Control Act of 1944, Congress ordered the Corps and the Department of Interior to consult with each other hen planning their studies and to share date from their investigations.[5]

In preparing the comprehensive review of the 308 Report, the Corps declined the Bureau of Reclamation's attempts to join the effort as a co-equal preparer of the final report. Instead, the Corps sought to limit the Bureau and other federal water resources agencies to the subordinate role of data collectors and technical reviewers. The Corps cited Congressional directives as its authority to be the sole author of the review report. Still, given the magnitude of the study, the North Pacific Division office ordered the districts to seek cooperation: "So that the results of the investigation will not conflict with the ideas of, and will be acceptable to, other federal departments and to state and other local interests, these other agencies will be requested to assist wherever appropriate." To that end, the Portland and Seattle Districts held numerous conferences, conducted public hearings, coordinated with federal and state agencies, and consulted with interest groups in the region on each aspect of the comprehensive report.[6]



Columbia River Basin Composition Plan Major Dams

As wartime Seattle District engineers thought about how best to tap the hydropower potential of the Columbia River, they realized that the data accumulated in the previous 308 Report gave them only a starting point; for much remained to be learned about the great river and its tributaries. The Columbia River, in its near natural state, seemed unpredictable and wasteful. Water flow stood at its lowest in winter, when demand was strongest. When the water was least needed in spring and early summer, the river flowed at its highest level. According to some estimates, this water regime wasted four-fifths of the Columbia's potential for generation of hydroelectricity. To remedy this unproductive situation, the Corps proposed storing the river's unused flow. As B. E. Torpen of the Portland District staff wrote in 1945, "storage is the key to complete development of the Columbia River."[7]

Through storage behind dams, the Corps could save water for release during normal low-flow periods to increase downriver power generation. The idea, though simple in concept, would prove difficult to achieve in reality. Human development in the Columbia basin created obstacles to certain storage options. Ideally, impoundment dams would be most effective when placed in narrow canyons that served as outlets for wide and relatively flat valleys. At one time, massive storage could have been provided by one large dam at The Dalles, creating an impoundment larger than the Puget Sound and several hundred feet deep. This was no longer feasible, since it would flood the Hanford atomic works. Powerful fisheries interest also opposed the detrimental effects on the salmon fishery of additional Columbia River main-stem dams. Only the high mountain tributaries of the Columbia seemed to offer realistic storage possibilities.[8]

Clearly, by the mid-1940s, changed conditions in the Columbia basin called for a thorough reassessment of the 308 Report and a new look at its tributaries. Planning for the tributaries, which had not been well developed in the 308 Report, would have to be a major consideration in any comprehensive plan for development of the power resources of the region. Attention to the Canadian portion of the Columbia, a delicate issue requiring consultations with authorities north of the border, would also be necessary. Congress, responding to the Corps' recommendation, authorized in

Junction of the Columbia River and the Yakima River Flood
31 May 1948

September 1943 a complete review of the 308 Report.[9]

In the comprehensive review, the North Pacific Division played a much greater role than in the earlier investigation. Then, the small division staff had to rely on the districts to accomplish the bulk of the effort, while it focused on coordinating and summarizing the results in a consistent presentation. In the new study effort, Colonel Theron Weaver, the Division Engineer, closely controlled the process and issued the major portion of the document under his own signature. The new approach required the Seattle District to conduct six river basin surveys: the Kootenai, the Clark Fork-Pend Oreille, the Spokane, the Yakima, and the Canadian and American portions of the upper Columbia River. This survey material prepared by the Seattle District appeared as appendices to Colonel Weaver's main report.[10]

Although preliminary investigations began in the fall of 1943, the full-scale effort got underway only after the end of World War II. Once the study got going, Colonel Weaver reported that "several hundred personnel" at both the division and district levels became involved "over a five-year period, either full time or in conjunction with their other duties." As Colonel Weaver noted, "extensive field surveys and investigations were made on the major streams of the Columbia River Basin to locate possible project sites of major importance . . . and to investigate the many local and sub-basin problems called to the attention of the Corps of Engineers by local interests." For example, the Seattle District studied the entire length of the Kootenai River and conducted drilling at four potential dam sites. The district held thirty meetings with private and public interests to make sure the report took into account the concerns of all interested parties in the region. The Corps also requested the BPA and the Federal Power Commission to project the future regional demand for hydroelectricity and used the meetings of the Columbia Basin Inter-Agency Committee (CBIAC), created in 1946 by the FIARBC, to discuss inter-agency issues bearing on production of the final plan.[11]

Colonel Weaver had set October 1948 as the target for completing the study; however, shortages of money and staff caused many to doubt that it could be done by that date. In addition, Canadian engineers failed to provide data on their portion of the Columbia Basin in a timely manner. The Chief of Engineers, on a visit to the Pacific Northwest in July 1946, verbally agreed to a two-year delay suggested by the Seattle District. No sooner had the Seattle engineers arranged their work to the new schedule then they had to revert to the old one. The Chief of Engineers' headquarters staff became alarmed when they learned of a possible delay in preparation of the comprehensive review report because they feared that the Bureau of Reclamation might get its rival report on the irrigation possibilities of the Columbia basin out first. Under pressure from the Corps' headquarters staff, Colonel Weaver agreed to revert to the 1948 target for report completion. Discouraged Seattle District personnel feared that the result of a speed up, assuming no additional funding, would led to a sacrifice in quality of the finished report.[12]

Colonel Weaver did submit the comprehensive review report on 1 October 1948. Although the recommendations immediately became public, the Army did not officially transmit the report to Congress until February 1950. Congress, in turn, delayed its publication, as House Document Number 531, until 1952. As finally published, the main report and appendices consisted of 4,000 pages of small-letter text, with extensive unpaginated diagrams, tables, and illustrations. The 22-volume report required an estimated 500 man-years of effort at a cost of $5 million. Meanwhile, the Bureau of Reclamation had published its own Columbia basin-wide report. Though substantial, the Bureau report was not as comprehensive as the Corps' document, since it was done without benefit of new investigations and based solely on existing data.[13]

The multipurpose approach of the original 308 Report on the Columbia River received an expanded application by the postwar planners in preparing the comprehensive review. In addition to hydropower, irrigation, flood control, and navigation, the Corps planners now considered fish conservation, pollution, domestic water supply, and recreation. Flood control as a factor in water resources development took on an added significance in light of the disastrous floods on the Columbia River system in May 1948. When the floods hit, the comprehensive report was in the final review stages. President Truman, on 1 June 1948, personally ordered the Corps to revise its report to take into account the cost and benefits of flood storage at future control works on the Columbia River system. Traditional and new concerns had greatly increased in magnitude since work on the old 308 Report. As Colonel Weaver noted, "the vigorous and continuing transition of these [Pacific Northwest] States from the status of isolated frontier settlements to that of busy and important elements in the economy of the Nation is a most significant factor in determining the needs for further water-resource development and how best to meet them."[14]

The Corps' comprehensive review reported dramatic growth in the Pacific Northwest since the beginning of World War II. Between 1940 and 1948, the population of Washington and Oregon had increased by 44 percent, compared to 11 percent for the nation as a whole. The Columbia basin population rose by approximately 18.5 percent. Experts forecast a further increase of 20 percent by 1960—three times the national projection. Such rapid growth required a comprehensive approach to basin-wide development. Colonel Weaver wrote:

> . . . that the various water resource problems in the Columbia River Basin can be solved satisfactorily only by adoption of a truly comprehensive plan of development, wherein all elements are carefully coordinated, both with respect to the immediate needs of each water use and with respect to the later expansion which will be necessary in the future. In no other way can it be assured that the optimum development of each water use will be accomplished in the best interests of each sub-basin, the region, and of the Nation as a whole; or that improvements made to meet the present needs will not block or interfere with the more extensive improvements that will be required in the future.[15]

The heart of the Columbia River and tributaries comprehensive report of 1948 was the main control plan of multiple-purpose reservoirs and lower Columbia River levees. It also reflected the Corps recognition of its expanded responsibilities for fish and wildlife conservation and the need to win Canadian cooperation in developing storage and power on the upper Columbia. The report also acknowledged Indian treaty rights involving fishing, inundation of Indian lands, and reservation status that required special consideration. The Corps admitted that ultimately Congress would need to address some of the Indian rights issues. The main thrust of the report, though, focused on flood control concerns, unmet power needs, and the role of inland navigation in furthering regional economic development.

To effectively carry out long-range development of the Columbia River basin proposed in the comprehensive report, the Corps' Board of Engineers recommended that the Corps establish a hydraulics laboratory at a suitable location in the basin for river engineering research. As the Board noted, "a development program of the magnitude of this comprehensive plan will involve many unprecedented problems of design, construction, and operation." A hydraulics laboratory that conducted tests on scale models could, according to the Board, "add materially to the fundamental knowledge of hydraulics and of the performance of hydraulic structures and machinery." The Board estimated the laboratory's initial cost at $15 million with $1 million in annual expenses, "exclusive of the costs for model construction and testing which should be charged to projects construction."[16]

The main control plan called for immediate construction of seven new multiple purpose dams. These were in addition to the previously authorized Hungry Horse, McNary, and Foster Creek projects. Four of the new dams in the main control plan—Libby, Glacier View, Albeni Falls, and Priest Rapids—were located within the Seattle District boundaries. The plan also called for modifications at Grand Coulee and levees and bank protection works on the lower Columbia River to "provide positive control of floods of a magnitude equal to the maximum of record on the lower Columbia River." Increased power generation, however, served as the key purpose of the plan because the projected power demand had outstripped existing capacity and the additional power generated would help to repay the reimbursable portion of the plan. The Corps estimated the total cost of the main control plan at $1.7 billion.[17]

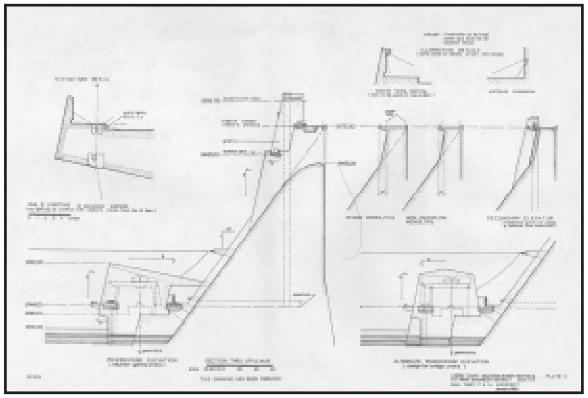
Although the Corps argued that the main control plan projects should be constructed in the near future, it conceded that some of the proposed projects might be delayed "as a result of conditions not completely determinable at this time." For example, the $239 million dam recommended for the Kootenai River, 11 miles above the town of Libby, Montana was subject to the final approval of the International Joint

Commission. The dam would generate 244,000 kilowatts of power, control flooding in the vicinity of Bonners Ferry, and provide storage for more efficient operation of downstream projects on the Columbia. The reservoir, however, would inundate land in British Columbia. Negotiations were underway for compensation to Canada, but resolution of the matter appeared unlikely to occur very soon. Construction of Libby Dam had to await a diplomatic resolution of outstanding issues.[18]

Other controversial projects proposed in the main control plan also were within the Seattle District. While numerous mountain dam sites made the Clark Fork-Pend Oreille system well suited to the purposes of the main control plan, the sites would cause harm to scenic and recreation locations, Indian reservations, and railroads. As the least objectionable alternative, the Corps recommended a $102 million earthen dam at Glacier View on the Flathead 176 miles up from the river's mouth. The dam would generate electricity and provide flood protection; but, unfortunately, would also back water into Glacier National Park. The National Park Service and conservationist groups loudly objected to the proposed dam. The Corps, nevertheless, retained Glacier View Dam in its plan, "with provision for the substitution of a feasible alternative."[19]

The opposition to Glacier View Dam represented an early example of the public resistance to Corps dams that would permanently degrade significant natural and scenic landscapes. The director of the National Park Service, Newton Drury, pointed out that some of the finest wildlife habitat in the United States "would be substantially reduced by the project." Secretary of the Interior Julius Krug went even further, arguing that Congress ought to exclude all large flood control and power projects from national parks "unless the need for such projects is so pressing that the economic stability of the country, or its existence, would be endangered without them." Some in the Corps did not take kindly to the National Park Service's opposition. At a meeting of the CBIAC, Colonel Weaver, incensed at the efforts to kill the Glacier View project, accused the National Park Service of "unethical" behavior. Bowing to the public outcry over the danger to Glacier National Park, however, the Corps eventually dropped the Glacier View project.[20]

At the Albeni Falls site two miles east of the Idaho-Washington line and below Pend Oreille Lake, the main control plan recommended a $31 million dam. In a September 1947 report, the Seattle District had already developed plans for a project at Albeni Falls. Although less controversial than Glacier View, Albeni Falls still generated some local opposition. Property owners on the edge of Pend Oreille Lake worried that their holdings would be flooded, while sportsmen had concerns for the popular Pend Oreille fishery.[21]



Libby Dam Powerhouse Elevation

On the main-stem Columbia, the main control plan carried forward the 308 Report recommendations for a dam at Priest Rapids. A 600-foot-high structure with an estimated cost of $326 million, it would provide 3.3 million acre-feet of storage for power generation and control of downstream flooding. This project stirred up considerable opposition from fisheries interests. They denounced all dams below Foster Creek because of their impact on fish runs. In addition, the Atomic Energy Commission, operator of the Hanford Works, expressed concern over possible damage to their atomic facilities on the right bank of the proposed reservoir. Clearly, no plan of such broad scope would please every one within the region.[22]

In addition to the multipurpose and flood control elements of the main control plan, the comprehensive report integrated other components related to the sub-basins of the Columbia River tributaries. These included modifications to the previously authorized Willamette Valley Project, irrigation projects of the Bureau of Reclamation on the upper Snake River and other tributaries, and various local flood protection works at scattered locations. The report also recommended associated projects of other federal agencies necessary to accomplish the main control plan benefits. These included expansion of the BPA transmission system, the Fish and Wildlife Service's lower Columbia River fisheries development plan, and the Department of Agriculture's soil and forest conservation programs, and an expanded hydro-meteorological network. Taken as a whole, the Corps asserted, the comprehensive plan, "will accomplish the desired basin and regional objectives at less cost and with larger benefits to the present and future economy than any other practicable system."[23]

In spite of sometimes-intense local opposition and broader fisheries and wildlife concerns, the Corps had worked to accommodate the views of such voices while developing the projects contained in its main control plan and subordinate elements. In approving the Division Engineer's comprehensive plan, the Board of Engineers stated that "such a plan not only should recognize the individual requirements of each useful purpose to be served but also should carefully integrate provisions for the many water uses into a balanced system which will yield the maximum combined public benefits." The Board concluded that "the comprehensive plan . . . fulfills these requirements."[24]

Columbia Valley Authority

As water resources policy for the Columbia River basin evolved during the New Deal and war years, no one voice spoke for the federal government. At least 20 separate federal offices representing 3 cabinet departments had jurisdiction over the river. In addition, the states of Oregon, Washington, Idaho, and Montana insisted on a role in all decision-making. To deal with this often chaotic and inefficient situation, President Harry Truman in 1945 proposed a fundamental revamping of federal water policy in the Columbia River basin. His solution for effective planning and development of water resources called for the extension of the Tennessee Valley Authority (TVA) concept to the Pacific Northwest. President Truman and his supporters in Congress proposed a Columbia Valley Authority (CVA) that would consolidate all of the various federal and state functions related to multiple purpose water resources development, including flood control, navigation, power generation and transmission, fish and wildlife conservation, reclamation, domestic water supply, and port facilities. The act would have transferred employees from existing agencies such as the Corps, Bureau of Reclamation, and BPA to the new super agency.[25]

For the next five years, Washington's Democratic Senators, Hugh Mitchell (later a Representative) and Warren Magnuson, and Representative Henry Jackson pushed the legislation calling for a CVA. Such a radical change from the status quo elicited a strong opposition in the region. Conservatives branded the proposed CVA as incipient socialism and mounted a fierce campaign against the proposal. Supporters of the existing federal water resources agencies such as the Corps and the Bureau, who feared the loss of their projects and bureaucratic empires within the region, aided them. State governors, national and state reclamation organizations, private utilities, local changers of commerce, and much of the press in the Pacific Northwest also joined in opposition. On the other hand, state grange organizations, public power advocates (especially public utility districts), and political liberals backed the CVA concept. Proponents of the CVA concept made several attempts to push their measure through Congress but were unable to get a bill out of committee in the Senate. At the Corps, the NPD actively opposed the CVA and pushed the 531 Study to early completion in order to show that adequate water resources planning for Columbia River basin, through the Corps' main control plan, already existed.

The CVA's threat to the water resource program of the Corps and the Bureau of Reclamation caused the two agencies to put aside their rivalries and concerns of potentially overlapping functions in the Pacific Northwest. Following President Truman's instructions of June 1948, they hammered out agreements that coordinated their comprehensive reports on developing the water resources on the Columbia River and its tributaries and divided up future project responsibilities in the region. Concluded in April 1949, the interagency agreement ceded to the Bureau the right to develop hydropower on the Hells Canyon section of the Snake River, while the Bureau accepted that the Corps would construct Chief Joseph on the Columbia and Lucky Peak Dam on the Boise River. For the future, both agencies agreed that in building new power projects, the Corps would be responsible for those undertakings where navigation and flood control constituted the additional multipurpose elements, while the Bureau would be in charge of those activities where irrigation, drainage, and domestic water supply comprised the added components of multipurpose development. Most importantly, the agreement established geographic boundaries to each agency's multipurpose water resources work in the region. The Corps would confine itself to the main stem of the Columbia below Grand Coulee Dam, the lower Snake River, the Willamette Basin, the Columbia's northern tributaries, and the Kooskia project on the Clearwater River. The Bureau, on the other hand, gained control of new development on the middle and upper Snake River basin, eastern Oregon, and Washington's central basin.

Much to the consternation of CVA proponents, the release of the joint Corps-Bureau agreement seemed to weaken their case for a new federal agency to better coordinate development of natural resources in the Pacific Northwest. As the CVA's supporters noted, while the accord might end wasteful bureaucratic rivalry, it did nothing to assure integrated planning for the most efficient use of water resources. A staffer to Representative Henry

Jackson wrote privately, "by and large, the agreement is a 'division of territory'. Each department agrees to stay out of the other's agreed territory, even in the investigation and planning of future projects."[26]

Congressman Jackson was incensed at the timing of the agreement's release, coming as it did just before the congressional debate on the CVA. In testimony before a House committee, Representative Jackson called the agreement a "shotgun wedding" and argued "the absurdity of trying to allocate the construction of dams to one or another agency on the basis of its predominance as an irrigation or a flood-control or a power project." As he pointed out, a modern dam serves "all of these purposes, and it is often a matter of dispute as to how much of each it actually does serve." To Representative Jackson and others, the agreement between the Corps and the Bureau was no substitute for the comprehensive planning envisioned under the CVA. Conspicuously absent from the agreement was any reference to such crucial subjects as fisheries, soil conservation, and forestry.[27]

Whatever its perceived shortcomings, the Corps-Bureau accord proved a major factor in halting the CVA movement. An aide to Congressman Jackson succinctly noted how the CVA's opponents used the accord to their advantage: "The argument runs like this: The established federal agencies have agreed upon a comprehensive plan for development of the Columbia Basin. All of the Governors favor it. Why then is CVA needed?" The agreement also proved valuable in the Corps' effort to rebut the contentions of the Hoover Commission that the Corps and the Bureau were engaged in wasteful competition throughout the West.[28]

In addition to the regional CVA proposal, the Corps' critics in the Truman Administration sought to take away its civil works responsibilities on a national basis. Through the presidentially appointed Hoover Commission on governmental reorganization, the Corps' critics attempted to strip it of its civil works program by consolidating the undertakings of various federal water resources agencies into a new federal office. The Hoover Commission proposed establishing a Water Development and Use Service within the Department of Interior, which would include the civil works functions of the Corps and the water resources responsibilities of the Bureau and other federal agencies. While much of the debate over the conduct of federal water resources policy occurred at the national level, Corps officials in the Pacific Northwest criticized their opponents as ill-informed and wrong-headed. The Corps-Bureau accord served as powerful evidence against the Hoover Commission charges about wasteful competition between the two agencies. The Corps and its supporters, moreover, could point to other successful, post-war planning efforts in the Pacific Northwest that helped to prevent wasteful duplication in water resources development. One pertinent example was the CBIAC.[29]

As noted above, FIARBC established the CBIAC as part of its attempt to integrate river planning at the national level. As a field committee of the FIARBC, the CBIAC was to provide "a means through which the field representatives of the participating federal agencies may effectively interchange information and coordinate their activities among themselves and with those of the States in the preparation of reports and in the planning and execution of works for the control and use of the waters of the Columbia River system and the streams of the coastal drainage area." Members included the Corps of Engineers, the Bureau of Reclamation, the BPA, the Federal Power Commission and several other agencies, along with the governors of Oregon, Washington, Idaho, Montana, Wyoming, Utah, and Nevada. The CBIAC was never intended to be anything other than an advisory and coordinating body. Actual project planning remained the prerogative of the federal resource agencies comprising the Committee.[30]

The CBIAC focused much of its early efforts on technical studies and held periodic conferences around the region to discuss developmental issues. Although the Committee met monthly, its work was slowed by the fact that it had no independent budget or staff of its own and thus was dependent upon the support of the agencies comprising it. Critics also noted that decisions required a unanimous vote and that it proved difficult to resolve controversial issues in the open meeting format under which the committee operated. Agencies were free to accept or reject its recommendations. In practice, the CBIAC served chiefly as a means of information exchange between member agencies and, through its public meetings, a way to educate the general public about federal water resources policies and programs. Still, the Committee represented to many within the region an adequate means of planning and program coordination and therefore a workable substitute for the CVA. The high level of state participation served as a strong point in the organization's favor to those northwesterners fearful of dictation from Washington, D.C.

The battle over CVA and the national attempts to take civil works responsibilities away from the Corps ended in the maintenance of the status quo in the Columbia River basin. A hodgepodge of federal agencies, state governments, public utilities districts, municipal electric systems, and private power companies continued to play the dominant role in water resources development. The Corps-Bureau accord reduced tension between the two rivals, but otherwise left them free to build water projects within their spheres of control. During the twenty years after the end of World War II, there were plenty of projects available to fully engage both agencies.

Chief Joseph Dam

While the division and headquarters elements of the Army Engineers concentrated on policy and political implications of water resources developments in the Columbia River basin, the Seattle District focused on actually building a major dam on the upper portion of the river. In response to the wartime demand for increasing amounts of electric power, Congress authorized studies for the Foster Creek project 50 miles downstream from Grand Coulee Dam and for Umatilla Dam just below the Washington-Oregon border. Seattle District engineers began surveying on the Columbia above the mouth of Foster Creek in 1942. The survey crews found the work challenging. The rugged topography was marked by broken hills interspersed among expanses of sand-filled depressions where sagebrush grew to a height of 10 feet. The lack of roads and bridges also limited access to the proposed dam site.[31]

In spite of the difficulties encountered, the Seattle District's geological investigations and laboratory tests clearly revealed the construction problems the dam builders would face. On the left bank and the river bottom, subsurface granite provided excellent foundation conditions. In contrast, the geologists determined that on the right, or northern bank, glacially deposited gravel extended for many miles upstream and several thousand feet inland. The investigators reported in 1944 that on the northern shore the terrace would be unacceptable as an abutment for the dam without extensive treatment to reduce seepage velocities and prevent future abutment failure.[32]

In his final report on the proposed Foster Creek Dam in the August 1945, Colonel Conrad Hardy, the Seattle District Engineer, noted that the presence 51 miles upstream of Grand Coulee Dam controlled several aspects of the project plan. For example, Foster Creek Dam could be no higher than 220 feet because the Columbia River could be backed up only to the base of Grand Coulee. In addition, because Grand Coulee Dam already blocked historic migratory fish runs, Foster Creek Dam would not need fish passage facilities. To mitigate Grand Coulee's barring of anadromous runs, returning fish had been transplanted to Columbia River tributaries below Foster Creek.[33]

The topographical and economic conditions at the proposed dam site also meant that the project would be a single-purpose undertaking, primarily for the production of hydroelectricity. The narrow valley and high canyon walls above Foster Creek restricted reservoir size to 22,000 acres, precluding any worthwhile flood storage. The studies conducted by Seattle District indicated that while 15,000 acres in the lower Okanogan country could be irrigated from the dam pool, the Bureau of Reclamation had not established the economic viability of such a project. Finally, the absence of river traffic made it unnecessary to provide navigation facilities at the dam.[34]

The Foster Creek dam site presented several technical difficulties. As noted above, geological studies by the district's foundations and materials specialists had revealed that the left riverbank consisted of the preglacial valley wall, while the right bank was composed of glacial sand, gravel, and till. This meant, as Colonel Hardy noted, "the control of seepage through the right abutment is the most serious engineering problem connected with the project." Based on their intensive investigations, the Seattle District engineers abandoned the site recommended in the original 308 Report. Instead, they proposed placing the dam axis further downstream, about a quarter of a mile above the mouth of Foster Creek.[35]

Colonel Conrad P. Hardy
Seattle District Engineer
1 December 1943-1 July 1946

At the new location, the right bank's overlaying till bed extended to a lower elevation, making the troublesome pervious sand and gravel layer thinner than elsewhere. In addition the bank had a gentler slope and was free of boulders and basalt. These factors were essential to controlling right abutment of the dam.

To control further, the Seattle District engineers designed a 2,600-foot long concrete cutoff wall that extended from the spillway to the protruding bedrock. This achieved, in the words of the engineers, the "positive prevention of seepage." Site geology further dictated that the intake works and powerhouse would be placed on the solid bedrock foundation of the impervious southern riverbank. Finally, Colonel Hardy noted that the recommended site eased certain construction requirements existing at the other possible dam sites studied: "The problems of river diversion and cofferdam operations are simpler than at the upstream axes because of the greater width of channel, the straight channel downstream, and the lower velocities."[36]

In his official report, Colonel Hardy recommended that the dam "be of [a] concrete, straight, gravity, overflow type with stilling basin at approximate stream bed elevation." The engineers designed the spillway to pass a flood of 1.25 million cubic feet per second. To accomplish this, the spillway, as built, occupied the entire river channel width, extending 922 feet in length and reaching 230 feet in height. As initially designed, it contained 25 taintor gates, each 40 feet long and 32 feet high, for discharging overflow. The dam's intake wall, penstocks, and powerhouse on the left bank extended downstream at a right angle, adjoining the left abutment with a short, curved concrete gravity non-overflow structure. The spillway connected to the intake structure and powerhouse with a curved, non-overflow concrete section founded on a mid-channel outcropping of rock.[37]

The water intake channel for the powerhouse was cut into the top of the bluff on the left bank. Steel penstocks in the concrete intake structure reached down the granite cliff for 240 feet to carry water to the powerhouse at the dam's base. The 1,564-foot long powerhouse held 15 Francis type turbines, each rated at 87,000 horsepower. The turbines drove generators rated at 64,000 kilowatts, which were so massive that they had to be constructed on-site within the building. The proposed Foster Creek Dam would have an installed capacity of 960,000 kilowatts once all units were in place. To account for increased future power demand, the designers provided for adding an extra generating unit and for further expansion of the powerhouse itself at some later date.[38]

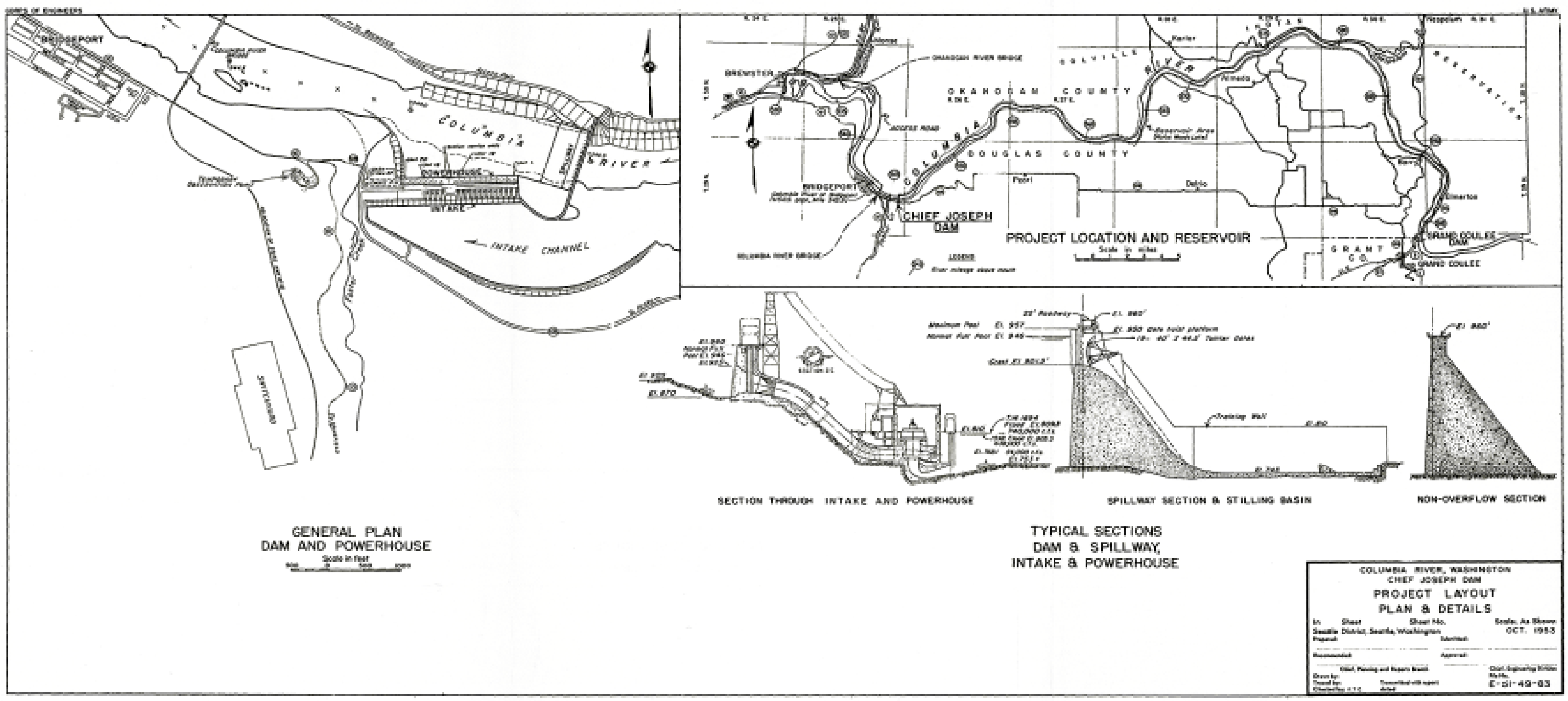
By designing the powerhouse and intake structure as separate units so as to take maximum advantage of the ledge rock underlying the intake structure, the planners reduced both the substructure costs and the amount of excavation needed. The engineers used extensive hydraulic model studies to arrive at the most economical channel design to control the flow velocities. The Hydroelectric Design Branch of the North Pacific Division prepared the initial design for the powerhouse generation features.[39]

Colonel Hardy estimated that the dam would require five years to construct. Site preparation work, including extension of the railroad from Brewster to the dam site and building bridges across Foster Creek and the Okanogan and Columbia rivers would take two years. He set funding requirements at $104 million. Even with a postwar return to a historical pattern of growth in electrical demand, the Seattle District's studies found output of all existing and authorized Pacific Northwest power plants would be utilized by 1954. Unless future needs were taken into account in the present, Colonel Hardy observed, "The industrial development of the region may be seriously handicapped."[40]

The Seattle District's cost estimates for the Foster Creek Dam caused problems for its proponents. The 308 Report had estimated construction at $48 million and even allowing for the increase in prices and wages from the depths of the Depression and the subsequent postwar inflation, the revised cost seemed excessive. Project proponents, however, pointed out that the earlier Army engineer investigation was very preliminary and had not uncovered the right bank foundation problem. The Corps had to take expensive steps to insure the dam's viability. The extra expense, as matters developed, did delay construction of the Foster Creek dam.

Prior to receiving Colonel Hardy's Foster Creek report, Congress approved construction of the Umatilla (renamed McNary Dam after the late Senator Charles McNary of Oregon) and the Snake River dams proposed by the Corps in the late 1930s. These undertakings would add 2.1 million kilowatts to the hydroelectric capacity of the Pacific Northwest and increased the likelihood that the federal government would not build additional dams in the region for the immediate future. In fact, in their November 1945 endorsement of Colonel Hardy's Foster Creek report, the Corps's Board of Engineers for Rivers and Harbors flatly stated, "in no event should construction of the Foster Creek project take precedence over that of the more important multiple-purpose projects on the Columbia and Snake Rivers already authorized by Congress." Compounding the cost problems facing the Corps and its supporters, the Bureau of Reclamation attempted to turn the undertaking into an irrigation project and have its construction and operation assigned to the Bureau. With assistance from Washington Representative Henry M. Jackson and Senator Warren G. Magnuson, the Corps managed to prevent this outcome.[41]

The Corps obtained funds from Congress in 1946 for more planning



Chief Joseph Dam Project Layout Plan and Details
Oct 1953

work on the Foster Creek project but for nothing further. Even this money became jeopardized when the Bureau of the Budget, anxious to return government spending to peacetime levels, advised President Harry Truman to veto the legislation. Only strenuous lobbying by Senator Warren G. Magnuson of Washington saved the Foster Creek funding from President Truman's veto pen. Despite Representative Jackson and Senator Magnuson's efforts, the Foster Creek project remained stalled at the preparatory stage. Congressional and Bureau of Budget resistance to yet more federal spending for Pacific Northwest projects proved too powerful to overcome. Past taxpayer largess for Bonneville and Grand Coulee dams, as well as current large appropriations for Mc Nary Dam and the Columbia Basin Irrigation Project seemed more than generous to many observers outside the region.[42]

Some frustrated development interests in the Columbia Basin even accused the Corps of not aggressively pursuing the Foster Creek project. The Chief of Engineers, Lieutenant General Raymond Wheeler, defended the Corps' record by noting that economy-minded Bureau of the Budget had denied the Army Engineers' requests for construction funds in 1947 and 1948. Additionally, interests in the states of Oregon and Idaho only reluctantly supported the Foster Creek project because they feared it would divert money from McNary and the Snake River dams. The fact that Foster

Creek was a single rather than a multiple-purpose project did not help its cause either. Representative Jackson expressed the frustrations of many in the Pacific Northwest at Congressional opposition to western water resources projects, such as Foster Creek. In a speech on the floor of the House, he stated, "for some people, the word 'economy' must mean strangling the great Western reclamation and public power projects which are the cornerstone of our expanding industry and agriculture. . . . Real economy would be to complete these projects as fast as possible so the American people can start to get some money back on the already huge investment they have made in the destiny of the West."[43]

Two developments in 1948 ultimately helped to revitalize the Foster Creek project. The advent of the Cold War with the Soviet Union accelerated a national military build-up that greatly increased the demand for airplanes constructed with aluminum produced in the Pacific Northwest. By 1947, consumption of hydroelectricity in the Pacific Northwest exceeded the wartime high. The Bonneville Power Administration reported that over half of the 9.2 billion kilowatt hours sold in 1947 went to aluminum and other defense industries. The national defense program was again dependent, as during World War II, on hydroelectric power provided by the Columbia River. The Corps astutely touted its proposed Foster Creek Dam, already well along in planning, as "the most economical source for an additional large power supply in the Pacific Northwest."[44]

Meanwhile, natural disaster placed the Pacific Northwest in the national news. Abnormally heavy rain coupled with a sudden spike in temperature following an exceptional winter snowfall produced in May and June 1948 the second greatest flood of record in the Columbia River's history. Destruction in the upper Columbia Basin within the Seattle District's responsibility was limited to the Kootenai River near Bonners Ferry, Idaho, and to locales along the Flathead, Okanogan, Yakima and Naches Rivers. In all, about 217,000 acres were inundated and two people died as a result of the flooding. Flood damages on the upper Columbia amounted to $19.7 million. The Seattle District provided technical help and flood fighting supervision at key points of the flood fight. The heaviest losses occurred on the lower Columbia, however, where rampaging floodwaters completely destroyed Vanport, a wartime community on the edge of Portland that still housed 18,000 residents. Vanport came within the jurisdiction of the Corps' Portland District. Basin-wide, over 30 people lost their lives—15 at Vanport alone—and the damages exceed $100 million. In the aftermath of the disaster, President Truman demanded that the Bureau of Reclamation and the Corps of Engineers better coordinate their flood control planning to bring the Columbia under control.[45]

Stalin's blockade of Berlin and mother nature together brought new action on the Columbia River. By late 1948, a congressional consensus emerged that power from both Foster Creek and McNary were necessary to meet Cold War energy needs and to help harness the river's destructive force. Although Foster Creek's limited reservoir could provide little flood protection, it could produce large amounts of hydropower. First, in a year-end supplemental appropriations bill and then in the regular rivers and harbors legislation of 1949, Congress provided the first construction funds for Foster Creek. The Corps officially named the project Chief Joseph Dam after the legendary Nez Perce Indian buried north of the Columbia River at Nespelem, Washington.[46]

The Seattle District began work at the Chief Joseph dam site in 1949 with the placement of roads and bridges. Contractors completed excavation for the troublesome north abutment and erection of a cofferdam to divert the river's flow toward the southern bank by June 1951. As work got underway, the outbreak of the Korean War in 1950 caused conflicting problems for the project. While electricity demand soared as aluminum mills added capacity to meet defense needs, federal funds necessary for dam construction were diverted to the conflict in Asia.[47]

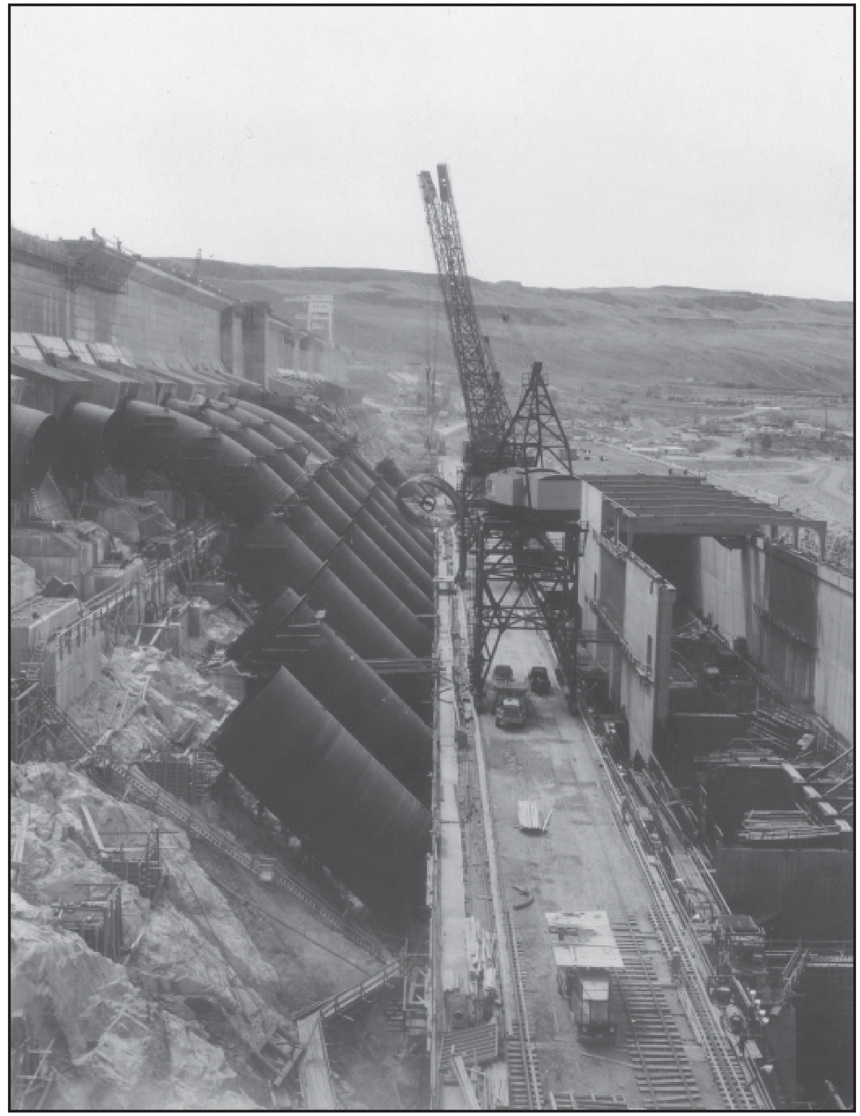
Soon after the Chief Joseph project began, the Corps made several important changes to cut construction costs and to provide a greater amount of electricity. Following the advice of a board of engineering consultants, the Seattle District engineers replaced the concrete cutoff wall designed for the northern bank with an impermeable blanket and a 1,000-foot relief tunnel driven into the abutment for a savings of $6.5 million. The massive blanket formed a seal composed of 694,000 cubic yards of compacted impervious glacial till spread over the exposed face of the riverbank. It extended from the solid rock in the riverbed to the water surface elevation of the reservoir and then upstream a distance of 2,000 feet. The engineers extended this impervious blanket an additional 4,000 feet upstream in 1957. The engineers also redesigned the spillway crest to reduce the number of taintor gates from 25 to 19 and save $5 million.[48]

In another cost savings move, the Corps decided to rely on highway rather than railroad access to the dam site, achieving a further $4.5 million reduction in costs. On the other hand, the Seattle District engineers discovered that the temporary cofferdam planned for the downstream end of the intake works at the powerhouse might fail. To avoid this problem, the engineers substituted a permanent concrete wall at an increase of $1.5 million. Finally, the Corps eliminated the plan for a government town at the project site, locating necessary government housing for the dam operators at the town of Bridgeport, only 1.5 miles distant. This change produced a savings of $2 million.

The Seattle District made other alterations in the project to increase the dams' output of electricity. Authorization for or the completion of new dams upstream on tributaries of the Columbia made these changes possible. For example, in 1951 the Bureau of Reclamation's Hungry Horse project neared completion on the Flathead River, and Congress authorized Corps' dams at Albeni Falls on the Pend Oreille River and Libby on the Kootenai River. Although Canadian opposition stalled the Libby project, the three dams would, when completed, add a potential 8.6 million-acre feet of upstream storage for more efficient year-round powerhouse operation of the Columbia River system of dams. To take advantage of this storage, the reservoir elevation at Chief Joseph was increased from 937 to 946 feet. The Corps decided moreover, to install 16 instead of 15 generating units in the first phase and to provide space for eventual installation of 11 more generators.

In spite of the Seattle District's efforts to save money, by January 1952, design changes and the effects of inflation had ballooned project costs to $206 million, almost double the initial estimate of $104 million. The House Committee on Public Works criticized the Corps of Engineers for the large increase in the estimated costs for the Chief Joseph project. In response, the Seattle District became determined to make Chief Joseph Dam's construction costs the lowest per kilowatt to that time. The Seattle District engineers scrutinized every aspect of the project during construction in the effort to reduce costs.

The Seattle District completed preparatory work on the project and began construction of the main dam (spillway and non-overflow sections at either end) by the middle of 1951. The first step consisted of excavating for the north abutment and construction of the north bank impervious blanket structure and the cofferdam. Problems with the first stage cofferdam, however, threatened to delay the start of major construction. High river velocities along the cellular steel sheet piling cofferdam undermined the structure and almost caused its collapse. The contractor saved the cofferdam by building a protective wall of steel sheet piling on the river side of the cofferdam. This measure, while securing the cofferdam area, resulted in a four-month delay in an already tight construction schedule. The Corps



Chief Joseph Dam
16 June 1954

realized that the second river diversion had to be accomplished before the

1952 spring high river flow or power could not be generated by 1956 as promised. The contractor met the challenge by doubling the work force and adding more heavy equipment, doing nine months of work in only five months.

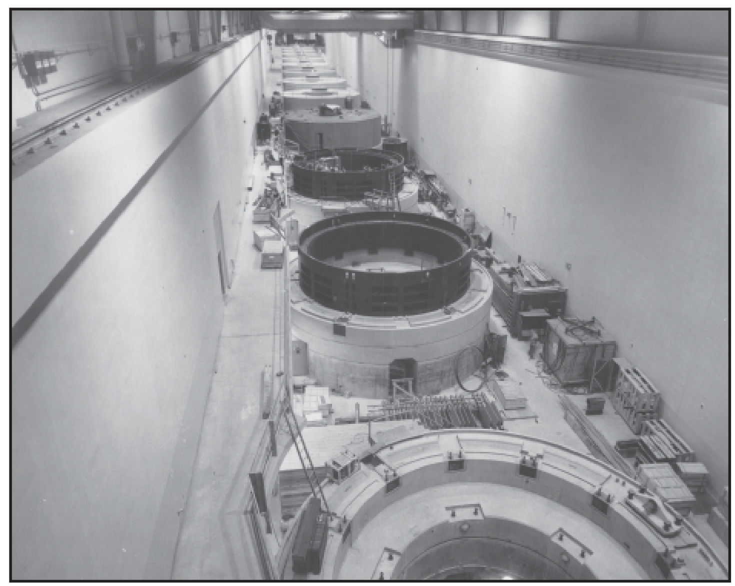
After the contractor completed the right abutment treatment and secured the cofferdam, workers began pouring the concrete for the spillway monoliths within the north half of the cofferdam. By early 1953, laborers had raised the north half of the dam to a height sufficient to pass water safely; and the south half of the dam was in progress behind its cofferdam. As work moved forward on the spillway, workers commenced excavating for the powerhouse and intake structures. Actual construction of these features started in mid-1952. By the middle of 1953, the project was 30 percent complete.

After the Corps overcame the initial cofferdam problem, construction proceeded without other major difficulties. Political controversy, however, erupted when the Seattle District announced that a British consortium was the apparent low bidder for the generators and the transformers. While American companies argued they should get the job, the British government insisted that the contracts be awarded on the basis of allied solidarity. To resolve the dispute, the Corps ordered a second round of bidding, and ended the problem by dividing the contracts between British and American suppliers. The Westinghouse Company built the 16 generators, while the English Electric Company manufactured 10 of the transformers and the American Pennsylvania Transformer Company built three others. Further problems developed when transformers from both suppliers arrived in damaged condition and had to be returned for extensive repairs. Still, the Seattle District remained confident that power would be on line by the projected September 1955 completion date.[49]

As events turned out, political changes in the nation's capital made it difficult for the Corps to get the funding necessary to meet the project deadlines. The election of Republican Dwight Eisenhower to the presidency in 1952 gave sudden prominence to two concepts that endangered federal funding for water resources projects. The newly powerful Republicans insisted that spending must be reduced from the supposedly excessive levels allowed by Roosevelt and Truman. President Eisenhower, moreover, touted a "partnership" doctrine, which assigned dam building to local governmental bodies and to the private sector whenever possible. The proper federal role, under this approach, was limited to providing technical assistance for the local undertakings. Reflecting these priorities, the incoming Republican Administration pared the outgoing Democratic Administration's last budget request for Chief Joseph in the spring of 1953. The new administration made additional reductions in the Corps funding in 1954.[50]

The budget slashing left only five of the initial 16 generators ready for operation by late summer 1955. Intense lobbying for more funds for the Chief Joseph project by the region's Republican governors and Democratic congressmen failed to sway the Eisenhower administration. Nevertheless, the Corps brought the remaining 11 generators on line by the end of 1958. Over the preceding three years, as units came on line, Chief Joseph Dam produced 14.9 billion kilowatt hours worth $35.1 million. At the time of its completion, Chief Joseph Dam was the second largest hydroelectric power plant in the world. It had a rate capacity of 1,024,000 kilowatts for 16 units and 1,728,000 kilowatts for 27 units. The powerhouse, at 2,036 feet in length when fully developed, was the longest single powerhouse in the world.

The design and construction of Chief Joseph Dam incorporated many technical and policy innovations. Perhaps most noteworthy was the technique the Corps used to cool the massive concrete lifts comprising the



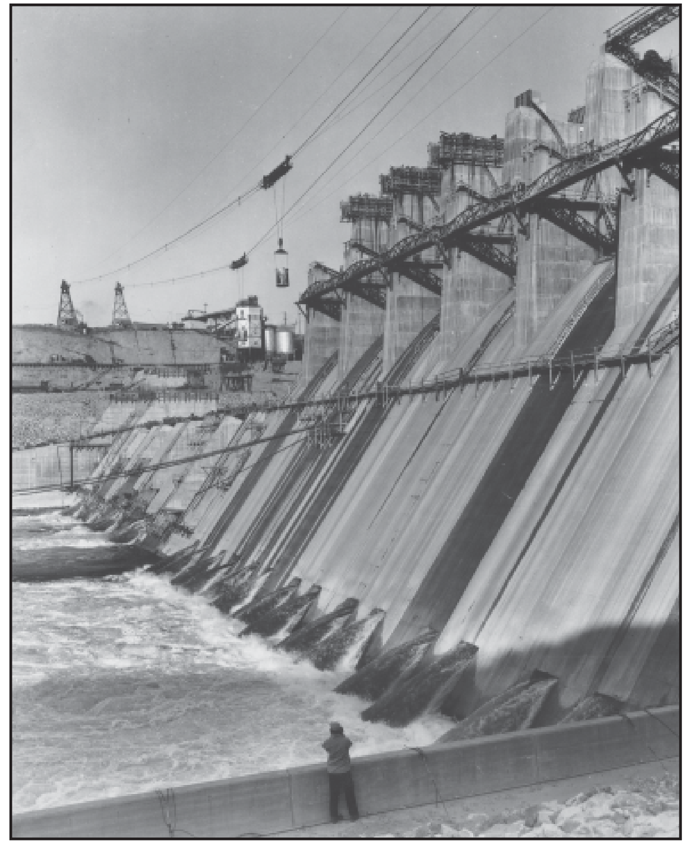
Chief Joseph Dam Turbine Installation

structure. As concrete placed in great masses hardens, it gives off heat that must be dissipated by means of internal cooling. Excessive heat will weaken the concrete in the finished structure. The usual method of removing excess heat involved embedding in the fresh concrete a system of pipes through which cooling water was circulated. Structures as large as Chief Joseph Dam, however, required huge quantities of expensive piping; and the process of installing it proved very labor intensive. The contractors, with the Corps approval, employed a different cooling process. Under the new method, the workers mixed the cement with ice water so that the concrete mixture would be pre-cooled to 40 degrees Fahrenheit, thereby preventing the internal heat from raising the mass to damaging temperatures. In addition, the gravel aggregates in the mix were also pre-cooled. The cooling method produced concrete that exceeded specifications and at substantial savings. When fully operational, the cooling and refrigeration plant used for treating the aggregates and cement was the most elaborate assembled on a construction site to that time.

To deliver the concrete and carry out other work on the dam, the contractors constructed two 25-ton capacity cableways, each with a span of 2,500 feet across the river. The cableways traveled 1,300 feet of track along the right bank from head towers 100-feet high, which connected to a single, 240-foot fixed tail tower on the left bank. The workers also employed the cableways to handle the installation of the massive taintor gates in the spillway. After partially assembling them on the right bank, workers then moved the taintor gates into place by means of the cableways for final assembly on the spillway.

Construction of the massive intake structure for the powerhouse also required considerable ingenuity. To deliver the necessary concrete, the contractors altered a 640-ton walking dragline (“Monighan”) by removing its pontoons and setting it on an electrically driven undercarriage, which traveled along 2000 feet of track paralleling the intake structure. The crane had a 205-foot boom and an 850 horsepower engine. Workers returned the crane to its walking pontoons and digging base and operated it as a dragline to carry out the large amount of excavation required to build the powerhouse and tailrace channel. The crane also handled concrete forms weighing up to 17.5 tons and helped erect various parts of the intake structure. In order to save money in the construction of the long powerhouse structure, the engineers used steel forms on the high walls, galleries, and draft tubes.

To measure the effects of unique design features and guide operation and maintenance of the finished dam, the Seattle District engineers installed an elaborate set of instruments in the various dam structures. These included gages for measuring hydraulic uplift pressures at the base of the dam and the amount of leakage through the various parts of the dam. They also installed piezometer wells in the right abutment and thermometers in the concrete. After establishing precise reference points, operations and maintenance personnel took regular readings with a Whittmore gage to track data on stress factors from displacement, expansion, and contraction of joints and cracks in the concrete. The instrumentation proved its usefulness in both 1956 and 1961 when readings indicated abnormal uplift pressure under the spillway. Inspection revealed a buildup of calcite in some foundation drains.



Chief Joseph Dam Spillway

Periodic cleaning of the drains solved the problem.

Another unusual aspect of the project involved the decision to build permanent government and contractor housing in the town of Bridgeport rather than a temporary construction camp. Congress authorized the Corps to build not only permanent housing both for construction and later project operation but also to upgrade and expand the town's water, sewer, and school facilities. Corps employees and contractor personnel even donated design services, labor, and materials to build a community park and swimming pool. Later, both government and contractors' housing was sold to Corps employees connected with the operation and maintenance of the dam. Project people became integrated into the community at an early stage of the project, avoiding the problems usually associated with boom and bust, ramshackle construction camps.

Chief Joseph Dam represented the largest civil project undertaken by the Seattle District up to that time. As completed, the concrete gravity dam rose approximately 220 feet above bedrock and extended 2,267 feet in length. The 922-foot concrete spillway had a design capacity of 1.2 million cubic feet per second at a pool elevation of 957 feet. Each of the 19 tainter gates measured 40 feet wide and 44.5 feet high. The project required 1.8 million cubic yards of concrete, and the total amount of excavated material came to 3.5 million cubic yards. The Chief Joseph project cost $148 million with the initial 16 power units installed. The cost per kilowatt came to $145. This sum represented a record low for hydroelectric dam construction in the United States, with the possible exception of Grand Coulee Dam, and achieved the Seattle District's goal of building Chief Joseph Dam for the lowest cost per kilowatt possible.

The urgent need for additional electrical generation capacity in the Pacific Northwest led the Seattle District to push the design and construction of the project as fast as possible. The rush to build, unfortunately, created problems and minor cost overruns. For example, the Hydroelectric Design Branch of the North Pacific Division prepared the original designs for the powerhouse, which were simply generalized drawings for the use of bidders. The incomplete drawings, however, presented potential problems during the biding process. The Seattle District design branch responded to the situation by developing a specification format that listed construction materials, such as reinforcing steel and cement, as separate bid items. The District expected that the actual quantities of items would be within 10 percent of the estimated amounts, thereby avoiding costly change orders. After receiving the more detailed drawings, however, some of the contractors claimed added compensation for what they considered to be work outside of the original contracts.

The builders, with Corps inspectors' approval, did not always follow initial plans and specifications in exact detail. When these changes were not well documented, they created future problems for the operations and maintenance forces. In one unfortunate incident, hasty placement of concrete in frigid weather without adequate protective measures resulted in the failure of concrete slabs in the roadway of a Columbia River highway bridge and the floor of the stilling basin. Another case of cutting corners occurred when excavated waste rock was dumped into Foster Creek instead of at more distant specified spoils areas. A flash flood washed a quarter of a million cubic yards of the improperly disposed waste rock into the Columbia River below the powerhouse tailrace. This debris had to be removed at great expense to prevent impairing the efficiency of the powerhouse. The engineers learned from their mistakes at Chief Joseph and applied them at subsequent large undertakings. As one District staffer later noted, "the lessons were not lost": "Thorough planning before and during construction; closer coordination between Engineering, Construction and Operations Divisions in all details of the work; and meticulous enforcement of contract provisions in the field have been observed on subsequent major projects."[51]

Over time, the Seattle District developed novel methods to maintain the Chief Joseph Dam. One example of innovative maintenance involved the stilling basin at the base of the dam. This reinforced concrete slab with baffles served to dissipate the destructive energy of the water coming through the spillway and was prone to erosion. The problem of excessive wear was exacerbated at Chief Joseph because workers had failed to clean up all of the boulders and debris that had spilled onto the stilling basin when the cofferdams were removed. The high velocity water, in turn, caused the boulders to churn around the stilling basin. During a routine survey of the Chief Joseph stilling basin in March 1957, inspectors noted severe damage to the end sill, baffles, and flat areas. The usual method for fixing such damage required installing a costly cofferdam and dewatering the area of the stilling basin needing repairs. To avoid such an expense (estimated at $1.4 million) and to develop a practical and less costly method for repairing the entire basin in the future, the Seattle District recommended conducting an underwater pilot repair in a limited area. After some hesitation, the Chief of Engineers approved a small pilot operation, including laboratory tests to determine appropriate concrete mixes and finishing techniques.[52]

The Seattle District conducted a series of underwater surveys and test repairs between 1958 and 1964 that showed that underwater repairs were economically and physically feasible. The process developed by the district required sending two Corps engineers trained as divers down 30 to 40 feet below the water surface to directly observe and oversee the repairs. This was necessary to insure proper surface cleaning, placement of the forms, and pouring of the concrete underwater. The Seattle District engineers who volunteered for the project, Vernon Cook and David Preble, had to complete a Navy course in deep sea diving before undertaking the repair work. In addition, Seattle District materials specialists had to conduct numerous tests to find just the right mixture of cement and aggregate to establish a good bond between the old and new concrete under water. Careful preparation of the original surface also proved important to developing a strong concrete bond.[53]

By 1964, annual inspections showed that the unrepaired sections of the stilling basin had continued to erode. The Seattle District Engineer, Colonel Ernest Perry, argued that the pilot underwater repair program worked and could accomplish the full renovation necessary at considerable savings—$2.3 million—over dry repair. After further inspections during the next two years, the North Pacific Division Engineer finally authorized the underwater method of repair over a large area of the eroded stilling basin in 1967. The Seattle District's innovative underwater repair of the Chief Joseph Dam stilling basin drew considerable attention within the national and international engineering communities.[54]

* * *

Between 1945 and 1955, the Seattle District carried out significant planning and engineering undertakings. The District's contribution to the HD 531 Report updated the multipurpose water resource planning for the upper Columbia River basin and helped develop the concept of upstream storage for enhancing flood control and more efficient hydropower production. Design and construction of the imposing Chief Joseph Dam proved an impressive accomplishment. Determined to build a dam that could produce large quantities of power at a reasonable cost, Seattle District engineers found the most economical right abutment treatment and the most efficient powerhouse arrangement. In all, the engineering at the Chief Joseph project employed many innovative and cost-effective design and construction techniques that would be used again in building future multipurpose structures on the Columbia River, such as The Dalles, John Day, and Priest Rapids dams.

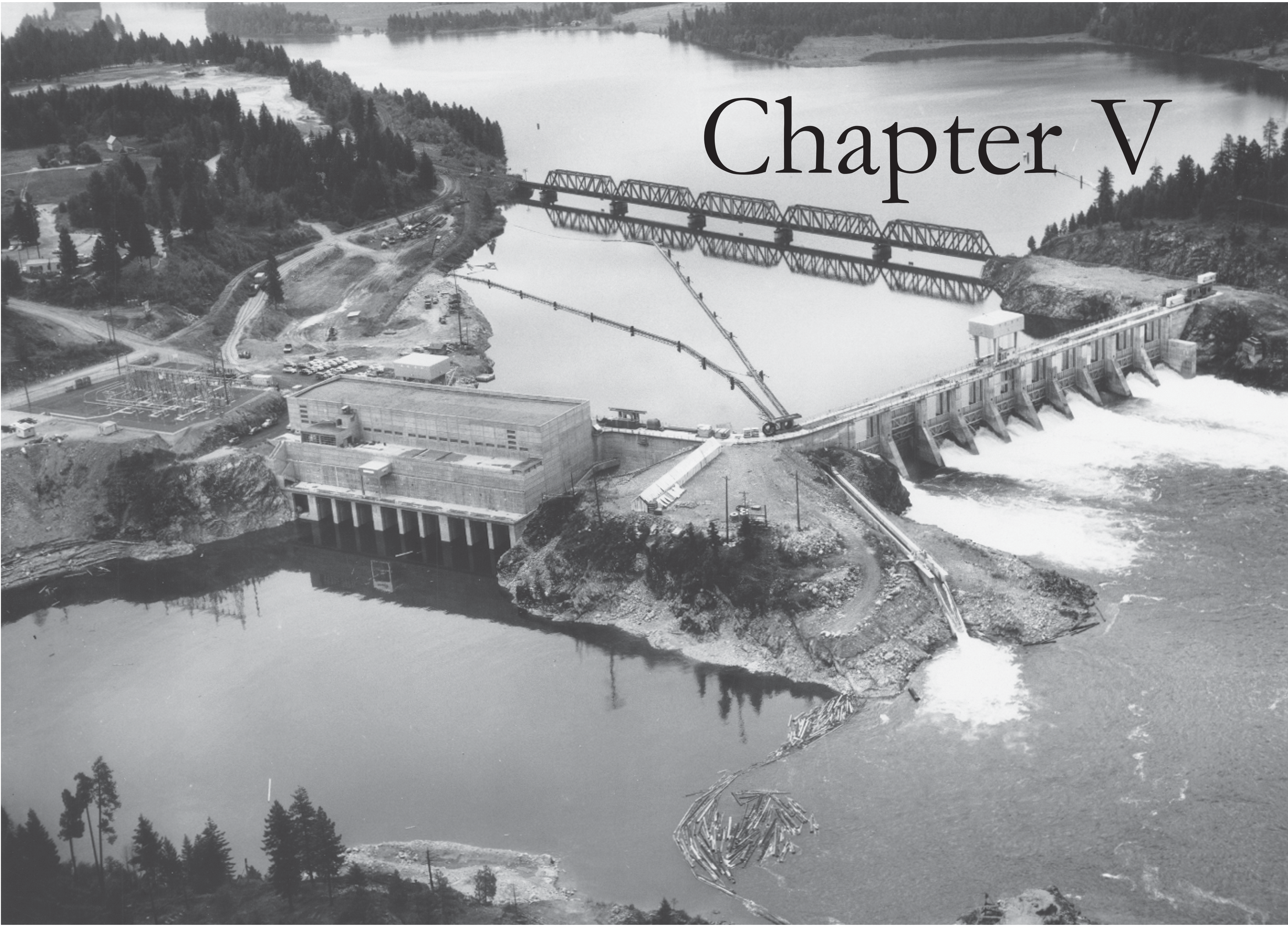
Other Post-war Work

While the Seattle District was heavily engaged in building the Chief Joseph Dam, it, oversaw had numerous other civil works projects. By 1950, the district had completed 32 rivers and harbors projects focused on navigation. These efforts stretched all the way from minor channel deepening at Deep River, Washington, at a cost of $15,400 to building modifications and other alterations at the Lake Washington Ship Canal for $3.5 million. Maintenance of the navigable waterways for the Seattle, Tacoma, and Everett Harbors annually ran into the thousands of dollars. At Grays Harbor on the coast, the Seattle District carried out a $6.6 million project for channel dredging and jetty construction. The district also had a $447,000 channel-deepening project at Olympia Harbor underway in 1950.[55]

In addition to the traditional navigation work, the Seattle District had completed flood control projects totaling almost $18 million. The largest of these was the $13 million Mud Mountain Dam on the White River. Material shortages during World War II had delayed completion of this project until 1949. It provided flood protection for the Puyallup River Valley and Tacoma's industrial section. To supplement Mud Mountain Dam, the Seattle District constructed 2.2 miles of channel improvements on the Puyallup River at Tacoma at a cost of $4.4 million. The channel improvement included the design and construction of steel bridges crossing the Puyallup River to accommodate the levees that had to be raised.

In 1950, the Seattle District could also look forward to a number of newly authorized navigation and flood Control projects. These included work on the Port Angeles Harbor and the Stillaguamish River. In addition, Congress authorized flood control work for Aberdeen, the Skagit River, and the Green River. The latter work involved constructing the 200-foot high, concrete Eagle Gorge or Howard Hanson Dam. The Corps estimated that this effort would cost $18.3 million and would protect 17,000 acres of rural and urban land from flood damage. The Seattle District also had a number of surveys for proposed navigation and flood control projects underway in the early 1950s. The new projects carried an estimated price tag of $7.5 million. Finally, the emphasis on storage reservoirs in the Corps' main control plan for the Columbia River and tributaries led to the construction of Albeni Falls Dam on the Pend Oreille River and Libby Dam on the Kootenai River by the Seattle District. The next two chapters will describe the new work undertaken by the Seattle District in the 1950s and 1960s.

Chapter V



MAJOR WATER PLAN PROJECTS

The Seattle District maintained a robust civil works program during the 1950s and 1960s. In addition to the already discussed Chief Joseph Dam project, the district constructed several additional dams for flood control and multiple purposes. These included Albeni Falls, Libby, and Howard Hanson dams and the start of Wynochee Dam. In addition, it conducted a busy river and harbors program along the coast of Washington, continued water resources planning on the Columbia River by reviewing the main control plan of 1948, and carried out emergency flood control efforts throughout the district. The Seattle District also had the resources to perform work for other Corps districts, such as Walla Walla, during this period. This chapter will focus on the Seattle District's work in the Columbia River basin during the 1950s and 1960s.

Given the political climate of the 1950s concerning federal water resources development, the size and scope of the Seattle District's civil works program was impressive. At first glance, several factors seemed to limit the possibilities for new work. First, the military needs of Korean War caused President Truman and Congress to cut domestic expenditures and to halt new federal civil works projects, unless justified by defense requirements. Then, newly elected President Eisenhower announced a so-called partnership policy to reduce federal involvement in water resources development. Under President Eisenhower's approach, the federal government would initiate no new starts in river basin development and, instead, encourage private interests to undertake investment in new power projects. The federal government, however, would fund non-reimbursable costs, such as flood control and navigation components of any multiple purposes initiatives undertaken on a joint public/private basis. This policy was never well received in the Pacific Northwest, and in practice the federal government continued to develop major water resources projects in the Columbia River basin during the 1950s.[1]

The Corps of Engineers tried to walk a fine line between the Eisenhower Administration's partnership policy and the powerful regional interests pushing for federal power, navigation, and flood control projects. Brigadier General E. C. Itschner, Assistant Chief of Engineers for Civil Works, explained the Corps' position to the American Power Conference on 24 March 1954, noting that while "it is to the interest of the Federal government to have the nation's water resources developed in a comprehensive way, . . . [this] does not mean that the Federal government itself must do all the construction or carry out all the utilization work." He went on to assure his audience that as the Corps carried out its water resources program, "it seeks to co-operate with all other agencies, public and private, that have a valid interest in the subject."[2]

Echoing President Eisenhower's call for federal partnerships with private enterprise or local governments in the field of power development, General Itschner stated that "from the viewpoint of the Corps of Engineers, such partnership would help to bring about possibly fuller, and certainly a quicker, development of potential hydro-power resources" because available federal funds could be spread over a larger number of projects as non-federal entities paid for the reimbursable portions of multiple purpose developments. He observed that the potential for such cooperation existed on the Upper Columbia River where Congress was authorizing public utility districts to undertake hydropower dams at Priest Rapids and Rocky Reach. The enabling legislation provided that the power projects should be planned so that the Corps of Engineers could add navigation locks or flood control features, either during construction or later, at federal cost.[3]

Other issues, such as fish conservation and treaty negotiations with the Canadians over Columbia River water usage, also influenced the pace and direction of the Seattle District's civil works program. Sorting out the tangled elements of the partnership policy, fiscal conservatism, international relations, and various conservation concerns slowed implementation of the Corps' 1948 main control plan. The debate over the construction of Libby Dam illustrated the Corps' problems.

Libby Dam Debate

Post-war development of the Columbia River required the United States to turn to Canada for assistance in fully developing the river's hydropower and flood control potential. Although Canada accounted for only 15 percent of the Columbia River basin, this segment provided a third of the total runoff. As the Seattle District Engineer, Colonel Leland Hewitt, wrote in the HD 531 Report, "the heavy run-off and mountainous topography of the headwaters make the Canadian portion of the Columbia River favorable for large storage reservoirs." Building such projects, he pointed out, "would firm the power at all points below the respective reservoirs, [and] would accomplish flood control to an extent not possible by any other means." In short, comprehensive development of the Columbia River system required including that portion of the watershed in Canada.[4]

Columbia River projects by either country had profound implications for the other nation. For instance, Libby Dam on the Kootenai would back the resulting reservoir into British Columbia, flooding agricultural land. On the other hand, Canadian plans for a storage dam in its territory would influence the final design for Libby. At a minimum, some form of compensation for land flooded by the proposed American reservoirs would be necessary. As Colonel Hewitt noted, "The determination of relative benefits and damages experienced by one country as a result of projects by the other country . . . gives rise to problems not found in a basin entirely within the United States."[5]

An existing treaty, the Boundary Waters Treaty of 1909, between the United States and Canada governed the way the two nations handled disagreements over common rivers and lakes. The treaty gave citizens of each nation equal water rights and privileges and established the International Joint Commission (IJC) to exercise jurisdiction over any conflicts arising under the treaty. While the federal government had sole authority over navigable waters within the United States, in Canada, water resources authority was divided between the national government and the provinces, in this case British Columbia.[6]

Although the Corps' original 308 report did not include a discussion of Canadian storage, a Corps of Engineers study of the Columbia and Snake Rivers in 1938 did. In this report, published as House Document 704, the North Pacific Division Engineer, Colonel Thomas Robins, proposed Canadian storage as an alternative to a high storage dam at The Dalles, Oregon. Despite the difficulties involved in getting an international water storage agreement, Colonel Robins argued that it would be less difficult to attain than to resolve the extraordinary problems created by a huge reservoir extending up river from The Dalles.[7]

As close cooperation between the United States and Canada developed during World War II, the two nations began to consider joint economic problems in their northwest regions. In 1944, they asked the IJC to study the possibility of the cooperative development of the Columbia River. The IJC, in turn, set up the International Columbia River Engineering Board to carry out a technical investigation of the issues. The board originally consisted of General Robins of the Corps, Glenn L. Parker of the U. S. Geological Survey, and two Canadian officials. The board created a subcommittee made up of the Seattle District Engineer, the regional director of the Reclamation Bureau, and their British Columbia counterparts to oversee the actual technical studies. Meeting for the first time in July 1944, the Engineering Board quickly focused on the Libby Dam and the Kootenai River.[8]

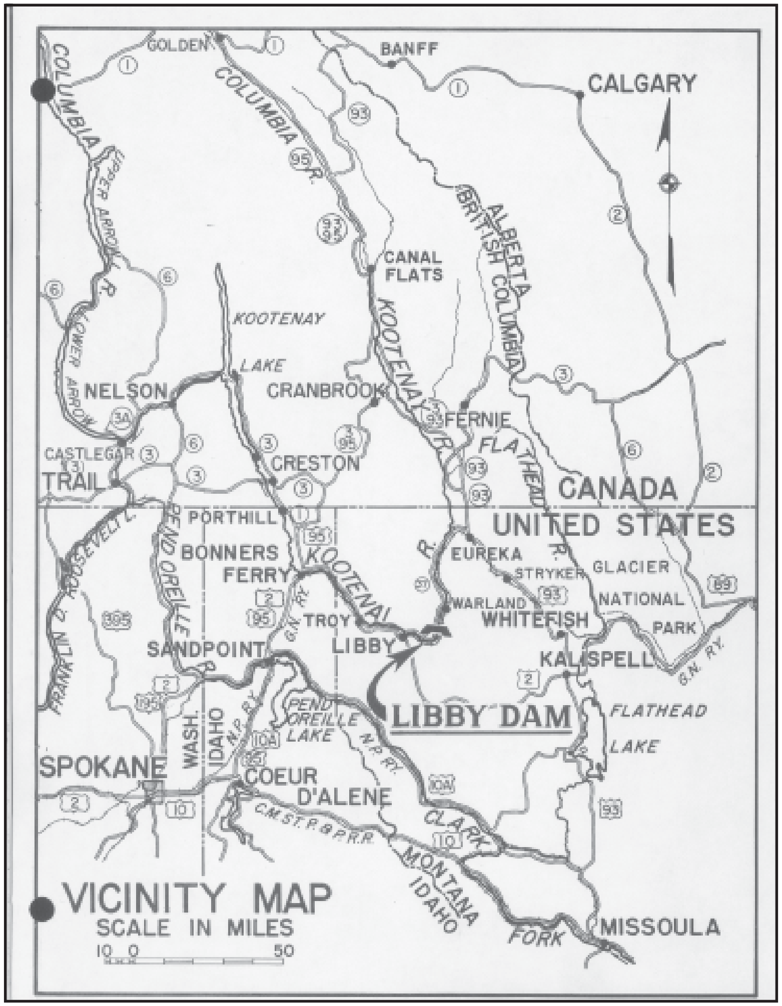
The planning for Libby Dam began as part of the Corps' HD 531 Report study of the late 1940s. Because any useful development of the Kootenai River would back water into Canada, the Engineering Board decided to ignore the international boundary in establishing the engineering elements of the best plan. In addition to Libby, the Seattle District also investigated four possible downstream dam sites on the Kootenai: Kootenai Falls and Tunnel No. 8 locations in Montana and the Katka and Souse Creek sites in Idaho. The studies showed that high dams at these locations would flood the town of Libby. To prevent this outcome, the Corps focused its attention on an upstream project.[9]

Public hearings in Idaho and Montana revealed grudging support for a dam site above Libby, Montana. Residents of Bonners Ferry and Kootenai Flats, hard hit by the 1948 flood, endorsed the project. Feelings of those living in or near Libby, however, tended to be skeptical of the proposed project. Vital railroad connections and valuable timber stands would be flooded, and many in the community expressed uneasiness over whether there would be appropriate compensation for such losses. Some also worried about the influx of workers and their transient lifestyle on the well being of the community. As the local newspaper opined, "A 'construction boom town' is hardly a joy to contemplate."[10]

Seattle District engineering studies determined that a location near the old steamboat landing of Jennings, eleven miles above the town of Libby (river mile 212) appeared the best of the available alternatives. The Corps project, according to Colonel Hewitt "would be founded on rock which is either exposed or lies but a few feet below the bed of the river." From the geological standpoint, it was the best site between Libby and the border. The site, however, still had major impacts on the railroad, timber, and mining interests in the area around the town of Libby. The Corps' design for the dam proposed a concrete gravity structure 2,300 feet long and 400 feet high. A reservoir 35 miles long would provide storage for 4.2 million-acre feet of water. The powerhouse, located on the left abutment, would contain an initial installation of six Francis type turbines with a combined capacity of 588,000 kilowatts. Total estimated construction costs came to $239 million.[11]

The Corps touted Libby Dam for both its flood control and power benefits. After the severe flooding of 1948 on the Kootenai, Libby's flood control mission seemed essential. Floods on the Kootenai River occurred usually during the spring snowmelt months, so multipurpose operation of the dam for power benefits fit comfortably with flood control requirements.

Operators would maintain the reservoir at higher levels during the winter, when demand for energy peaked in the Pacific Northwest, and then lower the reservoir in the late spring so as to provide storage capacity by May 1 of each year for anticipated flood waters. Even though Libby's projected power capacity amounted to only 5 percent of the total 11.7 million kilowatts to be available through implementation of the main control plan, this reflected only a small measure of the dam's potential contribution. Releases from Libby storage would add to the prime power at sites downstream in both the United States and Canada. Studies indicated that in excess of one in every 10 kilowatts produced by the Columbia River system could eventually be traced to Libby.[12]



Libby Dam Vicinity Map

While the benefits from the proposed Libby project appeared attractive, the sources of a large portion of the dam's costs almost derailed it. A third of the projected cost arose from needing to relocate the Great Northern Railroad and from compensating the private companies whose timber would be inundated. In order to reduce the impact on those interests and hold down costs, the Corps selected a new dam site at river mile 217. The Seattle District had earlier rejected this location because of uncertain foundation conditions. A reexamination, however, revealed that those conditions were, in fact, superior to the original downstream site. This new site, selected early in 1954, appeared to have the least impact on the timber, mining, and railroad interests in the region around the town of Libby. Based on the Corps' latest planning, Libby Dam would have usable storage of 5 million acre-feet of water, produce 600,000 kilowatts of power at the site, and cost $263 million to construct. Relocation costs amounted to $97 million of the total. The project had a benefit to cost ratio of 1.82 to 1.0. Unfortunately, before the Corps could finalize its new plans for Libby Dam, international complications forced deferral of the project.[13]

The main stumbling block in the negotiations between Canada and the United States centered on the matter of compensating Canada for the flooding caused by Libby Dam. People in the province of British Columbia maintained that they would lose productive farmland worth $5.5 million. In return, the net benefits to British Columbia appeared rather small, according to studies submitted to the IJC. Although Corps officials admitted that the Canadians had legitimate concerns, they were perturbed over the seeming stubbornness exhibited by the Canadians. According to Colonel John Buehler, Colonel Hewitt's successor as Seattle District Engineer, the provincial stance amounted to an attitude of "how much the traffic will bear." The Canadians argued that their compensation from the United States should be based on what the storage in British Columbia contributed directly to production at Libby, on the output at all downstream dams on the Kootenai and the Columbia, and on the loss of future income from flooded farmland.[14]

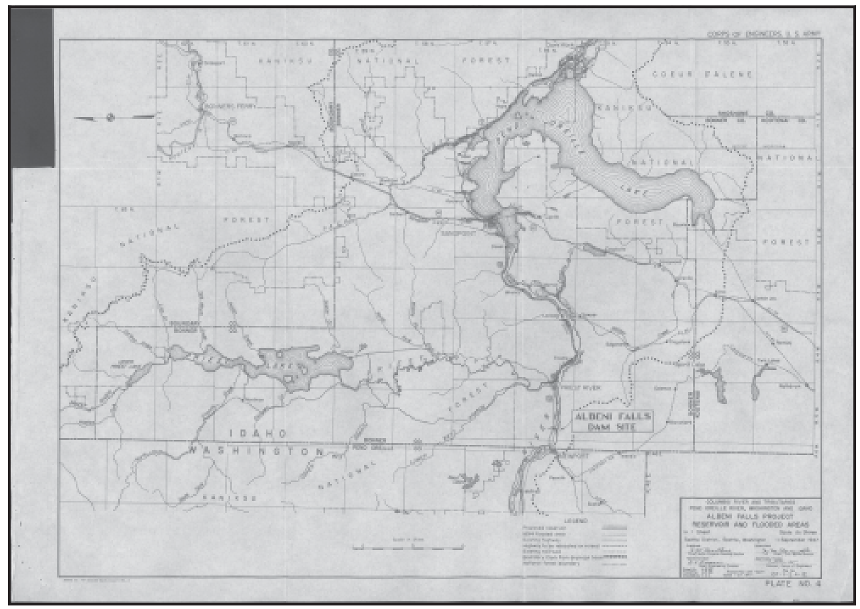
American negotiators rejected the second and third items on the Canadian bargaining list as impossible to calculate accurately. The United

States argued that given the partially developed condition of the Kootenai farmlands, it was impossible to fairly estimate potential production under full development. In addition, the calculation of Libby's contribution to downstream generation was even more difficult. In fact, because Libby would benefit the Canadian dams on the lower Kootenai, the United States itself might be entitled to compensation. Canada finally conceded to limit discussions to the direct power contribution from Libby Dam. After arduous negotiations, both parties determined in 1951 that storage north of the border would be considered responsible for 28 percent of the power production at Libby. In compensation, the Canadians would be allowed to purchase 69,400 kilowatts a year at the $17.50 per kilowatt Bonneville Power Administration rate, a bargain since British Columbia utilities then charged $30 a kilowatt. The United States also agreed to provide an additional 13,300 kilowatts annually as compensation for reservoir costs.[15]

Anticipating favorable action by the IJC, Congress had authorized construction of Libby Dam in May 1950. Proponents of the Libby project in the Pacific Northwest eagerly looked forward to the beginning of dam construction on the Kootenai River. The Portland *Oregonian* editorialized that the benefits from Libby Dam were so obvious "that Congress will have trouble in finding reasons not to build it." Unfortunately, events proved the *Oregonian* overly optimistic. Continuing problems with railroad relocation led to a withdrawal of the IJC application in April 1953. In early 1954, however, the Chief of Engineers, Major General Samuel Sturgis, enthused that Libby was "one of the finest of our potential projects but its construction is dependent on satisfactory arrangements with Canada." The Secretary of State resubmitted the Libby project request in May 1954, but the IJC indefinitely postponed action to allow for additional studies of Canadian storage sites and further haggling over compensation. The situation became even more complicated when the Canadians announced a plan to divert Columbia Basin water to the Fraser River through a tunnel. The Canadians also threatened to divert the Kootenai River into the headwaters of the Columbia at Canal Flats. The former plan for water diversion would have had disastrous effects on power production at all downstream Columbia River dams; the latter scheme would have made Libby Dam impracticable to build. As debate raged, Congress lost interest in the Libby Dam Project. In 1955, the Corps' headquarters cut off planning funds and Seattle District suspended all further work on the dam.[16]

Albeni Falls Dam Project

While the Seattle District wrestled with the Libby Dam situation, The Albeni Falls Dam Project proved much less controversial. The HD 531 Report considered both projects as important elements of the main control plan and both were authorized in the Flood Control Act of 1950. To the Seattle District planners, a power and storage dam at Albeni Falls on the Pend Oreille River, two miles east of the Washington/Idaho border, offered important attractions for multiple purpose development. According to the Corps' Board of Engineers for Rivers and Harbors, the "most important of these [attractions] from the standpoint of the evaluated benefits is the regulation of flow for use in the development of power at dams on the Columbia River." As the Board noted, "in view of the large water area of Pend Oreille Lake, the improvement will make available a large amount of controlled usable storage without inundating a large area of land." As an added bonus, the Corps' dam would stabilize "lake levels during the season



Albeni Falls project Reservoir and Flooded Areas
11 Sept 1947

when its recreational potentialities are great and use of the storage during the winter when power demands are a maximum."[17]

The Seattle District's river surveys during the mid-1940s revealed that the Clark Fork-Pend Oreille basin had great possibilities for future power development. While the Corps investigated over 100 potential dam sites, only a small number were actually feasible. Objections from mining, railroad, agricultural, or conservation interests blocked most of the identified sites. In addition, private power concerns developed two other sites in the basin, and the Bureau of Reclamation received authority to construct Hungry Horse Dam on the South Fork of the Flathead River. Based on the Corps' review and expressed public opinion, Colonel Hewitt believed "the only site that is economically feasible and at the same time acceptable to the people . . . [of the region] for development in the foreseeable future, is at Albeni Falls." Accordingly, he presented "a plan for stabilization of the level of Pend Oreille Lake and reduction of its stages during flood periods, production of hydroelectric power at Albeni Falls, and improvement of low flows in the Columbia River."[18]

The Seattle District plan called for a concrete gravity dam and hydroelectric power plant at Albeni Falls with a maximum pool elevation at 2,062.5 feet. At that height the Pend Oreille Lake would have an area of 94,600 acres, with usable storage of 1.1 million acre-feet. The lake elevation adopted by the Corps was the maximum that local interests would accept. The dam would provide modest flood control benefits along the narrow valley between Albeni Falls and Pend Oreille Lake. By stabilizing lake levels, the dam would enhance boating and other recreational pursuits, which otherwise were subject to large fluctuations throughout the year. Power operators would draw on the reservoir and lake storage during the winter when power demands were heaviest and then refill them during the spring snow-melt season. Lake levels would be held at normal pool level during the summer and early fall recreation season, and then the stored water would be drawn down for power production during the winter high demand period. Maximum drawdown would occur just prior to the spring freshet.[19]

The Corps' design for the dam placed a 90-foot high spillway section in the southern portion of the two main river channels and positioned the powerhouse in the northern channel. A rock island in the middle of the river anchored both sections of the dam. The power house and spillway met on the rock island at a 70 degree angle. The granite rock at that location on the river provided an excellent foundation for the dam's structures. The main spillway consisted of nine gated openings, each 40 feet wide. To the right of the main spillway sat an auxiliary spillway with three ungated openings.[20]

The power plant design at Albeni Falls proposed three units capable

Albeni Falls
16 July 1950

of generating 42,600 kilowatts. The units consisted of Kaplan vertical shaft turbines. Most importantly, the construction at Albeni Falls project would allow the installation of additional units at Foster Creek (Chief Joseph) and McNary dams. This would increase the firm power capabilities of the federal power plants in the Columbia basin by 251,000 kilowatts, a key factor in the justification for the Albeni Falls project. The Seattle District Engineer estimated the Albeni Falls Dam would cost $26,995,000, with a benefit to cost ratio of 1.11.[21]

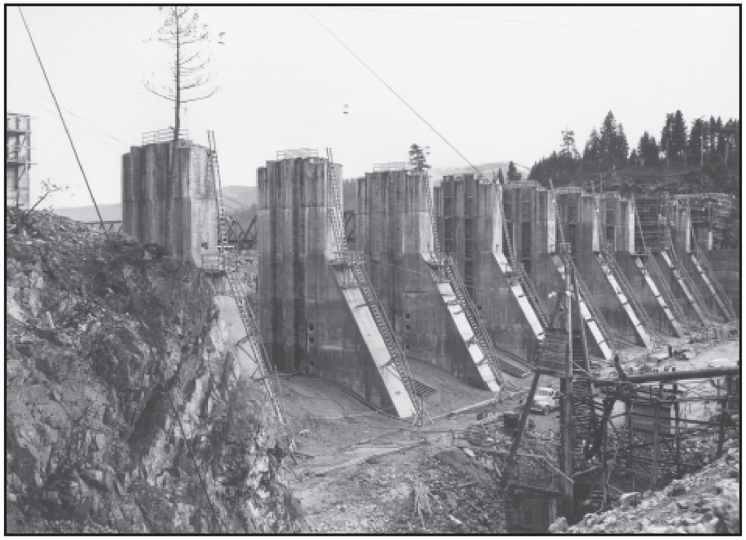
Although hydropower production provided the chief justification for Albeni Falls Dam, an important selling point of the project was the proposed recreation improvements it would make possible on Lake Pend Oreille. As one of the largest bodies of fresh water wholly within the United States, Lake Pend Oreille and the area immediately surrounding it had become a major recreation center in the Pacific Northwest. The location offered beautiful mountain scenery and outstanding boating, fishing, and hunting opportunities. At a minimum, the Corps' plan would benefit recreational boating and fishing by stabilizing water stages in the six month recreation period. The project plan, as noted above, would obviate rapid, natural drawdown of lake levels in late summer each year. Likewise, areas around Pend Oreille Lake that periodically suffered high water damage during the spring run-off would no longer experience such fluctuations because of controlled releases of impounded water.[22]

Albeni Falls
18 May1951

In addition to reservoir operations that benefited recreation activities on the lake, the Corps' proposed plan hinted at future recreation enhancements: "At such time as the Albeni Falls project is authorized by Congress, the further development of basic recreational facilities at Sandpoint and other localities on the reservoir will be an important part of the project, requiring a carefully prepared and detailed recreational plan." The report went on to mention such improvements as a small-boat basin at Sandpoint, Idaho, in conjunction with a dike required to protect the town's waterfront as a consequence of keeping the lake level at 2,062.5 feet. Other possible recreation items included extending beaches and improving existing recreation facilities when they had to be restored at the higher lake level. The Corps also proposed overhauling and enlarging Sandpoint's sewage treatment plant. While the Seattle District Engineer could not identify the exact recreation facilities enhancements and their cost in his report, he assumed "that the benefits from recreation and improved sanitation will at least equal the costs by whomsoever incurred, and the omission either of expected costs or probable benefits will not prejudice the economic justification of the Albeni Falls project."[23]

Albeni Falls
29 August 1951

Above all, though, the Seattle District Engineer argued that "the Albeni Falls project is the most economical and the most promptly available of several new developments that will be required to prevent a serious power shortage in the Pacific Northwest," projected to occur by 1960. The project, he maintained, would not conflict with any other water use, national forest, national park, or Indian reservation. The proposed dam would not adversely affect any other economic activity in the region or Canada. On the contrary, "the effects of increased dependable flow in Pend Oreille River and the Columbia downstream necessarily will be favorable not only to navigation but also to pollution abatement; domestic, industrial, and irrigation water



Albeni Falls
30 November 1951

supplies; or any other beneficial water use that may arise in the future."[24]

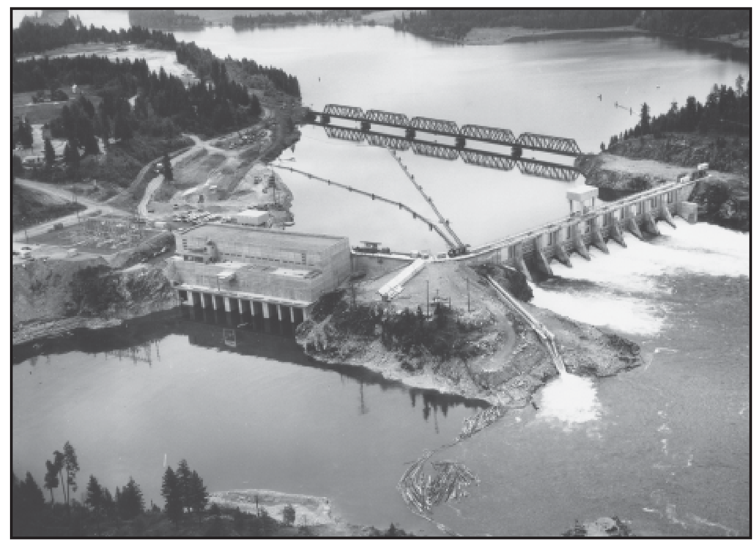
Congress authorized the Albeni Falls dam in the Flood Control Act of 1950 and made an initial appropriation, which allowed the Seattle District to start work on engineering plans and specifications and final survey and design elements in June 1950. The Seattle District engineering staff quickly completed all design work except for the powerhouse, which was contracted out to a private firm. Actual construction began in January 1951. Work literally began with a big bang. An unusually strong blast of explosives at the opening ceremonies almost wiped out the spectators attending the event. After this overly enthusiastic sendoff, work proceeded smoothly and the project reached completion in August 1955. Final project costs came to $30.3 million, very close to the construction estimate of $29.5 million.[25]

The Seattle District built the dam in two stages by alternately using the existing channels. First, the contractors enclosed the left channel or spillway section with cofferdams and diverted the river through the right channel. When workers finished the spillway section, they removed the cofferdams and built new ones to block the right channel. All flow then was diverted through the spillway structure, while construction proceeded on the powerhouse. In each river section, the upstream cofferdam consisted of crib construction, while the downstream cofferdam was made of earth and rock.[26]

Even a national steel strike in the winter of 1951-52, which threatened to delay material for the spillway gates, failed to throw the project off schedule. Once the strike was settled, the contractor managed to complete the gates, secure delivery, and rush installation in time to store the annual spring runoff. This new storage at the Corps' Albeni Falls dam proved timely because it enabled the BPA to avert a threatened brownout or electric service curtailment in the Pacific Northwest, projected to occur in the fall of 1953. Increased flows from the Albeni Fall project storage allowed the downstream power plants to generate the additional power needed to meet the regional demand.[27]

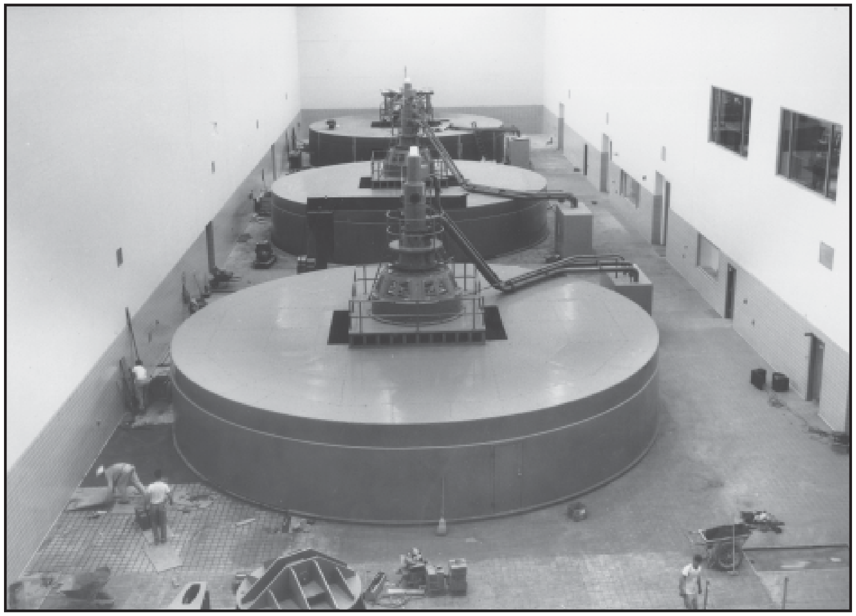
Major Water Plan

The rapid pace of population and economic growth in the Pacific Northwest led Corps officials to call for a review of the main control plan in 1955. By 1957, the Corps had completed the McNary, Albeni Falls, Chief Joseph and The Dalles projects but several other undertakings in the main control plan had been abandon or sidetracked. In addition, new information on Canadian water resources development and its effect on the United States,



Albeni Falls
16 September 1954

growth in river commerce and its impact on existing navigation projects, and the possibilities of atomic power all called for an update of the 1948 main control plan. Brigadier General Louis Foote, the North Pacific Division Engineer, in a 1956 speech to the Inland Empire Waterways Association noted, “We are at an interesting stage of development in the Columbia Basin.” While observing that progress had been “little short of miraculous” in recent years, he also pointed out that “to maintain our economy on an even keel, bigger and better miracles will be needed.”[28]



Albeni Falls
23 June 1955

In particular, the demand for electricity continued to burgeon. Between 1940 and 1955, annual per capita usage of electricity in the Pacific Northwest increased from 1,501 to 7,100 kilowatt hours. In 1955, the region consumed electricity at three times the rate for the nation as a whole. The region’s aluminum industry accounted for a large part of this electrical consumption. Oregon and Washington accounted for one-third of the nation’s output of this important metal, and aluminum production made up one half of the region’s industrial consumption of energy. The Corps’ research indicated that the aluminum industry would continue to be a growing consumer of power for the foreseeable future.[29]

Because of the rapidly changing conditions in the Columbia River Basin, the Senate Committee on Public Works directed the Corps to review the previous report on the Columbia River and Tributaries produced in 1948 and published as HD 531. The committee directed the Corps to examine navigation and hydropower as part of a hydrothermal system, to assess all related water uses, and to consider the advisability of modifying existing Columbia River projects. As with the previous comprehensive studies of the Columbia River, the districts furnished the technical data from their respective jurisdictions, while the North Pacific Division coordinated the work and authored the resulting report. The Assistant Chief of Engineers for Civil Works told the North Pacific Division Engineer that “the plan recommended should be practical and sufficiently flexible to meet future conditions” no further out than 25 years.[30]

Initially, the Division office hoped to complete the study by the spring of 1957. A tight budget and a short time frame limited the scope of work. The Division Engineer, General Foote, informed his district engineers that the review effort would “require careful planning and programming of studies and investigations and a rigid control of fund expenditures.” The study plan envisioned a significant public role with the appointment of an advisory committee of state and local officials and leaders of various regional interest groups. In addition, the Corps held two series of public hearings throughout the Northwest during the course of the investigation. General Foote, in a speech at a meeting of civil engineers, likened the Corps procedures in this study “to a fish bowl operation, since we are inviting everyone to look over our shoulders.” He went on to say, “I believe this is a departure from previous custom and while we can all appreciate the complications and problems added by reason of the extra cooks employed in the making of the broth, you engineers who are familiar with this type of work will recognize that in this increasingly complicated world many things must be considered other than straight engineering on a technical level.”[31]

The ultimate goal of the review, as stated in the completed study, was “a well balanced multipurpose development of the water resources in the Columbia River Basin.” This purpose was “of foremost concern to the people of the Pacific Northwest and of major interest to the entire Nation.” While the study placed the major emphasis on the hydroelectric system, it also addressed flood control issues, noting that “storage now available for flood control is still grossly deficient by comparison with amounts needed to control major floods to reasonable damage levels."[32]

Seattle District's work for the study focused on selecting dam sites on the upper Columbia River and tributaries and analyzing the feasibility of improving the upper Columbia for commercial navigation. A Seattle District civil engineer, Michael Spero, made a remarkable mile-by-mile inspection, by car and afoot, of the Columbia River between Chief Joseph and McNary dams. Other district personnel carried out more cursory examinations of the tributaries. Ultimately, the project engineers compiled a card file of 450 dam sites. After further study of the sites on that list, the district forwarded eight

Basin Map Major Dam And Reservoir Development
1 June 1958

potential water projects to the North Pacific Division. The Seattle District also provided the local public utility districts with the preliminary engineering data used in building the Priest Rapids and Wanapum dams on the Columbia River under the partnership program.[33]

At first glance, the Corps' renewed interest in navigation on the upper Columbia seemed surprising, for that use of the river had been long-dormant. In part, the Corps was responding to the efforts of the Inland Empire Waterways Association, supported by local booster groups, for canalization of the river beyond the head of the McNary pool. A new navigation undertaking also had bureaucratic advantages for the Seattle District. At a time when the Eisenhower Administration's partnership policy looked unfavorably upon new federal dams, navigation improvements, clearly a Corps responsibility, offered a way of maintaining organizational strength and robust budgets. As the final report optimistically noted, "water transportation continues to grow, and opportunities exist for projection of this lower cost transportation service into new areas." The Seattle District navigation studies focused on the means and cost of promoting waterborne commerce between McNary and Chief Joseph dams, a distance of 205 miles. The district had to determine the proper combination of channel deepening and locks at existing and future dams, establish where river ports were likely to develop, and estimate future traffic generated by agriculture and industry.[34]

Several public utility district dams already or soon to be built on the upper Columbia complicated the extension of navigation on that stretch of the river. At the time of the review studies, Washington state public utilities had under construction Priest Rapids (River Mile [RM] 397) and Rocky Reach dams (RM 474). An additional public utility dam, Wanapum, (RM 415) was scheduled to begin in 1959. Another non-federal dam, Rock Island, (RM 453) had been completed in 1932. Only minimal provision for future navigation lock installation had been included in the planning for these dams.

The Seattle District based its examination of navigation extension on prospective river-borne commerce between 1965 and 2015. Based on their studies, district planners found that a 12-foot navigation channel between the head of McNary pool and the foot of Rock Island Dam, a distance of 110 miles, would be cost effective but that a further extension of navigation above Rock Island to Chief Joseph Dam would not be economically justified. The district estimated that improvements to provide navigation between McNary and Rock Island dams would cost $65 million. Such work would add barge locks to Wanapum and Priest Rapids dams and channel improvements such as rock removal through the lower 57 miles of the project.[35]

In its restudy of potential multipurpose projects for the Columbia River basin, the Seattle District focused most of its attention on the Kootenai and Clark Fork drainages of the Columbia. District planners and engineers had to factor in a new element in their analysis. Canada, which accounted for nearly 30 percent of the Columbia's total runoff, proposed to construct three reservoirs in its part of the basin. These additions to the existing multipurpose system would substantially alter the economics of any subsequent projects. After considering all the factors involved, the Seattle District recommended five multipurpose projects to the Division office for inclusion in the final report. These projects represented key elements of the Division's major water plan, and included Libby Dam on the Kootenai River, Long Meadows on the Yaak River (in the Kootenai basin), Knowles Dam on the Flathead River, Ninemile Prairie Dam on the Blackfoot River (in the Clark Fork basin), and Enaville Dam on the Coeur d'Alene River (in the Spokane basin). Other prospective projects failed to win inclusion as main elements of the major water plan, although they were recommended for future development. These included three other projects on the Yaak River, the Katka Dam on the Kootenai River, and several dams proposed for the Clark Fork-Pend Oreille basin.[36]

Based on the Seattle District's latest planning, Libby Dam would provide 5 million acre-feet of storage in a reservoir that backed the Kootenai up to the Bull River dam site in Canada. The concrete gravity structure would tower 400 feet above bedrock, and would initially generate 344,000 kilowatts of power. The project would cost $308 million and have a benefit to cost ratio of 2.81. The proposed Long Meadows project, also in the Kootenai basin, consisted of a $27 million dam and reservoir on the Yaak River, 30 miles above the confluence of the Yaak and Kootenai Rivers. It would provide 400,000 acre-feet of storage and initially generate 9,000 kilowatts of power. The project had a benefit to cost ratio of 1.65.[37]

On the Clark Fork-Pend Oreille basin, the Seattle District recommended Ninemile Prairie Dam and either Paradise or Knowles dams. These proposed projects raised stiff local opposition because they would flood out valuable agricultural land and require extensive railroad and highway relocation. The Ninemile Prairie Dam, located on the Blackfoot River 22 miles upstream from its confluence with Clark Fork, drew the least public resistance. The 300-foot high earth fill dam would provide 885,000 acre-feet of storage and have an initial power installation of 60,000 kilowatts. The project would cost $55 million to construct and had a benefit to cost ratio of 2.05.[38]

Flathead River Flood
9 June 1964

Perhaps the most controversial project proposed by the Seattle District was Paradise Dam on the Clark Fork, located four miles below the mouth of the Flathead River. The Corps had originally suggested the Paradise Dam as an alternative to the widely unpopular Glacier View project in its main control plan of 1948. Paradise, a 270-foot high earth fill dam, would back water up both the Clark Fork and the Flathead Rivers and provide 4 million acre-feet of storage. It would initially produce 432,000 kilowatts of power. This project drew strong objections because it would flood two mainline railroads, three major highways, and 19,905 acres of the Flathead Indian Reservation. Valuable agricultural land would also be lost if the dam were built. Relocation expenses would amount to $291 million of the project's $554 cost of construction. It had a benefit to cost ratio of 1.51.[39]

As an alternative to the Paradise project, the Seattle District proposed the Knowles Dam on the Flathead River, 2.7 miles above the stream's mouth. This dam would provide 3.1 million acre-feet of storage and 256,000 kilowatts of power. While the Paradise project offered superior power and storage benefits to a dam at the Knowles site, the expenses for railroad and highway relocation would be less at the latter site. Either project would flood similar mounts of Indian lands. With construction costs estimated at $235 million, Knowles dam would cost less than one-half of what the Paradise project would require. The benefit to cost ratio for the Knowles project was 1.67. In short, the Corps argued that Knowles Dam could achieve 95 percent of the benefits projected for Paradise Dam at 65 percent of the cost and with much less disruption to the area involved. Montana interests, however, continued to vigorously object to either project. They argued, in part, that all of the benefits went to people in Idaho, Washington, and Oregon, while Montana bore all the costs.[40]

As its final multipurpose recommendation, Seattle District proposed a dam at Enaville, on the Coeur d'Alene River in the upper Spokane basin, 36 miles above Coeur d'Alene Lake. As a 280-foot high rock fill embankment with an imperious core, Enaville Dam would provide 700,000 acre-feet of storage and generate 30,000 kilowatts of power. The Corps estimated the total cost of the project at $81 million, with almost 40 percent of that amount going towards relocation expenses for roads and utilities. The project had a benefit to cost ratio of 1.47.[41]

In addition to the storage and power projects, the Seattle District also recommended inclusion of the Flathead Lake Channel Improvement project as an element of the Division's major water plan. Flathead Lake was located in Montana 77 miles above the confluence of the Clark Fork and Flathead Rivers. Kerr Dam, built in 1938 by a private power company, controlled the lake's outflow to generate power and provide flood control. The proposed channel improvement would increase outflow capacity and permit more effective control of storage in Flathead Lake in the interest of flood control. The improvements would also increase the peaking capability of the power operation at Kerr Dam. The $6 million project had a benefit to cost ratio of 2.78.[42]

The North Pacific Division combined the Seattle District proposals with those from the Portland and Walla Walla Districts and submitted the final plan to the Corps' Headquarters in June 1958. The Corps' report now referred to the revised main control plan for water resources development in the Columbia River basin as the major water plan. In presenting his case for accelerated development based on the Division's report, Brigadier General Allen Clark called attention to the fact that installed hydroelectric capacity in the Pacific Northwest amounted to 8.1 million kilowatts, two-thirds coming from federal projects. Non-federal dams in the process of completion would add 5.5 million kilowatts, while another 2.9 million were either licensed or authorized for construction.[43]

In General Clark's opinion, however, this power production was not sufficient to meet the region's projected needs. As he observed in the review report, "much more than half of the potential value of the basin's water resources remains unutilized." In addition, he noted, "storage now available for flood control is still grossly deficient by comparison with amounts needed to control major floods to reasonable damage levels." He also believed that opportunities existed to lower water transportation costs through navigation improvements on the Columbia River. While acknowledging that domestic and industrial water supplies were adequate at that time, "continued population and industrial growth will focus much greater attention on conservation of supplies for this use within the next few decades." The Division's report addressed these needs in its major water plan.[44]

The plan recommended 12 new dams—5 within the Seattle District—on various tributaries of the Columbia River. The entire plan would provide 22.5 million acre-feet of storage and produce 3.2 million kilowatts of power. Seattle District projects would have 11.3 million acre-feet of storage and an initially installed generating capacity of 699,000 kilowatts. Combined with an improved outlet for Flathead Lake and navigation improvements on the upper Columbia, the total cost of all the Columbia basin elements of the main water plan came to $1.9 billion. The overall benefit to cost ratio for the major water plan stood at 1.66. The run-off characteristics of the Columbia River made it possible to operate the projects as a system to provide for the multiple purposes of flood control, hydropower, navigation, and other water uses, such as irrigation and recreation.[45]

As contemplated by the Corps, the major water plan would be implemented over a fifteen year period beginning in 1960. If the dam building and navigation work were accomplished as planned, the Seattle District would have had a sizeable work load. Unfortunately, bureaucratic and congressional delays soon drained the water plan of its vitality. Although the Division forwarded the report in June 1958, the Corps' leadership did not submit it to Congress for another four years. Publication as House Document 403 did not occur until 1963. Internal Corps debates over the merits of the proposed plan and hearings by the Corps' Board of Engineers consumed the intervening years. In addition, as Major General Itschner noted in 1956, "before any analysis can be completed of a water resource development plan for the Columbia Basin within the United States, it will be necessary to analyze the effect of prospective developments in Canada and to evaluate the benefits to the United States that can be achieved by coordinated development of the water resources available in both countries."[46]

As the Corps recommendations contained in its major water plan circulated throughout the Pacific Northwest, the response proved unexpectedly critical. Public power interests, for example, complained that the Corps underestimated future electric power demand and as a consequence planned too few dams. Gus Norwood of the Northwest Public Power Association privately wrote that he had sat "almost helpless" as a member of the North Pacific Division's advisory board "while site after site . . . [was] written off or surrendered to partial development." He contended that instead of caving into the railroads over the Paradise project, the Corps should have started condemnation proceedings against them.[47]

Colonel Emerson C. Itschner
Seattle District Engineer
1 August 1949-11 July 1950

The anger of those favoring greater development on the Columbia mounted when they learned that both the Corps' Board of Engineers and the Chief of Engineers, Lieutenant General Itschner, had rejected the Division's recommendation on navigation. General Itschner was particularly well informed about the Pacific Northwest, having served both as a Seattle District Engineer (1949-50) and as North Pacific Division Engineer (1952-53). In his view, the "potential waterborne commerce and prospective transportation savings sufficient to justify improvement of the waterway . . . from the McNary project to Rock Island Dam are not reasonably assured at this time." Seattle District staffers privately admitted that they had not made a very strong case for a navigation project on the upper Columbia.[48]

By the time the Corps officially forwarded the HD 531 Review report to Congress, other changes in the major water plan were necessary. The recent conclusion of a treaty with Canada resolving the Libby Dam dispute increased that project's storage and made unnecessary the proposed Long Meadows, Ninemile Prairie, Enaville, and Wenaha projects. Aside from the Libby project, General Itschner recommended spending $922 million for the Knowles Dam, the improved outlet for Flathead Lake, and for five of the seven dams originally proposed for the Snake River basin. He emphasized that the modified major water plan was "not intended to be a plan for the ultimate development of the water resources of the basin." General Itschner went on to state "we may expect some of the projects to be constructed and others to be eliminated for various reasons. Another study will be required in about ten years to determine what changes and additional projects may be required."[49]

Indeed, before the Review report was published as House Document (HD) 403 in 1963, still further changes proved necessary. Strong opposition from fisheries interests and environmental organizations led the Corps to postpone three of the Snake dams and the Flathead project. An interagency agreement between the Corps and the Interior Department called for further fish studies and other conservation matters before any future work at these sites. If built at some future date, Knowles Dam was to be a Bureau of Reclamation project rather than a Corps undertaking. Of the Seattle District projects originally recommended in the HD 531 Review report, only Libby Dam remained in the final HD 403 Report.[50]

Fishery Issues

The most troublesome and complex issue facing the Corps of Engineers in the Pacific Northwest at mid-century involved not engineering matters but rather the anadromous fish controversy. Each year, salmon and steelhead in the millions returned from the sea to make the long upstream journey to distant spawning grounds. Native Americans depended upon the annual runs for their subsistence and cultural renewal. Since the late 19th century, Euro-American settlers in the Northwest had come to value the salmon for their commercial and recreational use.

Unfortunately, the annual salmon runs had been in serious decline since the 1880s. By the 1940s, the Columbia River salmon catch was half that of 1883. A number of reasons accounted for this situation. Over harvesting by commercial fisherman was a leading cause of the decline. In addition, stream pollution from environmentally unsound logging practices and losses from unscreened irrigation intakes took their toll on the fish runs. Most attempts to regulate fishing practices to limit harvests and to improve agricultural and timber operations proved futile. Dams, too, had a detrimental effect on the fish runs, even if they had fish passage facilities. Efforts to increase the supply of anadromous fish through artificial propagation in fish hatcheries also failed to alleviate the situation.[51]

By the 1930s, when the Corps began building dams on the Columbia River and its tributaries, the salmon runs were clearly in crisis. Pressure from commercial and sport fishers, as well as conservationists, caused the Corps to devise and construct an elaborate fish passage system at Bonneville Dam. The initial success of the Bonneville Dam Fish facilities gave observers hope that high dams would not be a permanent barrier to the fish runs. Grand Coulee Dam, built by the Bureau of Reclamation at the same time as the Corps built Bonneville, was too high to permit any feasible method of passing salmon. Instead, the Interior Department transplanted the upriver runs to the Wenatchee, the Entiat, the Methow, and Okanogan rivers, tributaries of the Columbia below Grand Coulee. When the Corps built Chief Joseph Dam, it saw no need to provide fish passage, since the dam's location at Foster Creek was above those streams and below Grand Coulee Dam.[52]

The Corps and supporters of its plan for additional high dams on the Columbia and tributaries used the apparent success at Bonneville to justify further development. Fisheries interests, however, remained skeptical that a series of high dams and healthy fish runs could co-exist. Construction of McNary Dam, for instance, was opposed on the grounds that it made more sense to fully develop all potential sites on the tributaries of the upper Columbia before building dams detrimental to downriver fisheries. Fish advocates took small comfort in the Corps' statement in the HD 531 Report that "while every reasonable means must be adopted" to protect salmon runs, "this one use of [the] Columbia River obviously cannot prevent development of other uses essential to the growing economy of the region."[53]

Fish

During the 1940s, the Corps generally took an optimistic stance on the question of how detrimental high dams were to migratory fish runs. While upstream runs seemed to benefit from the fish ladders the Corps built into its dams, the provisions for downstream migrating fingerlings proved more problematic over time. Initially, the Corps saw no problem. Testifying before the House Committee on Rivers and Harbors in 1941, Brigadier General Thomas Robins, North Pacific Division Engineer, boldly stated that downstream migrating fingerlings could safely pass the dams' turbines. He claimed that a mule could go safely downstream through the turbines, if it could be kept from drowning. General Robins closed his testimony with a rhetorical flourish: "We have done all that could be done to take care of fish. If they disappear it will be because of civilization and not because of the dam."[54]

For all of its surface bravado regarding the health of salmon runs, the Corps also hedged its bets by funding extensive research into migratory fish issues. By the end of the 1940s, it was funding ever larger amounts of scientific research on anadromous fish, both through its own biologists and in cooperation with the U. S. Fish and Wildlife Service. In its HD 531 Report, the Corps had recommended that Congress fund a 12-year, $20 million Lower Columbia River Fishery Development Program (LCRFDP) to research fish issues, construct hatcheries, and carry out other fish passage improvements at its projects and on streams throughout the region. During the 1950s, the Corps continued to operate an active fisheries research program. The Portland District, as the builder of the McNary and The Dalles dams on the Columbia, performed much of the research work under the active supervision of the North Pacific Division.[55]

The Corps' review of the HD 531 Report, the major water plan of 1958, reflected the considerable public attention now focused on fish issues. The review report included fish passage data from Bonneville, Rock Island, and McNary dams, described the current state of the commercial and sport fisheries, and detailed the fish research program funded by the Corps. It contained the crucial acknowledgement that no special facilities at Corps or public utility dams on the Columbia had been provided for downstream migrants and that the loss of fish going through the spillways and turbines was much greater than the Corps had previously admitted. The Corps still believed that hatcheries provided adequate mitigation for such losses. Under the LCRFDP, 12 fish hatcheries were in operation by 1956. The 1958 review report went on to note that between 1949 and 1957, the Corps had spent $18.5 million on the LCRFDP. In addition, the North Pacific Division had invested another $2.5 million on its own Fisheries Engineering Research Program initiated in 1951. The Corps' major water plan recommended further fisheries research, especially on the problem of downstream migration.[56]

A significant change in the Corps responsibility for fish and wildlife concerns at its projects occurred as it completed and sent forward its major water plan. In 1958, Congress amended the Fish and Wildlife Coordination Act, first passed in 1934 and amended in 1946, ordering that fish and wildlife conservation receive "equal consideration" with all other project purposes. Henceforth, the Corps had to evaluate a project's adverse and beneficial effects on fish and wildlife in all stages of planning and recommend changes or mitigation for all adverse project effects.[57]

As a large and influential segment of the public began to question the effects of the Corps' water resources development program on the natural environment, the agency found itself increasingly on the defensive. At first, Army Engineers reacted slowly to the new emphasis on environmental values. When sports organizations on Pend Oreille Lake expressed concerns in 1959 that Albeni Falls Dam might harm the lake's fishery, Colonel Robert Young, Seattle District Engineer, accused the groups of being "wildlife extremists." In 1970, the North Pacific Division Engineer, General Roy S. Kelley, gave a speech attacking some environmentalists as "emotional journalists and hysterical authors . . . willing to stop the world and get off." The Corps also noted that others had a share of the responsibility for the declining salmon runs. The Assistant Chief of Engineers, General J. L. Person pointed out in 1959 that "more than 40 dams were constructed by other agencies in the [Columbia] basin, most of them by the Department of the Interior, without fish passing facilities." Whatever Corps officials might think or say, the environmental challenge would not go away.[58]

Ben Franklin Dam

Once the Seattle District completed Chief Joseph and Albeni Falls dams in the mid-1950s, its multiple purpose work on the upper Columbia experienced a lull. As a consequence of the Eisenhower Administration's partnership approach, the dam building initiative passed from the Corps to the Washington State public utility districts. In the late 1950s, the district's role consisted mainly of providing engineering data and advice to the ambitious public utility districts as they embarked on dam construction and making sure that the dams did not preclude the possibility of adding navigation facilities in the future.[59]

As part of the HD 531 Review study, the Seattle District examined the possibility of building the Ben Franklin Dam on a stretch of the Columbia River between the head of McNary pool and Priest Rapids Dam. Based on extensive field exploration, the Seattle District proposed to build the power and navigation project at the Richland site, river mile 348. The low-head dam would produce 352,000 kilowatts and have a navigation lock with a clear width of 86 feet and length of 675 feet. The Corps also included fish passage facilities in the dam design. It estimated that the project cost would range from $262 to $342 million, depending on the size of the flowage costs necessary to protect the Hanford Works. The higher figure produced a benefit to cost ratio below unity.[60]

Although Ben Franklin Dam would utilize the last undeveloped stretch of river between Bonneville Dam and the international boundary, the Corps did not include the dam in its major water plan because of the projects possible "adverse effects" on the Hanford Engineering Works. At the time, Hanford was a major producer of plutonium; and the Seattle District sought ways to lessen the impact of the proposed dam on this strategically vital activity. The Corps found that a dam at the Ben Franklin site would lead to a

Ben Franklin Dam Site, Columbia River
6 Aug 1968

rise in the water table throughout the Hanford area, causing possible structural problems to the massive reactor buildings and to subsurface storage facilities containing highly radioactive wastes. In addition, increased water temperatures caused by the dam's reservoir might adversely affect plutonium production, which depended on cold river water for efficient reactor cooling.[61]

As the last undeveloped section of the Columbia River, the Hanford Reach had great environmental value as a nature preserve. It contained several miles of salmon spawning grounds and extensive areas of pristine habitat utilized by migratory waterfowl and resident game birds. It also contained numerous important archeological sites. The slack water pool created by the dam would flood this habitat and drown the spawning grounds and ancient Native American cultural sites. While conservation groups fought the Ben Franklin project, upriver economic development interest enthusiastically endorsed it as a means to extend slackwater navigation further up the Columbia River. The Atomic Energy Commission persisted in its opposition, however, and succeeded in preventing authorization of the dam in the late 1950s. As Major General Itschner, Chief of Engineers, informed Representative Catherine May in the spring of 1959, "the economics of the Ben Franklin project obviously are marginal at this time in view of its adverse effects upon the Hanford Engineering Works." Ironically, environmentally questionable nuclear power preserved one portion of the Columbia from further dam-caused environmental degradation. The proposed Ben Franklin Dam, though, came back to life rather quickly.[62]

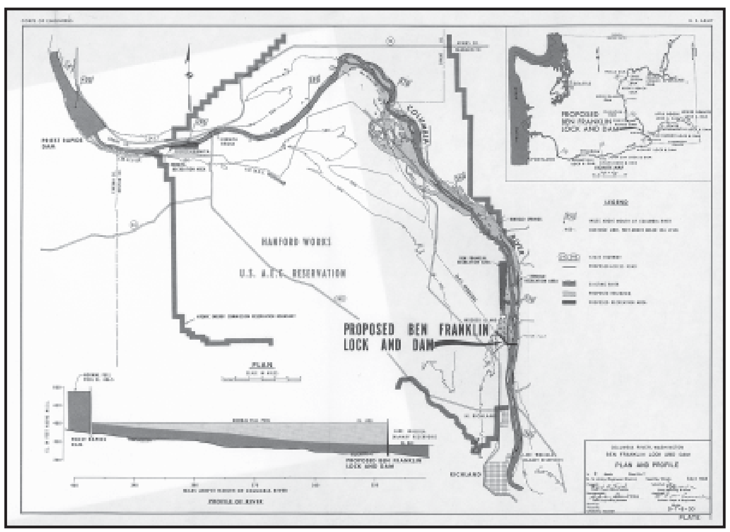
In May 1959, the Senate Committee on Public Works, at the request of Senators Warren Magnuson and Henry Jackson, instructed the Corps to reexamine the merits of constructing a multiple-purpose dam at the Ben Franklin site. The Seattle District spent the better part of the next decade carrying out the study. While the initial investigations completed in 1963 determined that the Ben Franklin project was feasible, detailed studies of the project's effects on the Hanford Works still had to be performed. In House Document 403, the Seattle District had estimated remedial measures at the Hanford facilities necessitated by the Ben Franklin project would cost between $25 and $100 million, depending on the reservoir pool height. Subsequent shutdown of several atomic reactors at Hanford altered the situation. A Corps-funded study costing $800,000 and carried out by the Atomic Energy Commission in the mid-1960s reduced the remedial costs at Hanford for a pool with a surface elevation of 400-feet to a mere $3.8 million.[63]

The Ben Franklin project also posed major foundation problems not previously encountered in constructing dams on the Columbia River. As the Seattle District Engineer, Colonel R. P. Young, reported to the Division Engineer, the chief difficulty arose from having to place the "powerhouse and other dam structures on a yielding foundation, known as the Ringold Formation, which overlay basalt bedrock in depths of 200 to 250 feet." The Ringold Formation—consisting of sands, gravel, and silts, and clay—was subject to elastic deformation and consolidation, resulting in an unstable foundation for the dam and associated structures. The Seattle District carried out extensive foundation studies and then designed a concrete dam and spillway with a spread foundation that would safely hold on the Ringold Formation. The geological investigations determined that seepage would not constitute a problem because the materials in the Ringold Formation had low vertical permeability.[64]

As proposed by the Seattle District, the revised Ben Franklin Dam would be a low head, concrete structure at river mile 348, having a 16-unit powerhouse capable of producing 938,000 kilowatts for regional power needs. The 15-bay spillway would extend 1,325 feet and the powerhouse would reach another 1,564 feet in a straight line along the dam axis. If

Congress authorized the extension of navigation from the head of the McNary pool to Wenatchee, the dam would contain a navigation lock. The 49-mile reservoir would have a maximum pool elevation of 400 feet and a storage capacity of 310,000 acre-feet. This level of storage would create a power head of 44 feet. The Seattle District included measures to mitigate the project's adverse effects on the Hanford Works and the rich fish and wildlife resources located along that stretch of the Columbia River. The District also proposed the addition of extensive water-oriented recreation facilities along the reservoir shoreline. The Corps estimated the construction costs at $298 million, including the navigation lock.[65]

The Ben Franklin Dam raised a number of environmental concerns, and these soon became the chief stumbling block to its acceptance. Fisheries interests quickly pointed out that the reservoir would destroy major salmon and steelhead spawning areas in a free-flowing stretch of the Columbia River and that the dam would impede the passage of upstream and downstream migrant anadromous fish. As mitigation for these impacts, the Seattle District proposed building fish ladders in the dam and off-site hatcheries. Large numbers of migrating waterfowl used the existing riparian and island habitat in the Hanford Reach of the Columbia, so the Corps proposed to



Ben Franklin Lock and Dam Plan
September 1968

establish suitable replacement habitat in the new reservoir for the inundated areas. An archaeological survey funded by the Corps and conducted by the Washington State University identified 105 sites "of critical importance in linking together archaeological research in contiguous areas." The Seattle District also proposed to conduct an archaeological salvage operation of the affected sites at a cost of $635,000.[66]

The Corps planners admitted that the Columbia River from the Ben Franklin dam site to the Priest Rapids Dam contained spectacular scenic and aesthetic attractions, such as the great "White Bluffs" and the free-flowing character of the natural river and the stable stream bank created by its 40-foot deep streambed. As the Seattle planners wrote in their report, "the steep bluffs and their earthen tones provide a magnificent setting for the cool shimmering waters of the Columbia. Countless arrays of color and form are created when these waters mirror the expansive sky and adjoining bluffs." This unique setting and "a portion of the river's beauty" would be forever altered by the slack water pool of the Ben Franklin Dam. The report noted that "the river would become quieter in appearance and the array of color and form would be lessened. The free-flowing primitive character of the river would be changed into quiet pools with gentle back water."[67]

Recognizing the need to assure consideration of all viewpoints concerning the important environmental features or characteristics of the project area, the Seattle District took the unusual step of sponsoring a public reconnaissance tour by barge of the proposed reservoir. The opinions of interested citizen groups attending the tour were furnished to the Corps beforehand in a written guide, which identified specific aspects of the natural environment that would be inundated or adversely affected by the project. Some environmentalists even recommended turning that section of the Columbia River into a congressionally-designated National Recreation Area. A public hearing held by the Seattle District in June 1968 also elicited comment both for and against the project from over 140 individuals and interest groups. The Seattle District report proposing the Ben Franklin project observed that "development of the Ben Franklin site was indorsed generally by locally elected public officials and electric power and navigation interests, and opposed generally by fish and wildlife interests and conservation groups." Both of Washington's powerful senators, Warren Magnuson and Henry Jackson, ardently backed the Ben Franklin Dam and the alternative navigation improvement project.[68]

While admitting that the intangible values of the free-flowing river, some of the fish and wildlife habitat, and many archaeological sites would be lost, the Seattle District asserted that mitigation measures costing about $25 million could compensate for most of such losses. To the Seattle District, moreover, the hydroelectric generation, navigation benefits, and water-oriented recreation facilities made the Ben Franklin project a worthwhile undertaking, with a benefit to cost ratio of 1.4 to 1.0. The Seattle District proposed to build the Ben Franklin Dam without a navigation lock if Congress failed to authorize the extension of the Columbia River navigation channel above the McNary pool. Alternatively, if Congress approved the navigation work but failed to authorize the Ben Franklin project, the Seattle District proposed to extend navigation upriver by dredging the Columbia River between the McNary pool and Wenatchee, Washington. In a report submitted in June 1967, the Seattle District found the extension of navigation on the upper Columbia River economically feasible.[69]

By the late 1960s, the voice of conservation and newly formed environmental groups had mounted a strong challenge to the water resource development interests of the Pacific Northwest and the Corps found its multiple-purpose projects on the Columbia increasingly under attack. Even state resource agencies joined in questioning Corps' projects. The Washington State Department of Fisheries strongly opposed the Ben Franklin project and the alternative construction of an open river navigation channel. The agency director, Thor Tollefson, bluntly stated "that the construction of Ben Franklin Dam would not only destroy the last natural spawning area in the Columbia River, but would have disastrous results on those populations of salmon utilizing the river below for either upstream or downstream migration purposes." Other Washington state resource agencies also opposed the project; and several local, regional, and national conservation groups joined together in an umbrella organization known as the Columbia River Conservation League. The Conservation League vociferously and effectively fought both the Ben Franklin Dam and the alternative navigation channel improvement project.[70]

An article appearing in the *Seattle Post-Intelligencer* effectively summed up the opponents' arguments against the proposed Ben Franklin project and concluded by noting simply that if the dam were built "the ecology . . . that once existed on the historical Columbia and now exists only over a 60-mile stretch will be changed radically and probably will be lost forever." The *Seattle Post-Intelligencer* also editorially opposed the Ben Franklin project, concluding that "the benefits Ben Franklin Dam would bring are relatively small, and cannot justify the expenditure of $280 million or more and the destruction of a unique and irreplaceable wildlife resource."[71]

Even important voices within the Corps had concerns with the project. In 1968, the North Pacific Division listed the Ben Franklin Dam and the Upper Columbia River projects as its two most controversial proposals. After a 19 September 1968 briefing for the Chief of Engineers, the Seattle District staffers present glumly reported that "General Cassidy appeared to express little or no enthusiasm for the Ben Franklin project and corollary to this lack of enthusiasm, no great amount of positive action to the Upper Columbia Navigation project." General Cassidy also reminded the Seattle District staffers that they had to be "extremely careful and extremely thorough" in covering environmental matters in their report.[72]

In April 1969, the Conservation League challenged the validity of the Seattle District's economic evaluation of the Ben Franklin project. Specifically, the Conservation League charged that the navigation benefits assigned to the project were too speculative and that the estimated future population growth for the region was unrealistically high. Most damaging to the Seattle District's case for the Ben Franklin project was the use of an old interest rate of 4-5/8 percent instead of the newer one of 5-1/8 percent. Ultimately, the debate over both the economic and environmental aspects proved too much for the Ben Franklin project. After the formal release of the Seattle District's favorable report for the project in July 1969, the Corps' newly formed Environmental Advisory Board called for a new economic and environmental review of the project. Support in Congress faltered; and, in September 1971, the Office of Management and Budget recommended against authorization.[73]

Libby Dam Resurfaces

While the Corps' headquarters considered the HD 531 Review report, the Seattle District's Libby project suddenly reemerged. After 15 years of studies, the International Columbia River Engineering Board finally issued its report in 1959. The United States and Canada then concluded their long, drawn-out negotiations over Columbia River development and signed a treaty in January 1961. By the terms of this treaty, Canada agreed to build three dams with a total of 15.5 million acre feet of storage that primarily would benefit flood control and power production in the United States. In turn, Canada was promised $64.4 million for the flood control benefits accruing to the United States and an entitlement to one-half of the downstream power benefits. This agreement also allowed the United States to construct a dam (Libby) that had north-of-the border storage and provided that after 1984 Canada could divert a portion of the flow for its own water resources purposes. President John F. Kennedy hailed the treaty as beneficial to both countries and requested that Congress appropriate funds for the Libby project.[74]

Although President Eisenhower and Prime Minister John Diefenbaker signed the treaty 17 January 1961 and the Senate approved it in March of that year, Canadian ratification required another 44 months to achieve. Internal Canadian politics accounted for much of the delay, although thorny institutional and technical arrangements necessary to implement the treaty also had to be worked out in the United States. Since Canada did not need the power entitlement provided by the treaty, it sold this energy to a United States entity for 30 years for money which Canada in turn used to finance construction of the three upstream Canadian storage dams called for in the treaty. While a consortium of public and private utilities in the Pacific Northwest purchased the Canadian power entitlement, they too, had no immediate need for the energy. Congress approved plans for building a power intertie between the Northwest and the Pacific Southwest, making it possible to market the surplus power until the Pacific Northwest could absorb it in the future.[75]

Lieutenant General Itschner, who previously had refused to allow the Seattle District to do any preparatory work while the treaty negotiations dragged on, now insisted that construction begin within 21 months of the project's official reactivation. The Corps received pressure from Montana politicians like Senator Mike Mansfield to start work as soon as possible. Montana interests eagerly awaited the jobs and income that the Libby project would bring to a depressed state economy.[76]

Planning for Libby Dam necessitated careful calculation, since a provision of the treaty required completion of the project within seven years of commencement of construction. As Brigadier General Allen Clark, the North Pacific Division Engineer, noted to the Chief of Engineers, it was important not to "set a starting date in our schedule contained in our notice to Canada in advance of a date that we can be reasonably certain of meeting. To do otherwise would jeopardize our ability to have the project ready for full storage operation within the prescribed period of seven years." The Seattle District pushed pre-construction efforts with dispatch. As one Seattle staffer put it, "Planning of Libby Project will be fast-moving operation in many areas, requiring rigid adherence to schedules, and it is essential that progress be closely evaluated and all problem areas pinpointed as soon as they arise." The district's efforts, unfortunately, were hobbled by the lack of funding.[77]

Even though the Chief of Engineers had ordered rapid progress on the planning process, he was unable to provide money to keep it on schedule. The district was told to proceed on the assumption that funding would be found in unspent, end-of-the-year monies. Colonel S. M. Lipton of the North Pacific Division informed the Seattle District Engineer that "our experience has been that fund surpluses generally develop Corps-wide in the last quarter of the fiscal year at which time projects will be sought which can utilize additional funds." Unwilling to stake their reputations on such an outcome, the Seattle engineers instead cut back the pace of Libby work. At one point, staffers assigned to the project were asked to take annual leave in order to reduce the budgetary pressure.[78]

The key problem that Seattle District faced in the Libby Dam project involved relocating 60 miles of Great Northern railroad track. In meetings with the Great Northern representatives, the railroad insisted that the Corps assume all costs and engineering responsibility for relocating the rail lines and give assurances that it would build no dams on the Kootenai River below Libby. Ultimately, the Great Northern got the Corps to build it a shorter and more efficient line along the Kootenai that included an expensive seven-mile long tunnel—the second longest railroad tunnel in the United States. To insure the safety of trains in the tunnel, the Seattle District had to design a complex ventilation and communications system. The ventilation fans could purge the tunnel of exhaust fumes in 18 minutes. The Corps also had to relocate 52 miles of state highways leading north from Libby to the border, 56 miles of Forest Service roads, and several utility systems. In addition, the project road relocations required the Corps to construct several bridges, one of which was the tallest and longest (2,437 feet) in Montana. The various relocations accounted for nearly half of the cost of the project.[79]

The Seattle District engineers designed an unusual environmental feature into the Libby project that enabled the dam operators to control the temperature of the discharge water. To provide the best water quality and temperature control in the Kootenai River downstream of the dam, the designers placed a selective withdrawal structure on the upstream face of the dam, allowing water to be drawn from various depths before passing through the penstocks. In the summer months, for example, cool water from the lower levels of the reservoir could be combined with the warmer surface water to achieve the appropriate downstream temperature for fish and wildlife.[80]

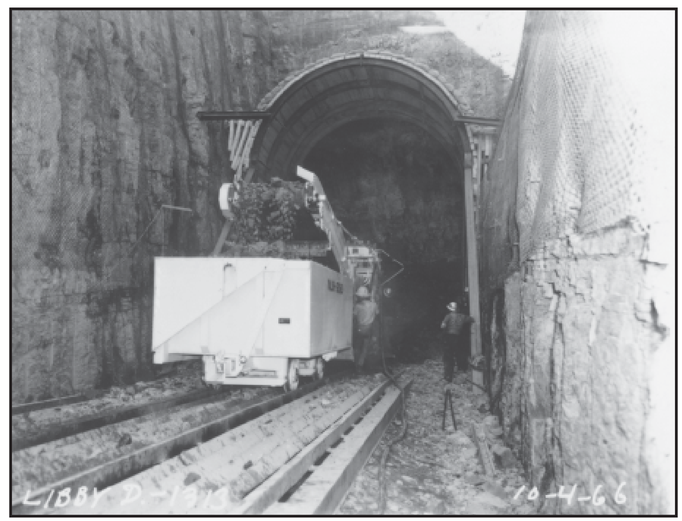
While district planners and engineers focused on relocations in the initial phase of the Libby project, they also found that the second dam site at river mile 217 was not as good as one located at river mile 219, 17 miles

Libby Dam
31 August 1967

above the town of Libby. Adapting the previous design elements to the new site required additional planning time. The engineers also had to take into account the effects on the dam's hydroelectric capacity if Canada exercised its option under the treaty to divert a portion of the Columbia River at some future time. The Corps eventually decided to install four generators and to provide space for an eventual addition of four more units.[81]

Construction of the dam got under way in the summer of 1966, beginning with the dam's west abutment. Unlike many major dam projects, Libby did not require diverting the river through a tunnel. Instead, the contractors built a low cofferdam, which channeled the Kootenai River along the west side of the valley. This allowed workers to begin construction on the east half of the dam. The major portion of Libby Dam's construction occurred after 1969 and will be covered in a subsequent volume of the Seattle District history. When completed, the dam had a crest length of 3,055 feet and reached 420 feet above bedrock. The 90-mile long reservoir held 5.8 million acre-feet of storage. The gravity concrete structure consisted of 3.8 million cubic yards of concrete, enough to build a two-lane highway from Salt Lake City, Utah, to New York. The spillway section had two taintor gates, 48 feet wide and 54 feet high. At the time Seattle District initiated construction, the project was estimated to cost $352 million and had a benefit to cost ratio of 1.5 to 1.0.[82]

Construction of the dam required the importation of a large labor force to the sparsely populated northwest Montana region. This placed major pressures on the community of Libby for additional housing, service facilities, and schools. In addition, Libby, dependent on the timber industry for its economic livelihood, expressed great anxiety over the issue of road and railroad relocation that affected the hauling of logs to Libby's mills. Libby town leaders also had concerns about the social and economic disruptions on housing and schools arising from the expected influx of transient construction workers. Local schools and social services would have to provide for as many as 2,000 construction laborers and their families. To alleviate these problems, the Seattle District took a number of actions. The Corps purchased and set up almost 100 new mobile homes for the government force required at the project. Under special authority passed by Congress, the Seattle District used $3.5 million of project funds to support the schools in the communities affected by the project. This allowed the gymnasiums, cafeterias, and libraries.[83]



Great Northern Railway Tunnel Construction

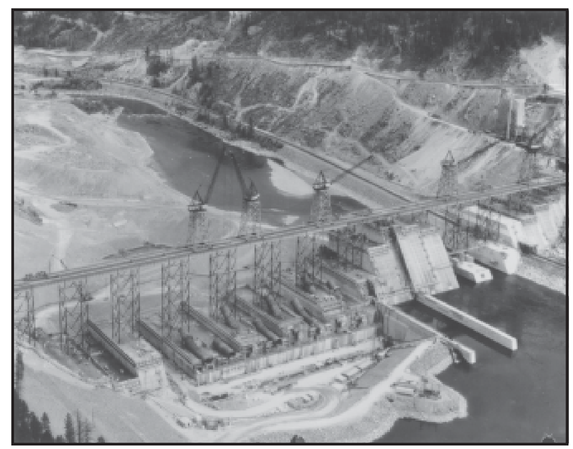
The Seattle District had to acquire about 43,000 acres for all of the features of the project. Only 15,000 acres were federally owned; the rest had to be acquired from the state and willing private owners. The Corps encountered much resistance to its policies for acquiring land from the private owners in the reservoir area. While some objected to the Corps' appraised values, others objected to the government's acquisition of private land for recreation, fish and wildlife purposes. Indeed, the Seattle District's extensive land purchases around the 90-mile reservoir behind the dam did reflect a departure from the Corps' former policy of obtaining only the minimum land necessary for operating the project. The new policy called for purchase of all land to the full-pool elevation of 2,459 feet, plus a lateral distance of 300 feet to provide proper public access to and enjoyment of shoreline recreation facilities. In adopting a new approach to providing extensive recreation opportunities at the Libby project, the Corps was responding to the new public desire for outdoor recreation supplied by the government.[84]

Since the Flood Control Act of 1944, the Corps had authority to construct, maintain, and operate public recreation facilities and grant leases associated with its projects. Initially, the Corps used this authority conservatively, but the facilities provided grew in popularity. In response to a public recreation demand that grew throughout the 1950s, Congress expanded the Corps authority in 1962 to provide free access to water and shoreline facilities at its projects. The Corps interpreted this to mean the acquisition of private land if necessary, as in the case at Libby. The Federal Water Project Act of 1965 further enhanced the Corps recreation role by specifying that recreational development should be given equal consideration with other project benefits and could even count towards benefits in the benefits to cost analysis. The Corps also helped the Forest Service and the Montana Fish and Game Department acquire wildlife lands, improve habitat, and construct a fish hatchery to mitigate for losses associated with the Libby Dam project.[85]

While moving in new directions with its recreation policy, the Corps also addressed, in its planning for Libby Dam, the growing environmental aesthetic of the 1960s. The forest and rugged mountain setting of the Libby Dam exhibited great natural beauty. In keeping with the new national environmental ethos, the Seattle District engineers and planners attempted to blend the dam into its scenic surroundings as sympathetically as possible. As Sydney Steinborn, the Chief of Seattle District's Engineering Division noted, the planners' approach was one of "dropping a hunk of concrete in the wilderness as gracefully as possible."[86]

Libby Dam
4 September 1968

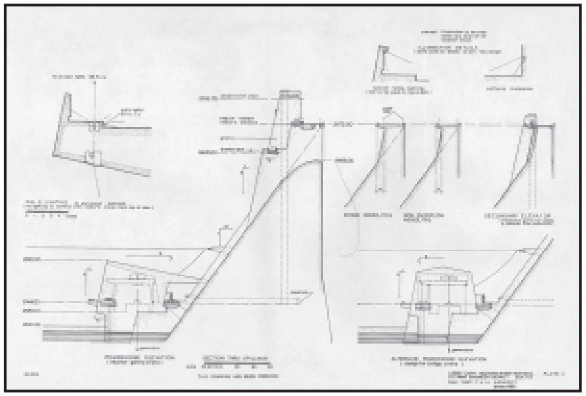
To achieve its aesthetic design goal, the Seattle District hired noted Seattle architect, Paul Thiry, to prepare a basic plan that would combine the beauty of the site with forcefulness of the dam structure. Thiry visited major dams throughout the United States to observe how the structures had been integrated into the physical environment. At the Libby Dam site, Thiry declared himself "inspired by the beauty and serenity of the scene and the majesty of the setting." He saw his design problem at Libby Dam as "one of making everything as compatible and homogeneous as possible and letting the wilderness live with the introduction of construction and an added form of wildlife known as Man." Thiry then formulated a plan that carefully combined into a single architectural unit the dam, powerhouse, and visitor's facilities and sensitively sited view points in the surrounding landscape. The basic structural element achieving the architectural integration of the powerhouse and the downstream face of the dam consisted of a huge slanted T-frame



Libby Dam

upon which were placed sandwich walls and roof. Thiry employed a post-tension design in the visitor's center and carried the architectural lines of the dam into the rock of the right abutment.[87]

Using Thiry's basic concepts, the Seattle District staff developed final designs and a comprehensive plan for the dam and exercised rigorous control of the contractor operations at the dam site to ensure the desired result. As a final element of Thiry's design, the Seattle District included a Treaty Tower on the crest of the dam to commemorate the international aspect of the project and to provide visitors an unobstructed view of the lake. According to Colonel Holbrook, the Seattle District Engineer, speaking at the ground breaking ceremonies, "the Treaty Tower atop the 420-foot-high structure will be symbolic of the longest unguarded border between two countries in the world today." The tower incorporated interpretive exhibits, as well as access to the interior of the dam and powerhouse and was located next to the spillway.[88]

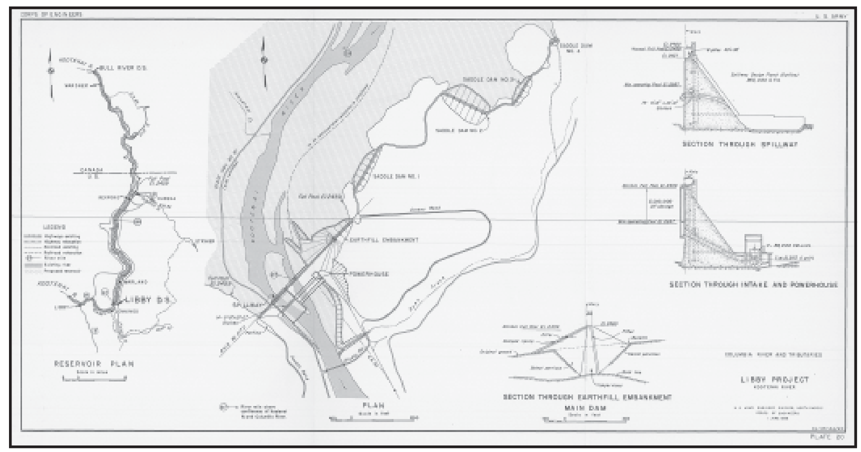


Libby Dam Powerhouse Elevation

By the time that the Seattle District completed construction of Libby Dam in 1975, the Canadians had finished the three dams they for which they had responsibility. Costing almost $383 million, Libby Dam was the most expensive civil works project undertaken by the Seattle District up to that time. The project took the Seattle District in new environmental directions, including enhanced recreation planning, wildlife and fisheries mitigation, and landscape aesthetics. These activities raised a host of financial and operations and maintenance issues that proved challenging over time.

Between 1950 and 1970, the Seattle District responded to the perceived development needs of the Pacific Northwest by building major multiple-purpose dams on the Columbia River and its tributaries. This work carried out the revised water resources plan of development for the Columbia River first set forth in the Corps' 308 Report, issued in 1932. The ultimate development of the Columbia River's potential for hydropower, navigation, and flood control required increased upstream storage. Achieving these objectives required the assistance of Canada. After arduous negotiations, the United States and Canada signed a treaty, permitting the last economically and politically feasible water resources projects in the Columbia Basin to be built.

The Seattle District, in building Albeni Falls, Chief Joseph, and Libby dams, played a key role in the final stages of the water resources development of the upper Columbia River. While the district faced minimal opposition to the Chief Joseph and Albeni Falls projects, it had to struggle to get the Libby Dam project off the ground and failed to win acceptance for the Ben Franklin Dam project or its alternative navigation improvement undertaking. The economic and environmental issues that arose over these last projects ushered in a new era of water resources development in the Pacific Northwest. Adapting to this new situation would prove a serious challenge to the Seattle District's engineering and political skills.

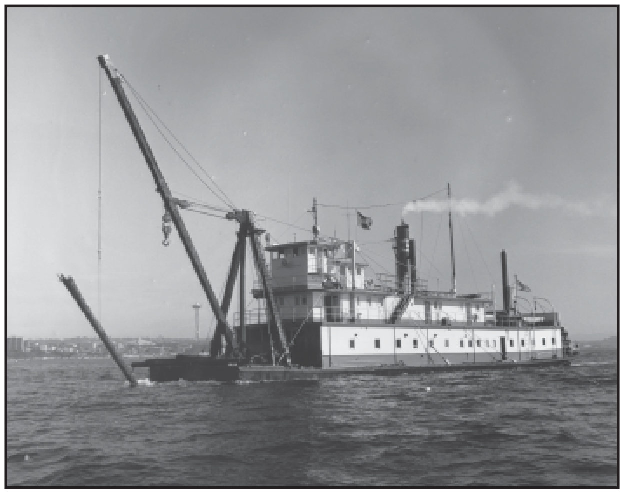


Libby Plate
20 June 1958

Chapter VI

MISCELLANEOUS CIVIL AND MILITARY PROJECTS

While the Seattle District planned and constructed the great dams in the Columbia River basin during the 20 years following World War II, it also continued its traditional rivers and harbors work on the Washington coast. The Corps' coastal projects greatly benefited waterborne commerce in western Washington. The annual work of the District chiefly involved maintenance of the early 20th century navigation improvements, but it also included project expansions or alterations as well. In addition, the District created new navigation facilities such as small boat moorages. The Seattle District's civil works responsibilities also encompassed flood control work.



W.T. Preston

This required emergency response flood fights as well as constructing flood control reservoirs. Finally, while carrying on its traditional civil works mission, the Seattle District also had an important military construction responsibility. The District's military work required a wide range of design and construction work for both the Army and Air Force, from radar and missile installations to base housing and recreation facilities for soldiers and airmen.

Rivers and Harbors Work

In support of the oldest Corps project on the Washington coast, Puget Sound and its tributary waters, the sternwheel snagboat *W. T. Preston* labored 10 months a year clearing debris from various tidewater rivers. In a typical season such as 1958, the vessel removed 3,535 snags, 40 pilings, and miscellaneous trees and debris and dredged 17,760 cubic yards of muck from the mouth of the Skagit River. Between 1882 and 1968, the Corps expended $4.3 million on the Puget Sound project. In carrying out this effort, the District Engineer would annually report "no permanent results are obtainable but the maintenance of existing channels requires practically continuous operation of the snag boat." Until the early 1970s, the venerable *W. T. Preston* faithfully gathered and disposed of debris from the rivers and harbors of the Sound.[1]

By mid-century, many of the Seattle District rivers and harbors improvements showed long-term wear-and-tear. In fact, rock jetties, subject to the constant pounding of tidal waves and severe storms, began deteriorating as soon as they were built and required periodic, often extensive repairs. For example, the District Engineer's 1950 annual report for Grays Harbor noted that portions of the south jetty, completed in 1902 and reconstructed from 1936 to 1940, had "showed subsidence to a maximum depth of 18 feet below grade, and the outer 900 feet had been destroyed by the sea." The annual report went on to note "serious erosion of the shore line" near Point Chehalis. The north jetty at Grays Harbor, completed in 1913 and reconstructed in 1916 and 1941-42, also had suffered heavy degradation by 1950. The Corps and the Port of Grays Harbor performed annual dredging to maintain the main channel at the project depth of 30 feet and two lesser channels at 18 and 12 feet respectively. The Grays Harbor project, costing $15.6 million by 1950, supported traffic of 1.8 million tons of cargo in 1949 and terminal facilities containing 29 wharves and piers. Most of the port's cargo consisted of wood and paper products.[2]

The Seattle District carried out significant navigation improvements at the Grays Harbor project between 1950 and 1970. The District completed a breakwater at Westhaven Cove in 1950 and constructed three rock groins for protection of Point Chehalis in 1951. Local interests constantly pressed for increased channel depths and channel extensions; and after favorable Corps studies completed in 1953, Congress approved dredging and maintenance of a 30-foot channel and turning basin from Aberdeen to Cosmopolis, Washington. Congress also authorized an additional 1,400 foot long breakwater at Westhaven Cove. When the Seattle district completed this work in 1956, project costs stood at $18.4 million, with maintenance amounting to $14 million of the total.[3]

Much of the public concern at Grays Harbor focused on the debilitated south jetty at the harbor entrance. By the late 1950s, the outer 7,000 feet were at or below grade, while most of the inner 5,500 feet stood at or near grade. The entrance channel across the bar, however, measured 35 feet deep, well above the project's authorized depth. During the 1950s, vessel cargo annually averaged 686,000 tons while an average of 1.2 million tons of rafted logs moved within the harbor. Since merchant vessels freely passed in and out of the harbor, Colonel Robert Young, Seattle District Engineer, reported in April 1960 that existing bar channel conditions did not justify rebuilding the south jetty or conducting another study of the situation. In fact most of the pressure for rebuilding the south jetty came from commercial and sports fishermen who lacked experience with the waters of Grays Harbor and wanted the jetty to form a protective breakwater, as well as secure the entrance channel depth. The Corps questioned the need for expending an estimated $10 million chiefly to benefit the sports fishing industry.[4]

Senator Warren Magnuson, however, wrote the Chief of Engineers that he was "very shocked" at the Seattle District Engineer's unwillingness to reexamine the conditions of the entrance channel at Grays Harbor. The senator found this position "at great variance" with "an aroused public opinion" that decried "the lack of reasonable navigation at all times and the business losses to the charter boats, commercial fisherman, and sports fishers." Senator Magnuson concluded that "in view of the hazards . . . this project to rebuild the jetty is of prime importance."[5]

Major General William Cassidy, Assistant Chief of Engineers, responded to Senator Magnuson by noting that while reconstruction of the outer end of the south jetty would probably alleviate turbulence in the entrance channel, it would also aggravate an erosion problem at Point Chehalis, "necessitating further corrective measures and thereby increasing project cost considerably." General Cassidy ended by stating that it would take a new study to resolve all of the conflicting navigation issues at Grays Harbor and that a congressional resolution would be necessary to conduct such a review.[6]

In fact, the Seattle District carried out new studies of the navigation conditions at Grays Harbor in the early 1960s. Based on this review and advice from the Corps' Committee on Tidal Hydraulics, the District reconstructed the shoreward 4,000 feet of the south jetty and left alone the remaining 6,000 feet extending seaward out of concern that a rehabilitation of the outer portion would cause renewed erosion at Chehalis Point, unwanted scour along the channel side of the south jetty, and a southward migration of the entrance channel. The Seattle District completed work on the inner portion of the south jetty in October 1966 at a cost of $5 million.[7]

The Corps found the Grays Harbor project an expensive undertaking to maintain, since the harbor and ship channel required annual dredging of almost two million cubic yards of material. Of the $29 million the Corps spent on the project prior to 1968, fully $19.8 million went for maintenance. To accomplish the necessary dredging at Grays Harbor, the Corps used the government hopper dredges *Pacific* and *Biddle* and leased the Port of Grays Harbor pipeline dredge, *Robert Gray*. The Corps justified the continued effort to maintain or improve the conditions of navigation along the coast of Western Washington because of the area's important waterborne commerce. In 1949, for example, while the port of Grays Harbor handled 2 million tons of freight, Tacoma had traffic of 4.7 million tons and Seattle, 11.3 million tons.[8]

Just as much of the maintenance effort at Grays Harbor focused on channel dredging, so did the work at Seattle and other coastal harbors. The Duwamish River yearly deposited large quantities of sediment in the Seattle waterway, which Corps-funded dredging had to remove. During 1950 and 1951, for example, the Corps removed 806,000 cubic yards of sediment in the Seattle harbor. To the north at Everett, Washington, silt from the Snohomish River continually threatened to undo the navigation improvement begun in the 1890s. By the later 1940s, controlling depths in portions of the harbor ranged from 12.6 feet to less than two feet. As Colonel Leland Hewitt, Seattle District Engineer, reported in February 1948, "Much of the past work has proved to be of an experimental nature." Colonel Hewitt also noted changes in the economic base of Everett. Pulp and paper production were replacing lumber manufacturing as the mainstay of the community's economy. Consequently, deep-draft ships, used for the export of lumber, called at the port less often; and smaller-draft vessels sufficed to ship pulp and paper products. Colonel Hewitt added that "small-boat traffic in Everett Harbor, particularly fishing and pleasure-boat traffic, has increased considerably in recent times."[9]

To accommodate the new navigation requirements, Colonel Hewitt proposed deepening of the existing harbor channel to 15 feet, as well as increasing its width. In addition, he recommended removing another section of the old closing dike at the mouth of the Snohomish River to reduce deposition of sediment. The colonel concluded by observing that "although the 15-foot depth appears to be more than adequate for the present majority of present-day vessels, it is believed desirable to adopt that depth at this time to provide for the trend toward larger fishing vessels, and to allow for development of a more general freight traffic in connection with industrial establishments." The Corps submitted Colonel Hewitt's project to Congress in March 1950.[10]

Congress authorized the $736,000 undertaking in 1954, but the Eisenhower Administration's effort to cut federal spending delayed the start of work. Senator Warren Magnuson pressed both the Chief of Engineers and District officials in Seattle to make the project a higher priority. Senator Magnuson also told the Port of Everett officials that "you boys are going to have to do the main selling job" to get the Corps to move ahead on the project. The Seattle District finally completed the recommended channel improvement in 1957. The District carried out further work at Everett between 1960 and 1963, widening and extending the navigation channel by dredging at a cost of $492,000. The Corps also studied ways of reducing sedimentation through control works at the heads of Steamboat and Ebey sloughs. Annual dredging, however, proved necessary throughout most of the 1960s.[11]

Grays Harbor, South Jetty Deterioration
30 January 1962

At the south end of Puget Sound, the Corps found the Tacoma harbor easier to maintain, since the navigation improvements at Commencement Bay had involved dredging out the tide flats rather than the mouth of the Puyallup River. Nevertheless, the Corps had to perform periodic dredging to keep the silting at bay. Officials of the Port of Tacoma focused their energies on convincing the Corps to extend the 30-foot deep channel between the Port Industrial Waterway (originally called Wapato Waterway) and the Hylebos Waterway to stimulate industrial development. The Seattle District, however, saw no urgency in the proposed extension, since it was designed to attract new industry rather than to serve existing business.[12]

Senators Warren Magnuson and Henry Jackson once again proved potent federal legislative instruments for local development interests. In 1954, Congress authorized extension of the Port of Tacoma's Port Industrial Waterway at a federal cost of $956,000. The Seattle District completed dredging in 1956 with the removal of 662,000 cubic yards of sediment. When investors failed to build new piers and warehouses along the reclaimed harbor front, the Seattle District—despite the lack of private development—supported the port's call for increasing the channel depth to 40 feet.[13]

Corps officials at the headquarters in Washington, DC, however, rejected the Seattle District Engineer's proposal for improving the Port of Tacoma. Arguing that shipping needs were more than adequately met by existing waterway dimensions, Colonel Carl Brown of the Corps' Board of Engineers for Rivers and Harbors noted that "the economic analyses employed to justify the improvements is unusual." According to Colonel Brown and other critics, the District had computed freight savings for industries that did not exist and would never exist unless the 40 foot channel fostered development. For his part, the Seattle District Engineer, Colonel Robert Young, was outraged at the rejection of his proposal and at the failure of the North Pacific Division to support his findings before the Board. When emotions had cooled, negotiations between the various Corps offices and the Port of Tacoma resulted in an agreement to deepen Port Industrial Waterway to 35 feet. The Seattle District carried out the necessary dredging between June 1965 and October 1966. Tacoma's harbor handled commerce averaging 5.5 million tons between 1958 and 1967.[14]

Not to be outdone by its sister port, Seattle pressed for an extension of the Duwamish Waterway four miles upstream to serve an industrial park in the lower Green River Valley. This time, the District and all levels of the Corps' hierarchy rejected the appeal for a navigation improvement. The

Corps asserted that the proposal represented a questionable expenditure of federal funds. Ray Holmes, a Seattle District civilian official observed, "The proposal appeared to be a land reclamation and development project and as such had no justification for consideration as a Corps of Engineers improvement." During the 1950s and 1960s, the Seattle District confined its work at the Port of Seattle to maintenance of the existing waterways. The Corps' maintenance effort supported commerce in the Seattle Harbor that averaged 13.6 million tons between 1958 and 1967.[15]

Other river and harbor projects maintained and improved by the Seattle District during the 1950s and 1960s included the Anacortes, Bellingham, and Blaine harbors, Quillayute River, Swinomish Channel, Neah Bay, Port Townsend, and the Willapa River and Harbor. All of the District's work at these locations involved maintaining or enlarging dredged channels, basins, and rock breakwaters and revetments. In all, the Seattle District maintained 22 deep-draft projects in Washington, ensuring safe navigating conditions and efficient access to ports. In addition, the Lake Washington Ship Canal required annual operation and maintenance activities. This project was one of the District's most popular. It consisted of two navigational locks, a dam and spillway, a fish ladder, a world-famous seven-acre botanical garden, and a visitor center. The Corps used the dam to regulate the freshwater levels of the ship canal and lakes. By preventing excessive salt water intrusion, the Corps protected the freshwater ecosystem of the lakes. Annually, an average of 75,000 vessels of all sizes used the navigation locks, including pleasure craft, fishing boats, sand and gravel barges, small freighters, and tugs. Over two million tons of commercial cargo transited the locks annually during the 1960s.[16]

The Seattle District's traditional rivers and harbors functions did respond to new uses occurring in coastal harbors following World War II. The rapid growth of fishing and recreational craft along the western coast of Washington brought calls for the expansion of harbor facilities in many locations. Seattle boasted the highest per-capita pleasure boat ownership in the nation. According to one Corps study, Puget Sound alone had at least 97 sites suitable for constructing small boat harbors. Both the Corps and Washington's congressional delegation supported building such harbors because of the positive image generated among the boating public by these improvements and because of their relatively low cost.[17]

In the 1950s, the Seattle District provided new or expanded small boat harbors at many points on Puget Sound and the Strait of Juan de Fuca. These locations included Anacortes, Bellingham, Blaine, Port Angeles, Port Townsend, and the cross-sound ferry terminus at Kingston. These projects, requiring excavation of a moorage basin and placement of protective breakwaters, involved a comparatively simple construction process and expenditures were comparatively modest in most cases. For example, the Seattle District built a 12 foot-deep basin and two pile breakwaters at Anacortes in 1957 at a cost of only $196,000.[18]

Shilshole Bay
12 April 57

One of the most important of the District's small boat projects was at Shilshole Bay, adjacent to the Lake Washington Ship Canal's western entrance. In response to Seattle's small craft owners' demand for increased moorage space, Congress in 1954 authorized $2.2 million for a 10- to 15-foot deep basin and 4,440 feet of breakwater at Shilshole Bay. The Seattle District completed the project in early 1958, but the Port of Seattle's tardy provision of dock facilities delayed its use by the public. When finally completed, the Shilshole Bay moorage proved a premier small boat haven for 1,600 pleasure craft and fishing boats.[19]

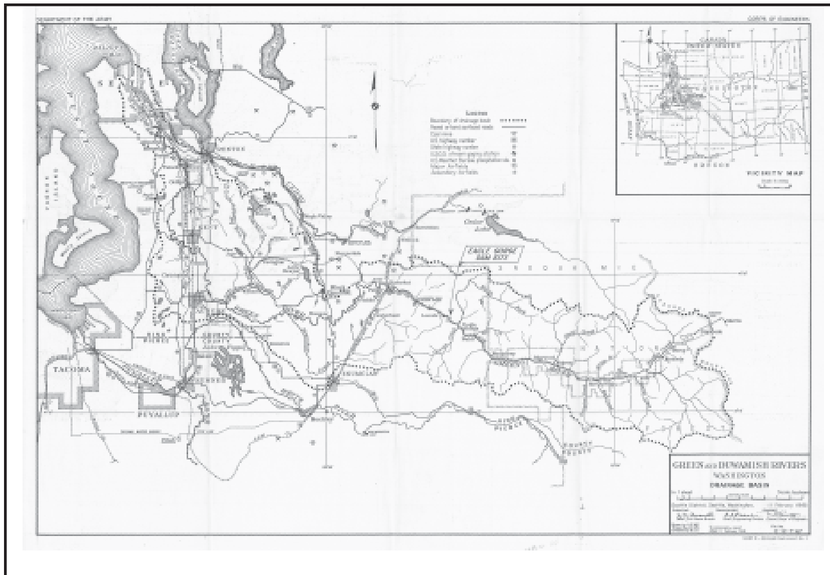
The Seattle District's rivers and harbors program during the 1950s provided for the full range of vessels navigating the waterways of western Washington. From Bellingham Bay on the northeast to Willapa Bay on the southwest, major port facilities accommodated the needs of oceangoing commerce. In addition, tugs, fishing and pleasure craft passed in increasing numbers into the newly provided small boat basins along the coastline and through the locks of the Lake Washington Ship Canal. Washington fisherman and weekend boaters could now count on having convenient, safe anchorages in a Corps-provided basin. In addition to rivers and harbor work, the Seattle District also constructed flood control dams west of the Cascade Mountains.

Howard Hanson Dam

In response to destructive flooding on the Green River, the Corps built the Eagle Gorge Dam (renamed the Howard A. Hanson Dam) in the late 1950s. The Green River rises in the Cascade Mountains and flows northwest for 60 miles until it joins with the Black River. From this junction, it is known as the Duwamish River, which continues north 12 miles where it enters Elliott Bay, a portion of the Puget Sound at Seattle. The lower section of the Duwamish River forms the Duwamish waterway, a major component of the Port of Seattle. The Corps maintained channel depths in the Duwamish and connecting east and west waterways to depths varying from 15 to 34 feet. The unimproved portions of the Duwamish River, however, experienced periodic flooding.[20]

The Green River Valley, a fertile agricultural area, periodically underwent severe flooding during the winter and spring runoffs, caused by rapid snow melt brought on by heavy rainfall and warm winds. Flash floods then roared down the steep river slope and spread across the valley floor from Auburn, Washington, to the Black River, an area roughly 3 miles wide and 20 miles long. Prior to 1906, this portion of the Green River, after it joined the Black in the vicinity of Auburn, was know as the White River; but a major flood in that year diverted the White River though the Stuck and Puyallup rivers to Commencement Bay at Tacoma. After the diversion became permanent, by means of a concrete dam and channel improvements, the river from its origins in the Cascades to its junction with the Black River became known as the Green River. Beginning in the 1920s, local interest lobbied for flood control and channel improvements on the Green River to protect agricultural land and to open the lower portion of the Duwamish River for future industrial development.

The Seattle District carried out two flood control studies in the early 1930s but absent specific federal authority allowing flood control work, recommended against a project. After passage of the Flood Control Act of 1936, the Corps again studied several options for flood control improvements; but the onset of World War II delayed any final proposal. The



Green and Duwamish Rivers
11 February 1948

Corps doubted whether enough benefits could be found to justify a federal project on the Green River drainage. Finally, in the late 1940s, the Seattle District studied the problem further and held several public hearings. Public testimony was divided over the issue of building a dam on the Green River. While commercial and agricultural interests strongly backed a storage dam, fishing interests opposed any project that would harm the river's natural spawning grounds. Howard Hanson, a Seattle attorney and leader in the Seattle Chamber of Commerce, spearheaded the drive for a federal flood control project for the Green River Valley from 1928 until Congress finally authorized the Eagle Gorge Dam in 1950. On behalf of the Seattle Chamber of Commerce, he tirelessly pointed out how flood control could help further development of industrial land on the lower Duwamish waterway.

The Seattle District ultimately proposed a dam at a site in Eagle Gorge, above the spawning grounds and an existing intake for the Tacoma water system. The Corps' proposed project, as reported in 1947, called for a multi-purpose dam and reservoir to provide flood control and storage for municipal water supply, irrigation, and pollution abatement. The release of stored water would also increase low summer river flows, benefiting fish. The Seattle District Engineer, however, could find no economic justification for an upriver extension of the Duwamish waterway improvement and recommended against any such federal project at that time. Local interests agreed to contribute $2 million to the project, which had an estimated cost of $18.3 million.

As initially proposed by the Corps, the Eagle Gorge Dam would have been a concrete gravity structure with an ungated spillway. Subsequent studies determined that foundation conditions necessitated a design change

Howard Hanson Dam Construction

Howard Hanson Dam Construction

to a rock-fill, earthen dam with a gated spillway on the left abutment. As built, the dam reached 235 feet above bedrock, and extended 675 feet in length along the top crest and 100 feet at the base of the dam. The width of the fill at the base of the dam extended 960 feet. The outlet works consisted of an intake tower on the left bank and a concrete-lined tunnel, 20 feet in diameter and 900 feet in length that emptied into a stilling basin at the base of the dam. A gated, concrete spillway on the left abutment contained two, 45-foot by 30-foot tainter gates. The rock fill contained 775,000 cubic yards of rock, and the sand and gravel core had 560,000 cubic yards of material. The reservoir had a storage capacity of 106,000 acre-feet, more than three times the storage required to control the largest flood of record.

The dam site, located in a narrow canyon of the Green River in the foothills of the Cascade Mountains, posed difficult geological conditions. Early site testing failed to reveal fully the complex nature of the rock and soil formations, resulting in difficult construction issues once work got underway.

In addition, the average annual rainfall of 90 inches hampered the pace of work. Also, since Tacoma drew its water supply from the Green River below the dam site, the contractor had to avoid muddying the water for lengthy periods. The immediate major concern facing the Seattle District stemmed from the need to relocate 14 miles of the mainline of the Northern Pacific Railroad, which crossed the entire length of the reservoir area. The Seattle District engineers initially estimated the relocation effort at $6 million or one-third of the cost of the dam.

Even though Congress authorized the Eagle Gorge Dam in the Flood Control Act of May 1950, the Seattle District was unable to start the project immediately. Because of the national emergency stemming from the Korean War, all new Corps projects had to receive certification as necessary to national defense. After gaining the required certification in May 1952, the project got some planning funds; but Congress did not appropriate construction money until 1955. By then, the design had changed from a concrete gravity structure to a rock-fill dam. Initial work focused on relocating the Northern Pacific Railroad. Contractors did not complete this difficult work, at a cost of $17 million, until 1959.

To overcome the various construction obstacles once work got underway on the dam embankment, the contractors, Henry J. Kaiser and Raymond International, devised a number of novel responses. For example, to avoid adding turbidity to the river, the contractor collected the worksite water runoff in two settling ponds where it then percolated back to the river through gravel filter beds. The contractors also built a horseshoe shaped concrete-lined tunnel and a cofferdam to reroute the river during the initial phase of construction. Both features eventually became part of the finished dam. To deal with the steep expanse of highly fractured rock above the diversion tunnel portals and spillway excavation, the contractors had to employ a large amount of rock bolting. After drilling and inserting bolts up to 40 feet in length into the rock, the workers then filled the bolt holes with grout and covered the area with heavy steel mesh to protect the workmen from any falling rock. In all, the contractors used four miles of rock bolts and 11,000 square yards of steel mesh.[21]

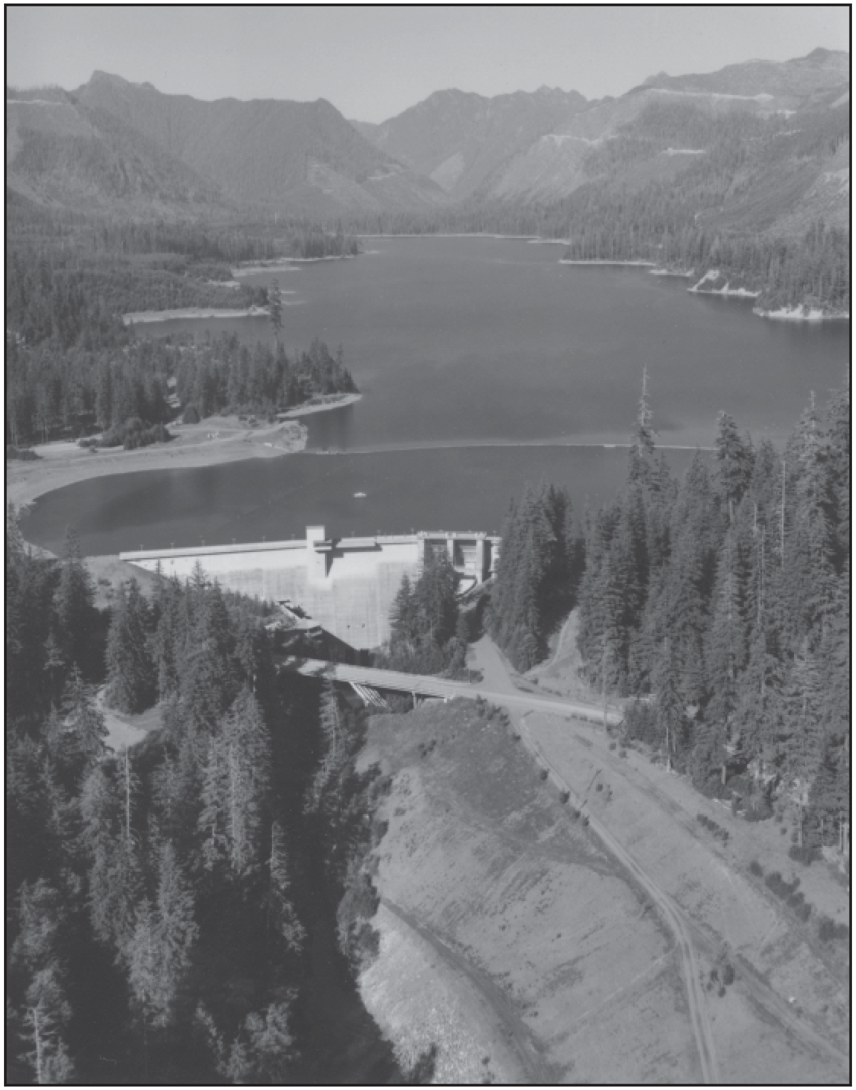
Unforeseen, unstable geological conditions also caused landslides at the dam site and required extra drainage measures to overcome the problem. In addition, high water in the flood of 1959 washed away part of the contractors' cofferdam, causing further delay. Although frustrated with the slowdown, Colonel Young, the Seattle District Engineer, refused to pressure the contractor into taking risky shortcuts to meet arbitrary schedules. He noted that "prudent supervision . . . will not permit us to accept the very serious risks that go with shortening the time available for the dam construction." To deal with the problem of blasting in wet ground, the contractors had to develop a process for packing ammonium nitrate in bags before placing the explosive. As work dragged on, costs escalated; and by the time of its completion in 1962, the Howard A. Hanson Dam project cost $39.5 million. Much of the cost increase resulted from the railroad relocation work.[22]

The dam soon proved its worth, containing flood waters in 1962 and 1965. During the latter event, a spring abruptly broke out about 350 feet downstream from the right abutment, threatening the stability of the dam. After careful study, the Seattle District in 1968 constructed a drainage tunnel that extended 650 feet into the right bank adjacent to the dam. This system adequately controlled abutment seepage during flood events. The engineers then drilled 12 relief wells to intersect and extend 20 feet below the tunnel floor to intercept the seepage. As a result of the flood protection provided by Howard A. Hanson Dam, the Green River Valley transformed itself from agriculture to industrial, commercial, and residential uses during the 1960s.[23]

Wynoochee Dam

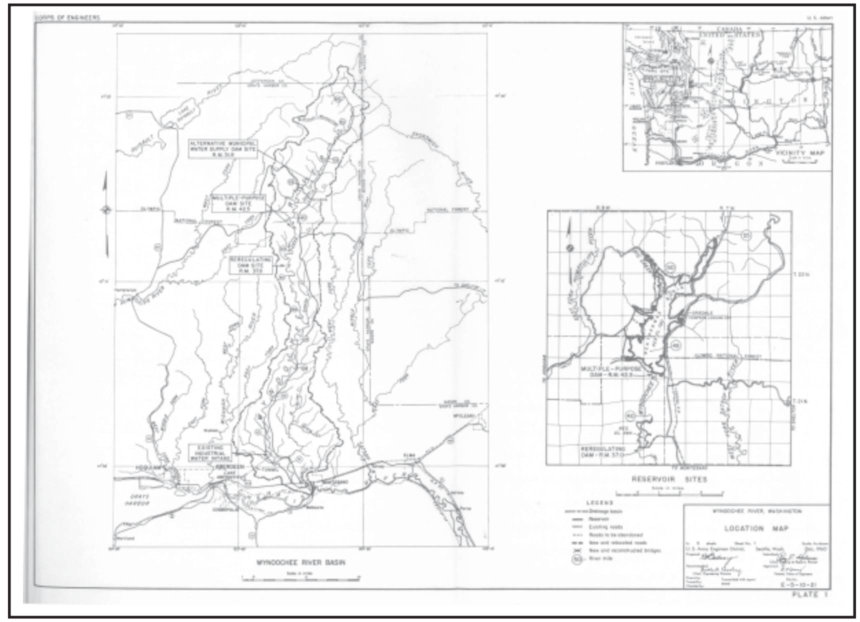
Just as the Seattle District completed work on Howard A. Hanson Dam, Congress authorized it to build Wynoochee Dam, primarily for flood control and water supply purposes. The Wynoochee Dam project originated partly out of local concerns over minor flooding problems in the Wynoochee River Valley but mostly from the city of Aberdeen's expressed need for an increased industrial water supply. The pulp and paper industry comprised the main economic activity in Aberdeen and by the late 1950s existing plants used all the reliable natural stream flow supplied by the 67 mile-long Wynoochee River.[24]

In a 1960 survey report ordered by Congress, the Seattle District recommended building a storage dam 42.5 miles upstream on the Wynoochee River for the combined purposes of flood control water supply, power, irrigation, and fisheries. Subsequently, on the advice of the Federal Power Commission, the Seattle District decided that power production could not be justified. Finally, Congress, in the Flood Control Act of 1962, authorized the Wynoochee Dam project, excluding the installation of power-generating facilities. The Seattle District then conducted new site-selection studies, which determined that a dam meeting all authorized project purposes should be located at river mile 51.8.



Wynoochee Dam

The Seattle District's Wynoochee Dam project called for a concrete gravity dam 660 feet long and 175 feet high, with a centrally-located spillway and earth fill dam extensions on each abutment. Two tainter gates, each 30 feet wide and 42 feet high, controlled flow over the spillway. The dam would create a reservoir 4.5 miles long, having a capacity of about 70,000 acre-feet. The project would triple minimum reliable stream flow and provide for existing and predicted flood control and irrigation needs. The proposed project also included facilities for collecting and transporting anadromous fish migrating upstream and fingerlings traveling downstream. The project required only minor road and bridge relocations. In 1968, the Seattle District estimated the proposed plan would cost $17.4 million. By



Wynoochee River Reservoir Sites
Dec 1960

federal law, local interests had to repay all construction costs allocated to water supply. In this case, Aberdeen agreed to repay $13 million of the construction costs over time. The Seattle District began construction in 1969 and completed the dam in 1972.

In the 1960s, while focusing its structural flood control efforts on the Wynoochee and Howard A. Hanson dams, the Seattle District also proposed to construct two multi-purpose storage reservoirs on the upper

Snoqualmie River to protect against flooding on the Snohomish watershed. The Snohomish River basin comprised the second largest in the Puget Sound region. Flooding along the basin's Snohomish, Snoqualmie, and Skykomish rivers plagued 35,000 acres of prime agricultural land, causing average annual damages of $2.5 million. The proposed storage reservoirs also would have increased municipal water supply, benefit downstream fisheries from augmented river flows, and provide enhanced recreational opportunities.

The proposed dams, however, sparked heavy opposition from environmental organizations and commercial timber companies. Environmentalists decried the loss of wilderness and scenic lands and further flood plain development. Timber interests feared the loss of productive private forest lands to reservoir development. Marginal flood control benefits and adamant opposition forced the Corps to eventually abandon the projects.[25]

Flood Fighting

Since Congress in 1936 established flood control as a federal concern and assigned the Corps of Engineers the key role in flood fighting, the agency has employed a two-pronged approach in carrying out its flood control mission. The Corps has tried to prevent floods by building upstream storage reservoirs—such as Mud Mountain, Howard A. Hanson, Wynoochee, and Libby dams—to contain excessive runoff and thereby reduce downstream flood stages. Often, however, suitable reservoir sites were limited by existing topography and hydrology; and even if sites met the necessary engineering criteria, economic, political, or environmental considerations prevented their use. The Corps' periodic effort to revise its multipurpose development of the Columbia River and tributaries to provide better flood control exemplified the problems posed in pursuing preventive approaches to flood control. If prevention through upstream storage proved impossible, then the Corps had to rely on traditional protective works such as levees, floodwalls, and channelization to hold back high flood stages. Whatever approach the Corps used, its projects had to be economically justified: the average annual benefits had to exceed the average annual flood damages before the Corps could proceed with an undertaking.

Congress gave the Corps some flexibility for urgently needed small flood control projects. In place of the requirement that each civil works project be individually authorized and funded, Congress delegated to the Secretary of the Army and the Corps of Engineers the authority and responsibility for selecting and funding emergency flood control projects under a special continuing authority program. Post-World War II amendments to the Flood Control Act of 1936 provided the specific legislative authorization and funding limits for such work and stipulated certain requirements of local cooperation. For example, Section 205 of the Flood Control Act of 1948 permitted the Corps to plan and construct small flood control projects that did not exceed $1 million per undertaking. Local interest had to provide financial participation in accordance with prevailing federal law. Section 208 of the Flood Control Act of 1954 allowed the Corps to carry out emergency snagging and clearing projects of less than $100,000 for flood control. Under the terms of Section 14 of the Flood Control Act of 1946, the Corps could engage in emergency bank protection for existing public works if the cost was under $50,000. Again, federal local cooperation requirements applied.[26]

The most important flood damage reduction measure available to the Corps came in Public Law 84-99 (PL-99) passed by Congress in 1955. This legislation authorized the Corps to engage in a broad range of emergency flood control measures, including advanced preparations, flood fighting, rescue operations, and repair and restoration of existing flood control works. The law set no monetary limits and established an emergency fund and authority to temporarily use other appropriations if necessary. The measure also emphasized that the Corps' advanced flood damage reduction measures were supplemental to local efforts and of a temporary nature, designed to meet an imminent flood threat. The local cooperation requirements for accomplishing advanced measures and rehabilitating flood control works were the same as those established in the Flood Control Act of 1936.[27]

Congress did establish rigid reporting controls to prevent the abuse of the continuing authorities program by the Corps. In general, the regulations required that each project be discrete and not merge with or overlap some other project; that it be investigated, justified economically and technically, and reported by a Corps of Engineers district; and reviewed and approved by higher authority in the agency. Congress, of course, retained its oversight through its annual program review and appropriations of the Corps' budget.

Typically, the Corps' continuing authority projects comprised a small part of the district workload. For example, in Fiscal Year 1967, the Seattle District carried out 11 Section 205 projects at an average cost of $10,000 each; 5 Section 14 projects, averaging $28,000; and 10 PL-99 projects, averaging $40,600. Over the twenty years between 1948 and 1968, the Seattle District spent about $7 million on spring flood fights. Floods in two years, 1956 and 1961 accounted for 75 percent of the total amount expended.[28]

The Seattle District's emergency flood fighting activities constituted one of its most visible public services. Like other Corps districts across the nation, the Seattle District maintained a trained, on-call group of engineers and technicians from throughout the organization ready to respond in a flood emergency. Those personnel were organized into teams and assigned in advance to specific river basins where floods often occurred. The Corps' periodic inspections of flood-prone areas provided the emergency response teams with a working knowledge of the flood problems that might be encountered. In addition, a District flood manual provided technical guidance, while a Disaster Control Center in the District's Operations Division mobilized and dispatched flood fighting teams to the scene of rising waters. The Seattle District also maintained a regular program of inspections for federally-constructed local flood protection projects operated and maintained by local interest to provide advice on any needed repairs.[29]

The Seattle District fought floods on both sides of the Cascade Mountains. The Nooksack, Skagit, Stillaguamish, and Snohomish rivers on the west slope of the Cascades proved particularly troublesome; while the Yakima, Wenatchee, Okanogan, Kootenai, Spokane, Clark Fork and Coeur d'Alene rivers regularly flooded east of the Cascades. The Seattle District's flood control activities in the Coeur d'Alene basin between 1936 and 1970 were typical of such undertakings, usually limited to emergency levee repairs and bank protection. The actual work, most often under the authority of PL-99, involved limited in-water movement of streambed or gravel bar materials by hired labor under the supervision of Corps personnel. Prior to 1970, the Seattle District conducted several studies for potential flood control undertakings in the Coeur d'Alene basin, but only two studies resulted in Congressionally-authorized projects. These projects provided protection against flood damage along the shoreline of Lake Coeur d'Alene in the City of Coeur d'Alene, Idaho, and along the banks of Placer Creek in Wallace, Idaho.[30]

Local interests built most of the flood control works on the Coeur d'Alene River and tributaries in the 1930s, using Works Progress Administration and Works Projects Administration financial assistance and oversight. The various works included channel straightening, cleaning, and lining; and the construction of cribbing, check dams, and revetments. Local diking districts also built dikes during the 1920s and 1930s to protect agricultural lands, and county governments constructed levees. Flood prevention proved difficult because of the swift water current from upstream and tributary sources having exceedingly steep gradients and side slopes. The Corps found no practicable or cost-effective structural method, such as a reservoir, for preventing the flooding problems on the Coeur d'Alene River and its tributaries.[31]

The earliest flood control work by the Corps in the Coeur D'Alene basin occurred in the late 1930s as a result of studies called for in the Flood Control Act of 1936. Based on the Corps' preliminary examination and surveys, Congress approved a project in 1938 to protect certain low-lying areas in the cities of Spokane, Washington, and Coeur d'Alene and St. Maries, Idaho, estimated to cost $308,000. The Corps carried out the initial project on Lake Coeur d'Alene at the city of Coeur d'Alene. The project, built between September 1940 and August 1941, provided a concrete and steel pile flood wall and levee for one and one-half miles along the lake and the Spokane River shore. The construction effort was confined largely to the bankline along the shore. The project, protecting the southwestern section of Coeur d'Alene, provided a freeboard of two feet when the lake reached an elevation 2,144 feet, the critical height resulting from the maximum possible flood.[32]

Prior to 1965, the Seattle District performed only limited flood control work in the Coeur d'Alene basin. In one project built in 1950, the Seattle District used Section 14 authority to construct bank stabilization along a highway on the Coeur d'Alene River at Springston, Idaho. In 1957, under PL-99 authority, the Corps carried out emergency repairs on two levees on the Coeur d'Alene River, compacting and reshaping the existing levees. In the aftermath of

Kootenai River Flood Fight
5 June 1961

flooding in the winter of 1964-65, the Corps and local interests repaired several levees and performed bank protection work on Pine Creek, Lake Creek, and Big Creek. The Seattle District responded to the threat of major flooding in the Coeur d'Alene River basin in 1969, with advanced flood emergency operations at six locations. The work involved primarily channel clearing and woody debris removal.[33]

At Placer Creek, a tributary of the South Fork of the Coeur d'Alene River, the Seattle District carried out both an emergency flood rehabilitation work and a Congressionally-authorized flood control project to replace existing flood control elements that were failing. Placer Creek flows northwesterly from a 15.6-square- mile, step-sided drainage basin through the City of Wallace, Idaho, to its confluence with the South Fork of the Coeur d'Alene River. Between 1896 and 1978, Wallace had endured six major floods.

In response to the flooding problem, Wallace intermittently improved the downstream reach of the creek. The improvements consisted of straightening and enlarging the channel and constructing concrete and log crib walls. During the early 1930s, the Works Progress Administration constructed a concrete flume, extending 550 feet upstream from the creek's mouth. The Flood of 1964 caused considerable damage to the city's flood protection works; and, under PL-99, the Corps carried out $105,000 in repair work. In 1965, the Seattle District followed up the temporary work with more durable repairs, noting at the time that such work would not correct the basic problems of an unstable channel. In 1965, the Congress directed the Corps to study the flooding problems on Placer Creek to determine the feasibility of further improvements for flood control. Based on its investigations, the Seattle District recommended constructing a concrete channel 5,000 feet long with an upstream debris barrier to confine Placer Creek flows at Wallace, at an estimated cost of $1.74 million. Congress authorized the project in 1970 but failed to appropriate funds for the project until 1978.[34]

Prior to 1970, the Seattle District had its most expensive and difficult flood fight in May and June, 1961, on the Kootenai River at Bonners Ferry, Idaho. The town sat at the head of a broad, flat valley containing rich agricultural land. Local farmers, to protect this developed land (known as Kootenai Flats) from flooding, had constructed over 100 miles of levees. The protective capabilities of the levee system varied greatly. After high water on the Kootenai began to threaten the levees near Bonners Ferry in late May, the Seattle District activated its Disaster Control Center and dispatched a flood fighting team to the area. By early June, levees began to fail and 6,237 acres flooded. The inundated area, however, represented only one-fifth of the diked land. This situation contrasted favorably with the great flood of 1948 when the high water crested 2 feet below the 1961 level but still flooded all diking districts. The difference stemmed from the Seattle District flood fight.[35]

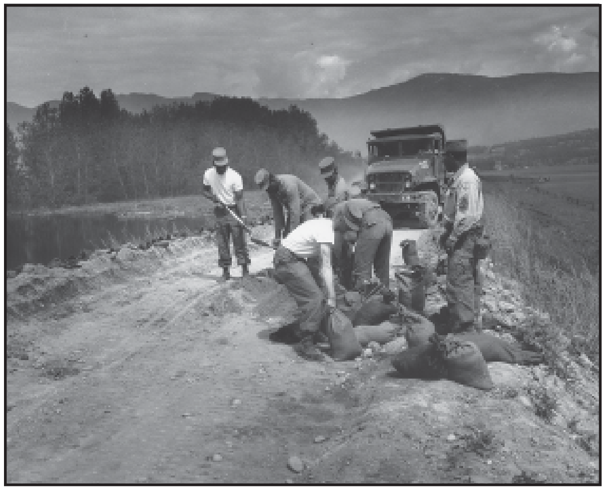
During the 1961 flood fight, the Corps marshaled 76 employees and 39 pieces of Corps equipment and supplemented this with 2,181 temporary laborers and 170 pieces of rented equipment. The flood fighting crew used 651,700 sand bags to strengthen the embattled levees. The Idaho National Guard and various other state, county, and municipal agencies helped with additional men and material. In all, the Seattle District spent $1.08 million on its portion of the flood fight. While the valley sustained $3.4 million in flood damages, the Corps' efforts prevented additional losses estimated at $3 million.[36]

Flood Plain Management

In spite of all the Corps' flood control efforts, the annual flood losses nationwide continued to mount. In 1958, water resources expert Gilbert White estimated that in the 34 years prior to 1936, total losses came to $4.1 billion, while between 1936 and 1958, flood damages amounted to $6.6 billion. The continued human encroachment on flood plains for housing, commercial, and industrial purposes resulted in ever greater losses from flooding. Until the late 1950s, nonstructural flood control measures, such as zoning and prohibiting or restricting building in flood-prone areas, played little part in Corps' programs. At the time, most Corps officials opposed regulating land use for flood protection for philosophical reasons. Corps leaders did not want to seem opposed to development, even in flood-prone areas. Ultimately, however, the question of regulation became a question of cost. The Chief of Engineers, Lieutenant General Samuel Sturgis framed the issue in these terms:

> The difficulties of prescribing and enforcing evacuation and rezoning must be weighed against the long-range requirements for development of an area and the effect thereof in aggravating natural flood conditions, increasing hazards to life and property, and future protection costs. Progress cannot be stopped, but it can be guided wisely.[37]

A new willingness on the part of the Corps in the late 1950s to consider nonstructural approaches to flood damage abatement resulted from recent studies in the field of flood prevention. Francis C. Murphy, an



Bonner's Ferry, Idaho Flood Fight
23 May 1956

experienced and widely respected hydrologist in the Seattle District, played a key role in disseminating this new research within the Corps. Murphy had been an engineering planner in the field of flood control for twenty years. At the invitation of Gilbert White of the University of Chicago, the Corps allowed Murphy to join White's research group in investigating new approaches to flood damage control.[38] Murphy's subsequent study published as *Regulating Flood Plain Development*, argued that managing development on the flood plain was a necessary and economical way to deal with the problem of flood damages. The key to effective flood plain management, he pointed out was developing hydrographic data and flood maps so that localities could adopt effective policies. He also suggested that carefully devised flood insurance could prove valuable in restricting flood plain development so that it was not just a subsidy for unwise growth. Murphy's work and recommendations reinforced the findings from other Corps' studies and reports that argued for the agency to take a lead role in gathering and disseminating flood data to allow the regulation of flood plain development.[39]

In January 1959, Murphy produced a brief overview of his work for use within the Corps. The Seattle District and the North Pacific Division endorsed the document and forwarded it to the Office of the Chief of Engineers. Murphy's overview was highly critical of Corps personnel. He charged that too many flood control engineers and administrators were either ignorant of or philosophically opposed to the meaning and use of various flood plain regulating techniques. Murphy also encouraged greater cooperation with local officials, observing that "I was given the impression that Corps relations with local communities leave something to be desired." Murphy observed that there was "a definite feeling that we are too dogmatic in our general attitude and in our presentation of engineering solutions . . . . We do not give local officials choices of alternative answers to problems but exhibit a 'take-it-or-leave-it' attitude." He also warned that "if we do not crystallize a positive approach to flood plain zoning and formulate needed zoning criteria, then this work may be done by other agencies."[40]

Murphy's call for an active Corps program of flood data gathering and dissemination struck a responsive chord within the Corps. The Chief of Engineers, Lieutenant General Emerson Itschner, was supportive and worked with the Senate Select Committee on National Water Resources to recommend the regulation of flood plain use. Finally, Congress took action. Based on draft legislation prepared by the Corps, the Flood Control Act of 1960 authorized

> the Secretary of the Army through the Corps of Engineers to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies, and general criteria for guidance in the use of flood plain areas; and to provided engineering advice to local interests for their use in planning to ameliorate the flood hazard.[41]

In 1961, the Seattle District initiated its flood plain information program. Under the program, the District carried out studies and prepared reports containing information on flood hazard potentials, standard project floods and flood frequency curves, and flood plain maps. By 1967, it had completed flood plain reports for the Stillaguamish, Nooksack, Skagit, Snohomish, and Sumas river basins. As the demand by local governments grew for flood plain management advice, the Corps responded in 1966 by establishing full-time flood plain management services in each district and division. By the late 1960s, the Seattle District's Flood Plain Management Service coordinated an expanding program of flood plain information with appropriate federal, state, and local governments in the effort to check heedless encroachment on the natural plains of the rivers within the District's jurisdiction. In 1969, the State of Washington began exercising control over development in flood plains by requiring construction permits and encouraging local governments to adopt flood plain regulations. In addition, the State mandated that local government regulations be based on the Corps' flood plain information reports.[42]

Water Resource Planning

The rise of environmentalism in the 1960s profoundly impacted the way the Corps went about the business of water resource development. Heightened public concern over the impact of water development projects on natural resources, wildlife, and anadromous fish required the Corps to adjust its project planning policies and procedures. During the 1960s, the Corps increasingly found itself on the defensive over environmental concerns related to its water projects and saw the necessity of addressing such issues more seriously within the planning process.

The administrations of Presidents Kennedy and Johnson were committed to a nationwide program of comprehensive and coordinated river-basin planning. In 1962, President Kennedy established an ad hoc Water Resources Council to oversee a series of federally-conducted comprehensive river basin studies to be completed by 1970. In 1965, Congress enacted the Water Resources Planning Act, which institutionalized the work of the ad hoc Water Resources Council by replacing it with the statutory Water Resources Council. This cabinet-level body—consisting of the Secretaries of Agriculture; Army; Interior; and Health, Education, and Welfare—sought to supervise river basin planning and prepare comprehensive and consistent executive branch water resources policies. The Council mainly focused on carrying out the nationwide comprehensive river basin planning goal. It exercised this responsibility partly through a revision of existing interagency water planning committees, such as the CBIAC in the Pacific Northwest.[43]

In March 1967, at the request of the governors of Oregon, Washington, Idaho, Montana, and Wyoming, the Council replaced the CBIAC with the Pacific Northwest River Basin Commission (PNRBC). This new body consisted of five members representing the requesting states, eight federal departments with water resources and related land use planning responsibilities, and a member representing the international United States-Canada Columbia River Treaty. The chairman of the PNRBC was appointed by the President of the United States. The PNRBC and river basin commissions were strictly planning agencies with no authority to construct and operate projects or regulate river flows. Through its technical staff in Vancouver, Washington, the PNRBC sought to coordinate regional comprehensive planning for water and related land resources.[44]

In the late 1960s, the Seattle District participated in two broad investigations under the PNRBC authority. One, a comprehensive study of the Puget Sound and adjacent waters, covered 12 counties and an area of 16,000 square miles. The Seattle District played a central role in carrying out the study and formulating recommendations for future water resources development. The District used 40 percent of the study's $3.25 million budget. A major finding of the Puget Sound study was that future power needs of the region could not be met by hydropower alone and that the main reliance would have to be placed upon nuclear energy. The study recommended that reactors be clustered near Puget Sound urban centers.[45]

The other investigation, the Columbia-North Pacific Study, was essentially an attempt to update the needs assessment for the continued development, use, and management of water and related land resources for the Pacific Northwest. The undertaking provided for 18 framework studies, covering the Columbia River basin, that part of the Great Basin in Oregon, and all of the coastal streams of Oregon and Washington. The study inventoried resources; projected water resources needs for the years, 1980, 2000, 2020; and prepared general frameworks to serve as guidelines for more detailed water resource planning in the future. The framework studies were not completed until after 1970. The Seattle District prepared information relative to its area of responsibility in the region.[46]

To better accomplish comprehensive water resources planning activities, the Corps worked to improve its internal planning processes and organization. This required it to hire more non-engineering professionals, such as economists, fish and wildlife biologists, and recreation planners, and to enhance the planning function within the engineering organization at all levels of the agency. This effort at internal organizational improvement proceeded slowly and initially achieved more success at the Office of the Chief of Engineers than in the districts and divisions during the 1960s. The Chief of Engineers established a Policy and Analysis Division in the Directorate of Civil Works in 1966 to formulate and disseminate policies governing the Corps' civil works program. Over time, this division became the center of influence for organizational and planning policy in the Chief's office. The decentralized decision-making process in the Corps, however, meant that organizational reform and policy change succeeded more slowly in the field. Corps districts, such as Seattle, would undergo more rapid change after 1970.[47]

Work for Other Corps Districts

Based on its engineering and design expertise, the Seattle District performed work for other Corps' districts. Some of these undertakings resulted from the North Pacific Division's need to balance work loads among its four civil works districts or provide emergency assistance. For example, Seattle District was called upon to perform site feasibility studies for the

Alaska District's proposed Rampart Dam on the Yukon River. Following the 1964 Alaskan earthquake, the Seattle District helped Alaska District by studying the geology and seismology of the Seward, Valdez and Homer areas. For Portland District, Seattle engineers prepared the main design memo for Applegate Dam.[48]

Some of the engineering and design work, however, assisted Corps districts in other parts of the nation. These efforts included work on the Hodges Village Dam for the New England Division; the Greenup Dam for Huntington District; the Markland Dam for Louisville District; and rehabilitation of the Tidal Basin and Lock, Inchon Harbor, Korea, for the Far East District. The Seattle District was chosen to assist with the Greenup and Markland dams because of its expertise in the design of large taintor gates and taintor gate anchorages. Other significant work for non-Corps agencies involved design, procurement, and construction supervision of veteran's hospitals at Spokane and Seattle and design work for alteration and rehabilitation of the Panama Canal locks. Also, the Seattle District's Real Estate office acquired the land for Priest Rapids Dam built by the Grant County, Washington, Public Utility District. The Walla Walla District, however, provided an opportunity for the Seattle District to perform its most significant piece of engineering work done for others.[49]

In the summer of 1960, when Congress appropriated money to begin construction of Lower Monumental Dam on the Snake River, the Walla Walla District found itself stretched to the limit with projects. It was completing Ice Harbor Dam on the Snake and fully engaged in major construction on the John Day Dam on the Columbia River. It also had initiated planning for the next dam to be built on the Snake River, Little Goose. In 1962, with Walla Walla District's staff overworked and Seattle District employees facing possible layoffs from a lack of work, the Division Engineer assigned the Seattle District responsibility for design, procurement, supervision of construction, and railroad relocation for the Lower Monumental Dam project. Walla Walla District, which had supervised initial planning and construction, remained in charge of overall project planning and of design for the powerhouse, fish ladders and the navigation lock. Upon completion of the project, Walla Walla District assumed operation and maintenance responsibility for the dam.[50]

The Lower Monumental Dam, part of the Corps' four-dam Lower Snake River Development, proved a major construction undertaking for the Seattle District. The dam consisted of an eight-bay concrete spillway section, 352 feet long, and a six-unit powerhouse, 695 feet in length. It also contained a 695 foot-long navigation lock with a lift of 83 feet and fish passage facilities for anadromous fish. The project required relocation of nearly 37 miles of railroad track and resulted in the design and construction of the first prestressed concrete railway bridges in the country. The Corps initially installed three power units of 135,000 kilowatt capacity each; it later added three additional units, bringing the ultimate power capacity to 810,000 kilowatts.[51]

High water, fishery concerns, and archaeological issues bedeviled the builders of Lower Monumental Dam. Since the Snake River supported an important anadromous fishery, maintaining fish passage during construction became a major concern. The Seattle District engineers provided a variety of temporary passage facilities each year around the active construction areas until 1969 when they put the permanent fish ladders into service. Another problem arose when large floods occurred in 1964 and 1967. The massive flood of December 1964 breached the cofferdam and inundated the construction site and delayed work for three months. The cofferdam again failed in April 1965 and workers were unable to complete repairs until August of that year. High water in the spring of 1967 once again threatened to overtop the cofferdam. To avoid this happening, the contractor opened the navigation lock to divert part of the river flow. The gamble worked and construction proceeded within the cofferdam enclosure. At the peak of construction, the Seattle District supervised contractors who employed more than 1,000 laborers at the site. The Seattle District completed the dam in 1969 at a cost of $177 million.[52]

When work began on Lower Monumental Dam, archaeologists pointed out that the area to be covered by the dam's reservoir contained significant prehistoric remains. One site in particular, known as the Marmes Rockshelter, intrigued archaeologists. With funding provided by the U. S. Park Service and the Corps, archaeologists began a race against time to recover as much data as possible before the dam's backwaters covered the Marmes site. Initial discoveries revealed bone fragments and other cultural remains at least 11,000 years old. The importance of these artifacts and human remains caused the Corps to provide $120,000 to accelerate research and recovery during the spring of 1968. In August 1968, under pressure from the archaeological community and Senator Warren Magnuson, the Corps agreed to construct a temporary levee to protect the cave area from impending inundation while dam construction proceeded. In October, the Corps decided to make the levee permanent; and after President Lyndon

Johnson gave his approval, the Walla Walla District designed the structure and the Seattle District supervised construction.[53]

The Corps had to complete the levee in time to allow the pool rise necessary for operating the fish ladders, which were essential to passing the annual spring anadromous fish runs. Even though it lacked the time to adequately explore the bedrock, the Seattle District completed the levee by the agreed time in February, gambling that the structure would hold. The Corps lost the wager, however, as the porous foundation allowed heavy seepage of backwater into the levee enclosure. The flow of water exceeded the capacity of the pumps trying to remove it. The Corps temporarily lowered the reservoir but lacked the time to fix the leak, lying at 100 to 200 feet beneath the levee, before the migrating salmon and steelhead arrived at the dam seeking passage up stream. Instead, crews covered the site with plastic sheets and dumped fill over the top of them to preserve the stratigraphic record. Archaeologists then watched as the engineers removed the pumps and 40 feet of water covered the area. While the Corps remained ready to dewater the site, they never received authorization or funding to carry out the task.

Military Program

From 1941 to 1970, Seattle District had a military construction mission as well as its civil works responsibilities. The District's primary military role consisted of supporting the defensive build up of the United States in response to the military threat posed by Soviet Russia and Communist China during the Cold War era. The Seattle District undertook the design, construction, and modernization of facilities at Army and Air Force installations throughout the Pacific Northwest, including Montana. The program included designing and building installations needed for newly developed weapons systems; troop support facilities such as housing, medical, and recreation buildings; new or expanded airfields for defense units; training camps; petroleum storage and dispensing operations; enemy aircraft and missile detection and interception networks; and various ground defense systems. As an indication of the magnitude of such work, at the height of the Korean conflict in 1952, Seattle District had a military construction program totaling more than $54 million.[54]

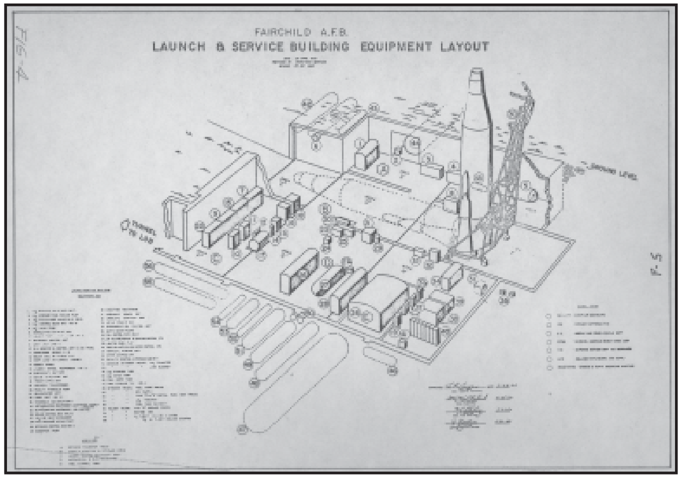
The major thrust of the Seattle District's military program over time focused on supporting the efforts to counter the perceived threat from Soviet Russia's long range bombers and intercontinental missiles armed with atomic weapons. These efforts involved building throughout the Pacific Northwest aircraft warning and interception systems; supporting civil defense programs; and constructing various missile installations, such as the Nike, Bomarc, Atlas, and Minuteman.[55]

In response to the perceived Soviet threat after 1949, the Air Force directed the Corps to construct a radar network to cover major metropolitan areas throughout the nation and Atomic Energy Commission sites in Washington and New Mexico. In the early 1950s, the Corps built 75 permanent radar stations in the continental United States and ten in Alaska. In addition, mobile radar sites were constructed to supplement the permanent installations. Technological advances led to constant upgrading of the radar network during the 1950s and 1960s.[56]

The initial defensive tasks of the Seattle District centered on building or upgrading the radar warning systems located in the Pacific Northwest and Alaska. The District initially built 50 so-called "gap filler" radar stations for the Air Control and Warning system in the Pacific Northwest and many sites for the Distant Early Warning (DEW) in Alaska. The long-time Chief of the Design Branch in the Seattle District, Edwin Derrick, observed that much of the District's work on radar systems became obsolete before it was finished:

> The first radar that was available was not as effective as it should be so we put up a bunch of what are known as "gap-fillers" on high ridges in between the radar stations to plug their blind spots. We built tortuous roads up to the tops of these knolls or peaks, and built small concrete structures to house the radar. By the time we got these built, there was no need for them because the newer designs of radar had improved range and efficiency so much that there were no more gaps. The Forest Service got a lot of free roads for fire-fighting purposes and hundreds of hunters and fishermen got free access roads to different parts of the wilderness.[57]

Since many of the DEW line sites were in the Arctic north and accessible only via the Bering Sea and Arctic Ocean, the Seattle District had a major logistic challenge to overcome. During winter, the Corps assembled shipments of heavy construction materials and maintenance supplies on Pier 37 in the Seattle harbor. Shipments were then timed to coincide with the breakup of arctic ice so that charter vessels and barges could make delivery and return during the brief open-water season. As Sherman Green, an early chronicler of the Seattle District noted, "the story of this battle against the rigors of the far north rivals that of the Aleutian campaign, lacking only the hazards of enemy attack but involving forces equally fearsome—the arctic floes."[58]

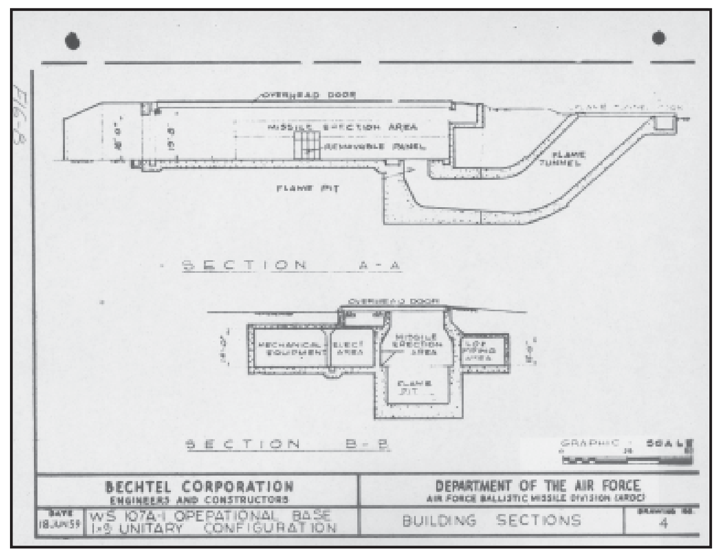


Fairchild AFB Launch and Service Building Equipment Layout

At the same time that the Seattle District added to the aircraft detection system, it designed and constructed new or converted older facilities for fighter-interceptor and Strategic Air Command bases. As Derrick noted, these tasks kept the District busy: "Some years we might have 75-100 projects to build for the Air Force and maybe 25 to build for the Army at the same time, plus our civil work. The kind of work we did ranged from the Air Force base at Glasgow, Montana, to Fort Lewis and McChord Air Force base, to Fairchild Air Force base [all in Washington], to Umatilla Ordnance Depot in Oregon and Camp Adair in Oregon, and on and on." Fort Lewis and McChord AFB absorbed much of the District's attention. Derrick listed typical projects for those installations such as "motor pool facilities, gasoline dispensing facilities, airfield pavements, hangars, hospitals, aircraft control towers and a munitions storage area—you name it, just one kind of job after another." In an effort to improve base housing for soldiers at Fort Lewis in the early 1960s, the Seattle District supervised the construction of 1,356 units of Capehart housing. Congress had created the Capehart program in 1955 to overcome an acute shortage of military family housing during the Cold War era. Located on or near military installations, private developers financed and built the Capehart units while the military operated and maintained them.[59]

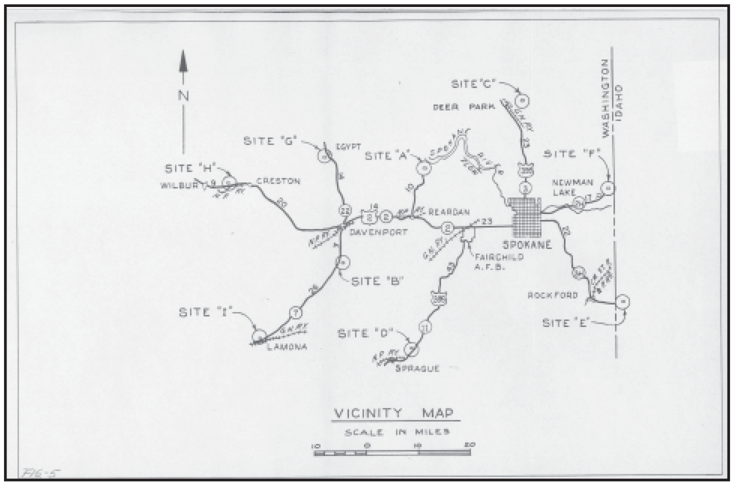
Uncertainty over the capability of the nation's defenses against enemy airborne attack during the 1950s led to a nationwide civil defense program. The Seattle District conducted surveys to find suitable places, usually in basements of buildings, to shelter people and stock supplies in case emergency evacuations proved necessary. Seattle District engineers attended courses in shelter design and in implementing methods for detecting and copying with nuclear radiation hazard.

The major defensive response to the threat from high-flying aircraft armed with conventional or nuclear weapons involved the installation of surface-to-air missile batteries around 40 major American cities and military/industrial centers. Between 1953 and 1963, the Nike defense system included approximately 300 batteries in the United States. Over time, the Army replaced the first generation Nike-Ajax missile with more advanced versions known as Nike-Hercules and finally, Nike-Zeus systems. Although located near large population centers, Nike missile bases were low-scale, relatively obscure, facilities. The short active life of the Nike system meant that the installations were closed and abandoned before many people realized the full extent of what existed at a Nike site. With the exception of four bases in Florida and Alaska, the Army phased out all of the Nike batteries by 1974.[60]



Fairchild AFB WS 107A-1 Operational Base

The Army built the Nike bases from standardized plans, arranging their various components to fit the specific landscape and military needs of each site. Typically, the Nike sites consisted of launching pads, missile assembly and testing facilities, radar pads, storage and administrative facilities, barracks for 80 to 110 men, canine kennels, shop facilities, utilities, and roads. The Corps had the mission to acquire the sites and supervise the construction of the Nike bases. The Seattle District had responsibility for building 14 Nike-Ajax and



Fairchild Site Map

or Nike-Hercules facilities in the vicinity of Seattle and Spokane. The District acquired real estate, conducted site feasibility studies, adapted facilities plans, and supervised construction in the field. In the case of the Nike sites adjacent to Fairchild AFB and near Seattle, it also provided a total of 64 units of off-post housing (Capehart). When the Army deactivated the Nike bases, the Seattle District handled the real estate disposal actions for the Seattle and Spokane facilities. The district also remodeled the Nike site north of Seattle into a headquarters for the Federal Emergency Management Agency.[61]

As part of its military mission, the Seattle District was involved in the Air Force's missile defense program, known as Bomarc. While the Army developed the Nike system, the Air Force simultaneously worked on its own surface-to-air missile program. The Seattle District nearly completed Bomarc installations at Paine Field, Washington, and Camp Adair, Oregon, before the Department of Defense suspended the program. The sites were never manned or armed.

The Seattle District found its responsibilities for the Atlas Intercontinental Ballistic Missile (ICBM) program the most complex undertaking of the various missile programs in which it was involved. Following the Soviet launch of Sputnik in 1957, the United States accelerated its missile program. Nuclear deterrence through an arsenal of ICBMs became the primary means of preventing war. As the construction agent for the Air Force, the Corps built the Atlas bases. In 1958, the Seattle District began developing nine Alas sites near Fairchild AFB, Spokane. The District established an Area Field Office at Fairchild in January 1959 and started construction in May of that year. While its responsibilities for siting Atlas bases were much the same as in the previous Nike and Bomarc projects, the new work proved more complex and exacting. The liquid-fueled Atlas required massive excavation and underground construction of the launcher operations facilities, including duplicate power generators, and an above-ground operations building at each site.[62]

The technical systems installed under District supervision necessitated meticulous oversight and safeguards. For example, the Atlas relied on a mixture of highly flammable fuel and liquid oxygen for propulsion. Both ingredients were stored underground and had to be pumped rapidly into the rockets prior to firing. The selection and installation of equipment for safely handling the liquid oxygen, kept at extremely low temperatures and high pressure, proved especially demanding. The material for tanks, pumps, and pipe fittings had to be high quality stainless steel alloys of special design and strength. The assembled liquid oxygen systems had to be leak proof and chemically clean, since any contact with flammable matter would cause instant, explosive combustion.

To achieve the necessary level of safety, the Corps minutely inspected and tested every component of the Atlas oxygen systems before their installation. At the completion of the construction phase of the initial three of nine Fairchild Atlas bases, Colonel R. P. Young, Seattle District Engineer, described the unusual standard of cleanliness necessary for assembling the complex system of pipes and valves in the missile launch building: "one of the requirements is that the piping shall contain no particle of dust larger than 150 microns." He went on to note, that "greases and oils are equally unacceptable and the slightest trace of either is enough to cause rejection of the piece of pipe concerned. . . . The insides of pipes and valves are cleaned by soaking in special chemicals, by scrubbing with brushes, abrasives and by further rinsing and washing in other chemical

ICBM Missile Site and Supporting Facility

solutions. The term 'surgically clean' has been applied to the condition that must be achieved."[63]

Two other problems complicated the Atlas project. A national steel strike occurred just as construction got underway, delaying the delivery of critical supplies such as blast doors. Supply disruptions in turn caused further delays by upsetting the coordination and timely sequencing of work at the sites. In addition, the Air Force was still designing and testing the missiles while construction of launching facilities and supporting installations was taking place, causing the Corps and its contractors to deal with many change orders. Major changes included redesign of the fuel storage tank system and revisions to much of the electrical and mechanical work. In all, 459 modifications added $6.6 million to the project costs.[64]

By September 1960, the Seattle District had completed the initial Atlas sites near Fairchild AFB, and the Air Force had begun to install additional specialized equipment and prepare the launch facilities for operational status. By the end of 1960, the Seattle District completed the construction phase for all nine sites at a cost of $32.5 million. As Colonel Young observed, the "completion of the nine ICBM missile sites and supporting facilities in the Spokane area has been a real challenge both to the Corps and the construction contractors." He assured the public that "the Corps of Engineers recognizes the great significance of this work to our national defense effort."[65]

The Seattle District had barely completed its work on the Atlas ICBM program when it received a new missile site construction task. The Air Force designed the solid fuel Minuteman ICBM to replace the Atlas missile; and, as the construction agent for the Air Force, the Corps established the Corps of Engineers Ballistic Missile Construction Office (CEBMCO) in August 1960 to carry out the crash program to build the Minuteman launching sites. Working under CEMBCO, the Seattle accomplished the advance engineering and real estate acquisition for 15 Minuteman launch control locations and 150 launch sites in Montana. The District work, directed out of a field office in Great Falls, Montana, included site feasibility studies, surveys, soils and foundation investigations, and utilities at the control sites. The Seattle District Design Review Section also performed design constructability and quality control review for other CEMBCO installations early in the missile program.[66]

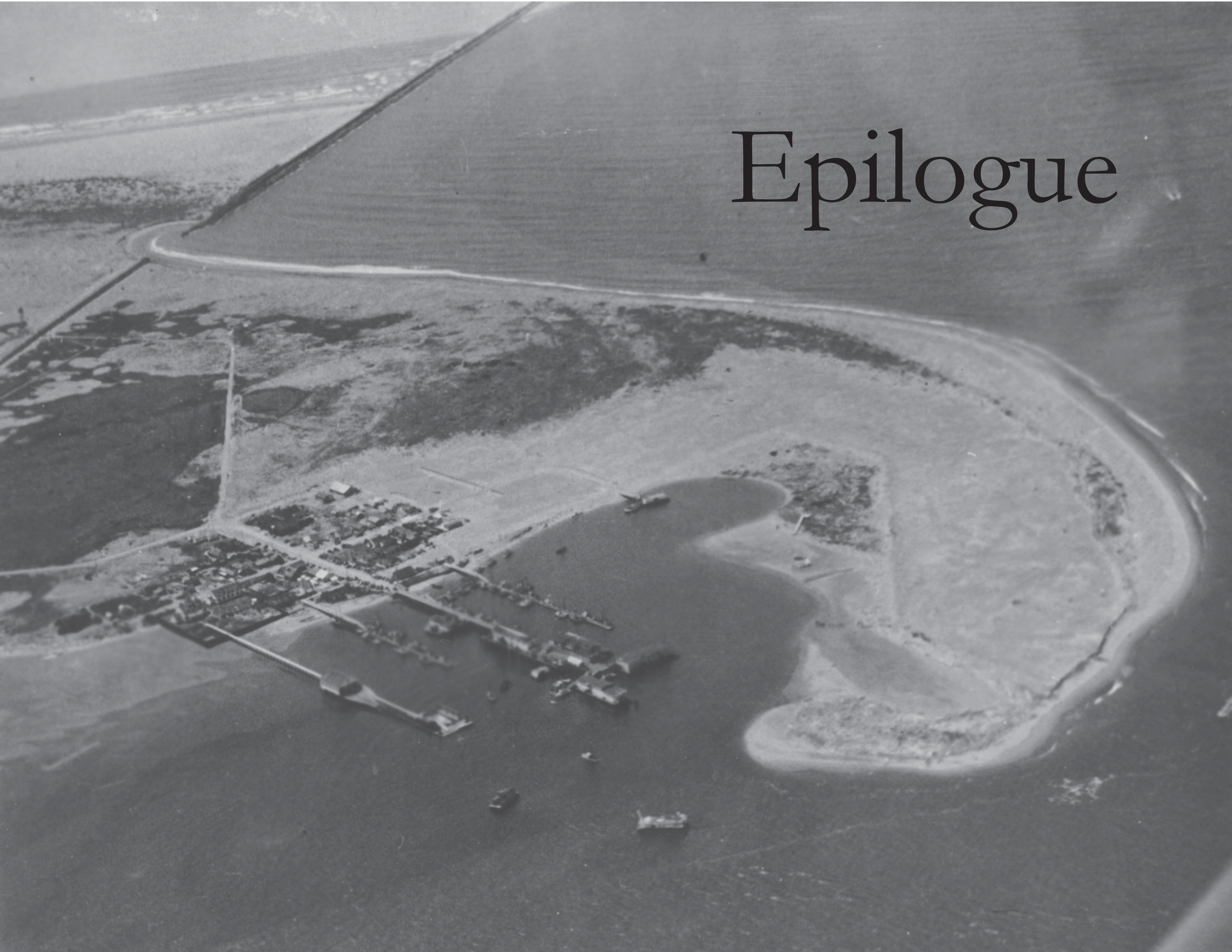
The most complex part of the effort in Montana involved securing all the land rights necessary for construction and operation of the entire missile complex. The fact that the physical components of the missile launching and control facilities were still in an early stage of development when the Seattle District Real Estate Office began its assignment vastly complicated the land acquisition program. As layouts and designs changed, the real estate personnel had to revise and refine their program to conform to altered requirements. Often, original rights of entry or easements expired and had to be renewed before actual construction got underway.[67]

The Corps' Minuteman program for land acquisition ultimately involved 5,200 tracts scattered across 20,000 square miles in north-central Montana. To accomplish its real estate undertaking, the Seattle District established field offices at Malmstrom AFB, Great Falls, and Conrad, Montana, staffed with up to 80 appraisers, negotiators, title searchers, and support personnel. There ensued a four year process of obtaining rights of entry; appraisal; negotiation of final easement, lease, or fee purchase; and recordation of final deed documents. Complicated ownership arrangements and clouded titles bedeviled the process. The real estate actions required for the communication and fire control cable line connecting all of the bases and sites was an enormous task in its own right, since it involved 1,800 miles of right-of-way. In 1964, the Seattle District was ordered to acquire real estate for an additional 55 launcher and control sites in Montana. Ultimately, the Corps purchased outright 420 acres and gained easements on another 7,125 acres.[68]

The Seattle District's military mission came to a sudden halt in 1970, when the Corps reorganized its military program. At that time, Seattle District's military responsibilities were transferred to the Sacramento District. The Facility Engineer at Fort Lewis soon grew unhappy with this move, because the Corps office in Sacramento was too distant to provide the kind of rapid response to post needs that the Seattle District had been able to achieve over time. With the return of a major national military construction program in the early 1980s, the Seattle District got its military mission back from the Sacramento District in 1981.[69]

For twenty-five years the Seattle District sustained a major design and construction program for both civil and military projects. This work encompassed building dams for both flood control and multipurpose water resources development. At the same time, the District continued the maintenance and expansion of its rivers and harbors improvements along the Washington coast. In response to the nation's Cold War defense needs, the Seattle District built radar and missile installations and provided design and construction support to Army and Air Force bases throughout the Pacific Northwest and Montana. To accomplish this wide diversity of undertakings required the focused efforts of talented professional and support personnel under strong leadership—both civilian and military. The epilogue will explore this part of the Seattle District history.

Epilogue



EPILOGUE

No discussion of the Seattle District history would be complete without a look at its people and processes. This is necessary to understand fully how the district has carried out its civil and military missions in the fifty years between 1920 and 1970. While changes in district military leadership occurred on a regular basis every two or three years, the civilian management and technical personnel showed great persistence over time. Given the great design and administration demands on the district's employees, this continuity proved an important element in its successful engineering and construction record.

Workforce and Personnel

By the late 1960s, the Seattle District workload had reached an all-time high, with the civil works portion amounting to a little over 91 percent of a budget totaling $97 million. Heavy engineering and construction responsibilities for Libby, Lower Monumental, and Wynoochee dams accounted for much of this effort. Other important parts of the Seattle District civil program included studies such as the Puget Sound and Adjacent Waters and Columbia-North Pacific Basin investigations. The district also had underway several minor river basin studies, harbor surveys, and flood plain management assessments.

From the beginnings of the multiple-purpose era in the 1930s, the civil work of the Corps of Engineers had become evermore complex. As technical aspects of water resources development became more demanding, the debate over the role of the federal government and its chief construction agency for navigation, flood control, and hydropower projects became more heated. The economic feasibility of civil works projects, expressed as a benefit-to-cost ratio, required the detailed and accurate gathering and analysis of data by Corps planners, economists, and engineers. Over time, the surveys and examinations conducted by the Corps' districts to determine the technical and economic feasibility of proposed civil works projects received ever closer public and Congressional scrutiny.

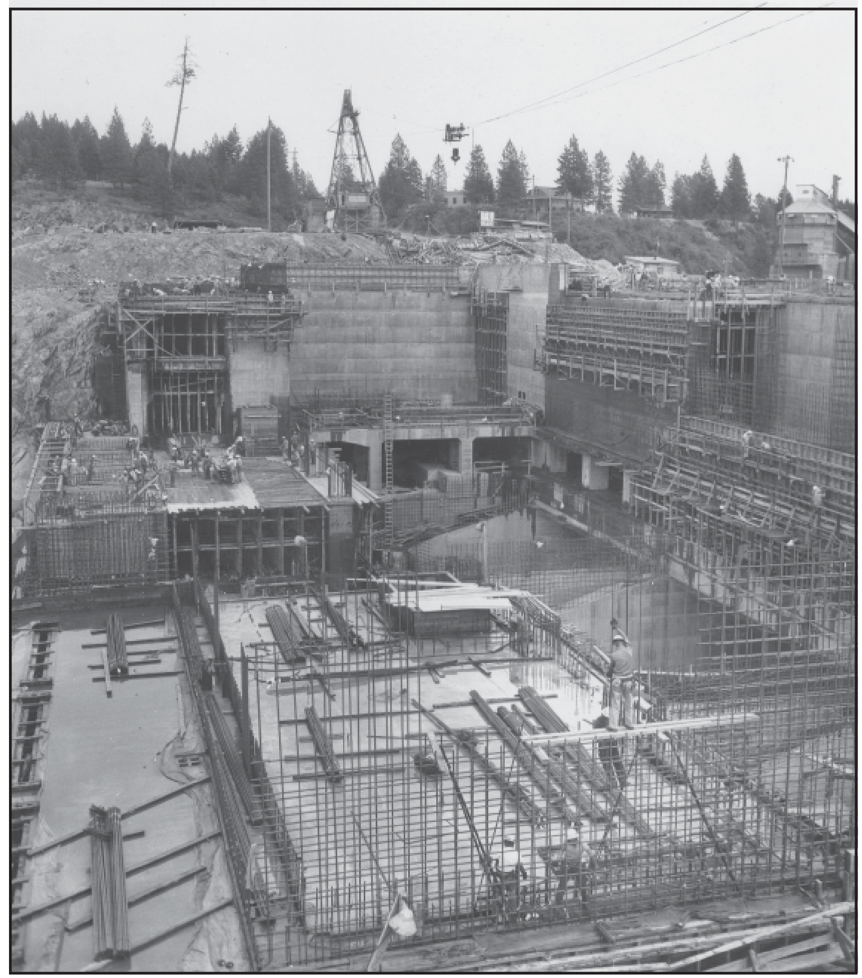
In spite of what some critics have charged, the Corps had a record of resisting water resources projects that lacked technical or economic merit. For example, between 1880 and 1941, only 70 out of 248 (28 percent) published engineering reports on proposed civil works projects by the Seattle District resulted in authorized undertakings. Over half of the investigations received unfavorable recommendations by the district, while another 20 percent failed to pass reviews by higher authorities, such as the Division Engineer, Board of Engineers for Rivers and Harbors, Chief of Engineers, or Congress. Since World War II, new environmental and budgetary constraints have worked to keep the Corps' proposed project survival rates low. Two examples of water resources projects that failed to survive the Corps' review process for economic or environmental reasons were the proposals to extend navigation on the upper Columbia River and to build the Ben Franklin Dam.[1]

The actual planning and administration of authorized civil works projects always has been problematic for the Corps, since no firm schedule or budget can be drawn until Congress actually appropriates funds. As Sherman Green noted in his earlier look at the Seattle District record, "even after . . . a project has been authorized by the Congress and approved by the President, no assumptions can be made about what times or in what amounts the funds for beginning construction or for successive stages of construction will be included in the President's budget, appropriated, and finally allocated to the local Engineer District for expenditure." Nevertheless, a district, in conducting its civil works program, had to carry out much preconstruction planning and scheduling in order to marshal the designers, contractors, manufactures, transportation companies, and all of the others who would contribute to a major construction project. As Green observed, Such diverse factors as the manufacturers' minimum required fabrication times for component equipment; the probable times, durations and magnitudes of high water in a stream, or other limiting physical conditions; the vicissitudes anticipated in acquiring real estate; the responses of local interest; and a host of other consideration must be evaluated and integrated into schedules of time, manpower, and money, then constantly revised as events upset initial schedules.[2]

Two examples from the Seattle District construction experience exemplify this point. Early in the construction Chief Joseph Dam, 24 alternative schedules, each requiring the interrelated operations of 104 construction contractors and equipment suppliers, had to be prepared in order to evaluate the contingencies that might result from a threatened cut in funds. In building the Albeni Falls Dam, the Seattle District encountered another challenging planning and administration situation. The district had the Albeni Falls project well underway when a Presidential Executive Order threatened to suspend all work. Most of the mechanical and electrical machinery was on order and soon to be delivered to the worksite. The district quickly prepared cost estimates determining that it would be far more expensive to terminate outstanding contracts or indefinitely store delivered machinery than to go ahead with completion of the project as scheduled. With these data, the district was allowed to finish the project.[3] The annual civil and military workloads of the Seattle District fluctuated greatly between

Albeni Falls
18 June 1953

1950 and 1970. During that time, the military program averaged $26 million, while the civilian program averaged $29 million. As Tables II and III reveal, however, both programs have shown great annual variations. The annual military work has swung between extreme highs and lows by 28 percent of the mean, while civil work experienced a similar annual deviation of 27 percent of the mean. Fortunately, the heavy and light programs for military and civil work did not occur at the same time, thus balancing out the overall workload. Nevertheless, the combined programs still demonstrated volatility, swinging through a variation of 152 percent of the mean. For example, the peaks and valleys in Seattle District's total workload showed dramatic changes over short periods of time, ranging from a low of $13



Albeni Falls
18 June 1953

million in 1949 to a high of $91 million in 1952. By 1958, the total District effort had dropped back to $47 million but then reversed course over the next few years, reaching $89 million in 1960. Two years later, however, it declined to $40 million only to change course once again and top out at $97 million in 1969.[4]

Such wide fluctuations in workloads could have had disastrous consequences for the stability of the workforce, causing corresponding cycles in hiring and firing employees. Several practices, however, helped to alleviate the problem. First, the district contracted out most of the project construction and fabrication work. Second, to stabilize technical design work through peak demand times, the district "shopped out" the work to consulting architects and engineers or to other Corps districts. On the other hand, when it had a low workload, the Seattle District could perform engineering design and construction supervision for other Corps districts. The sharing of work between Corps' offices minimized the hiring, firing, and disruptions of organizations that might have taken place, given the wide swings in yearly work requirements.[5]

Throughout all the changes in civil and military missions, programs and projects between 1920 and 1970, the Seattle District experienced a remarkable continuity of civilian leadership. For example, from 1918 until 1943, Harold Baker served as the chief civilian engineer on all civil and military work, overseeing the preparation of reports and the design and construction of authorized projects. From 1929 to 1931, he was in charge of preparing the Seattle District portion of the Columbia River 308 Report. Baker actually began his Corps career in 1903, overseeing construction of Fort Ward on Puget Sound. Baker's principal assistant for many years was Eugene Pease. He began working for the Seattle District in 1910 and continued until 1952. From 1932 to 1941, Pease was responsible for rivers and harbors and flood control investigations. After World War II, he served as Chief of the Engineering Division (1946-48) and, until he retired in 1952, acted as consultant to the District Engineer on special engineering problems related to the International Joint Commission. Pease also had a large role in preparing the 308 Report.[6]

Other long-term civilian employees of note prior to World War II included Edward Carpenter, Arthur Sargent, and Richard Davis. Carpenter served the Corps from 1892 to 1932. His most noteworthy work occurred as resident engineer at Grays Harbor, during construction of the jetties. Sargent's Corps career lasted from 1903 until 1942, supervising harbor defenses of Puget Sound and construction of the Lake Washington Ship Canal and Locks. Finally, Richard Davis held a number of important positions between 1905 and 1944. These involved various regulatory duties and river and harbor work. During World War II, he supervised the construction and repair of steel and wooden vessels for the Armed Services. This responsibility also included the inspection and rehabilitation of private ships purchased for military needs.[7]

Following World War II, another long-serving group of civilian engineers oversaw the demanding period of large dam building and military construction. From 1938 to 1962, Noble Bosley supervised the district's major civil and military design and construction work, serving successively as the Chief of the Design Branch and as Chief of the Engineering Division. Gerald Bletcher's government service lasted from 1935 to 1964. From 1952 to 1964, he was in charge of the Spokane Resident Office and oversaw a heavy load of military construction work and emergency flood response activity. Karel Smrha worked for the Seattle District from 1930 to 1965, becoming Chief of the Operations Division in 1950. He was responsible for the operations and maintenance of all completed civil works projects in the District. Lastly, Captain George Murch's government career spanned both the pre- and post-World War II periods. Beginning in 1920, he served successively as the Chief Engineer of the pipeline dredge *Oregon* and the snagboats *Swinomish* and *W. T. Preston*. In 1936 he became Master of the *W. T. Preston* and continued in that position until his retirement in 1962. Over the course of his 42 years of service with the Corps, he sustained a perfect safety record.[8]

Training and Development

During the post World War II period, employee training and development became increasingly important to the recruitment and retention of a productive workforce. These efforts grew from elementary courses aimed at self-improvement to more specialized instruction relating to technical subjects and workplace safety issues. A big boost to Corps' training and development program occurred in 1958 when Congress gave statutory recognition to civilian employee training. The subsequent Presidential Executive Order No. 10800 and several Department of Defense directives provided added emphasis, making "command and management responsible for the development of the individual to his top potentiality on the job."[9]

While much of the employee training and development effort in the Seattle District was the responsibility of the Personnel Office, the district also established an Employee Development Officer in 1960. The types of training given ranged from short courses in supervision and management to classes on the latest technical development in various engineering fields. The Seattle District also pioneered in the used of computers to track and store personnel training records. These early efforts at computerized record keeping and analysis of individual training progress and costs proved so useful that in 1965 other government agencies and the Office of the Chief of

Engineers requested information on the program.[10]

In 1964, the District Engineer, Colonel C. C. Holbrook established a District Training Committee to oversee an executive development seminar. Both Corps personnel and university instructors taught seminars on updated administrative techniques and decision making for upper management. In the mid-1960s, 187 employees completed the two-year course of developmental seminars. As a measure of the district's training efforts, the number of employee person hours of training rose from 50,658 to 102,017 between 1964 and 1968. Over that same time period, average person hours of training per employee increased from 48.1 to 83.9.[11]

The Seattle District found it challenging to recruit and retain young engineers. Heavy retirement and turnover rates in the late 1940s led the District to establish a recruitment and training program for newly graduated engineers. At the time, however, the federal pay scale for engineers—about two-thirds of the industry average—placed the Corps at a disadvantage. Over time, federal pay increased and a generous fringe benefit package helped to ease the recruit situation. From 1950 to 1968, the district managed to hire 182 recently graduated engineers; and 97 stayed to establish professional careers in the district. The training period for the junior engineers lasted 18 months, during which they worked in different elements of the district. This rotation process gave the newly-minted, young engineers experience in a variety of technical work and gained them a wide acquaintance with the people, organization, and work of the district. A senior staff engineer supervised each engineer trainee, offered advice, and ultimately assisted them in the selection of a regular assignment appropriate to the person's demonstrated interests and talents.[12]

Colonel Charles C. Holbrook
27 August 1964 - 1 September 1967

Fifty Years of Service

For 30 years from 1920 to 1970, the Seattle played an important role in water resources development and national defense in the Pacific Northwest. During World War II, the District constructed military installations throughout Washington and provided crucial supplies for the defense of Alaska. It assisted in the construction of the Hanford Works. In the Cold War era, the Seattle District built radar and missile defense sites and designed and constructed various kinds of facilities for Army and Air

Libby
27 March 1968

Libby
1 June 1968

Force bases in the Pacific Northwest and Montana. Military construction activities helped to even out some of the valleys in the district's civil workload during the 1950s and 1960s.

The Seattle District carried out significant water resources planning and development that helped to remake the environment and economy of the region. From single purpose navigation improvements on the Washington coast to multiple purpose dams on the Columbia River and its tributaries in eastern Washington, Idaho, and Montana, the Seattle District aided the growth of shipping, commerce, and industry. Its flood control projects contributed materially to the reduction of flood losses in the region. The Seattle District also conducted numerous feasibility and planning studies for various water resources improvements. In particular, the 308 Report of 1933 and its periodic updates over the next 30 years provided the blueprint for the multiple purpose development of the Columbia River basin.

To accomplish the ambitious plan for harnessing the potential benefits of the Columbia River, the Seattle District designed, built, and operated Chief Joseph, Albeni Falls, and Libby dams. These structures and other elements of the Corps' Columbia River program carried out by the Portland and Walla Walla Districts profoundly altered the environment, endangering some natural resources such as anadromous fish, while providing navigation, hydropower, and flood control benefits to the region. The noted historian, Richard White, has written that through the work of the Corps of Engineers and other federal agencies "the Columbia has become an organic machine which human beings manage without fully understanding what they have created. The organic machine has, in turn, spawned a virtual river whose life influences the actual Columbia." As the 1960s drew to a close, the development phase of the Columbia River's history was about to pass and a new era of managing the environmental and economic consequences of harnessing the power of the river was soon to begin. Over the next 30 years, the Seattle District would play a crucial role in the river's future, just as it had in the stream's past.[13]

In its years of service to the economic development of the Pacific Northwest, the Seattle District opened and maintained Washington's coastal rivers and harbors for world commerce. From 1920 to 1970, the district played a key role in remaking the Columbia River to serve the growing population of the region. In meeting the diverse water resources developments needs of the Pacific Northwest, the Seattle District carried on a proud tradition of Army engineering for the public benefit.

Appendix A

**DISTRICT ENGINEERS ASSIGNED
TO THE SEATTLE DISTRICT
1920-1970**

Name	Rank	From	To
J. A. Woodruff	Lt. Colonel	9 September 1919	11 August 1920
E. H. Schulz	Colonel	12 August 1920	16 May 1923
W. J. Barden	Colonel	19 June 1923	10 June 1927
John S. Butler	Major	20 July 1927	20 August 1931
C. L. Sturdevant	Colonel	21 August 1931	7 February 1935
H. J. Wild	Colonel	8 February 1935	10 August 1939
L. E. Atkins	Lt Colonel	11 August 1939	22 July 1940
Beverly C. Dunn	Colonel	23 July 1940	14 April 1942
P. Goerz	Lt Colonel	15 August 1942	6 December 1942
Richard Park	Colonel	1 December 1942	30 November 1943
Conrad P. Hardy	Colonel	1 December 1943	1 July 1946
L. H. Hewitt	Colonel	2 July 1946	11 July 1949
Emerson C. Itschner	Colonel	1 August 1949	11 July 1950
John P. Buehler	Colonel	25 August 1950	14 May 1952
Norman A. Matthias	Colonel	1 July 1952	30 June 1956
R. J. B. Page	Colonel	1 July 1956	21 June 1959
R. P. Young	Colonel	22 June 1959	15 October 1961
Ernest L. Perry	Colonel	31 October 1961	30 June 1964
Charles C. Holbrook	Colonel	27 August 1964	1 September 1967
Richard E. McConnell	Colonel	2 September 1967	10 July 1970
Howard L. Sargent	Colonel	11 July 1970	3 January 1972

Appendix B

WASHINGTON GROWTH [POPULATION]
1920-1970

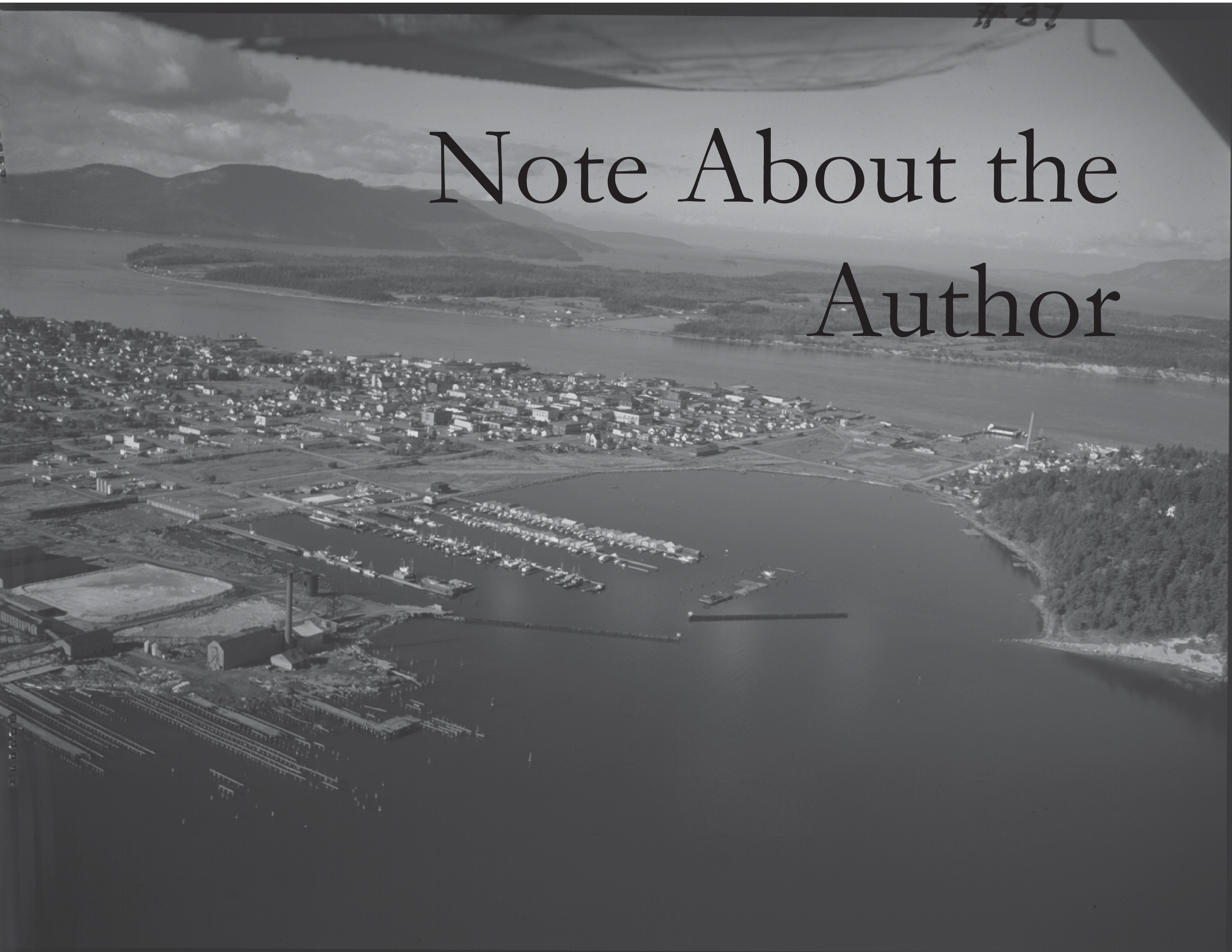
	1920	1930	1940	1950	1960	1970
NUMBER						
Washington	1,356,621	1,563,396	1,736,191	2,378,963	2,853,214	3,413,250
Seattle	315,312	365,583	368,302	467,591	557,087	530,831
Spokane	104,437	115,514	122,001	161,721	181,608	170,516
Tacoma	96,955	106,817	109,408	143,673	147,979	154,581
Walla Walla	15,503	15,976	18,109	24,102	24,536	23,619
PERCENTAGE CHANGE						
Washington		15.24	11.05	37.02	19.94	19.63
Seattle		15.94	0.74	26.96	19.14	-4.71
Spokane		10.61	5.62	32.56	12.30	-6.11
Tacoma		10.17	2.43	31.32	3.00	4.46
Walla Walla		3.05	13.35	33.09	1.80	-3.74

Source: 2005 DATA BOOK. Office of Financial Management, State of Washington.
Web address: http://www.ofm.wa.gov/databook/population/

Abbreviations

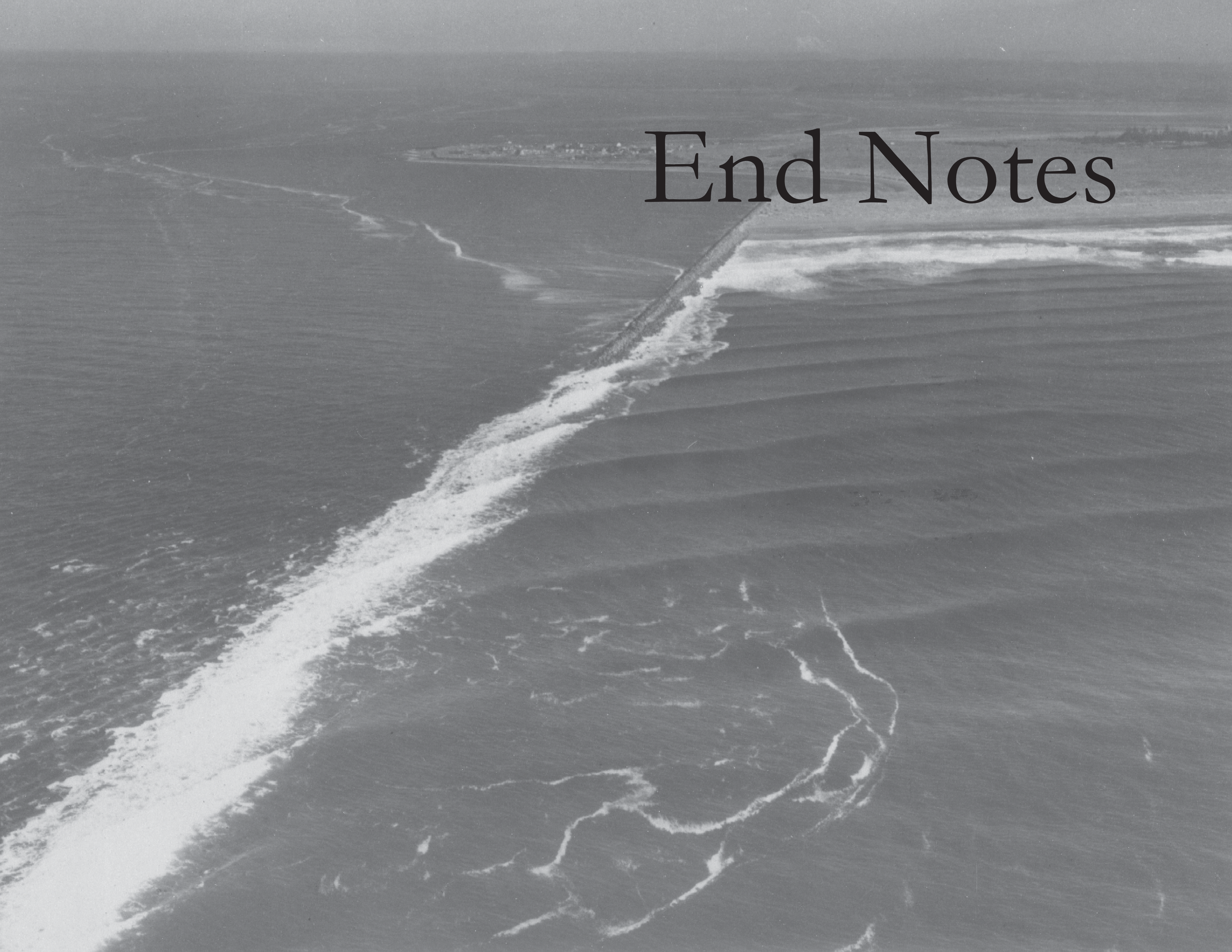
AFB, Air Force Base
ARCE, Annual Reports of the Chief of Engineers
BPA, Bonneville Power Administration
CBIA, Columbia Basin Inter-Agency Committee
CEBMCO, Corps of Engineers Ballistic Missile Construction Office
COL, Colonel
CVA, Columbia Valley Authority
DEW, Distant Early Warning
ED, Engineer Department
FIARBC, Federal Inter-Agency River Basins Commission
GIS, Geographic Information Systems
GPO, Government Printing Office
HD, House Document
ICBM, Intercontinental Ballistic Missile
IJC, International Joint Commission
IMO, Information Management Office
LCRFDP, Lower Columbia River Fishery Development Program
LTC, Lieutenant Colonel
NPD, North Pacific Division
PL, Public Law
RM, River Mile
TVA, Tennessee Valley Authority

Note About the Author



William F. Willingham served as Historian of the Portland District and the North Pacific Division of the Army Corps of Engineers, from 1981 to 1996. He graduated from Willamette University (1966) and earned his Ph.D. in history at the Northwestern University (1972). He taught at a number of colleges and universities including the University of Kentucky and Lewis and Clark College in Portland, Oregon. His previous writings include *Eliphalet Dyer, Connecticut Revolutionary* (1977); *Army Engineers and the Development of Oregon* (1983); *Water Power in the "Wilderness": The History of Bonneville Lock and Dam* (1987); *Northwest Passages: A History of the Seattle District, 1896-1920* (1992); *The Classic Houses of Portland Oregon, 1850-1950* (1999); *Service—Tradition—Change: A History of the Fort Worth District, U.S. Army Corps of Engineers 1975-1999* (2000); *Starting Over: Community Building on the Eastern Oregon Frontier* (2005); and numerous scholarly articles and reviews.

End Notes



Chapter 1

[1] U. S., *Statutes at Large*, v. 43, pt. 1, 1190; U. S. Cong., *House Doc.* No. 308, 69th Cong., 1st sess.

[2] U. S. Army Corps of Engineers, Office of History, *The History of the U. S. Army Corps of Engineers* (Washington, DC: GPO, 1998), 130.

[3] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge, MA: 1959); Beatrice H. Holmes, *A History of Federal Water Resources Programs, 1800-1960*, Miscellaneous Publication No. 1233 (Washington, DC: U. S. Dept. of Agriculture, Economic Research Service, 1972), 8-9; Mary E. Reed, *A History of the North Pacific Division* (Portland, OR: North Pacific Division, 1991), 24-29; William F. Willingham, *Army Engineers and the Development of Oregon, A History of the Portland District, U. S. Army Corps of Engineers* (Washington, DC: GPO, 1983), 92-93.

[4] Reed, *North Pacific Division*, 24.

[5] Quote in Reed, *North Pacific Division*, 24.

[6] For a discussion of the Corps' work in the Pacific Northwest prior to the 1920s, see Willingham, *Army Engineers*, 1-90; Willingham, *Northwest Passages: A History of the Seattle District U. S. Army Corps of Engineers, 1896-1920* (Seattle: Army Engineer District, Seattle, 1992), 1-116; Reed, *North Pacific Division*, 1-20, 24-25.

[7] The following discussion of the rival Columbia basin irrigation plans is based on Reed, *North Pacific Division*, 28, 34-35; Paul Pitzer, *Grand Coulee: Harnessing a Dream* (Pullman, WA: Washington State University Press, 1994), 9-59; Robert Ficken, *Rufus Woods, The Columbia River, and the Building of Modern Washington* (Pullman, WA: Washington State University Press, 1995), 95-139.

[21] *Spokane Spokesman Review*, "Jadwin to Push Basin Surveys," 22 Feb. 1929, clipping in RG 77 NARCS, SD, Box 151; Reed, *North Pacific Division*, 38; Pitzer, *Grand Coulee*, 52-53; Lieut. S. Matthew to District Engineer, 21 May 1930, RG 77, NARCS, SD, Box 153.

[22] Chief of Eng. to Col. Lukesh, 31 Oct. 1929, RG 77, NA, Box 299; Col. Lukesh to Chief, 20 Nov. 1929, ibid; see also Reed, *North Pacific Division*, 39.

[23] Col. Lukesh to Chief of Eng., 25 Nov. 1929, RG 77, NA, Box 299; Maj. Butler to Col. Lukesh, 9 Nov. 1929 and 17 Nov. 1929, RG 77, NARCS, SD, Box 152; Reed, *North Pacific Division*, 39-40; Willingham, *Army Engineers*, 93. Col. Lukesh also expressed considerable frustration with the overwhelming demands of his dual role as both division and district engineer. Portland District had a very heavy workload and, combined with the special responsibilities to coordinate and supervise the 308 studies of the Portland and Seattle Districts, meant that he was "unable to give each meritorious item of his division and district work the attention it deserves." The Chief of Engineers subsequently relieved Col. Lukesh of his district responsibilities. Col. Lukesh complained, too, that the instructions issued by the Chief's office had not been consistent, timely, or clear. Accordingly, Col. Lukesh requested new directions from headquarters and guidance covering preparation of the 308 Report. The Chief's office tartly responded that "a new circular of instructions for these reports is unnecessary since it appears that the district engineers in the North Pacific Division now understand what is desired." The Chief's spokesperson drove the point home, stating that "other district engineers have been submitting satisfactory reports under the instructions already issued." Maj. E. Daley to Col. Lukesh, 6 Dec. 1929, RG 77, NA, Box 299; Ficken, *Rufus Woods*, 104.

[24] Sen. Jones to Maj. Gen. Brown, 16 Dec. 1929, RG 77, NARCS, SD, Box 152; Brig. Gen. Deakyne to Sen. Jones, 13 Jan. 1930,

ibid.; Col. Lukesh to Chief of Eng., 31 Dec. 1929, ibid..

[25] Maj. Butler to Col. Lukesh, Memo, 17 Nov. 1929, RG 77, NARCS, SD, Box 152; Maj. Butler to Col. Lukesh, 9 Nov. 1929, ibid.; Col. Lukesh to Maj. Gen. Brown, 31 Dec. 1929, ibid.; see also, Col. Lukesh to Maj. Gen. Brown, 25 Nov. 1929 and 22 Dec. 1930, RG 77, NA, Box 299; Col. G. R. Lukesh, "The Columbia River System," *The Military Engineer*, XXII (August 1930): 328-35.

[26] Barry Dibble to Maj. Butler, 11 Aug. 1930, RG 77, NARCS, SD, Box 153; Hugh L. Cooper to Butler, 23 Apr. 1931, RG 77, NARCS, SD, Box 154.

[27] Maj. Butler to Maj. Gen. Jadwin, 2 May 1929, RG 77, NARCS, SD, Box 151; Maj. Butler to Mark Woodruff, 24 Feb. 1930, RG 77, NARCS, SD, Box 152; House Doc. 103, *Columbia River and minor Tributaries*, 568-570, 592-94, 607-11; see also Col. Lukesh to Maj. Gen. Brown, 25 Nov. 1929, RG 77 NA, Box 299; Maj. John S. Butler, "The Columbia River—for Irrigation and Power," *Civil Engineering*, vol. I (Sep. 1931): 1077-78.

[28] Maj. Butler to Maj. Gen. Brown, 12 Aug. 1930 (and endorsements), RG 77 NARCS, SD, Box 153; Maj. Butler to Col. Lukesh, 12 Sept. 1930, ibid.; Maj. Butler to Maj. Gen. Brown, 5 Sept. 1930, ibid.; Maj. Gen. Brown to Director of the U.S. Geological Survey, 12 Sept. 1930, ibid.; Director of the U.S. Geological Survey to Maj. Gen. Brown, 17 Sept. 1930, ibid.; *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 569-71, 587-88; Maj. John S. Butler, "The Columbia River—for Irrigation and Power," 1077-79.

[29] Maj. Butler to W. E. Southard, 13 May 1929, RG 77, NARCS, SD, Box 151; Maj. Butler to Lt. Col. M. C. Tyler, 13 Apr. 1931, RG 77, NARCS, Box 154; *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 720-26; Ficken, *Rufus Woods*, 100-01.

[30] Maj. Butler to Col. Lukesh, 7 Jul. 1931, RG 77, NARCS, North Pacific Division (NPD), Box 6.

[31] Col. Lukesh to Brig. Gen. Pillsbury, 16 Oct. 1930, ibid; in his Sept. 1931 article in *Civil Engineering* outlining the 308 studies, Maj. Butler noted that " the War Department does not undertake to report on streams where irrigation alone is involved, but in the case of the streams under consideration, there are many interrelated questions that affect the general problem of the full utilization of water resources. . . . It therefore seems necessary and desirable that one single agency of the Federal Government . . . should be called upon to prepare a comprehensive plan." Major John S. Butler, "Columbia River—for Irrigation and Power," 1075.

[32] Pitzer, *Grand Coulee*, 50, 62, 65; Reed, *North Pacific Division*, 40; see also, Donald J. Pisani, *Water and American Government: The Reclamation Bureau, National Water Policy, and the West, 1902-1935* (Berkeley, CA: University of California Press, 2002), 262-66.

[33] The Interior Department memo is quoted in part in Pisani, *Water and American* Government, 265. Much of the following discussion of the relationship between the Corps and Bureau regarding the Columbia River is based on my own research and that of Mary Reed. See especially her *North Pacific Division*, 40-43 and endnotes at page 45.

[34] Major Butler to Col. Lukesh, 15 Oct. 1930, RG 77 NARCS, SD, Box 155; A. J. Wiley to Maj. Butler, 3 Nov. 1930, ibid.

[35] Sec. Of War James Good to Rep. Louis Crampton, 18 May 1929, RG 77 NARCS, SD, Box 151; Col. Lukesh to Maj. Butler, 28 May 1919, ibid.

[36] Maj. Butler to Maj. Gen. Brown, 11 Aug. 1930, RG 77,

NARCS, SD, Box 153; Maj. Butler to Roy Gill, 28 Jul. 1930, ibid; Roy Gill to Maj. Butler, 9 Aug. 1930; Maj. Butler to Roy Gill, 13 Aug. 1930, ibid.

[37] Col. Lukesh to Maj. Gen. Brown, 12 Aug. 1930, RG 77, NARCS, SD, Box 153; Lieut. Col. John Kingman to Col. Lukesh 3 Sep. 1930, ibid.

[38] Elwood Mead to Mark Woodruff, 20 Aug. 1930, RG 77, NARCS, SD, Box 153; Roy Gill to Editors of Newspapers, 28 Aug. 1930, ibid; Maj. Butler to Maj. Gen. Brown, 2 Sep. 1930, ibid; Col. Lukesh to Maj. Gen. Brown, 6 Sep. 1930, ibid; Lieut. Col. Kingman to Col. Lukesh, 12 Sep. 30, ibid.

[39] Maj. Butler to Maj. Gen. Brown, 7 Nov. 1930, RG 77, NARCS, SD, Box 155; Maj. Butler to Col. Lukesh, 12 Sep. 1930, RG 77, NARCS, SD, Box 153; for examples of continuing agitation for a joint report, see Sen. Wesley Jones to Sec. of War Patrick Hurley, 2 Oct. 1930, RG 77, NARCS, SD, RG 77, NARCS, SD, Box 155; Sen. Jones to Sec. of Interior Ray Wilbur, 2 Oct 1930, ibid; Hurley to Sen. Jones, 13 Oct. 1930, ibid.; news clippings, *Seattle Times*, 5 May 1931 and *Seattle Post Intelligencer*, 6 May 1931, both in RG 77 NARCS, SD, Box 154; Elwood Mead to Sec. of Interior (memo), 14 Oct. 1930, RG 77 NARCS, SD, Box 155; Wilbur to Sen. Jones, 15 Oct. 1930, ibid.; F. Payne to Sen. C. C. Dill, 25 Oct. 1930, ibid; news clippings, *Seattle Post Intelligencer*, 28 and 31 Oct. 1930, ibid.

[40] Maj. Butler to Maj. Gen. Brown, 7 Nov. 1930, RG 77, NARCS, SD, Box 155; Maj. Butler to Col. Lukesh, 11 Dec. 1930, ibid.; Elwood Mead to Mark Woodruff, 20 Aug. 1930, RG 77, NARCS, SD, Box 153; Lieut. Col. John Kingman to Col. Lukesh, 4 Dec. 1930, RG 77, NARCS, SD, Box 155.

[41] Maj. Butler to Maj. Gen. Brown, 7 Nov. 1930, RG 77, NARCS, SD, Box 155; A. J. Wiley to Butler, 3 Nov. 1930, ibid.; James O'Sullivan to Maj. Butler, 16 Dec. 1930, RG 77, NARCS, SD, Box 155; Maj. Butler, 18 Dec. 1930, ibid.; Elwood Mead to Maj. Gen. Brown, 2 Jan. 1931,RG 77, NARCS, SD, Box 154; Lieut. Col. John Kingman to Col. Lukesh (and endorsements), 8 Jan. 1931, ibid.; Maj. Ben. Brown to Elwood Mead, 8 Jan. 1931, ibid.; Maj. Butler to Maj. Gen. Brown, 30 Jan. 1931, RG 77, NARCS, SD, Box 155. For Butler's efforts to cooperate with the Bureau while maintaining an unbiased approach to irrigation studies, see Maj. Butler to Col Lukesh, 15 Oct. 1929 and 31 Oct. 1930, RG 77, NA, Box 299; Maj. Butler to Col. Lukesh, 15 Oct. 1930, RG 77, NARCS, SD, Box 155; Maj. Butler to Maj. Gen. Brown, 11 Aug. 1930, RG 77, NARCS, SD, Box 153; Maj. Butler to Col. Lukesh, 11 Dec. 1930, RG 77, NARCS, SD, Box 155; Maj. Butler to Maj. Gen. Brown, 12 Aug. 1930, ibid.; Maj. Butler to Col. Lukesh, 15 Oct. 1930, ibid.; Maj. Butler to Maj. Gen. Brown, 4 Oct. 1930 (and endorsements), ibid.; Bashore to Maj. Butler, 27 Oct. 1930, ibid.; Maj. Butler to Bashore, 1 Nov. 1930, ibid.; Maj. Butler to Maj. Gen. Brown, 7 Nov. 1930, ibid.

[42] Col. Lukesh to Brig. Gen. Pillsbury, 16 Oct. 1930, RG 77, NARCS, NPD, Box 6; see Maj. Butler to Maj. Gen. Brown, 11 Aug. 1930, RG 77, NARCDS, SD, Box 153; Col. Lukesh to Maj. Gen. Brown, 12 Aug. 1930, ibid.; Col. Lukesh to Maj. Gen. Brown, 6 Oct. 1930, RG 77, NARCS, SD, Box 155; Col. Lukesh to Maj. Butler, 9 Dec. 1930, ibid.

[43] Col. Lukesh to Seattle and Portland District Engineers, 22 Dec, 1930, RG 77, NA, Box 299.

[44] Reed, *North Pacific Division*, 41; Maj. Butler to Maj. C. L. Sturdevant, 2 Oct. 1931, RG 77, NARCS, SD, Box 155; Maj. C. L. Sturdevant, 5 Oct. 1931, ibid.; Maj. John S. Butler, "The Columbia River—for Irrigation and Power," 1075.

[45] *House Doc.* No. 103, *Columbia River and Minor Tributaries*," 5; Elwood Mead to Maj. Gen. Brown, 13 Jan. 1932, RG 77, NA, Box 299; Maj. Gen. Brown to Elwood Mead, 15 Jan. 1932, ibid. Bertha Nienburg, consulting economist to the Corps, character-

ized Mead as "something of a grizzly bear," Nienburg to Col. Lukesh, 16 Dec 1930, RG 77, NARCS, SD, Box 155.

[46] *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 21, 571.

[47] Ibid., 19-20, 26-28,31-34, 571, 667, 690, 697-703; Brig. Gen. Herbert Deakyne, 14 Dec. 1931, RG 77, NA, Box 300.

[48] *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 72, 867, 1061-62.

[49] Ibid., 73-81, 873.

[50] Ibid., 592-94, 613, 1017-33, 1037, 1051-52, 1064-67.

[51] Ibid., 34.

[52] Ibid., 53-55, 703; Willingham, *Army Engineers and the Development of Oregon*, 93-95; The overly cautious Board of Engineers of the Corps replaced a high dam at The Dalles with smaller dams at that location, at John Day rapids, and at Umatilla rapids. The final Corps recommendation called for a total of 10 dams; *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 2-30, 9, 12-13, 799.

[53] *House Doc*. No.103, *Columbia River and Minor Tributaries*, 59, 570-71, 587-88, 762-68; William Willingham, *Water Power in the "Wilderness," The History of Bonneville Lock and Dam* (Portland, OR: Army Engineer District, Portland, 1987), 4-7.

[54] *House Doc*. No. 103, *Columbia River and Minor Tributaries*, 56, 726-755.

[55] Ibid., 56-57, 755-762.

[56] Ibid., 34-36, 48-49, 456-80.

[57] Ibid., 39, 44-47, 50, 85-456.

[58] Ibid., 11, 50.

[59] Ibid., 2-3.

[60] Ibid., 4-5, 12-13, 1066-67.

[61] Ibid., 7; Willingham, *Water Power in the "Wilderness,"* 3-4, 43; Ficken, *Rufus Woods*, 126-39; Pitzer, *Grand Coulee*, 61-80.

CHAPTER 2

[1] For a discussion of Washington during the 1920s and 1930s, see Robert Ficken and Charles LeWarne, *Washington: A Centennial History* (Seattle, University of Washington Press, 1988), 90-126.

[2] For a discussion of the Corps' work prior to 1920, see Willingham, *Northwest Passages*, 1-116; *Annual Reports of the Chief of Engineers* (hereafter *ARCE*), *1920*, 1898.

[3] *ARCE, 1920*, 1897; *ARCE, 1925*, 1723; *ARCE, 1930*, 1918.

[4] Ronald R. Burke, "Heritage of a Snagboat: Story of the W. T. Preston," 1999, 4-6.

[5] Burke, "Heritage of a Snagboat," 11; Pamela Negri, "History, Management, and Interpretation of the *W. T. Preston*, a Sternwheel Snagboat" (M.S. thesis, University of Washington, 1982), 33-35, 42-43.

[6] Burke, "Heritage of a Snagboat," 11-12; Negri, "History, Man

agement, and Interpretation of the *W. T. Preston*," 43-52.

[7] U. S. Cong., *House Doc.* No. 307, 70th Cong., 1st sess.; Maj. Barden to Chief of Eng., 14 Jan. 1924, 22 Jan. 1927, RG 77, NARCS, SD, Box 198; Maj. Butler to Chief of Eng., 21 Sept. and 31 Oct. 1927 and 8 Feb. 1928, ibid.; *ARCE, 1928*, 1787; *ARCE, 1930*, 1918; *ARCE*, 1935, 1542; *ARCE, 1940*, 2053.

[8] *ARCE, 1920*, 1884-87; *ARCE, 1924*, 1785-86; *ARCE, 1925*, 1711-15; *ARCE, 1930*, 1903-07.

[9] *ARCE, 1935*, 1529-34; *ARCE, 1936*, 1542; *ARCE, 1939*, 2033-35; *ARCE, 1940*, 2043-46.

[10] *ARCE, 1920*, 1887-90; *ARCE, 1925*, 1715-18; *ARCE, 1930*, 1907-10.

[11] *ARCE, 1920*, 1890-93; *ARCE, 1925*, 1718-21; *ARCE, 1930*, 1910-12; Maj. Butler to Chief of Eng., 14 Nov. 1927 and 14 Oct. 29, RG 77, NARCS, SD, Box 170.

[12] *ARCE, 1932*, 1815-22; *ARCE, 1933*, 1176-78; *ARCE, 1935*, 1534-40; *ARCE, 1940*, 2046-50.

[13] *ARCE, 1935*, 1535-36.

[14] Lt. Col. Sturdevant to Chief of Eng., 29 Aug. 1933, RG 77, NARCS, SD, Box 170; Lt. Col. Wild to Div. Eng., 27 Feb. 1935; ibid.; Lt. Col. Wild to W. J. Murphy, 9 Aug. 1937, ibid.; Maj. Shearer to Div. Eng., 14 Apr. 1939, ibid.; *ARCE, 1936*, 1547; *ARCE, 1940*, 2046-50.

[15] *ARCE, 1920*, 1903-06.

[16] Ibid.; *ARCE, 1931*, 1939-41.

[17] *ARCE, 1930*, 1928, 1932.

[18] *ARCE, 1931*, 1939-42; *ARCE, 1932*, 1836.

[19] *ARCE, 1934*, 1374; *ARCE, 1939*, 2045-47; *ARCE, 1940*, 2056, 2058; Lt. Col. Wild to Div. Eng., 10 Jan 1936 and endorsements, RG 77, NARCS, SD, Box 216.

[20] Capt. Williams to Chief of Eng., 3 Dec. 1910, RG 77, NARCS, SD, Box 160.

[21] *ARCE, 1920*, 1906-08.

[22] Col. Schultz to Chief of Eng., 27 Jun. 1922, RG 77, NARCS, SD, Box 160; Chief of Eng. to Sec. of War, 6 Dec. 1923, ibid.; Col. Barden to Chief of Eng., 2 Apr. 24, RG 77, NARCS, SD, Box 161; Maj. Butler to Chief of Eng., 12 Nov. 1927 and 19 endorsements, ibid.; U. S. Cong., *House Doc.* No. 108, 68th Cong., 1st sess.; *ARCE, 1930*, 1929-34; *ARCE, 1920, 1908*; for a political and social history of the Port of Seattle during the 1920s and 1930s, see Padraic Burke, *A History of the Port of Seattle* (Seattle: Port of Seattle, 1976), 64-94.

[23] Sen. Wesley Jones to Maj. Butler, 4 Oct. 1928 and Butler to Jones, 8 Oct. 1928, RG 77, NARCS, SD, Box 160; Maj. Butler to Chief of Eng., 2 Dec. 1928 and 16 May 1929, ibid.; Col. Lukesh to Chief of Eng., 7 Jan. 1929 and 17 May 1929, ibid; Board of Eng. to Chief of Eng., 6 Mar. 1929 and 22 Oct. 1929, ibid.; Chief of Eng. to Sec. of War, 30 Nov. 1929, ibid.

[24] Chief of Eng. to Sec. of War, 5 Jan. 1932, RG 77, NARCS, SD, Box 162; *ARCE, 1932*, 1840; *ARCE, 1935*, 1549.

[25] Lt. Col. Wild to Chief of Eng., 13 Feb. 1936, RG 77, NARCS, SD, Box 160; Col. Robins to Chief of Eng., 25 Feb. 1936, ibid.; Chief of Eng. to Sec. of War, 17 Nov. 1936, ibid.; *ARCE, 1940*,

2058.

[26] Willingham, *Northwest Passages*, 76-97; *ARCE, 1920*, 1911-12.

[27] *ARCE, 1930*, 1934-41; *ARCE, 1932*, 1843-49; *ARCE, 1940*, 2061.

[28] *ARCE, 1920*, 1743-45; *ARCE, 1930*, 1841-45.

[29] *ARCE, 1931*, 1956-58; *ARCE, 1932*, 1850-53; *ARCE, 1937*, 1577; *ARCE, 1939*, 2055; *ARCE,1940*, 2063; U. S. Cong., *House Doc.* No. 377, 71st Cong., 2d sess., 12-31.

[30] *ARCE, 1920*, 1921-23; *ARCE, 1925*, 1750-52; *ARCE, 1930*, 1953-55.

[31] The local harbor commission did construct a breakwater in 1933 using federal relief funds. The Corps refused to extend it; Chief of Eng. to Rep. J. J. Mansfield, 26 Jul. 1935, RG 77, NARCS, SD, Box 146. See also, Col. Schultz to Chief of Eng., 7 May 1923, ibid.; Chief of Eng. to Sec. of War, 10 Mar. 1924, ibid.; Chief of Eng. to Sec. of War, 21 Feb. 1928, ibid.; Col. Barden to Chief of Eng. 12 May 1927 , ibid.; Chief of Eng. to Sec of War, 4 May 1932, ibid.; Chief of Eng. to Rep L. Hadley, 4 Aug 1932; *ARCE, 1931*, 1967-68; *ARCE, 1940*, 2066-67.

[32] *ARCE, 1920*, 1915-17; *ARCE, 1930*, 1945-47; *ARCE, 1932*, 1853; *ARCE, 1920*, 1918-19; *ARCE, 1932*, 1854-55; *ARCE, 1940*, 2065.

[33] *ARCE, 1920*, 1920-21; *ARCE, 1930*, 1949-52; Maj. Butler to Chief of Eng., 15 Dec. 1930, RG 77, NARCS, SD, Box 145; Maj. Butler to Chief of Eng., 18 Jan. 1928 and 15 May 1931, ibid.; Chief of Eng. to Sec. of War, 9 May 1933, ibid.; Lt. Col. Wild to Div. Eng., 25 Aug. 1938, ibid.; *ARCE, 1939*, 2057-58.

[34] The discussion of the proposed canal between the Puget Sound and the Columbia River is based on the following source: The Canal Commission of the State of Washington, *Report on Proposed Canals Connecting Puget Sound—Grays Harbor—Willapa Bay and Columbia River* (Olympia, WA: State of Washington, 1933).

[35] Ibid., 15.

[36] Col. Strudevant to Chief of Eng., 29 Dec. 1933, RG 77, NARCS, SD, Box 201; see also, Maj. Butler to Chief of Eng., 27 Apr. 1931, ibid.; Col Lukesh to Chief of Eng., 5 May 2931, ibid.; Lt. Col. Robins to Chief of Eng., 2 Feb 1934, ibid.; Col. Barden to Chief of Eng. 6 Aug 1934, ibid.; Maj. Gen. Markham to Rep. J. J. Mansfield, 20 Dec 1934, ibid.

[37] For background on the Flood Control Act of 1936, see Joseph Arnold, *The Evolution of the1936 Flood Control Act* (Fort Belvoir, VA: Office of History, U. S. Army Corps of Engineers, 1986); Office of History, *The History of the U. S. Army Corps of Engineers*, 47-51, 130-31.

[38] Col. Schultz to Chief of Eng., 21 Mar. 1923, RG 77 NARCS, SD, Box 202; Col. Barden to Chief of Eng., 26 Jun. 1926, ibid.; Col. Butler to Chief of Eng., 1 Feb. 1929 and 31 Jan. 1930, ibid., Box 208; Col. Sturdevant to Chief of Eng., 18 May 1932, ibid., Box 213; Col. Barden to Chief of Eng., 26 Jun. 1926 and 29 Jan. 1934, ibid., Box 202; Col. Robins to Chief of Eng., 25 Apr. and 14 Dec. 1933, ibid., Box 208; Col. Lukesh to Chief of Eng., 4 Feb. 1929, ibid., Box 170.

[39] The 1938 act relieved local interests of the responsibility of maintaining and operating flood control projects. The 1941 law specified that all dam and reservoir projects were to be constructed and operated entirely at federal expense. *ARCE, 1936*, 1588-93; *ARCE, 1937*, 1551; *ARCE, 1938*, 1859; *ARCE, 1941*, 1992.

[40] *ARCE, 1938*, 1916.

[41] *ARCE, 1937*, 1600-01; *ARCE, 1939*, 2083-84.

[42] Col. Barden to Chief of Eng., 26 Jun. 1926, RG 77, NARCS, SD, Box 202; Maj. Butler to Chief of Eng., 27 Mar. 1931, ibid.; Board of Eng. to Chief of Eng., 29 Jun. 1931, ibid.; Chief of Eng. to Sec. of War, 9 Dec. 1931, ibid.

[43] Board of Eng. to Chief of Eng., 20 Jan. 1936, ibid.

[44] Ibid.

[45] *ARCE, 1936*, 1588; *ARCE, 1937*, 1599; *ARCE, 1938*, 1910-11; *ARCE, 1939*, 2081-83;

[46] *Engineer Memoirs: Lieutenant General Arthur G. Trudeau*, interview by Colonel Calvin J. Landau (Fort Belvoir, VA: Office of History, U. S. Army Corps of Engineers, 1986), 58; Seattle District, White River Flood Control Project: Mud Mountain Dam (Seattle, Army Engineer District, Seattle, 1939), 1-13.

[47] Gen. Pillsbury to Chief of Eng., 20 Jan. 1936, RG 77, NARCS, SD, Box 202; Col. Wild to Div. Eng., 7 Dec. 1936, ibid.; *ARCE, 1940*, 2085-86; North Pacific Division, The Corps of Engineers in Washington (Portland, OR: Army Engineer Division, North Pacific, 1950), 14.

[48] *ARCE, 1939*, 2081-82; *ARCE, 1941*, 2033-35; Sherman Green, *History of the Seattle District, 1896-1968* (Seattle, WA: Army Engineer District, Seattle, 1968), 2/12, C/3-C/5

[49] *ARCE, 1938*, 1917-20; *ARCE, 1939*, 2084-88; *ARCE, 1940*, 2088-92; *ARCE, 1941*, 2036-45; U. S. Cong. *House Doc.* No. 617, 75th Cong., 3d sess.

[50] Willingham, *Northwest Passages*, 73-74; *ARCE, 1920*, 1928-30.

[51] Lisa Mighetto and Carla Homstad, *Engineering the Far North: A History of the U. S. Army Engineer District in Alaska* (Anchorage, AK: Army Engineer District, Alaska, 1997), 17-24.

[52] Ibid.; *ARCE, 1941*, 2018-25, 2040-44.

[53] Green, *History of the Seattle District*, 2/10-2/15, D/1-D/6.

[54] Ibid., 2/14-2/15.

[55] Ibid., 2/15-2/18, quote on 2/18.

CHAPTER 4

[1] Reed, *North Pacific Division*, 104-07; Charles McKinley, *Uncle Sam in the Pacific Northwest: Federal Management of Natural Resources in the Columbia River Valley* (Berkeley, CA: University of California Press, 1952), 180-88; Willingham, *Army Engineers and the Development of Oregon*, 150.

[2] Bonneville Power Administration, The Columbia Basin Study, Interim Report, 1 Jan. 1946, RG 77, NARCS, SD, Civil Works Project Files, Box 7; Seattle District, Minutes of a Conference on the Review of the “308” Report of the Columbia River, 26 Nov. 1943, ibid., Box 6; Seattle District, Program for Columbia River and Tributaries Review Report, May 1944, ibid.

[3] Quote in Reed, *North Pacific Division*, 105-06

[4] Ibid., 106; McKinley, *Uncle Sam in the Pacific Northwest*, 90-91.

[5] Reed, *North Pacific Division*, 106-07; McKinley, *Uncle Sam in the Pacific Northwest*, 89-91, 459-67; Roy Scheufele, *History of*

the Columbia Basin Inter-Agency Committee (Portland, OR: Pacific Northwest River Basins Commission, 1970), 2-9.

[6] Reed, *North Pacific Division*, 114-15, quote on 116; McKinley, *Uncle Sam in the Pacific Northwest*, 91-94.

[7] B. E. Torpen, Memorandum, Storage for Power, Columbia River Basin, Aug. 1945, RG77, NARCS, SD, Civil Works Project Files, Box 37; Green, *History of the Seattle District*, 4/10-4/11

[8] B. E. Torpen, Power and Columbia River Storage, Projects in the Region's Potential, 12 Dec. 1951 (Portland, OR: Columbia Basin Interagency Committee).

[9] Reed, *North Pacific Division*, 114; McKinley, *Uncle Sam in the Pacific Northwest*, 90-91.

[10] Reed, *North Pacific Division*, 114-15; Green, *History of the Seattle District*, 4/10.

[11] U. S. Cong., *House Document* No. 531, *Columbia River and Tributaries, Northwestern United States*, 81st Cong., 2d sess., 45-46, 451; North Pacific Division, Review Report on Columbia River and Tributaries, 1 Oct. 1948; Roy W. Scheufele, *History of the CBIAC*, 16-36; Green, *History of the Seattle District*, 4/11.

[12] Ficken, "Building the Pacific Northwest," 333-34.

[13] The following discussion of the Columbia River comprehensive review report is based primarily on U. S. Cong., *House Document* No. 531; Reed, *North Pacific Division*, 117-20; Green, *History of the Seattle District*, 4/20-4/22. For the Bureau's Columbia basin report, see McKinley, *Uncle Sam in the Pacific Northwest*, 94-95.

[14] Quote in U. S. Cong., *House Document* 531, 306.

[15] Ibid., 58-61, quote on 337.

[16] Ibid., 20.

[17] Ibid., 339-45, quote on 340.

[18] Ibid., 330-31, quote on 15.

[19] Ibid., 16, 18, 145, 150-54, 330-31, 342, quote on 16.

[20] Drury quote in Michael Spero, "The Upper Columbia River Priest Rapids Dam to Columbia Lake" (unpublished ms in Office of History Research Collections, 1987?), X-94/X-97; Weaver quote in Scheufele, *History of the CBIAC*, 30-31; Krug quote in McKinley, *Uncle Sam in the Pacific Northwest*, 630-40.

[21] U. S. Cong., House Document No. 531, 148-50, 331.

[22] Ibid., 178-82, 331.

[23] Ibid., 337-40, quote on 340.

[24] Ibid., 18-19.

[25] The CVA discussion is based on the following sources: Reed, *North Pacific Division*, 120-24; McKinley, *Uncle Sam in the Pacific Northwest*, 98-99, 543-659; Scheufele, *History of the CBIAC*, 22-40; Elmo Richardson, *Dams, Parks and Politics* (Lexington, KY: University Press of Kentucky, 1973), 19-38; Dept. of Interior, Memorandum from the Secretary's Office, 25 Apr. 1949, Henry M. Jackson Papers, University of Washington Library (hereafter, Jackson Papers), Acc. No. 3560-2, Box 51. The Jackson Papers contain extensive material on the proposed CVA; see especially, ibid.

[26] The Corps-Bureau understanding, known as the Krug-Royall Agreement, was named for the Secretary of the Interior, Julius Krug, and the Secretary of the Army, Kenneth Royall. Dept. of the Interior and Dept. of Army, Columbia River Basin Agreement on Principles and Responsibilities for the Comprehensive

Development, April 1949, Jackson Papers, Acc. No. 3560-2, Box 51; quote in Memorandum, The Corps of Engineers "308" Report and the Bureau of Reclamation's Report on the Columbia River Basin, ibid.; there are two versions of this memo in the Jackson Papers. See also, Scheufele, *History of the CBIAC*, 33-35.

[27] Press Release, 17 and 20 Jun. 1949, ibid.; see also Jackson's speech to the Public Utility Law Section of the American Bar Association at St. Louis, 6 Sep. 1949, copy in ibid.

[28] Quote in Memorandum cited in endnote 25.

[29] Reed, *North Pacific Division*, 123-24; Office of History, *The History of the Corps of Engineers*, 131-32.

[30] The discussion of CBIAC is based on Scheufele, *History of the CBIAC*, quote on 7-8.

[31] C. P. Holdridge, Geology of the Foster Creek Dam Site with Photographs, May 1942, RG77, NARCS, SD, Civil Works Project Survey Reports, Box 35; U. S. Cong., *House Document* No. 693, *Columbia River at Foster Creek, Washington*, 79th Cong., 2d sess., 5-6.

[32] E. B. Burwell, Memorandum on Geology of Foster Creek Dam Site, Feb. 1944, RG77, NARCS, SD, Civil Works Project Survey Reports, Box 35; E. B. Burwell, Foundation Investigations of Foster Creek Dam Site, 1947, ibid.; Seattle District, Characteristics of Glacial Till, Foster Creek Dam Site (Seattle, July 1945), ibid.

[33] U. S. Cong., *House Document* No. 693, 24-26, 50-51.

[34] Ibid., 25-26, 47.

[35] Ibid., 27-30, 48, quote on 32.

[36] Ibid., 28-30, 47-48, quote on 48.

[37] Ibid., 30.

[38] Ibid., 35-37, 46-47.

[39] Ibid., 27, 32-33.

[40] Ibid., 52, quote on 47.

[41] Ibid., vii, xi-xiii, quote on 3; Willingham, *Army Engineers and the Development of Oregon*, 150-51; McKinley, *Uncle Sam in the Pacific Northwest*, 98-99; Henry Jackson to Warren Magnuson, 12 Jun, 1946, Jackson Papers, Acc. No. 3560-2, Box 64; Statement of Warren G. Magnuson, 7 May 1952, Warren G. Magnuson Papers, University of Washington Library (hereafter Magnuson Papers), Acc. No. 3181-4, Box 205.

[42] ARCE, 1950, 2589; Warren Magnuson to Thomas Welborn, 15 and 25 July 1946, Magnuson Papers, Acc. No. 3181-4, Box 142; Summary of Senator Magnuson's Record on Power and Reclamation for Columbia Basin, ibid., Box 206; Statement of Warren G. Magnuson, 7 May 1952, ibid., 205.

[43] Lt. Gen. Raymond Wheeler to Warren Magnuson, 19 Mar. 1947, Magnuson Papers, Acc. No. 3181-4, Box 143; Kirby Billingsley to Henry Jackson, 11 Oct. 1948, Jackson Papers, Acc. No. 3560-2, Box 64; Jackson to Billingsley, 6 Nov. 1948, ibid.; Arthur Langlie to Henry Jackson, 26 Apr. 1949, ibid., Box 59; Congressional Speech by Rep. Henry Jackson, 1948, ibid.

[44] U. S. Cong., House Document No. 531, 12, 92-95; Seattle District, Planning Report: Chief Joseph Dam Columbia River, Columbia River Basin, Washington (Seattle, Jan. 1952), RG77, NARCS, SD, Civil Works Project Files, Box 34.

[45] Seattle District, Report on Flood of May-June 1948, Columbia River and Tributaries, 21 July 1949 (Seattle); Seattle District, Flood Emergency Report, 1948 Columbia River Flood (Seattle, 10 Aug. 1948); Willingham, *Army Engineers and the Development of Oregon*, 151-58; U. S. Cong., House Document No. 531, 79-80; Reed, *North Pacific Division*, 117-18; Warren Magnuson to Lt. Gen. Raymond Wheeler, 17 Aug. 1948, Magnuson Papers, Acc. No. 3118-4, Box 141.

[46] Seattle District, Chief Joseph Dam, Apr. 1951, SD Public Affairs Office.

[47] Warren Magnuson to Lt. Gen. Lewis Pick, 1 Apr, 5 Jul. 1949, Magnuson Papers, Acc. No. 3181-4, Box 205; Lt. Gen. Lewis Pick to Warren Magnuson, 6 Apr. 15 Jun., 26 Jul. 1949, ibid.; ARCE, 1950, 2586-2589; Summary of Senator Magnuson's Record on Power and Reclamation for Columbia Basin, 7 May 1942, ibid.

[48] The discussion of dam construction and technical features of Chief Joseph Dam is based on the following sources: *ARCE, 1949-1959*, Seattle District, Chief Joseph Dam, passim; Seattle District, Planning Report: Chief Joseph Dam, Columbia River, Columbia River Basin, Washington (Seattle, Jan. 1952, 1953), RG77, NARCS, SD, Civil Works Project Files, Box 34; Seattle District, Project Information, Chief Joseph Dam, Columbia River, Washington (Seattle, 1957?); William S. Stinchfield, Chief Joseph Dam (6th International Congress on Large Dams, 1958), Seattle District Public Affairs Office; Doug MacRae, "Progress at Chief Joseph Dam," *Pacific Builder & Engineer* (Aug. 1951): 54-57; "Chief Joseph Dam," *Western Construction* (May 1952): 69; W. N. Evans and K. L. Parker, "Twice the Work, Half the Time in Building Chief Joseph Dam," ibid.: 70-76; G. M. Shupe, "A Million Pounds on Wheels," *Pacific Builder & Engineer* (Oct. 1953): 88-89; Green, *History of the Seattle District*, 4/12-4/19; Spero, "The Upper Columbia River," VII-15/VII-37; Ed Derrick to author, personal communication, 24 Jan. 2003.

[49] For a discussion of the British-American dispute, see Stephen Ambrose, *Eisenhower: The President* (New York: Simon and Schuster, 1984), 77-79; Colonel Welling to Asst. Chief of Engineers for Civil Works, 14 May 1953, Samuel D. Sturgis Papers (hereafter Sturgis Papers), Box 45, folder 278, U. S. Army Corps of Engineers, Office of History Research Collections (OHRC); "British Hand U. S. Another Low Bid Test," *Washington Post* (14 May 1953): 5.

[50] For a discussion of President Eisenhower's "partnership" doctrine, see Richardson, *Dams, Parks and Politics*, 114-15; Reed, *North Pacific Division*, 124, 130-33.

[51] Green, *History of the Seattle District*, quote on 4/18.

[52] Col. Ernest Perry to Division Engineer, 20 Mar. 1964, subj.: Chief Joseph Dam, Stilling Basin Pilot Repair Program, Interim Status Report, Supplement to Design Memo No. 24 (and attachments and endorsements), Civil Works Engineering Files, Seattle District Records Holding Area; Chief of Design Branch to Chief of Engineering Division, 26 Sep. 1963, ibid; Ed Derrick to William Willingham, 19 Jun. 2003, personal communication.

[53] Ibid.; William Willingham, Interview with Vernon Cook, 11 Jun. 2002 , transcript in Seattle District Historical Records File, 16-21;

[54] Acting District Engineer to Division Engineer, 4 Apr. 1966, subj.: Chief Joseph Dam, Stilling Basin Repair Program, Inspection Report, Supplement to Design Memo No. 24 (and endorsement), Civil Works Engineering Files, Seattle District Records Holding Area. K. S. Pathak to Robert Sato, 3 Jun. 1963, Civil Works Engineering Files, Seattle District Records Holding Area; G. B. Hunt to H. H. Buckman, 28 Feb. 1962, ibid.; H. H. Buckman to Col. R. Young, 26 Jun. 1961, ibid; Willingham, Interview with Vernon Cook, 20-21.

[55] This section is based on North Pacific Division, The Corps of Engineers in the Washington (Portland, OR, July 1950), 1-31; *ARCE, 1945-49*, Seattle District, passim.

CHAPTER 5

[1] Reed, *North Pacific Division*, 124, 130-33; Gus Norwood, *Columbia River Power For the People: A History of Policies of the Bonneville Power Administration* (Portland, OR: Bonneville Power Administration, 1981), 189-200.

[2] Brig. Gen. E. C. Itschner, "The Corps of Engineers in Water Resources Development," *The Military Engineer* (May-Jun., 1954): 171.

[3] Ibid. The Chief of Engineers, Maj. Gen. Samuel Sturgis also supported the partnership policy. He wrote the Assistant Secretary of the Army that the "Corps of Engineers has given much consideration to the principles involved in developing the nation's water resources under this new approach [i.e. partnership policy], and in working out procedures and details of arrangements whereby the cooperative approach can be implemented"; Memorandum for the Assistant Secretary of the Army, 23 Apr. 1954, subj.: Informal Report of the Chief of Engineers, Sturgis Papers, Box 41, folder 231.

[4] U. S. Cong., *House Doc.* No. 531, 395; Reed, *North Pacific Division*, 138.

[5] U. S. Cong., *House Doc.* No. 531, 132, 395-99, quote on 441.

[6] Reed, *North Pacific Division*, 138-39; Green, *History of the Seattle District*, 4/20.

[7] U. S. Cong., *House Doc.*, No. 704, *Columbia and Snake Rivers, Oreg., Wash., and Idaho*, 75th Cong., 3d sess., 28-30; Reed, *North Pacific Division*, 139; U. S. Cong., *House Doc.* No. 531, 378.

[8] Green, *History of the Seattle District*, 4/20.

[9] U. S. Cong., *House Doc.* No. 531, 467-74, 488-94.

[10] Ibid., 139; quote in Ficken, "Building the Pacific Northwest," 356.

[11] U. S. Cong., *House Doc.* No. 531, 135-39, 459-68, 479-87; quote on 459.

[12] Ibid.

[13] Col. N. A. Matthias to Div. Eng., 23 Jun. 53, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 115; Col. N. A. Matthias, Progress Report on Libby Project, 23 Jun. 1954, ibid.; Seattle District, Planning Report: Libby Dam and Reservoir (Seattle, 1954), ibid.

[14] Neil A. Swainson, *Conflict over the Columbia* (Montreal: McGill-Queen's University Press, 1979), 41-51; quote in Ficken, "Building the Pacific Northwest," 361.

[15] Swainson, *Conflict over the Columbia*, 41-51; Ficken, "Building the Pacific Northwest," 361-63.

[16] Brig. Gen. Louis Foote, Remarks at Ninth Annual Pacific Northwest Council of American Society of Civil Engineers, 27 Apr. 57, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16; Memorandum for the Assistant Secretary of the Army, 23 Apr. 1954, subj.: Informal Report of the Chief of Engineers, Sturgis Papers, Box 41, folder 231; Portland, *Oregonian*, 28 Apr. 1954; see also articles in "Power Development on the Upper

Columbia River—A Symposium in *Pacific Northwest Quarterly*, 49 (July 1958): 99-120.

[17] U. S. Cong., *House Doc*. No. 531, 148-50; U. S. Cong., *Senate Doc*. No. 9, *Improvement at Albeni Falls on Pend Oreille River Idaho*, 81st Cong., 1st sess., 5, 19-21.

[18] U. S. Cong., *Senate Doc*. No. 9, 4, 19-21.

[19] Ibid., 4, 19-22, 23, 27.

[20] Ibid., 7, 29.

[21] Ibid., 5, 27-29, 41, 46.

[22] Ibid., 21-22, 32-33, 39, 45-46.

[23] Ibid., 33, 40.

[24] Ibid., 38, 45.

[25] Green, *History of the Seattle District*, 4/23-4/24; *ARCE, 1951*, 2324-27; *ARCE, 1952*, 2236-38; *ARCE, 1953*, 1944-46; *ARCE, 1954*, 1516-18; *ARCE, 1955*, 1571-73.

[26] U. S. Cong., *Senate Doc*. No. 9, 32; Green, *History of the Seattle District*, 4/23-4/24; Seattle District, Construction Report on Foundation of Spillway Dam and Powerhouse (Seattle, WA, 1954).

[27] Green, *History of the Seattle District*, 4/25.

[28] Maj. Gen. E. C. Itschner, Testimony before Senate Committee on Interior and Insular Affairs and Senate Committee on Foreign Affairs, 26 Mar. 1956, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16; Ficken, "Building the Pacific Northwest," quote on 371; North Pacific Division, *Water Resources Development of the Columbia River Basin*, 5 vols. (Portland, OR, 1958), I: v.

[29] North Pacific Division, *Water Resources Development of the Columbia Basin*, I: 10-13, 46-50, III: 25-38, 44-45, 170.

[30] Ibid., I: vi; Reed, *North Pacific Division*, 133; Secretary of the Army, Robert Stevens to Director of the Bureau of Budget, Rowland Hughes, 14, Dec. 1954, Sturgis Papers, Box 44, folder 276; Brig. Gen. E. C. Itschner to Div. Eng., 17 Aug. 1955, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16.

[31] North Pacific Division, *Water Resources Development of the Columbia Basin*, I: x; Div. Eng. to Dist. Engs. 23 Sep. 1955, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16; Brig. Gen. Louis Foote, Remarks at the Ninth Annual Pacific Northwest Council American Society of Civil Engineers, 27, Apr. 1957, ibid.

[32] North Pacific Division, *Water Resources Development of the Columbia Basin*, I: 1.

[33] Div. Eng. to Dist. Eng., 8 Aug. 1955, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16; Mary Reed, Interview with Michael Spero, 21-22 Dec. 1983, U. S. Army Corps of Engineers, Office of History Research Collections, 29-44; Green, *History of the Seattle District*, 4/38.

[34] North Pacific Division, *Water Resources Development of the Columbia River Basin*, I: 80-83, 226-27, 377-78, 388, II; appendix B, quote on I: 1.

[35] Ibid.

[36] Green, *History of the Seattle District*, 4/38; North Pacific Division, *Water Resources Development of the Columbia River Basin*, I: 126-30.

[37] North Pacific Division, *Water Resources Development of the Columbia River Basin*, I: 131-45.

[38] Ibid., I: 145-50.

[39] Ibid., I: 181-91.

[40] Ibid., I: 174-80.

[41] Ibid., I: 199-205.

[42] Ibid., I: 162-66.

[43] Ibid., I: 45.

[44] Ibid., I: 1.

[45] Ibid., I: 377-80, 383-87, 393-95.

[46] U. S. Cong., *House Doc.* No. 403, *Columbia River and Tributaries*, 87th Cong., 2d sess.; iii-v, 1-31, A: 1-29; Maj. Gen. E. C. Itschner, Testimony before Senate Committee on Interior and Insular Affairs and Senate Committee on Foreign Affairs, 26 Mar 56, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16.

[47] Ficken, "Building the Pacific Northwest," quote on 384-85.

[48] U. S. Cong., *House Doc.* No. 403, 1-18, A: 1-29, quote on 12. Gen. Itschner felt some anguish in rejecting the navigation project. Writing in private to a navigation supporter, he stated: "It is very difficult in any case to deny endorsement of a project desired by many sincere, enthusiastic people. The difficulty is increased when the proponents are my good friends." Lt. Gen. Itschner to Kirby Billingsley, 6 Jan. 1960, RG 77 NARCS, SD, Civil Works Project Survey Reports, Box 16; Gullidge, Memo for Record: Upper Columbia River Navigation, 11 Apr. 1959, ibid, Box 6; Noble Bosely, Memo for Record: Supplemental Studies for Board of Engineers, 531 Review Report, 1 Apr 1959, ibid., Box 16.

[49] U. S. Cong., *House Doc.* No. 403, iii-v, 1-18, 22-31, quote on 2.

[50] Ibid.

[51] Willingham, *Army Engineers and the Development of Oregon*, 192; Reed, *North Pacific Division*, 133; Lisa Mighetto and Wesley Ebel, *Saving the Salmon: A History of the U. S. Army Corps of Engineers' Efforts to Protect Anadromous Fish on the Columbia and Snake Rivers* (Portland, OR: Army Engineer Division, North Pacific, 1995), 11-40; Joseph Taylor III, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington Press, 1999).

[52] Willingham, *Water Power in the "Wilderness,"* 47-53; Mighetto and Ebel, *Saving the Salmon*, 49-58.

[53] Mighetto and Ebel, *Saving the Salmon*, 69-72; Reed, *North Pacific Division*, 134-35; U. S. Cong., House Document No. 531, 310.

[54] Reed, *North Pacific Division*, 134-35, quote on 135.

[55] Ibid., 135-36; Mighetto and Ebel, *Saving the Salmon*, 81-88, 103-10, 112-13; Willingham, *Army Engineers and the Development of Oregon*, 199-200; Brig. Gen. Louis Foote, Remarks at

the Ninth Annual Pacific Northwest Council American Society of Civil Engineers, 27 Apr. 1957, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 16.

[56] Ibid.; North Pacific Division, *Water Resources Development of the Columbia River Basin*, I: 90-98.

[57] Reed, *North Pacific Division*, 136-37.

[58] Ficken, "Building the Pacific Northwest," quotes on 392, 394-95.

[59] Green, *History of the Seattle District*, 4/21-4/22.

[60] The Ben Franklin Dam was named for Benton and Franklin counties that adjoined the project. North Pacific Division, *Water Resources Development of the Columbia Basin,* I: 228-33.

[61] Ibid.

[62] Maj. Gen. Itschner to Rep. Catherine May, 4 May 1959, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 7.

[63] Sen. Warren Magnuson to Maj. Gen. Itschner, 6 Feb. 1959, ibid.; Maj. Gen. Itschner to Sen. Warren Magnuson, 20 Mar. 1959, ibid.; Ben Franklin Dam: Status of the Project, 22 Oct. 1963, ibid, Box 95; R. Edens, Memo for Record: Ground Water Effects from Ben Franklin Dam on Waste Disposal at Hanford Works, 27 Oct. 64; ibid.; Briefing Data for Col. Holbrook: Ben Franklin Dam, 22 Oct 1965, ibid.

[64] Seattle District Eng. to Div. Eng., 15 Mar, ibid., Box 7; Seattle District, Ben Franklin Lock, Dam and Reservoir, Columbia River, Washington (Seattle, 1969), 29; Draft of newspaper article on Ben Franklin Dam, 19 Sep. 1966, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 95.

[65] Seattle District, Ben Franklin Lock, Dam and Reservoir, 29-31, 37.

[66] Ibid., quote on 74; Seattle Dist. Eng. to Div. Eng., 1 Apr. 1968, RG 77, NARCS, SG, Civil Works Project Survey Reports, Box 99.

[67] Seattle District, Ben Franklin Lock, Dam and Reservoir, quote on 44.

[68] Ibid., 46, 60, 78; Testimony by Sen. Warren Magnuson on Ben Franklin Dam, 11 Jun. 1968, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 99; Senators Magnuson and Jackson to Sen. Jennings Randolph, 30 Sep. 1970, Jackson Papers, Acc. No. 3560-4, Box 84.

[69] Seattle District, Ben Franklin Lock, Dam and Reservoir, 2, 28, 39-45, 77-83.

[70] Ibid., 46-70; Reed, *North Pacific Division*, 154; Thor Tollefson to Maurice Ahlquist, 3 May 1968, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 99; Dist. Eng. to Div. Eng., 1 Apr. 1968, ibid.; Dist. Eng. to Div. Eng. 23 Jul. 1968, ibid.

[71] John deYonge, "Last of the Columbia wilderness?" *Seattle Post-Intelligencer*, 8 Sep. 1968; "Is Dam Needed?" *Seattle Post-Intelligence*, 24 Sep 1968; Dist. Eng. to Div. Eng., 23 Jul. 1968, RG 77 NARCS, SD, Civil Works Project Survey Reports, Box 99.

[72] Reed, *North Pacific Division*, 154; Sydney Steinborn to Dist. Eng., 24 Sep. 1968, RG 77, NARCS, SD, Civil Works Project Reports, Box 99.

[73] Reed, *North Pacific Division*, 155; the Office of Management

and Budget also recommended against the upper Columbia River Navigation project; Stanley Resor to Sen. Jennings Randolph, 16 Oct. 1970, Jackson Papers, Acc. 3560-4, Box 84.

[74] Reed, *North Pacific Division*, 140; John V. Krutilla, *The Columbia River Treaty: The Economics of an International River Basin Development* (Baltimore: The Johns Hopkins Press, 1967); Donald E. Spritzer, *Waters of Wealth: The Story of the Kootenai River and Libby Dam* (Boulder, CO: Pruett Publishing Co., 1979), 142-45; Green, *History of the Seattle* District, 4/34-4/35; Norwood, *Columbia River Power*, 227-36; for a convenient summary of the various documents forming the U. S. and Canadian agreement for developing the Columbia River, see B. C. Hydro and Power Authority, Columbia River Development (24 Mar. 1964).

[75] Ibid.; Norwood, *Columbia River Power*, 237-46.

[76] Col. R. P. Young to Div. Eng. 17 Nov. 1960, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 6; Brig. Gen. Allen Clark to Chief of Eng. 6 Dec. 1960, ibid.; Maj. Gen. William Cassidy to Brig. Gen. Clark (and ind.), 23 Dec 60, ibid., Box 4; Daily Log-Executive Office, 18 Jan. 1961, ibid.; Brig. Gen Clark to Maj. Gen. Cassidy, 18 Jan 1961, ibid.; Sen. Mike Mansfield to Lieut. Gen. Itschner, 13 Dec. 1960 ibid., Box 6; Lieut. Gen. Itschner to Sen. Mike Mansfield, 20 Feb. 1961, ibid.

[77] Brig. Gen. Clark to Maj. Gen. Cassidy, 18 Jan. 1961, ibid., Box 4; Noble Bosley to Chiefs of Division, 14 Apr. 1961, ibid.

[78] Col. S. M. Lipton to Seattle Dist. Eng., 9 Nov. 1961, ibid., Noble Bosley to F. S. Brown, 2 Oct 1961, ibid.; Holmes to Chief, Eng. Div., 13 Dec. 1961, ibid.; Col. E. Perry to Div. Eng., 29 Dec. 1961, ibid.

[79] Col. R. P. Young to Div. Eng., 17 Nov. 1960, ibid., Box 6; Noble Bosley, Memo for Record, 20 Feb. 1961 and 13 Apr. 1961, ibid., Box 4; Noble Bosley to Boyd Rasmussen, 22 May 1961, ibid.; Col. Richard McConnell, “Libby Dam and Reservoir,” *The Military Engineer* (May-Jun., 1969): 180-82; H. Dale Burkholder and Kenneth Ramsey, “Relocation Routes at Libby Reservoir,” *The Military Engineer* (Nov.-Dec., 1969): 424-27; Lorraine McConaghy, Interview with Edwin Derrick, 10 May 1996 (Army Engineer District, Seattle); 35-43; Kermit Scott and Richard Leatherman, “Railway Tunnel Libby Dam,” *The Military Engineer* (Nov.-Dec., 1969): 428-30; Lt. Col. James Harper to Div. Eng, 6 Apr. 1962, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 25.

[80] Seattle District, Libby Dam and Lake Koocanusa Project, Final Progress Report (Seattle, WA, October 1973), 17; Ed Derrick to William Willingham, 17 Jun. 2003, personal communication.

[81] McConnell, “Libby Dam and Reservoir,” 180-82; Seattle District, Background Information on Libby Dam and Reservoir, Northwestern Montana (Seattle, 13 Aug. 1966); Wendell Johnson to Chief of Eng. Div., Inspection of Libby Dam Site, 25 Jun. 1962, RG 77, NACRS, SD, Civil Works Project Survey Reports, Box 25; Col. Don DeFord to Chief of Engineers, 20 Sep. 1963, ibid.; Sydney Steinborn to Div. Eng., 28 Jun. 1963, ibid.

[82] McConnell, “Libby Dam and Reservoir,” 180-82; Seattle District, Background Information on Libby Dam and Reser voir; Green, *History of the Seattle District*, 4/36, C/11-C/12.

[83] McConnell, “Libby Dam and Reservoir,” 180-28; Spritzer, *Waters of Wealth*, 148-50; Reed, *North Pacific Division*, 141; McConaghy, Derrick Interview, 45-50; Green, *History of Seattle District*, 4/36-4/37.

[84] Green, *History of Seattle District*, 4/37; Reed, *North Pacific Division*, 141-43.

[85] Reed, *North Pacific Division*, 142-43; Spritzer, *Waters of Wealth*, 152; McConnell, "Libby Dam and Reservoir," 182; Lt. Col. S. Black to Div Eng., 31 Jan 1966, RG 77, NARCS, SD, Civil Works Project Survey Reports, Box 75; Maj. Gen. Jackson Graham to Sen. Mike Mansfield, 17 May 1966, ibid.; Liut. Gen. William Cassidy to Sen. Mike Mansfield, 1 Oct. 1968 and 17 Dec. 1968, ibid., Box 98; Lieut. Col. Lowell Dezarn to Div. Eng. (and ind.), 2 Nov. 67, ibid.; Bob Ayers to Sydney Steinborn, 19 Jan 1968, ibid.; Sydney Steinborn to Dist. Eng., 22 Jan 1968, ibid.; Lieut. Gen. William Cassidy to Sen. Mike Mansfield, 12 Mar. 1969, ibid., Box 102; Stanley Resor to Rep. John McCormack, 14 Nov. 1969, ibid.

[86] Ficken, "Building the Pacific Northwest," quote on 403; Sydney Steinborn, "Aesthetic Factors in Planning and Design of Libby Dam," *Journal of the Power Division, Proceedings of the American Society of Civil Engineers*, 96 (Jan. 1970): 39-54.

[87] Reed, *North Pacific Division*, 141-42; McConnell, "Libby Dam and Reservoir," 182; Green, *History of the Seattle District*, 4/35; Paul Thiry, Libby Dam, Proposed Arch. Treatment (Seattle, Army Engineer District, Seattle, 1965), quotes on 15, 16; Steinborn, "Aesthetic Factors," 41-53.

[88] Ibid.; Seattle District, Background information on Libby Dam and Reservoir, quote on 2.

CHAPTER 6

[1] *ARCE, 1958*, 1723-24; Green, *History of the Seattle District*, B/3, F/1.

[2] *ARCE, 1950*, 1300-01, 2604-10, quote on 2608.

[3] *ARCE, 1952*, 2225; U. S. Cong., *House Doc*. No. 412, *Grays Harbor and Chehalis River, Washington*, 83d Cong., 2d sess.; ibid., *House Doc*. No. 30, *Grays Harbor and Chehalis River, Wash., Westhaven Breakwater*, 84th Cong., 1st sess.; *ARCE, 1957*, 1748-54.

[4] *ARCE, 1959*, 1818-23; Maj. Gen. Cassidy to Sen. Warren Magnuson, 11 Apr. 1960, Magnuson Papers, Acc. No. 3181-4, Box 196.

[5] Sen. Warren Magnuson to Chief of Engineers, 26 Apr. 1960, Magnuson Papers, Acc. No. 3181-4, Box 196.

[6] Maj. Gen. Cassidy to Sen. Warren Magnuson, 7 Jun. 1960, ibid.

[7] Corps of Engineers, Review of the Improvements Recommended at Grays Harbor, Washington (Vicksburg, Jul. 1963), RG 77, NARCS,SA, Civil Works Project Survey Reports, Box 49; Seattle District, Project Information Sheet: Grays Harbor and Chehalis River—South Jetty Rehabilitation (Seattle, 21 Feb. 1963), ibid.; Lt. Col. Allan Nesbitt to Zane Rockey, 13 Sep, 1966, Magnuson Papers, Acc. No. 3181-4, Box 196; *ARCE, 1966*, 1604-05; *ARCE, 1967*, 1558-59.

[8] *ARCE, 1968*, 1559-60; *ARCE, 1957*, 1752, *ARCE, 1950*, 1381, 1389-91, 1395-1400.

[9] *ARCE, 1950*, 2385, 2596; *ARCE, 1951*, 2305; U.S. Cong., *House Doc*., No. 569, 81st Cong., 2d sess., 12-13, 16-17, 23-24, 29, quotes on 24 and 29.

[10] U. S. Cong., *House Doc*., 569, 25-26, 29-31, quote on 29; *ARCE, 1950*, 2585.

[11] *ARCE, 1955*, 1548-49; *ARCE, 1957*, 1732-33; *ARCE, 1958*, 1736; *ARCE, 1964*, 1522-23; *ARCE, 1967*, 1556; Ficken, "Building the Pacific Northwest," 415.

[12] Ficken, "Building the Pacific Northwest," 416.

[13] Sens. Warren Magnuson and Henry Jackson, 19 Jul. 1954, Jackson Papers, Acc. No. 3560-3, Box 18; Ficken, "Building the Pacific Northwest," 416; *ARCE, 1954*, 1501-04, *ARCE, 1955*, 1558-60, ARCE, *1956*, 1773-74; *ARCE, 1957*, 1747.

[14] Ficken, "Building the Pacific Northwest," 417; *ARCE, 1964*, 1537; *ARCE, 1965*, 1507; *ARCE, 1966*, 1613; *ARCE, 1967*, 1567; U. S. Army Corps of Engineers, North Pacific Division, *Corps of Engineers in Washington* (Portland, OR, 1969), 59.

[15] Quote in Ficken, "Building the Pacific Northwest," 418; ARCE, 1950-1970, passim; see also Robert Graham to Sen. Warren Magnuson, 4 Apr. 1960, Magnuson Papers, Acc. No. 3181-4, Box 196; Sen. Warren Magnuson to Robert Graham, 11 Apr. 1960, ibid; North Pacific Division, Corps of Engineers in Washington (1969) , 52-53.

[16] North Pacific Division, Corps of Engineers in Washington (1969), 37-60; *ARCE, 1970*, 1147-53.

[17] Ficken, "Building the Pacific Northwest," 418-19; North Pacific Division, Corps of Engineers in Washington (1969), 77-79.

[18] Ibid.; *ARCE, 1957*, 1725-28; *ARCE, 1958*, 1731.

[19] *ARCE, 1956*, 1768-69; *ARCE, 1957*, 1740; *ARCE, 1958*, 1744; *ARCE, 1961*, 1909; *ARCE, 1962*, 1947; North Pacific Division, The Corps of Engineers in Washington (1969), 54.

[20] The discussion of Howard A. Hanson Dam is based on the following sources: U. S. Cong., *House Doc*. No. 271, *Green River and Duwamish Rivers, and Duwamish Waterway, Seattle Harbor, Wash*., 81st Cong., 1st sess., 16-48; Howard A. Hanson, "More Land for Industry: The Story of Flood Control in the Green River Valley," *Pacific Northwest Quarterly* (Jan. 1957): 1-7; Green, *History of the Seattle District*, 4/27-4/28, C/9-C/10; Seattle District, Design memorandum No. 27: Howard A. Hanson Dam—Eagle Gorge Reservoir Project Master Plan (Seattle, U. S. Army Engineer District, Seattle, 1999), 2/4-2/13, A/1-A/3; *ARCE, 1950*, 2621-22; *ARCE, 1955*, 1574-76; *ARCE, 1956*, 1789-91; *ARCE, 1959*, 1837-39; *ARCE, 1960*, 1846-48; *ARCE, 1962*, 1972-74; McConaghy, Derrick Interview, 27; North Pacific Division, The Corps of Engineers in Washington (1969), 21-22.

[21] "Ingenuity pays off at Hanson Dam," *Western Construction* (May 1960): 49-53, 56.

[22] Ibid.; Seattle District, Proceedings of Meeting with Board of Consultants for Howard A. Hanson Dam, Green River, Washington, 1 Mar. 1960, 1-6; Col. Robert Young to Sen. Henry Jackson, Mar. 1960, Jackson Papers, Acc. No. 3560-3, Box 51.

[23] Seattle District, Design Memo No. 27, 2/7-2/8.

[24] The discussion of Wynoochee Dam is based on U. S. Army Engineer District, Seattle, Wynoochee River, Washington, Advance Report on Site Selection (Seattle, March 1965), 1-25; Seattle District, Fact Sheet: Wynoochee Project—History, Purpose, Structures, Schedules (Seattle, Aug 1967), Jackson Papers, Acc. No. 3560-4, Box 55; *ARCE, 1966*, 1626-27; *ARCE, 1967*, 1581; Green, *History of the Seattle District*, 7/3-7/4, B/2; North Pacific Division, The Corps of Engineers in Washington, 28.

[25] Col. C. C. Holbrook to Sen. Henry Jackson, 21 Apr. 1967, 4 May 1967, Jackson Papers, Acc. No. 3560-4, Box 55; Lt. Col. Allan Nesbitt to William Larson, 18 May 1967, ibid; William Larson to Lt. Col. Allan Nesbitt, 23 Jun. 1967, ibid; Col. R. E.

Mc Connell to Sen. Jackson, 6 Mar. 1969, ibid., Box 84; Lt. Col. Kenneth Mc Intyre to Sen. Jackson, 8 May 1969, ibid; Bert Cole to Board of Engineers for Rivers and Harbors, 3 Jun. 1969, ibid.; Ficken, "Building the Pacific Northwest," 428-29.

[26] Before the Corps could carry out non-reservoir flood control work, the law required local interests to (a) provide all lands, easements, and rights-of-way necessary for construction without cost to the United States, (b) hold and save the United States free from damages due to construction work, and (c) maintain and operate all completed work in accordance with rules established by the Secretary of the Army. Between 1938 and 1986, however, the federal government assumed nearly the entire cost for flood control reservoir projects. Green, *History of the Seattle District,* 4/40-4/44.

[27] Ibid.

[28] Ibid., 4/44-4/45.

[29] Ibid., 4/45.

[30] Ibid., 4/45-4/48; for an example of a typical flood fight, see Col. R. E. Mc Connell to Sen. Jackson, 24 Jan 69, Jackson Papers, Acc. No. 3560-4, Box 84.

[31] Corps of Engineers, Report of Preliminary Examination and Survey for Flood Control, Spokane River and Tributaries, Washington and Idaho (Seattle, Army Engineer District, Seattle, March 1944); Corps of Engineers, Plan of Study Interim Flood Control Study, Spokane River and Tributaries, Idaho (Seattle, Army Engineer District, Seattle, 1946).

[32] Corps of Engineers, Operation and Maintenance Manual, Spokane River and Tributaries, Flood Control Works at Coeur D'Alene, Idaho (Seattle, Army Engineer District, Seattle, 1946).

[33] Seattle District Engineer to North Pacific Division Engineer, Report of Flood Problem along the Coeur D'Alene River, Springston, Idaho and enclosures, 13 Feb. 1950; Seattle District Engineer to North Pacific Division Engineer, Report on Pring and Frazier Levee Repairs, Coeur d'Alene River, Idaho, 26 Jul. 1957; Seattle District, Contract for Emergency Levee Repair, Coeur d'Alene River, Idaho (Frazier and Pring Property), 20 Feb. 1957; Seattle District, Memo on Pine Creek, and attachments, 15 Jan. 1965; Seattle District, Pine Creek, Idaho, 1965 Levee Repair, 25 Oct. 1965 and Job Visit Report, Pine Creek 1965 Levee Repair, 18 Oct 1965; Seattle District, Specifications for Bank Protection, Lake Creek, Coeur d'Alene River, Idaho, 1 Apr. 1965; Seattle District, Memo on Big Creek, Hydraulic Analysis, Bank Protection, 12 Apr. 1965; Seattle District, Report on Dec. 1964 Flood Damage Repairs Accomplished by City of Kellogg, Idaho, 2 Jul. 1965; Seattle District Engineer to North Pacific Division Engineer, Memo on Flood Emergency Operations Required by Snowpack, Coeur D'Alene-Spokane River Basin, Channel Clearing and Debris Removal, 25 Mar. 1969; Seattle District Engineer to North Pacific Division Engineer, Memo on Flood Emergency Operations required by Heavy Snowpack, Apr. 1969; all documents in Seattle District Records Holding.

[34] The discussion of emergency and other flood control project work at Placer Creek is based on the following sources: Corps of Engineers, Spokane River and Tributaries (Placer Creek): Review of Reports on Flood Control (Seattle, Army Engineer District, Seattle, Mar. 1968); U. S. Cong., House, Committee on Public Works, *Placer Creek at Wallace, Idaho,* 91st Cong., 2d sess., 1970; Corps of Engineers, Hydrology of Placer Creek at Wallace, Idaho (Seattle, Army Engineer District, Seattle, 1979); Seattle District, Memo on Placer Creek, 11 Jan 1965; all documents in Seattle District Records Holding.

[35] Green, *History of the Seattle District*, 4/45-4/47.

[36] Ibid.

[37] Ibid., 4/41-4/42; Jamie W. Moore and Dorothy P. Moore, *The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy* (Boulder, CO: Institute of Behavioral Science, 1989), 34-54, quote on, 41.

[38] Moore and Moore, *The Corps and Flood Plain Management*, 48; Green, *History of the Seattle District*, 4/42.

[39] Moore and Moore, *The Corps and Flood Plain Management*, 48-50; Francis C. Murphy, *Regulating Flood Plain Development*, Department of Geography Research Paper No. 56 (Chicago, IL: University of Chicago Press, 1958); see also *Water Resources People and Issues: Gilbert F. White*, interviewed by Martin Reuss (Fort Belvoir, VA: Office of History, U. S. Army Corps of Engineers, 1993).

[40] Moore and Moore, *The Corps and Flood Plain Management*, 51; Francis C. Murphy, "Auxiliary Report on Regulating Flood-Plain Development, Seattle District, 19 Jan. 1959. Unfortunately, Murphy did not live to see the full impact of his work, as he died soon after returning to Seattle; Green, *History of the Seattle District*, 4/42.

[41] Moore and Moore, *The Corps and Flood Plain Management*, 51-54; quote in Green, *History of the Seattle District*, 4/42.

[42] Green, *History of the Seattle District*, 4/43; For an example of a flood plain report, see Corps of Engineers, Skagit River Basin, Washington, Flood Control and other Improvements (Seattle, Army Engineers District, Seattle, Mar. 1965), 1-64; North Pacific Division, The Corps of Engineers in Washington, 6-8; Moore and Moore, *The Corps and Flood Plain Management*, 86-88.

[43] Moore and Moore, *The Corps and Flood Plain Management*, 55-58, 88-98; Beatrice Hort Holmes, *History of Federal Water Resources Programs and Policies, 1961-1970*, Economics, Statistics, and Cooperative Service Miscellaneous Publication No. 1379 (Washington, DC: U. S. Dept. of Agriculture, 1979), 43-47, 75-100, 249-81.

[44] Green, *History of the Seattle District*, 4/39.

[45] Ibid., 4/39-4/40; Ficken, "Building the Pacific Northwest," 430-32; North Pacific Division, The Corps of Engineers in Washington (1969), 5.

[46] Green, *History of the Seattle District*, 4/40; North Pacific Division, The Corps of Engineers in Washington (1969), 4.

[47] Moore and Moore, *The Corps and Flood Plain Management*, 77-86.

[48] Green, *History of the Seattle District*, 4/8-4/9.

[49] Ibid.; McConaghy, Derrick Interview, 33-34; 79-80, 82-83.

[50] Keith C. Peterson and Mary E. Reed, *Controversy, Conflict and Compromise: A History of the Lower Snake River Development* (Walla Walla, WA: Army Engineer District, Walla Walla, 1994), 117-19; Green, *Seattle District History*, 4/28; McConaghy, Derrick Interview, 30-31.

[51] Green, *History of the Seattle District*, 4/30, C/13-C15.

[52] Ibid., 4/30-4/31.

[53] The discussion of the Marmes incident is based on the following sources: Ibid., 4/32-4/34; Peterson and Reed, *Controversy, Conflict and Compromise*, 17-20; Reed, *North Pacific Division*, 172-74.

[54] Much of the section on the Seattle District's military work is

based on Green, *History of the Seattle District*, 5/1-5/9.

[55] For excellent background on the cold war missile program, see John C. Lonnquest and David F. Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program* (Champaign, IL: U. S. Army Construction Engineering Laboratories, 1996), 1-139.

[56] David Winkler, *Searching the Skies: The Legacy of the United States Cold War Defense Radar Program* (U. S. Air Force Air Combat Command, Langley AFB, VA, June 1997).

[57] Green, *History of the Seattle District*, 5/2; McConaghy, Derrick Interview, 106.

[58] Green, *History of the Seattle District*, 5/2.

[59] McConaghy, Derrick Interview, 109-10; Division Eng. to Chief of Engineers, Jan.-Oct. 1961, Civil Works Files, Periodic Letters, Box XI, Office of History Research Collections; Arnold F. Swanberg, "The Development of the Army Planning Process: A Case Study of Fort Lewis" (MA thesis, University of Washington, 1982), 202-07; for background on the Capehart program, see William Baldwin, "Wherry and Capehart: Army Family Housing Privatization Programs in the 1950s," *Engineer* (Apr. 1996): 42-44.

[60] A good overview of the Nike program can be found in Christina M. Carlson and Robert Lyon, *Last Line of Defense: Nike Missile Sites in Illinois* (Denver, CO: US Army Corps of Engineers, Chicago District and National Park Service, Rocky Mountain System Support Office, 1996), 10-37; Lonnquest and Winkler, *To Defend and Deter*, 55-60, 165-83.

[61] Ibid.; Office, Chief of Engineers, Real Estate Disposal Report Nos. 162 and 230,1 May 1964 and 31 May 1966, Magnuson Papers, Acc. No. 3181-4, Box 134; Edwin Derrick to Eyland Washington, 14 Jan. 2004, personal communication.

[62] Seattle District, History of Corps of Engineers Activities at Fairchild Air Force Base, Construction of Atlas "E", Missile Complexes, Jan. 1959-Feb. 1961 (Seattle, 1961); Lonnquest and Winkler, *To Defend and Deter*, 209-26.

[63] U.S. Army Engineer District, Seattle, Press Release: Atlas ICBM Project, 25 Sep. 1960, Magnuson Papers, Acc. No. 3181-4, Box 110.

[64] Seattle District, History of Corps of Engineers Activities at Fairchild Air Force Base, II-2/II-36, \IV-7.

[65] U. S. Army Engineer District, Seattle, Press Release: Atlas ICBM Project, 25 Sep. 1960, Magnuson Papers, Acc. No. 3181-4, Box 110.

[66] McConaghy, Derrick Interview, 100-103. CEMBCO also had construction responsibility for the remaining work on the Atlas program; U. S. Army Corps of Engineers Ballistic Missile Construction Office, WS133A Minuteman Technical Facilities Malmstrom Air Force Base Great Falls, Montana (n.d.), 1-1/1-2; see also, Lonnquest and Winkler, *To Defend and Deter*, 80-81, 241-58.

[67] Green, *History of the Seattle District*, 5-5/5-7; U. S. Army Corps of Engineers, Ballistic Missile Construction Office, History of Malmstrom Area During Construction of Collocated Squadron No. 20 Minuteman II ICBM Facilities (Malmstrom Air Force Base, Montana, 31 Dec. 1966), 2-2.

[68] Ibid.

[69] McConaghy, Derrick Interview, 164-65; Joseph J. Hagwood,

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[1] Green, *History of the Seattle District*, 4/5

[2] Ibid., 4/5.

[3] Ibid., 4/7.

[4] Ibid.

[5] Ibid., 4/7-4/8.

[6] Ibid., E/12-E/13, E15-E/16.

[7] Ibid., E/11-E/14.

[8] Ibid., E/16-E/19.

[9] Quoted in ibid., 7/5.

[10] Ibid., 7/4-7/7.

[11] Ibid.

[12] Ibid., 7/9-7/10.

[13] Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York, Hill and Wang, 1995), 108.

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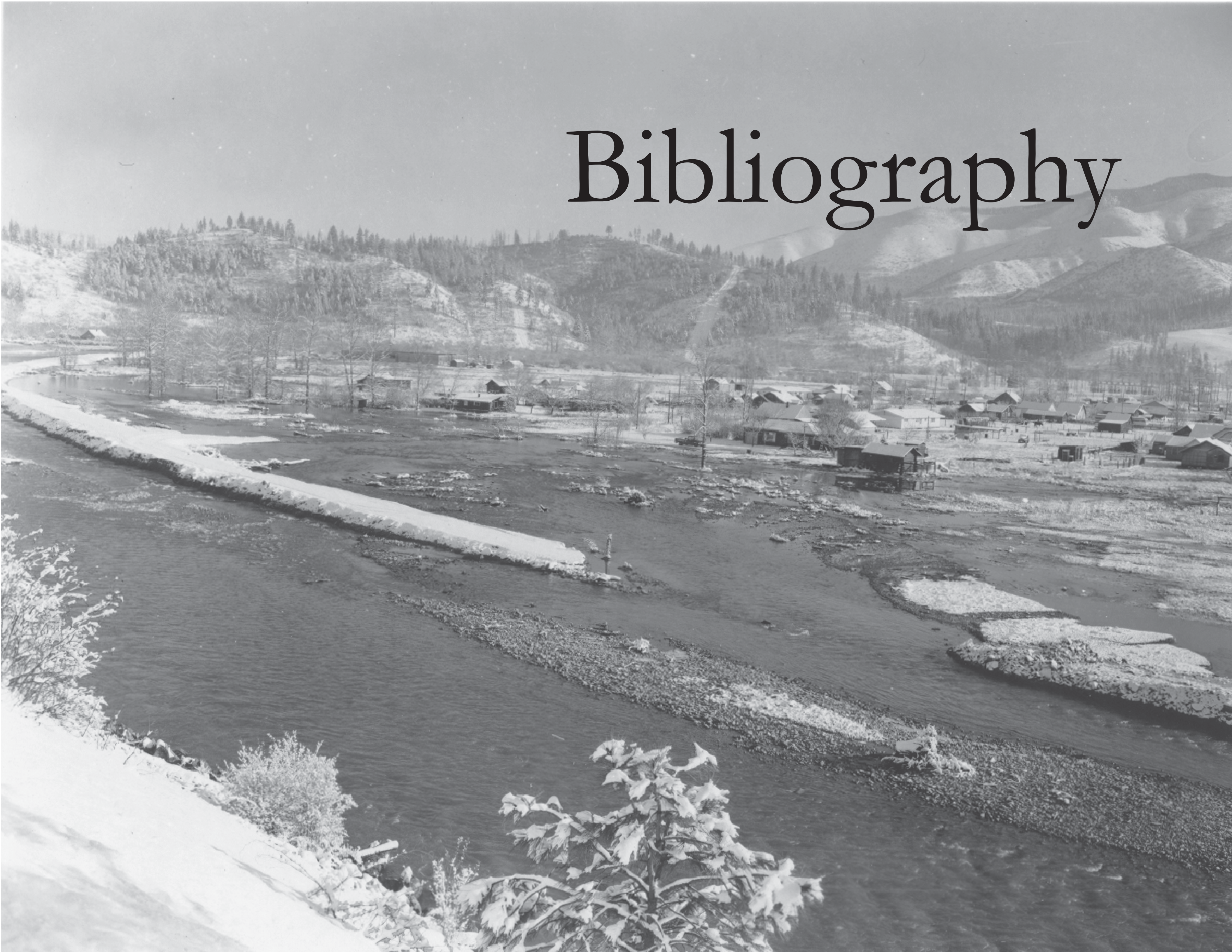

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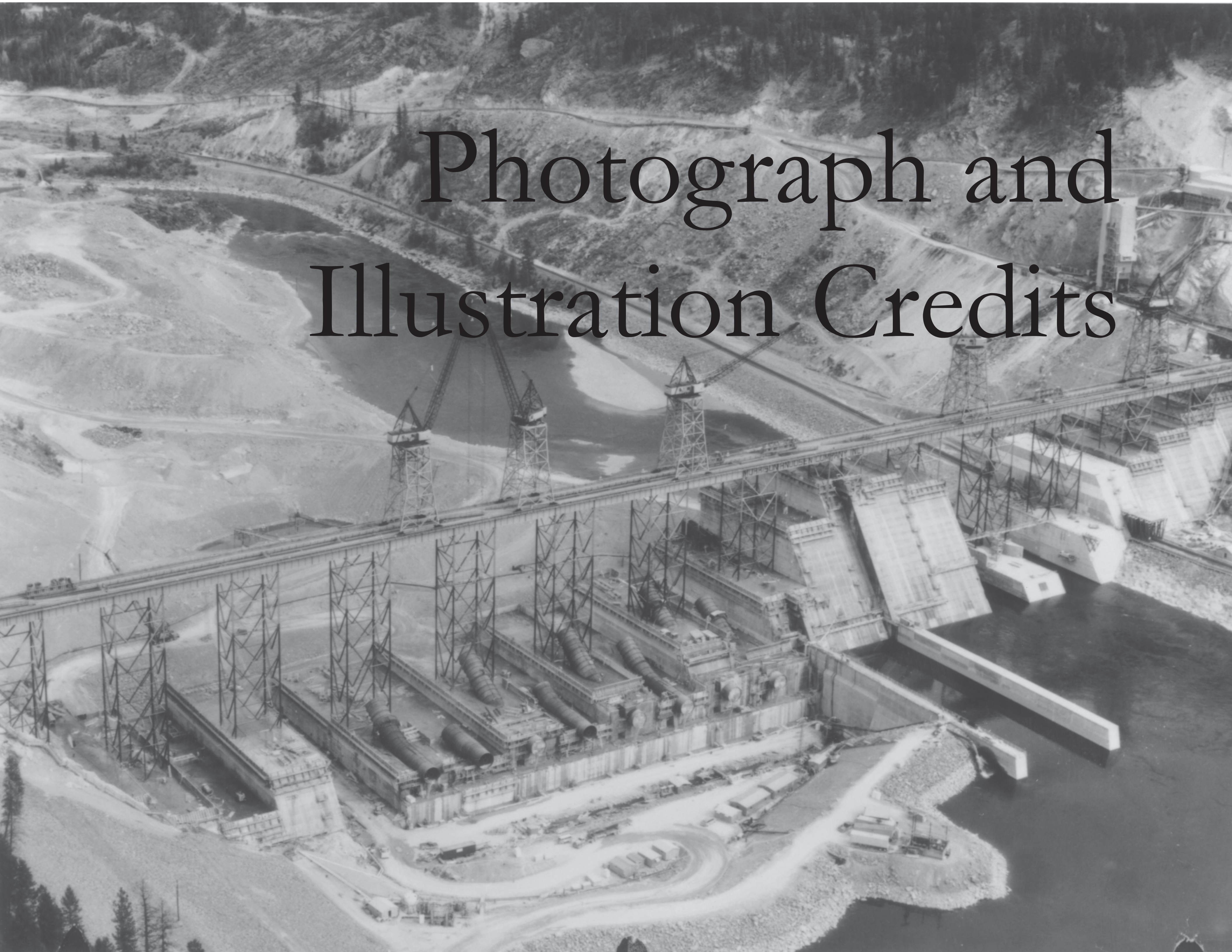

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Forward

	COL Lewis, District Commander	Seattle District, Public Affairs images

Chapter 1

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Chapter II

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Boundaries and Responsibilities

Seattle District: Boundaries and Responsibilities

The maps on the back cover show the three boundaries of the Seattle District – civil, military and regulatory. The changes that took place consisted of shifting civil and military responsibilities among Army Corps of Engineers districts on the West Coast. The key changes are below.

1921 – The Corps reassigned the Alaska civil works projects from the Seattle District to the newly created Alaska District based in Juneau.

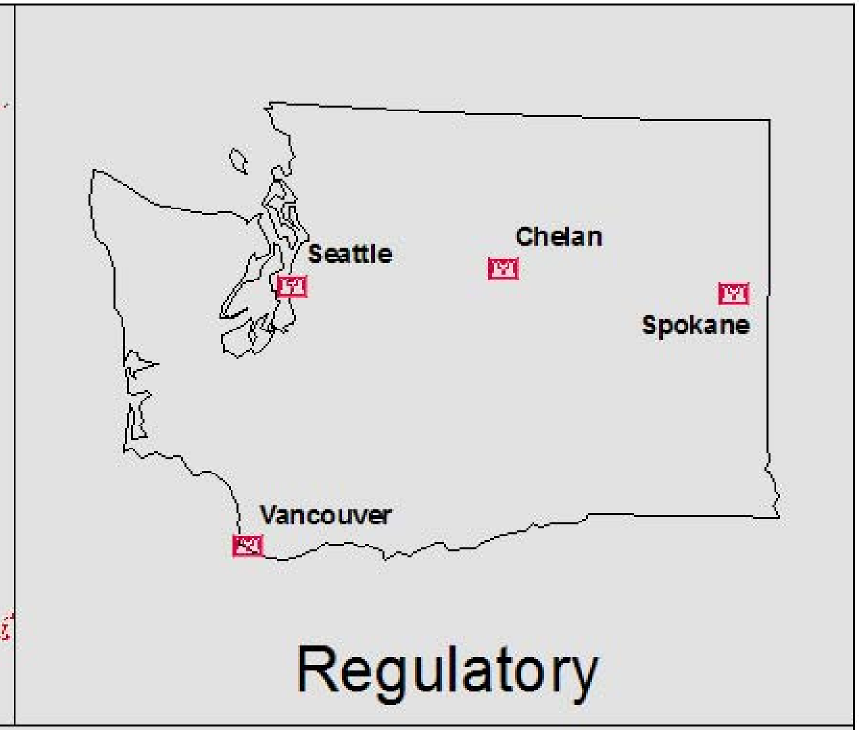
1932 – The Corps closed the Juneau office and the civil works projects were reassigned to Seattle district.

1941 – Seattle District received responsibilities for the massive Alaska military construction program.

1942 - Jurisdiction for Alaska military construction program was switched from the Corps to the Western Defense Command.

1946 - The Corps re-established Alaska District with its headquarters in Anchorage.

1970 - Seattle District's military responsibilities were transferred to Sacramento District due to Corps reorganization. [Seattle regained those responsibilities later.]



Seattle District's civil works boundaries encompass 99,000 square miles and include 4,700 miles of shoreline. The boundaries include the Columbia River system upstream of the mouth of the Yakima River, much of western Washington, northern Idaho and western Montana to the Rocky Mountains. The district shares 600 miles of international border with Canada, and the district engineer sits on three International Joint Commission Boards of Control.

Seattle District's military boundaries include the states of Washington, Oregon, Idaho and Montana.

The district has regulatory jurisdiction over Washington State, administering Section 10 of the River Harbor Act of 1899, Section 404 of the Clean Water Act of 1972, and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972.