**PDHonline Course C785 (15 PDH)**

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# GRAND COULEE DAM and the Planned Promised Land

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**2020**


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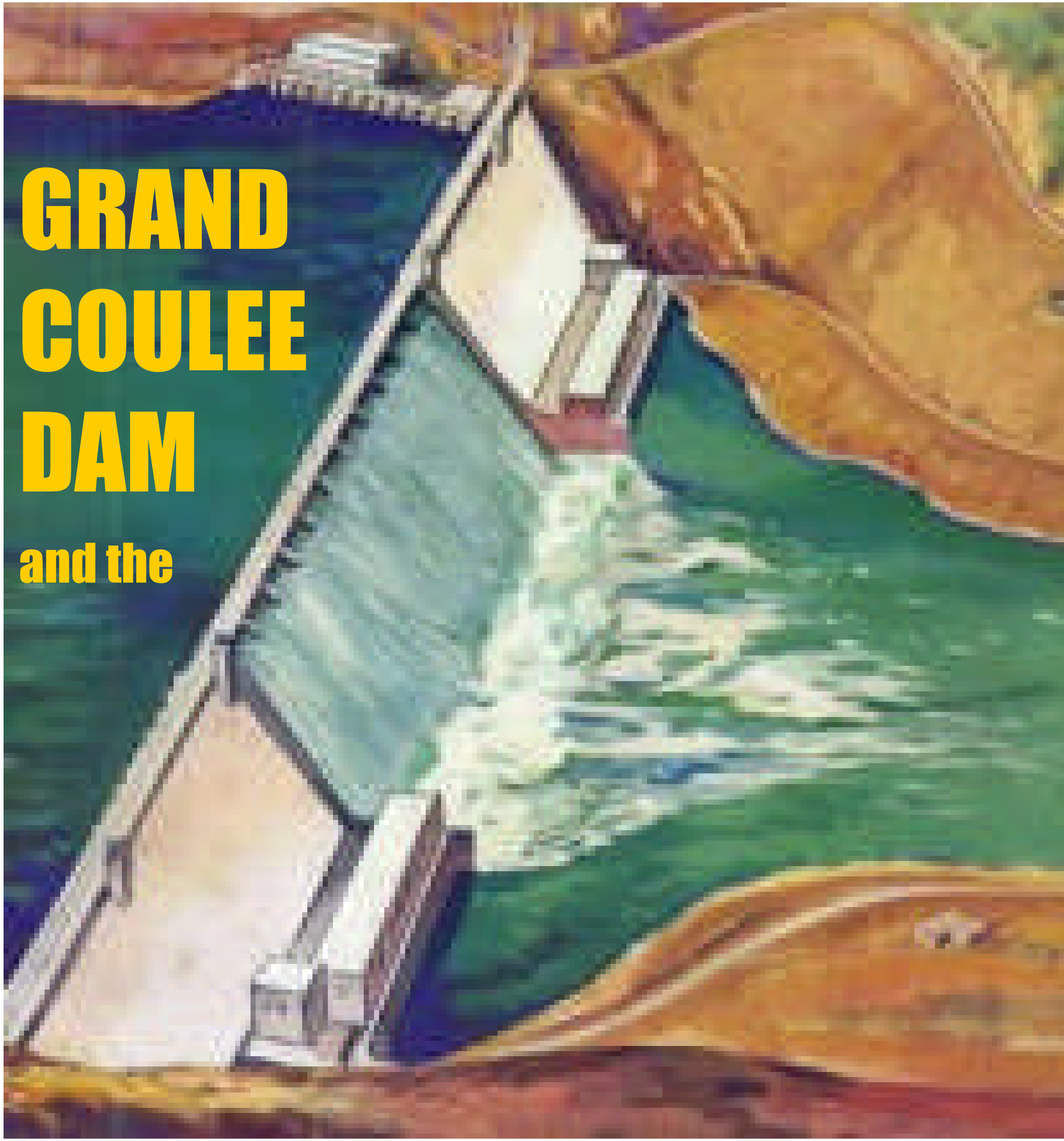

# GRAND COULEE DAM

and the

# *Planned Promised Land*

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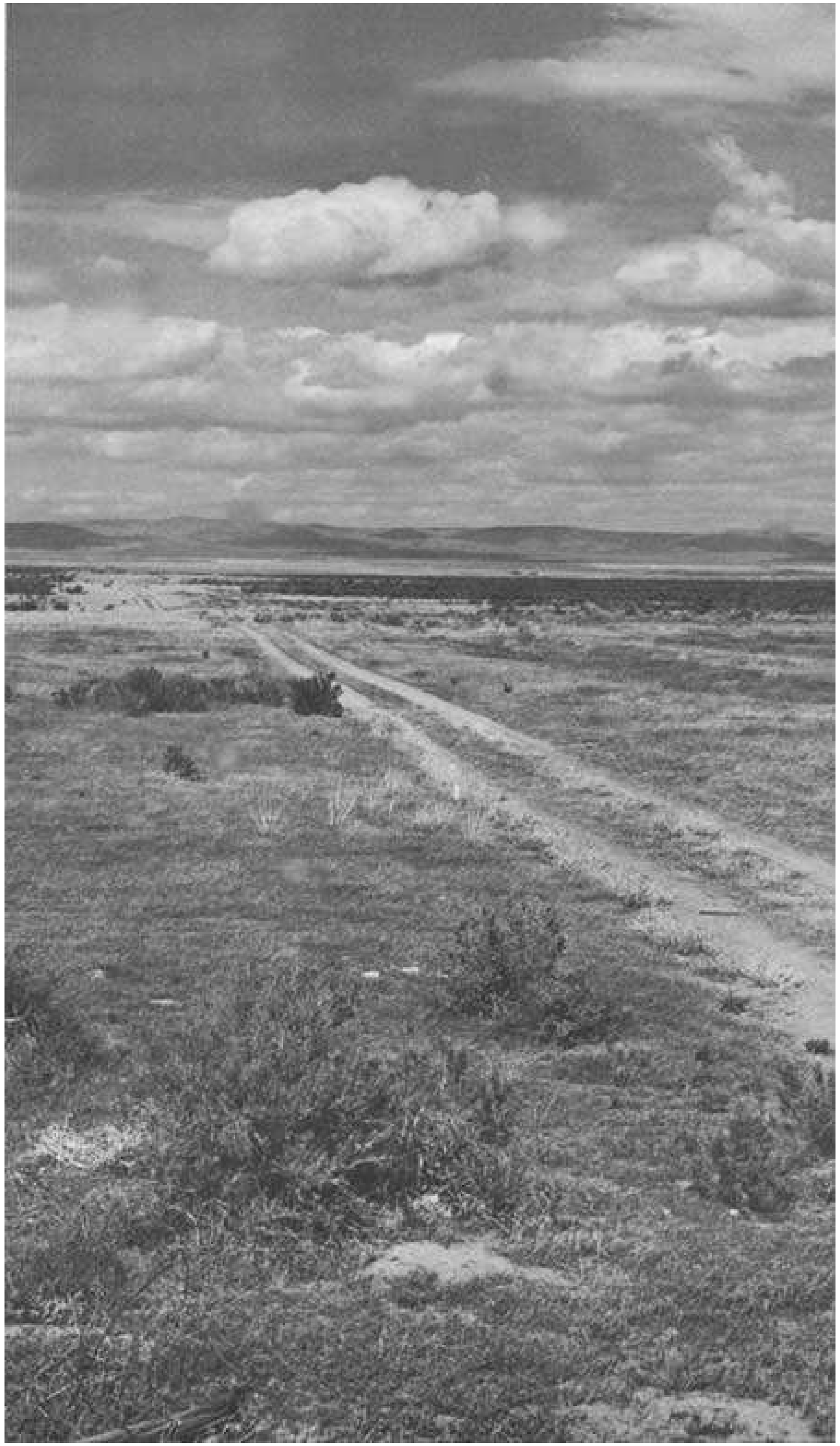
# A Dream of Fifty Years

# A Hint of Hope



***"…projects in the west have an additional purpose which eventually will be far more important than that of supplying power alone. The eleven arid and semi-arid western states contain forty percent of the country's area, only nine percent of its population, and less than five percent of its farmed area. Vast tracts could be devoted to agriculture if only water were available…"***

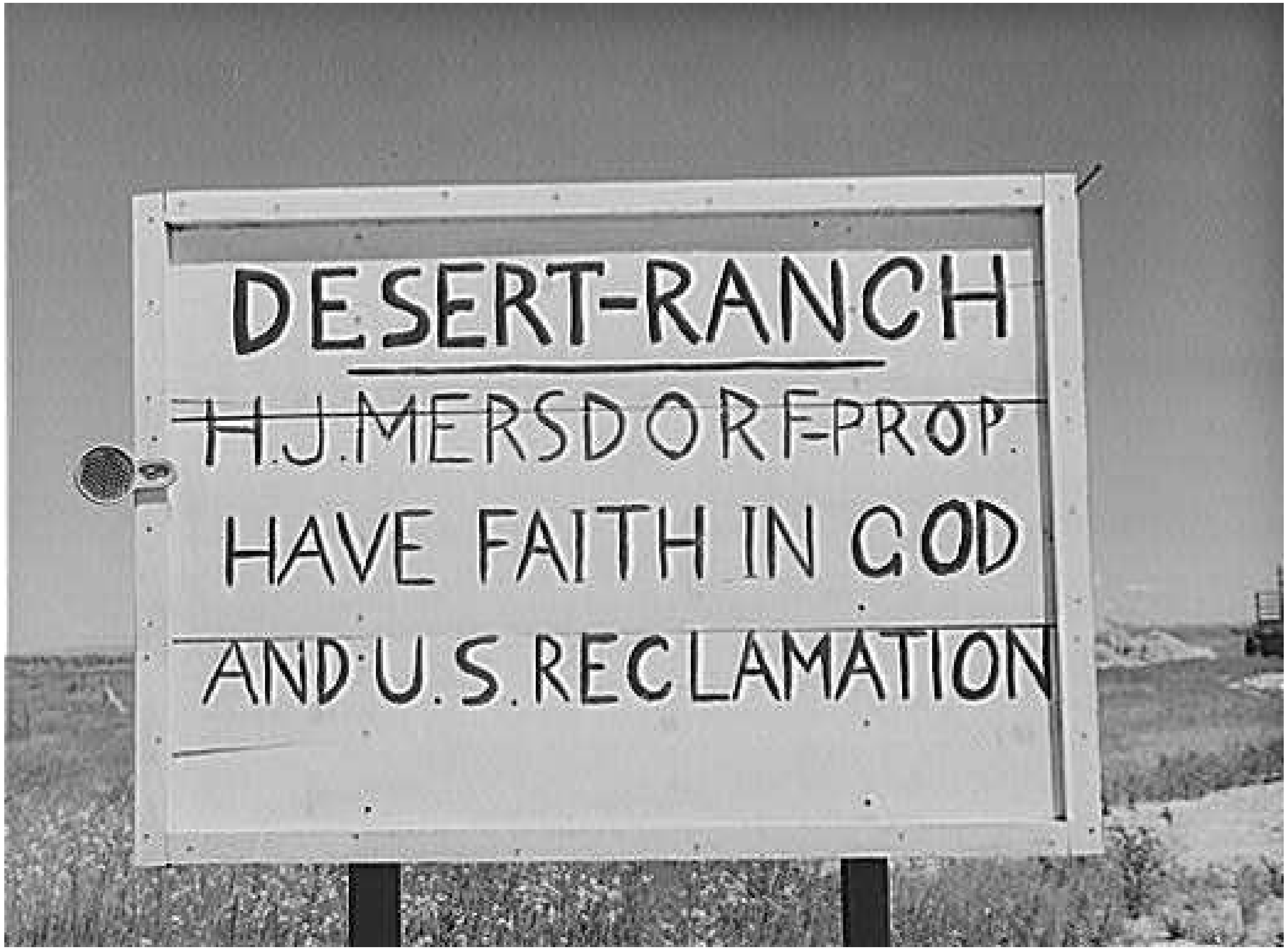
***Popular Mechanics*, May 1942**

**<u>Left</u>: caption: "Before irrigation - sparse desert vegetation and a faint road running across the prairies like a hint of hope."**

***"…Already the Bureau of Reclamation has completed three dozen projects in the west by which the scanty rainfall is conserved and made available for irrigation. These projects cost some 250 million dollars but the nearly one million people who have settled on them have already produced a crop wealth of two and a half billion dollars."***

***Popular Mechanics,* May 1942**

**Left: caption: "Aerial view of the principal end-goal of an irrigation project: farmland for farmers to raise food for people"**

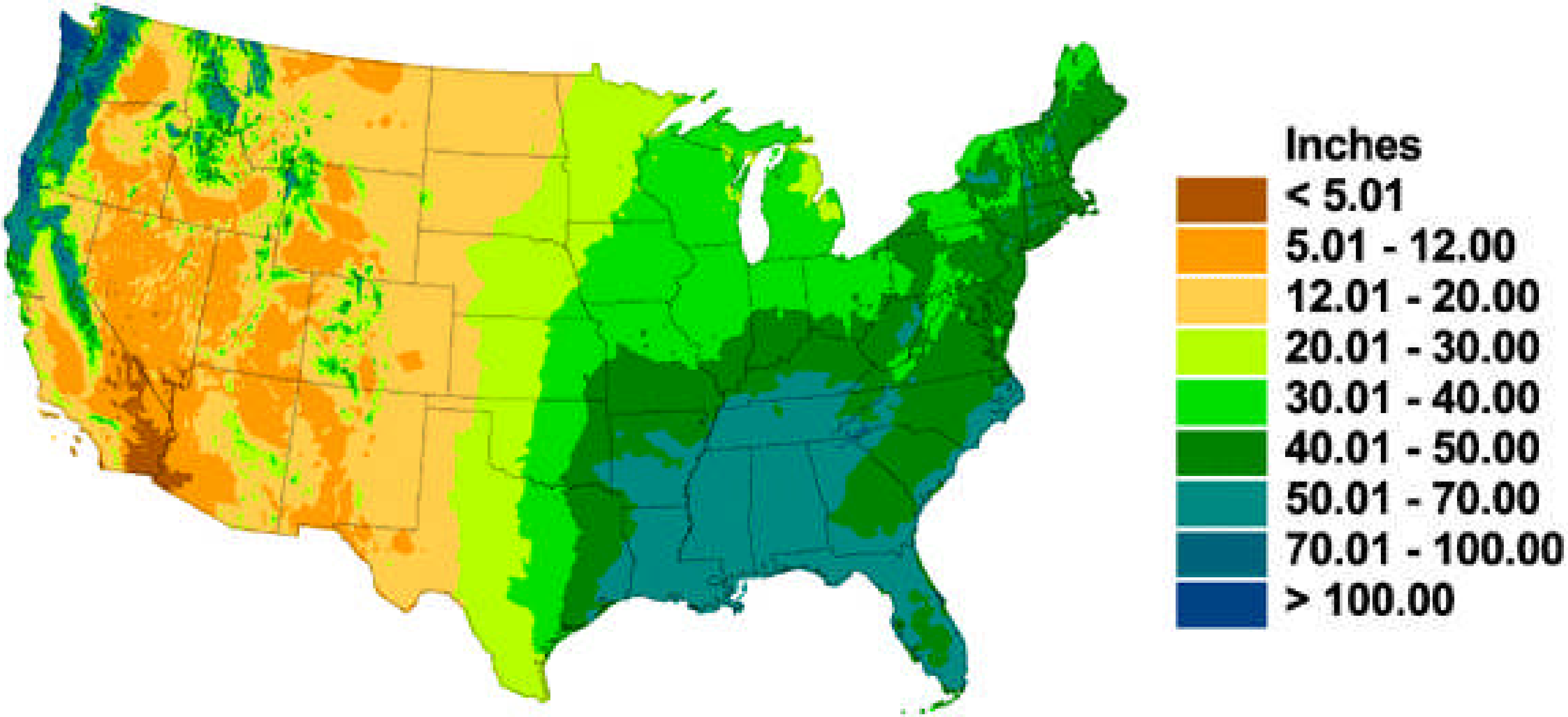

DESERT-RANCH
H.J.MERSDORF-PROP.
HAVE FAITH IN GOD
AND U.S. RECLAMATION

# Teaching Old Rivers New Tricks

*"An old river can learn new tricks when it is taught by the reclamation engineers of the Interior Department. The Department's 44-year-old Bureau of Reclamation is using river-taming techniques that have revolutionized the 4,000-year-old science of irrigat-ion. The Colorado, the Columbia, the Sacramento, and the Missouri, which for centuries ran wild and free are now being leashed and put to work by monumental dams and hydroelectric plants. They are being trained to fetch and carry and thus lighten the labors of many men. These are not the only American rivers that will be taught to work for man. Almost forty river bas-ins or sub-basins are included in rec-lamation plans for full conservation and development of the water resou-rces of the west…"*

***Popular Mechanics,* August 1947**

**<u>Above</u>: caption: "With continued delivery of irrigation water to the fields each year, the land has improved and the settler has prospered."**
**<u>Left</u>: caption: "Development of this land means a larger measure of prosperity for the nation and a bright future for the project settler and his family."**

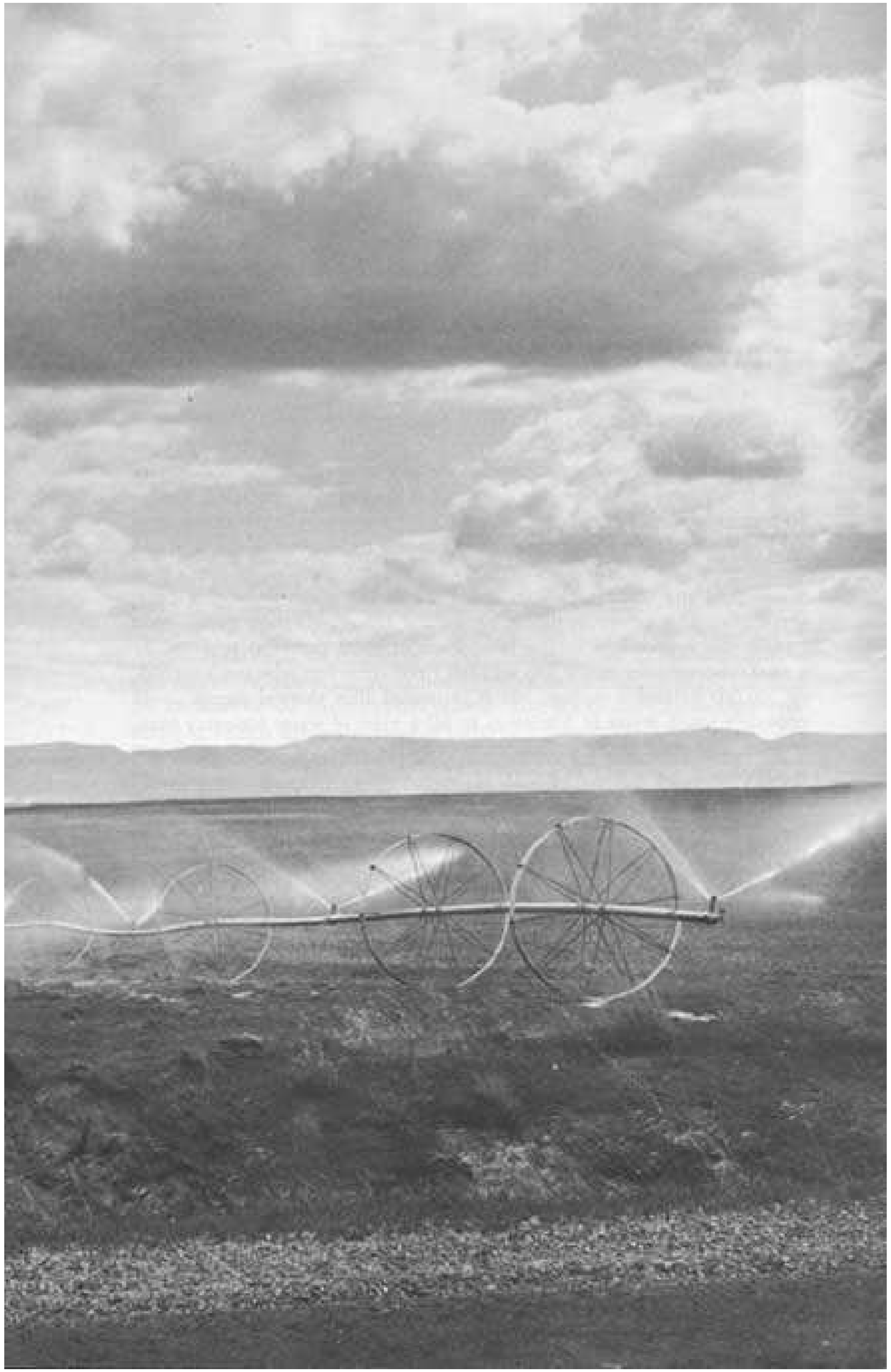



***"…To understand the great need for river regulation, we must look at a weather map of the United States. One third of the land area of the nation lies in a zone where rainfall, except in high mountains on a narrow western coastal strip, is insufficient or improperly distributed for sustained crop production, For this reason, irrigation is essential for stabilized agriculture…"***

***Popular Mechanics,* August 1947**



**<u>Above</u>: caption: "Annual Mean Total Precipitation"**



*"…Early in our national history, western leaders realized that if the water that wasted into the sea were diverted to their arid but fertile soil, they could turn much of the desert wastelands into prosperous farm lands. These men, however, had neither funds nor skills to construct vast engineering projects. After the limits of community effort and private capital had been reached in the construction of irrigation facilities, the West appealed to the federal government for help, and in 1902 Congress passed the Reclamation Act. It provided for conservation and use of the water resources of the West on a scale theretofore impossible…"*

***Popular Mechanics,* August 1947**

**Left: caption: "Irrigation of arid western land transforms it into highly productive farmland"**

The *Reclamation Act of 1902* (a/k/a “Lowlands Reclamation Act” and/or “National Reclamation Act”) funded irrigation projects for the arid lands of twenty western states. At first, the act covered only thirteen of the western states The act set aside money from sales of semi-arid public lands for the construction and maintenance of irrigation projects. The newly irrigated land would be sold and the revenue placed into a revolving fund that supported more such projects. This led to the eventual damming of nearly every major western river. Under the act, the Secretary of the Interior created the *United States Reclamation Service* (U.S.R.S.) within the *United States Geological Survey* (U.S.G.S.) to administer the program. In 1907 the U.S.R.S. became a separate organization within the *Department of the Interior.* The Act was authored by (the appropriately surnamed) Representative *Francis G. Newlands* of Nevada.

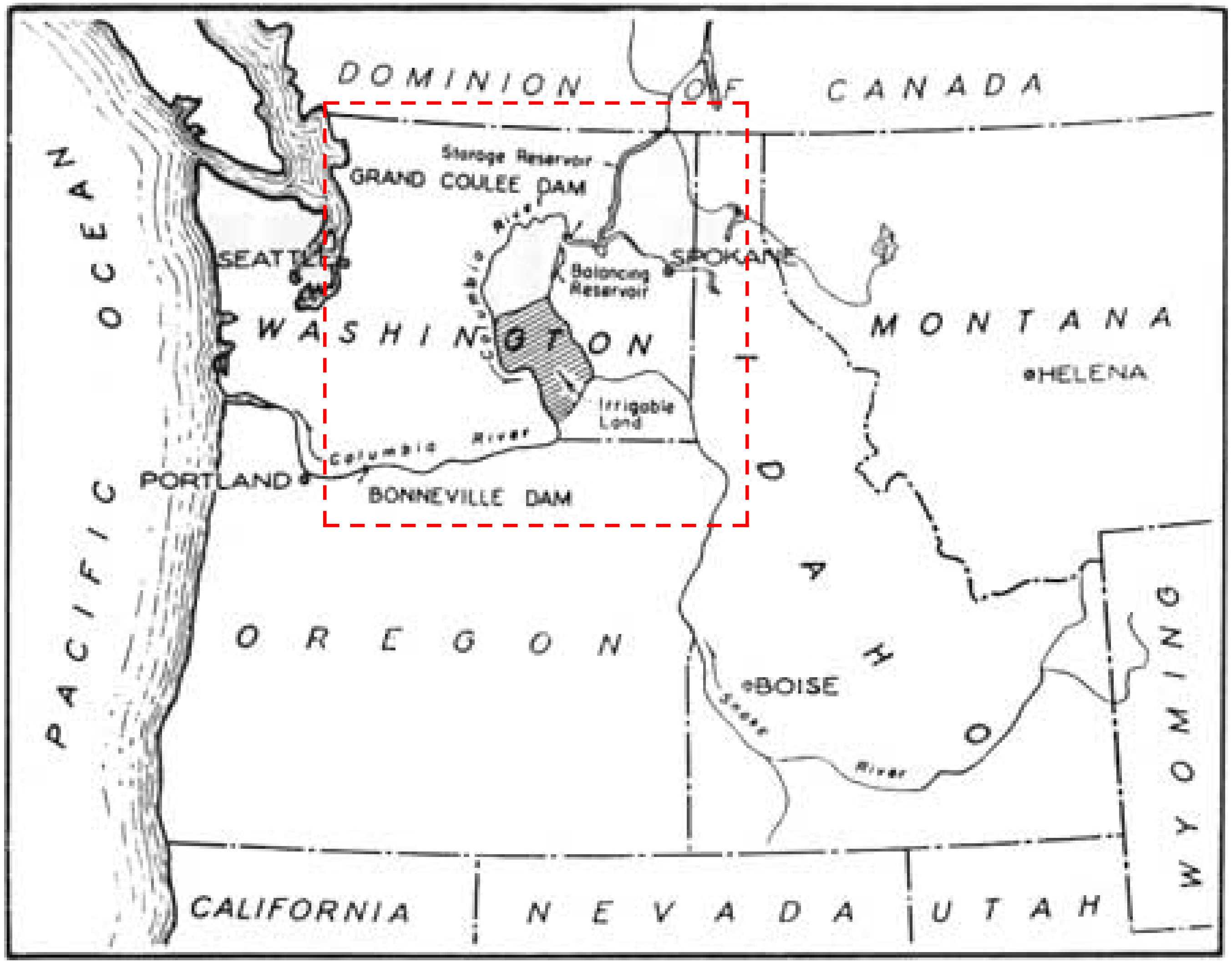
**<u>Left</u>: POTUS *Theodore Roosevelt* depicted in a period political cartoon as protector of public lands**

# A New Era

***"More than one hundred dams have been built by the Reclamations Bureau of the United States Government in the Western States. These structures have irrigated and made productive millions of acres of barren. The Federal Government is conducting great engineering enterprises in all parts of the United States, including the work of the Tennessee Valley Authority. The object of the works in the Western States is the reclamation of the huge tracts of desert land which have so far defied full settlement and cultivation. Technically this region is not all desert, but water is scarce, the soil is dry and temperatures are high. By large-scale irrigation the American engineers are creating a vast new country which will be able to support millions of people. So far the United States Government has spent more than £50,000,000 on irrigation works in the Western States, not including the money spent on the Boulder Dam, nor the cost of building the Grand Coulee Dam - an even bigger structure across the Columbia River, in the State of Washington. Work on this dam was begun in December 1935, and when it is finished the structure will contain three times as much concrete as the Boulder Dam…"***

***Wonders of World Engineering,* November 1937**

**Above: caption: "Excess water from Franklin D. Roosevelt Lake, behind the Grand Coulee Dam, plunges over the dam's spillway."**

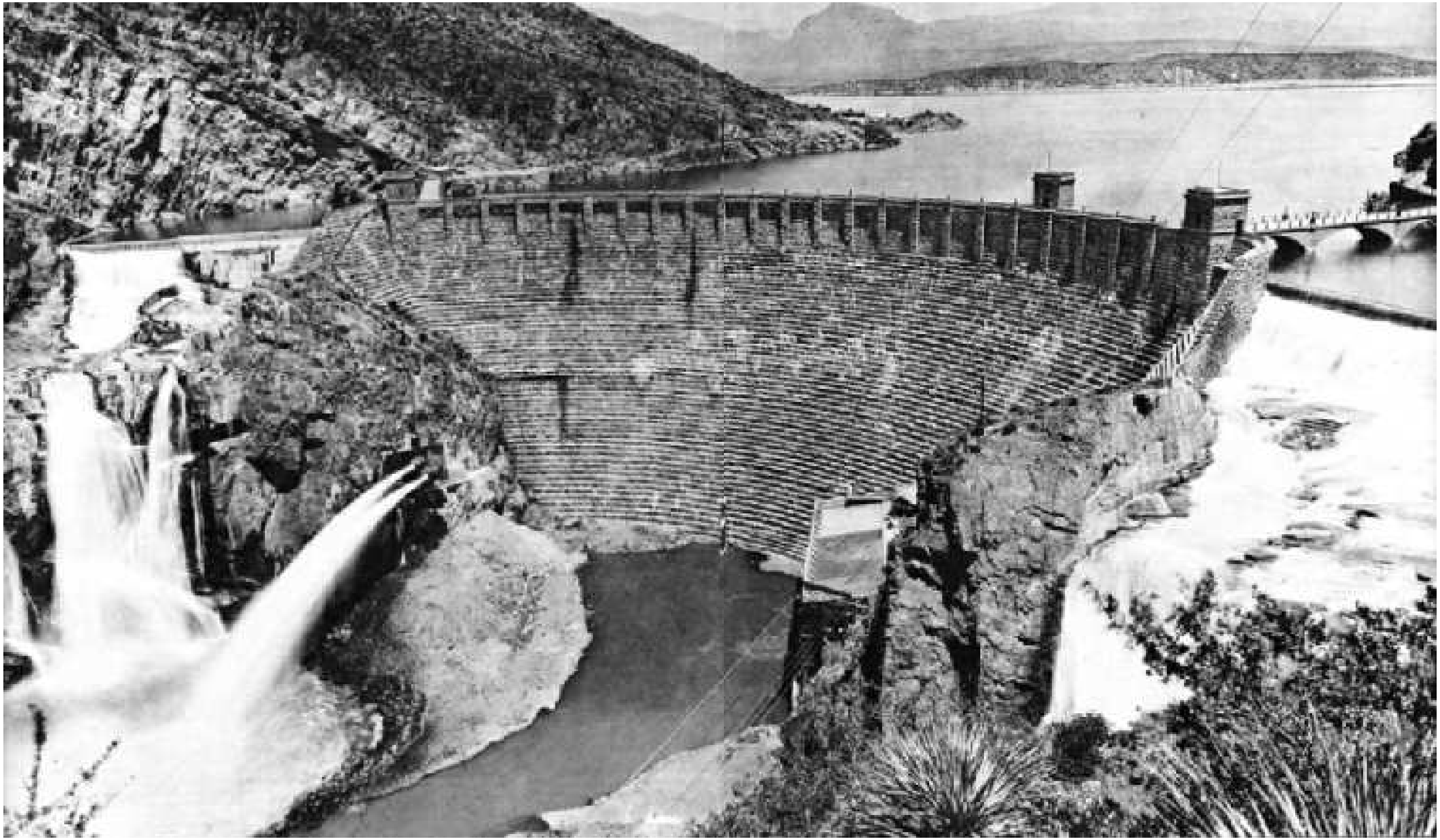

DOMINION OF CANADA
PACIFIC OCEAN
Storage Reservoir
GRAND COULEE DAM
Columbia River
SEATTLE
SPOKANE
Balancing Reservoir
WASHINGTON
MONTANA
HELENA
Irrigable Land
Columbia River
PORTLAND
BONNEVILLE DAM
IDAHO
OREGON
BOISE
Snake River
WYOMING
CALIFORNIA
NEVADA
UTAH

**<u>Above</u>: caption: "Elephant Butte Dam was built across the Rio Grande river in 1915, and was at that time the largest structure of its kind. The dam is 1,200-feet long, with a maximum height of 300-feet. The reservoir created by the dam is forty-five miles long and serves to reclaim nearly 200,000 acres of fertile land from the desert."**

***"…A number of dams have been built on the Colorado River and on the Salt River, Arizona. Perhaps the best known of these is the Roosevelt Dam, which has formed a lake with a surface area of twenty-five and a half square miles. Idaho, Nevada, Wyoming, Utah and New Mexico all have their water conservation schemes…"***

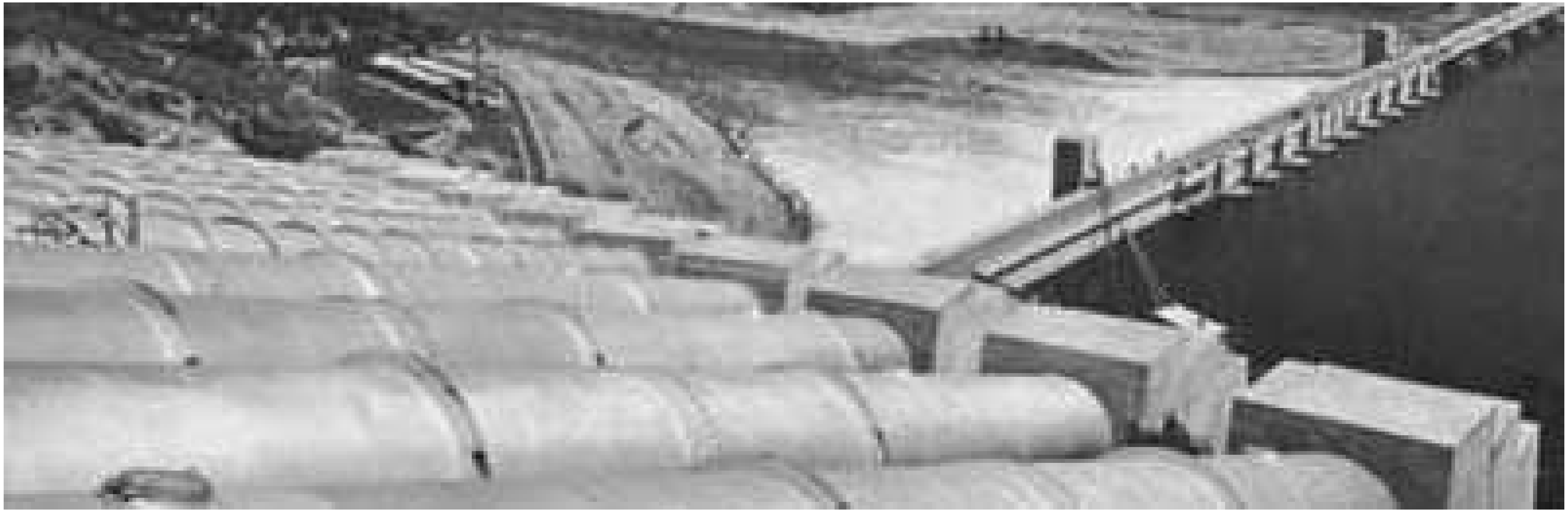
***Wonders of World Engineering,* November 1937**

**Left:** ***Roosevelt Dam***



**<u>Above</u>: caption: "Two Spillways, one on either side of the dam, release the overflow waters from the reservoir created by the Roosevelt Dam, across the Salt River, Arizona. The spillways have a normal capacity of 113,000 feet-per-second, and are each 200-feet long. The dam is of rubble masonry with coursed rubble faces, laid in Portland cement mortar. It has a length of 1,125-feet at the crest and a width of 158-feet at the base, with a height of 280-feet."**

# Life-Giving Waters

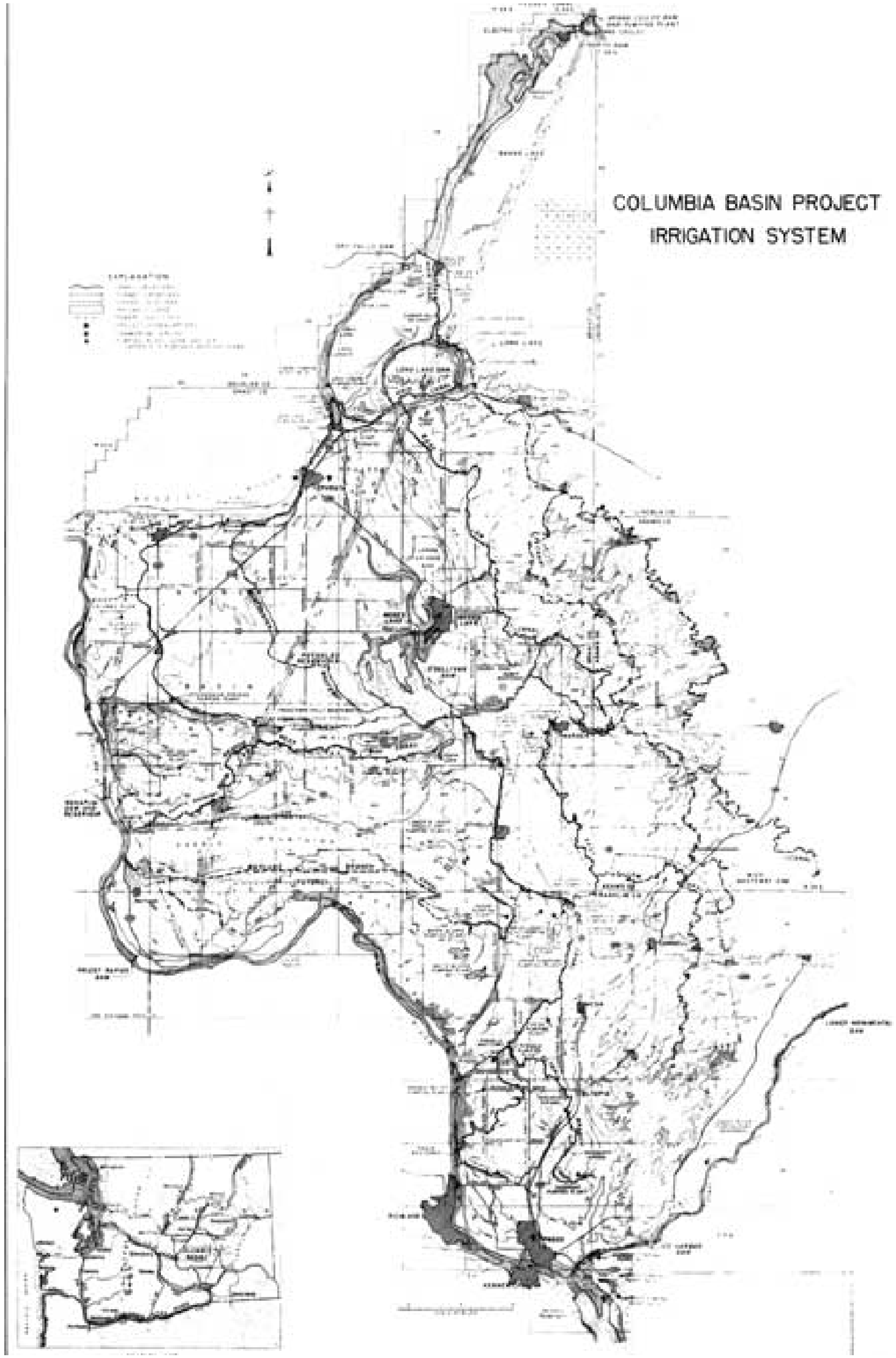


***"A dream of fifty years, the irrigating of a vast tract of rich desert and dry-farming load in central Washington, is about to be realized through the construction of the Grand Coulee Dam, and a system at canals that, in time, will cover an area sixty miles wide, east and west, and eighty-five miles long, north and south, and bring to it the life-giving waters of the Columbia River. When fully developed, the Columbia Basin Reclamation Project will reclaim over 1,200,000 acres of land, regulate the flow of the Columbia River far the benefit of downstream power plants and navigation, and develop electric energy to be used in pumping for irrigation and far other purposes, on the project and elsewhere..."***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**<u>Above</u>: caption: "Twelve giant pipes scale the wall of the Columbia River Gorge at Grand Coulee, lifting irrigation water 280-feet from the reservoir behind the dam. Each pipe is 12-feet in diameter and can carry 720,000 gallons a minute. Only six pipes are being used at the project's present stage of development." (ca. 1964)**

**An irrigation project must be located so that its produce can be easily exported to processing plants and markets. The approximate center of the irrigated lands of the Columbia Basin is 135 air-miles from Seattle, 105 miles from Spokane and 150 miles from Portland. The area is served by major truck, rail, bus and air lines, It is also crossed by state and federal highways and a network of county roads. Markets of the world can be reached through the ports of Vancouver, Portland and Seattle. Barges range upriver as far as Pasco at the south-end of the project, where there are water terminal facilities.**



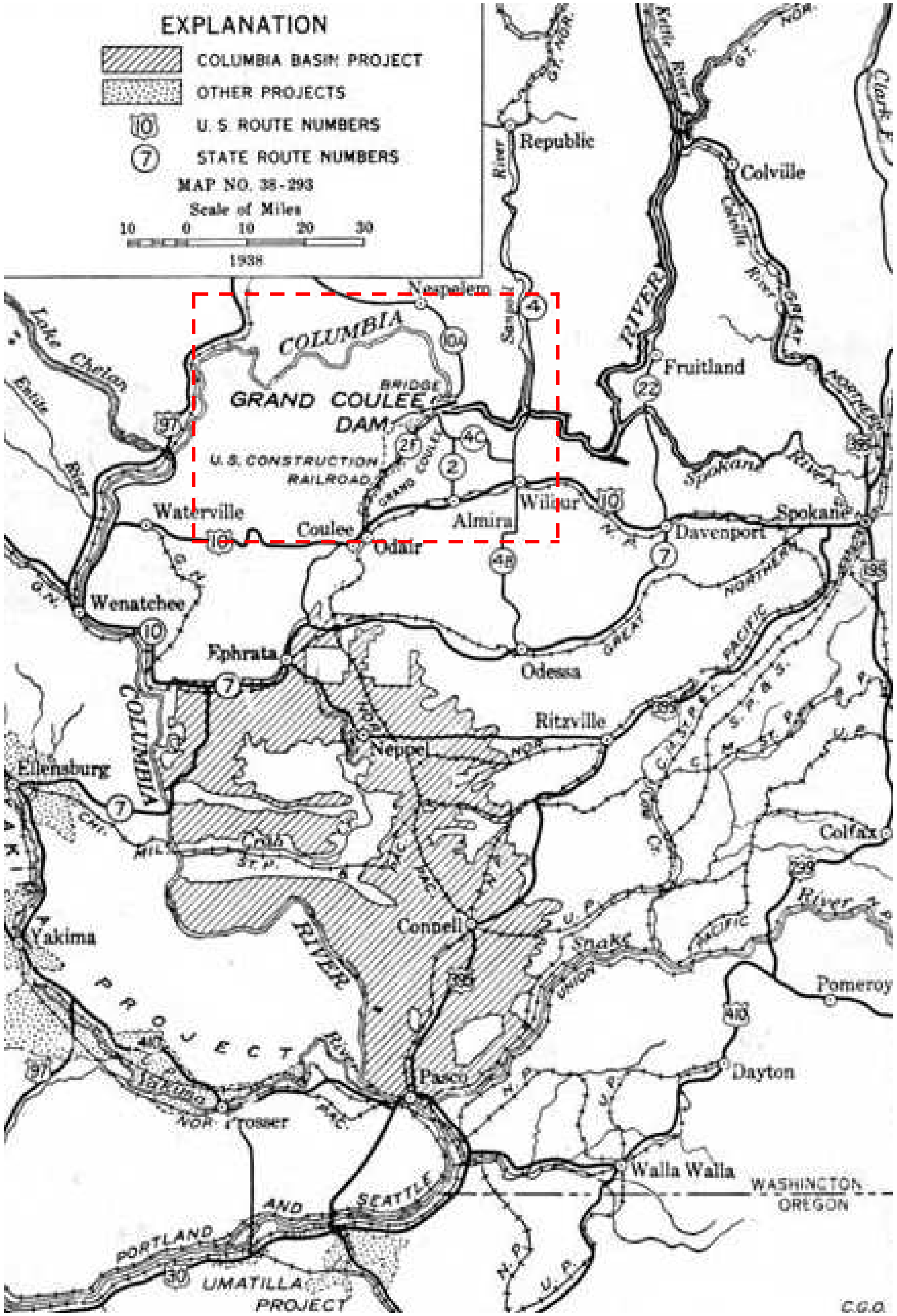

<u>Left</u>: caption: “The supply and distribution system for the project’s irrigation water starts at Franklin D. Roosevelt Lake, the reservoir behind Grand Coulee Dam, and stretches south and west to the city of Pasco at the southern tip of the project, 160 miles away. A network of thousands of miles of waterways traverse the project area, bringing water to the fields and removing the excess. At present, there are more than 2,000 miles of canals on the project. Included in this 2,000 miles of waterways are sixteen large canal siphons and two tunnels, which carry the water of the Columbia across coulees and through barriers of high ground with little loss of elevation. The largest of these irrigation structures is the Soap Lake Siphon, which carries the waters of the West Canal across the lower end of the Grand Coulee. It is actually an inverted siphon which dips from the high ground to the east of Soap Lake, crosses the Coulee in a semicircle around the northern end of the lake, and comes out on high ground to the west. This concrete tube is 12,883-feet long and has an inside diameter of 22-feet 4-inches for the major portion of the distance, with the remainder 25-feet in diameter. Though it will hold forty-one million gallons of water, engineers say the water in it will change every sixteen minutes when the water in the canal is flowing at full capacity.” (ca. 1964)

The *Columbia Basin Project* embraced an area roughly twice the size of Delaware. Nearly half of this land was irrigable, with the remainder being rough and unsuitable or taken up by town sites, airports, reservoirs and/or wasteways. Since the upper edge of the irrigated lands of the project is about 45 miles south and slightly west of *Grand Coulee Dam*, getting the water to the land, distributing it and draining off the excess required an extensive and complex infrastructure.

__Top Left__: caption: “With the dam completed, work began in earnest on the many miles of waterways needed to transport the water to the land”

__Top Right__: caption: “Work on the irrigation system of the project got underway after World War II. Here, huge machines pave the Main Canal below Long Lake Reservoir”

__Left__: caption: “The project’s Main Canal. During irrigation season the water here is 21-feet deep, with a capacity of 4,365,000 gallons per minute”




***"…The Grand Coulee Dam, principal and outstanding engineering feature of the project, is located on the Columbia River just below the head of the Grand Coulee, where for a short distance the river flows north. It is 94 miles north and west of Spokane, and 259 miles by highway east of Seattle. It is 151 miles downstream from the Canadian border, and about 600 miles above the mouth of the Columbia at Astoria. Although it is not at the narrowest point in the river's canyon, the site for the dam was chosen because, here, close to the head of the Grand Coulee, a granite barrier once lay across the river's course and extended from the Okanogan highlands far into the basalt plateau which farms the left bank of the river above and below the dam site. The remains of this granite barrier form exceptionally good foundation and abutments for the dam…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Colossus of the New World

***"Standing astride the mighty Columbia River like a Colossus of the new world, Grand Coulee Dam is a giant in a land of superlatives. Only after touring the installation and studying it from all angles does a realization of its bigness begin to dawn. It is the largest concrete dam in the world, containing 10,585,000 cubic yards, or 21,154,000 tons, of concrete. It towers 550-feet from bedrock to the crest and tapers from a width of more than 450-feet at its base to 30 feet at its top. The dam reaches as high as the Washington Monument and contains enough material to build 275 monuments of the same size. Its immensity dwarfs the two powerhouses at its base, each of which is as tall as a 13-story office building. There is enough concrete in the dam to build a standard two-lane concrete highway 22-feet wide and 8-inches thick from Seattle to Miami, with a 3-foot sidewalk for pedestrians."***

***U.S. Bureau of Reclamation***

**<u>Left</u>: caption: "Grand Coulee Dam Spillway and Powerhouse – drawing by Hugh Ferriss, 1942"**


***"Undoubtedly one of the most eye- and ear-catching features of the dam is the waterfall, which pours over the face of the dam during the summer. The overflow begins in the latter part of May and continues through August and occasionally into September, creating a waterfall more than half as wide as Niagara Falls. At the peak of the high water flow in a normal year, 135 million gallons of water a minute cascade over the spillway and thro-ugh the gates of the dam and plunge twice as far as the Niagara River at Niagara Falls. At night the whole of this frothing curtain of water is illuminated by alternating colored lights."***

***U.S. Bureau of Reclamation***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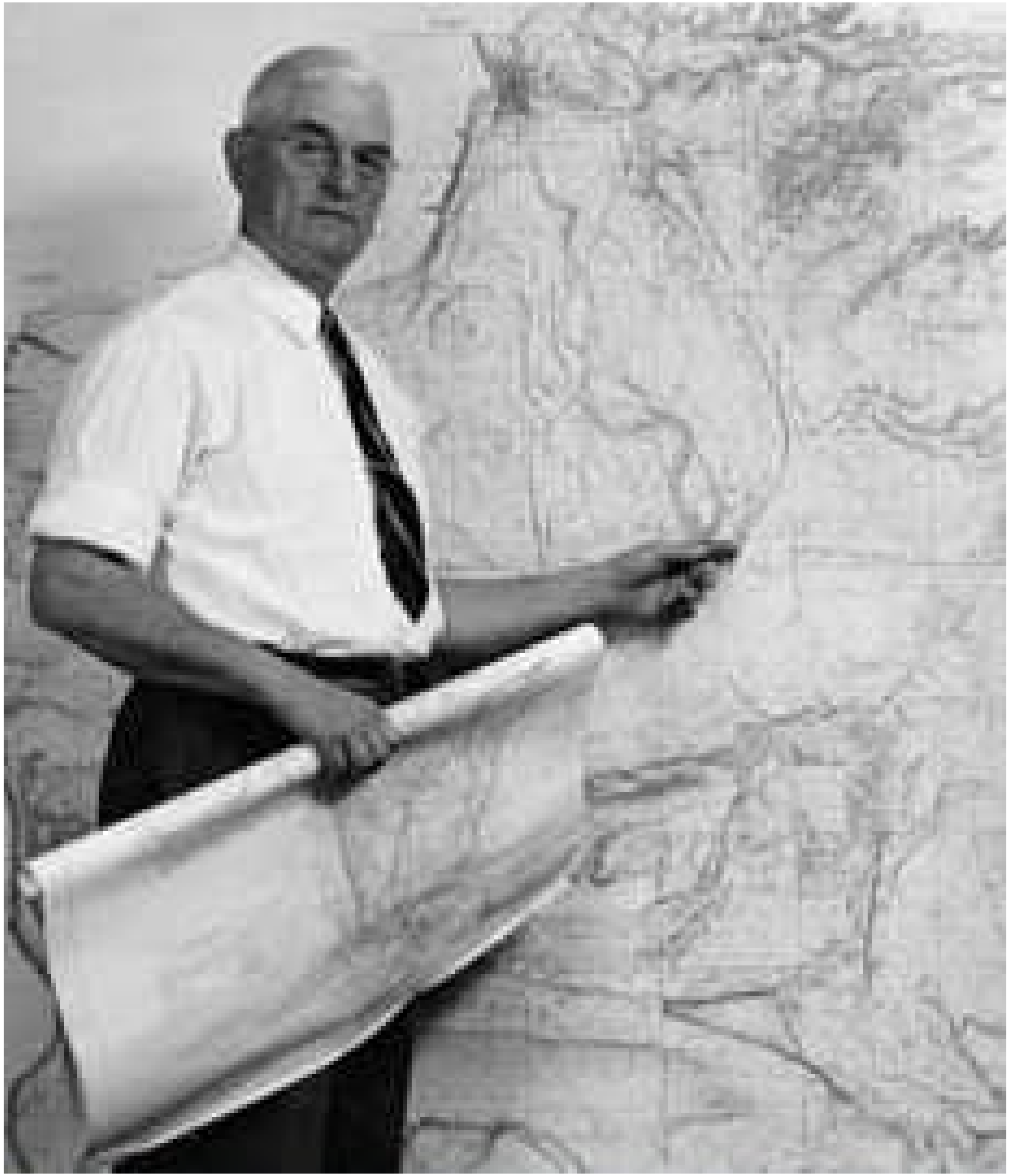
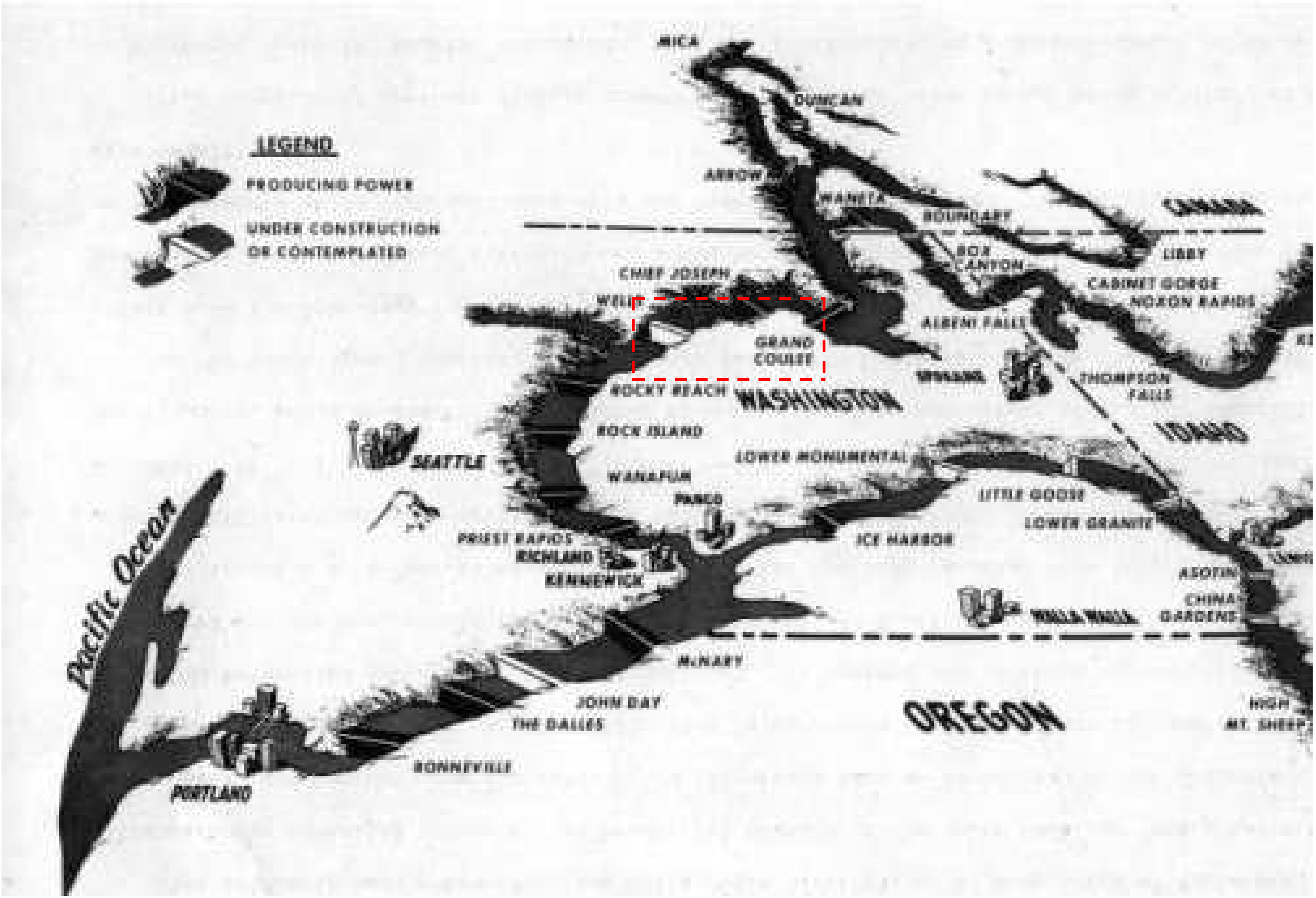
# Built to Last



***"More than seventy huge dams, including the five largest concrete dams in the world, have been completed in the United States during the last ten years or are now under construction. They have been built to last forever…"***

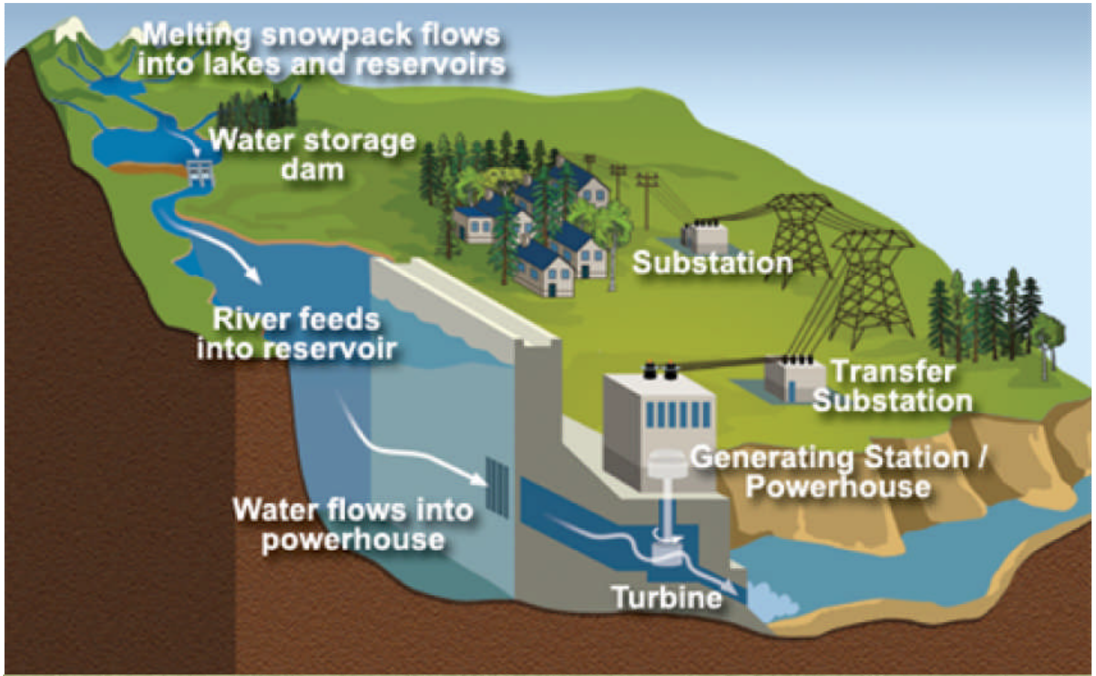
***Popular Mechanics,* August 1942**

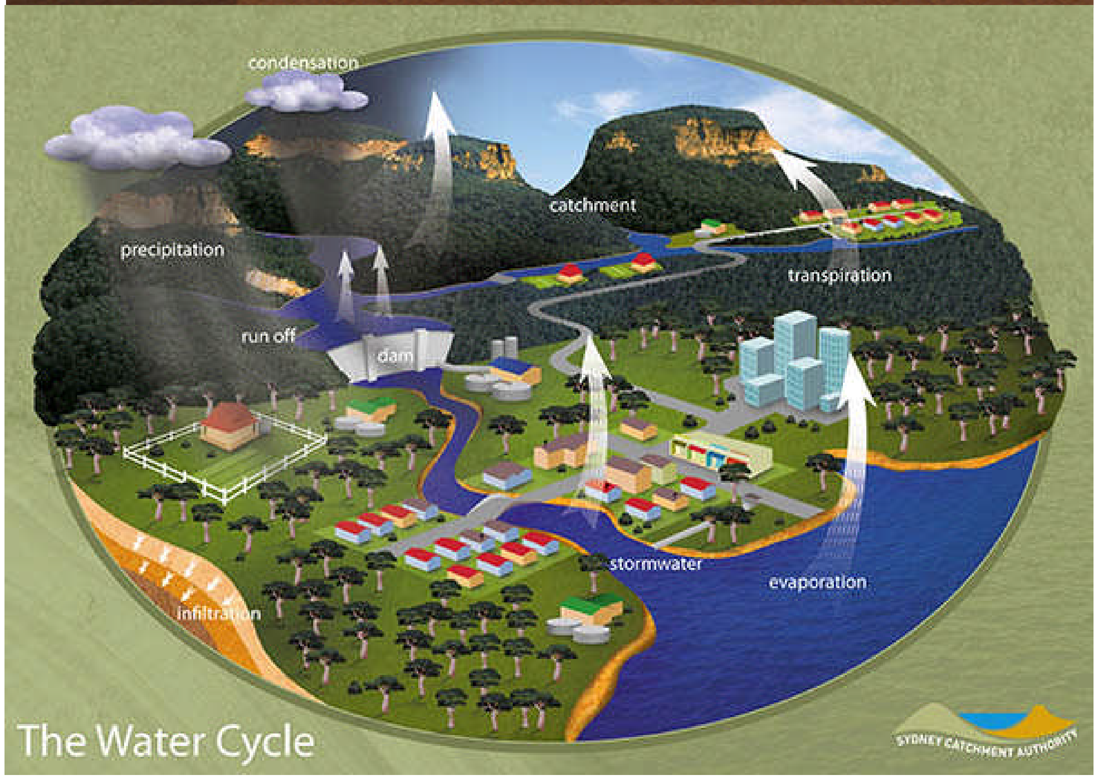
**Left: caption: "Frank A. Banks, Chief Construction Engineer, Grand Coulee Dam"**




**<u>Above</u>: map created by the *U.S. Army Corps of Engineers* illustrating completed and existing Corps projects throughout the northwest, ca. 1960**


Columbia River Basin
Mica
Revelstoke
Arrow Lakes
Duncan
Keenleyside
Kootenay Lake
Canada
U.S.
Grand Coulee
Chief Joseph
Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids
Albeni Falls
Libby
Hungry Horse
Noxon
Pend Oreille Lake
Flathead Lake
Kerr
Seattle
Little Goose
Lower Monumental
Lower Granite
MT
WA
Dworshak
Ice Harbor
The Dalles
Portland
Bonneville
McNary
John Day
Hells Canyon
Oxbow
Brownlee
ID
OR
Willamette R.
Boise Projects
Jackson Lake
N
CA
NV



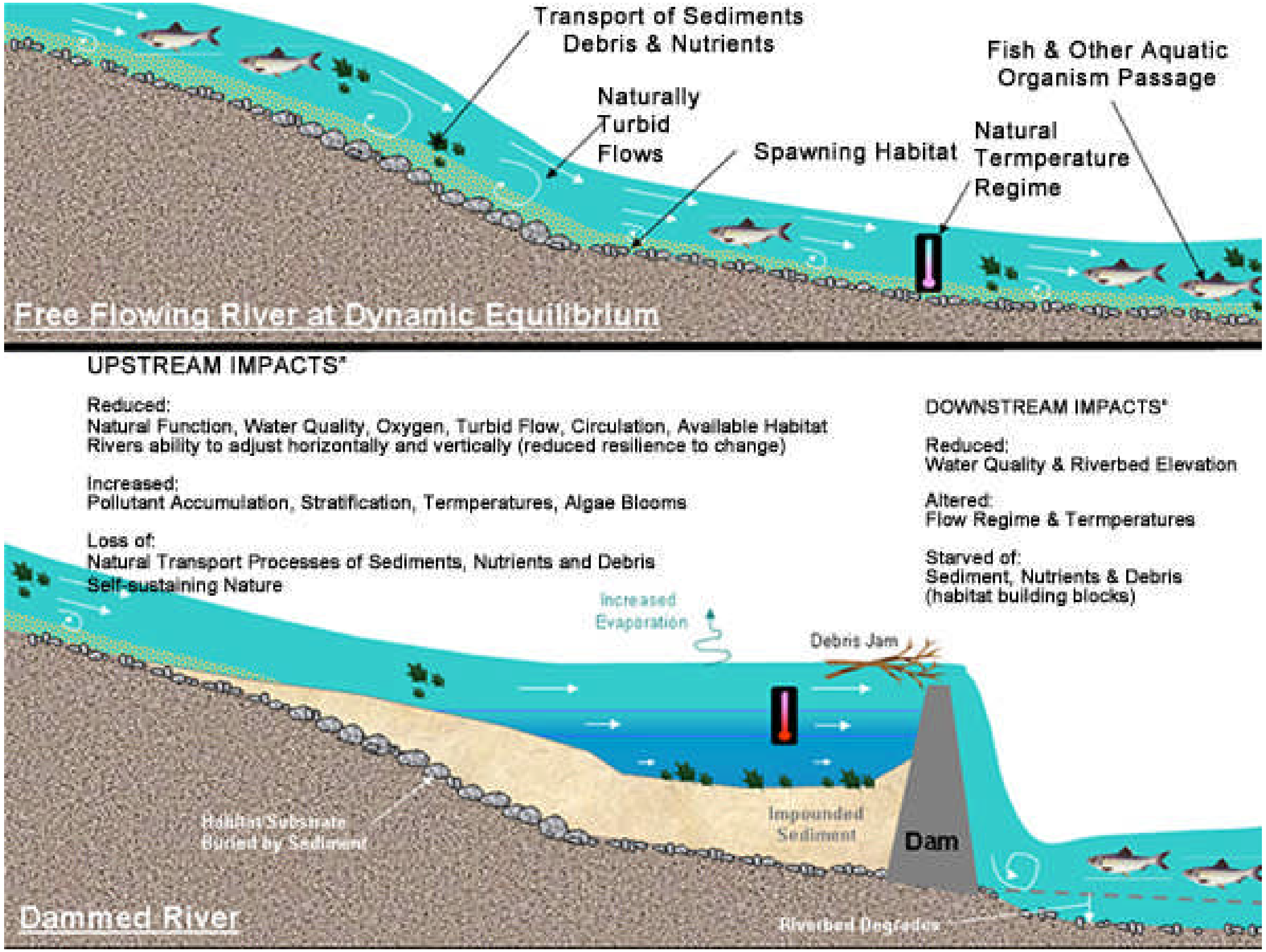




***"…Some people wonder whether a dam ultimately becomes useless because of the silt that flows down the river and is trapped in the reservoir. In time the silt may fill up the reservoir, they think. But engineers don't regard this as a serious factor. The silt deposit simply reduces the amount of dead storage, and besides, as soon as the current in the river is slowed down by the dam, much of the silt begins dropping far upstream of the reservoir area…"***

***Popular Mechanics,*** **August 1942**

**Top: caption: "Columbia River Basin dam diagram"**

**Bottom: caption: "The Water Cycle"**




***"…The streams tributary to the Columbia are almost always clear and free from silt. Solid matter causing slight turbidity during part at the flood season is extremely fine, and practically all of it is carried in permanent suspension. Silt will have no detrimental effect on the utility of the reservoir…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

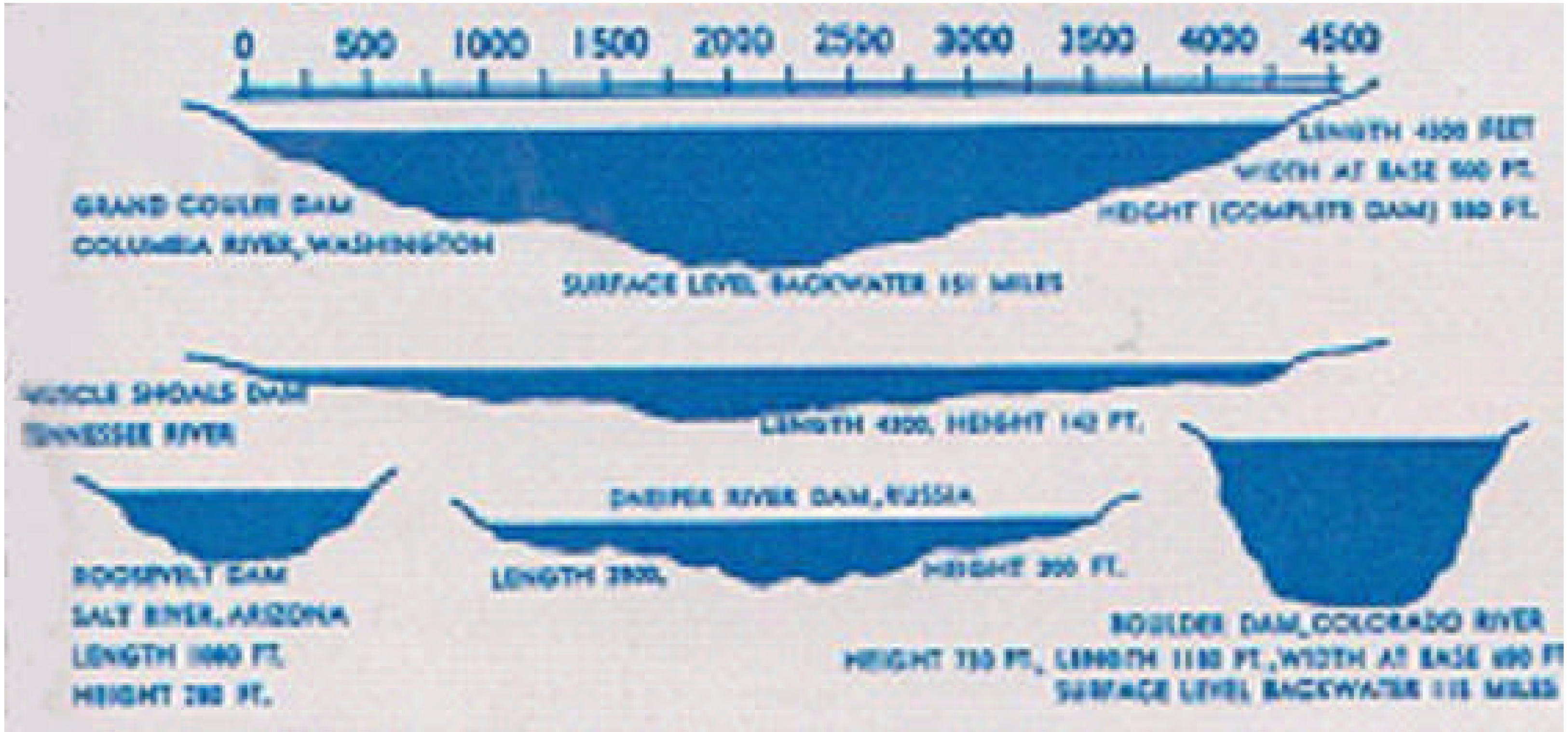
# Something for Nothing

***"…A dam is a device by which mankind gets something for nothing. Build a dam across a river and at once there are all sorts of benefits that didn't exist before. A source of electric power is created that will continue as long as rainfall occurs. A check is provided to hold back disastrous spring floods. Then the water can be released gradually during the rest of the year to maintain the navigable water level below the dam. Water can be drawn from the reservoir for irrigating dry farm lands. Long after they have earned their cost, possibly for thousands of years hence, we shall be enjoying the benefits of these dams…"***

***Popular Mechanics,* August 1942**

***"Approximately one billion dollars is being spent by the federal government to develop the hydroelectric resources of the nation. This vast sum is split among nine vast plants. These plants stretch from northwest to southeast and from southwest to north central United States. The greatest is Muscle Shoals or the Tennessee Valley development. Here the government has projected an outlay of some $300,000,000. Boulder dam, on the Arizona-Nevada border, draws $165,000,000; Grand Coulee, in Washington state, calls for an expenditure of $63,000,000; Bonneville, in Oregon, $43,900,000; Fort Peck, in Montana, $59,000,000; Verde, Caspar-Alcova and Owyhee, in Arizona, Wyoming and Idaho-Oregon respectively, $49,600,000 and Loup river, Nebraska, $7,300,000. Supplement the foregoing figures with the initial cost of Muscle Shoals - $150,000,000 – and $140,000,000 advanced to states and municipalities plus the subsidiary program cost of TVA and the total hovers around one billion dollars…"***

***Popular Mechanics,* January 1935**




***"…The government has in mind with these great power plants to serve great sections of the United States with cheap electrical power, to furnish 'yardsticks' by which power production costs in private and public utility plants can be measured and to open up for exploitation hitherto un-exploited areas of our national domain…However, not all the dams are being built for power alone…"***

***Popular Mechanics,* January 1935**

**<u>Above</u>: caption: "Comparative Sizes of the World's Largest Dams"**

***"…The dam and its power plant will cost an estimated $186,000,000 with an additional $208,000,000 estimated as the cost of the irrigation system that is part of the project. In spite of this staggering price the engineers regard it as a bargain. It will provide water for cultivating 1,250,000 acres of rich but arid land now lying useless. That's the same as adding an area about the size of Long Island to the most valuable agricultural assets of the nation…"***

***Popular Mechanics,* April 1940**

**<u>Above & Left</u>: caption: "Peppermint and spearmint oils are extracted from mint crops grown on the Columbia Basin Irrigation Project and are shipped to chewing gum and candy manufacturers all over the Nation." (ca. 1964)**

# Wheat, Heat and Rattlesnakes

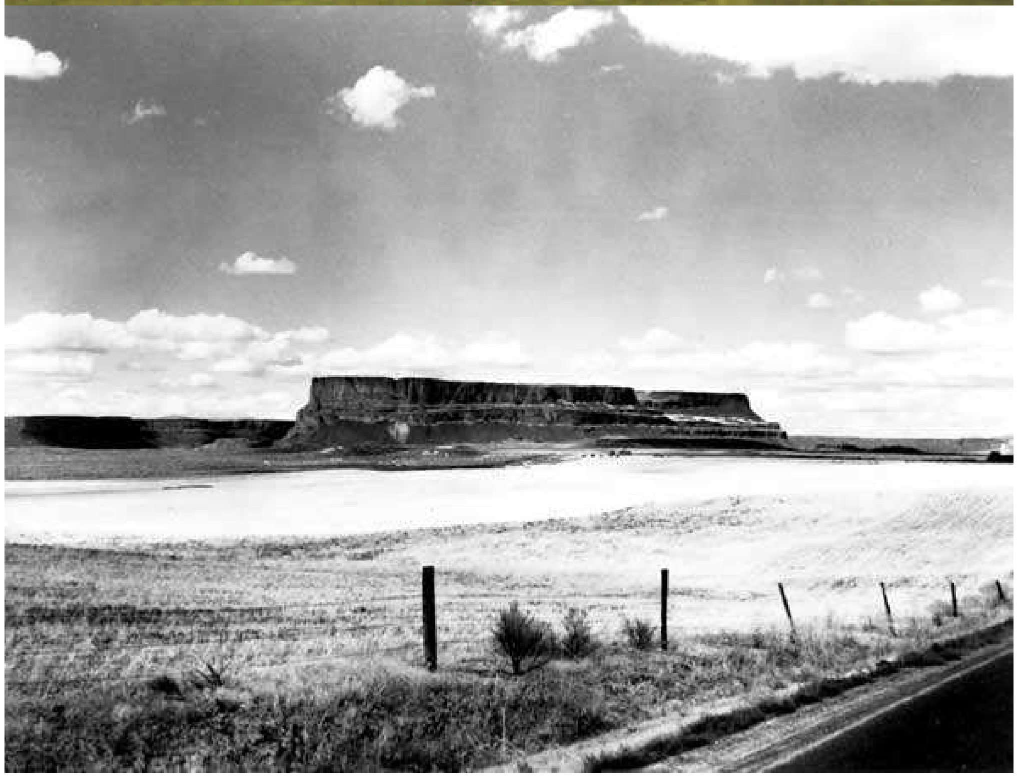
***"…From twenty-five to fifty years will be needed to develop the region, opening a minimum of 25,000 acres per year to cultivation. This agricultural empire, extending as far as 150 miles from the dam, will provide comfortable living for from 100,000 to 200,000 people. Mean annual temperature of the area is 50.4 degrees with an average frost-free period of 159 days. Forty acres of land per settler or eighty acres per couple may be purchased at terms governed by the Anti-Speculation Act…"***

***Popular Mechanics,*** **April 1940**

**RE: when construction of *Grand Coulee Dam* began in 1933, the *Columbia Basin* was at its lowest ebb. One rancher, a longtime resident of the area, described it as: *"being known mostly for wheat, heat, and rattlesnakes."***

**<u>Above & Left</u>: caption: "Steamboat Rock, Upper Grand Coulee"**


STEAMBOAT ROCK, UPPER GRAND COULEE, WASHINGTON



# The Anti-Speculation Act

***"…The development of speculative land prices on the Columbia Basin Project will be reduced to a minimum by means of the provisions of the Anti-Speculation Act of May 27, 1937. A similar policy was applied successfully on the Kittitas, Owyhee, and Vale Projects. The principal requirements of this act are (1) that privately owned lands within the area to be served be impartially appraised to determine their present-day market value without reference to the proposed irrigation works; (2) that contracts for the repayment of the part of the cost of the project allocated by the Secretary of the Interior to irrigation, and for other purposes, be made with an irrigation district or with irrigation districts; (3) that private land-owners agree to limit their holdings to 40 acres for an individual or 80 acres for a man and wife; (4) that landowners agree to sell lands held in excess of these minima at the Government-appraised price; (5) that in the event excess lands are sold at higher prices or are retained, no water shall be delivered to the lands involved; (6) that water may be obtained for lands which were purchased at prices above the Government appraisal, unless they were excess land so purchased, upon payment to the Government by the vendor of a portion of the excess price, varying from 50 to 100 percent with the length of time which has elapsed since the sale, this money to be applied in inverse order to the construction payments charged against the land; and (7) that the State of Washington by appropriate legislation shall authorize, adopt, ratify, and consent to all the provisions of the act which come within the jurisdiction of the State. Conditions under which water can be obtained for any tract of land run with the land as part of any title to it…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…Copies of the appraisals of project lands mode under the direction of the Secretary of the Interior will be on file in county offices, and will be accessible to prospective buyers of land. The collecting of annual installments for const-ruction, and for maintenance and operation charges, through the taxing power of irrigation districts, will tend to prevent the holding of idle land for speculative purposes…"***

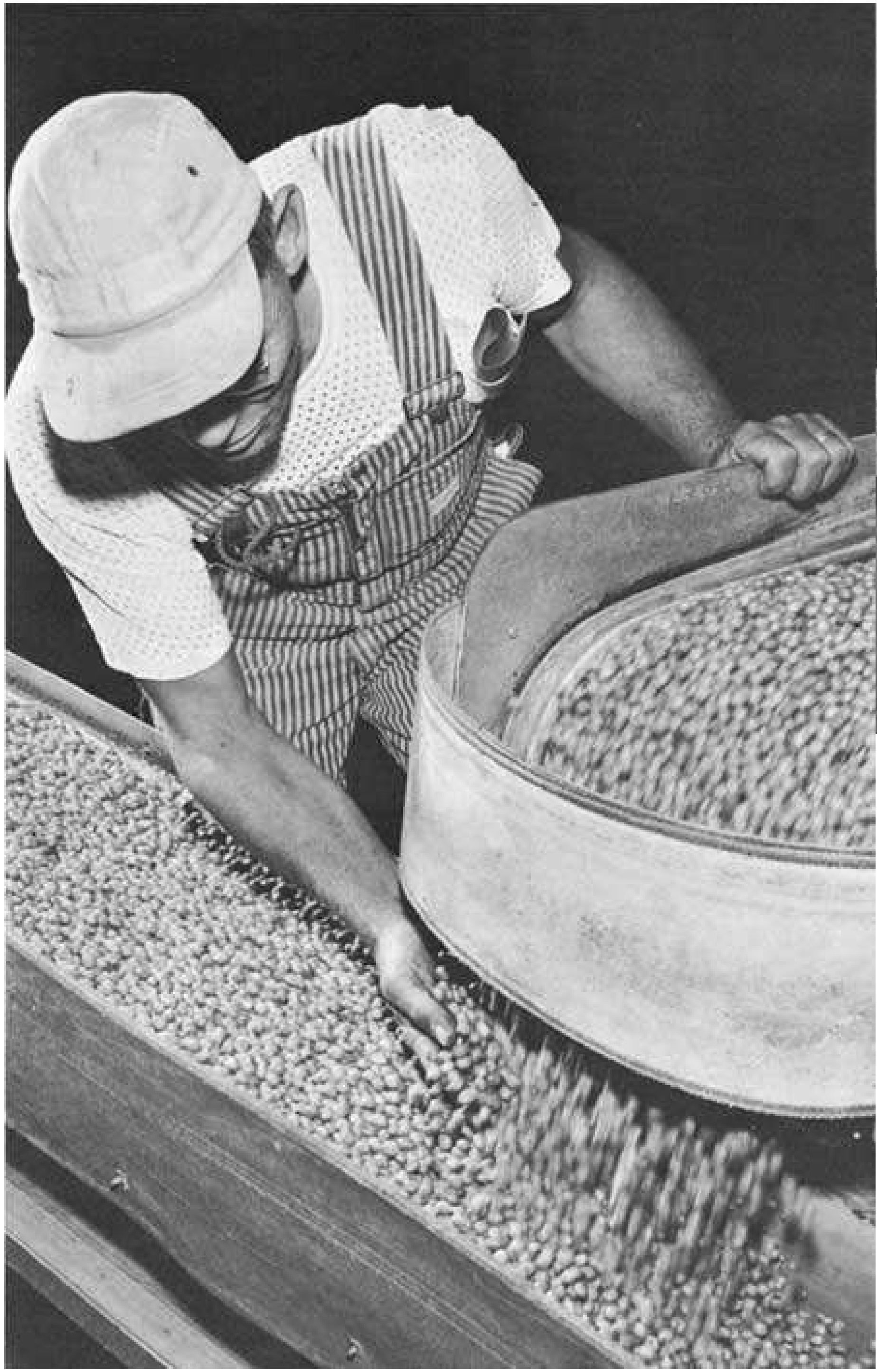
***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Mr. Average Settler

***"Let's take a look at Mr. Average Settler of the mid-1950's and his family as depicted by a 1956 sociological study. The man is 40 years old and his wife is about 4 years younger. They have been married 15 years and have two or three children. The average settler and his wife came to the project with a good education. He spent 12.3 years in school, while the average educational level for farmers in the State at that time was 8.9 years and the national average was 8.6 years. His wife had an average of 12.4 years of schooling, also far above the State and national level. Overall, 25 percent of the settlers and their wives attended college and about 8 percent had degrees. Chances were one in three that he had studied vocational agriculture in high school and, if he attended college, that he had studied forestry or agriculture. One in every five settlers took part in the veterans farm training program and about the same number had attended short courses at a State college or had been in 4-H Club work."***

***U.S. Bureau of Reclamation*** **(ca. 1956)**

**In the mid-1950s, a study was made of *Columbia Basin Project* settlers. Most of those who came from a non-agricultural job said that they came because they preferred farm work and rural living. Those who had been farming elsewhere said that they felt the project offered more opportunity and a chance to develop a better farm. Others moved there from a tenant or sharecrop farm because the project offered a chance to build a farm of their own. Surprisingly, the possibility of greater financial returns was a consideration of only a few. According to the study results, the average settler felt that the best part of farm life on the project was the independence and security it offered. Most of the settlers in the study agreed that the successful farmer on the project must be an adaptable person. Personal characteristics, as outlined by the settlers themselves, were stamina, a willingness to put in long hours and hard work, determination, perseverance, courage, and confidence. Also, they stated that the prospective settler should be willing to learn, to seek advice and he/she must keep up-to-date on the latest farming methods.**



**Above: caption: “Pioneer-like living quarters and facilities made house-keeping difficult for many project sett-lers while they were developing their farms.”**

**Left: caption: “The production of peas for freezing offers a quick cash crop for settlers, and processing plants on the project provide part-time work for settlers and basin families.”**

# An Electrified Paradise

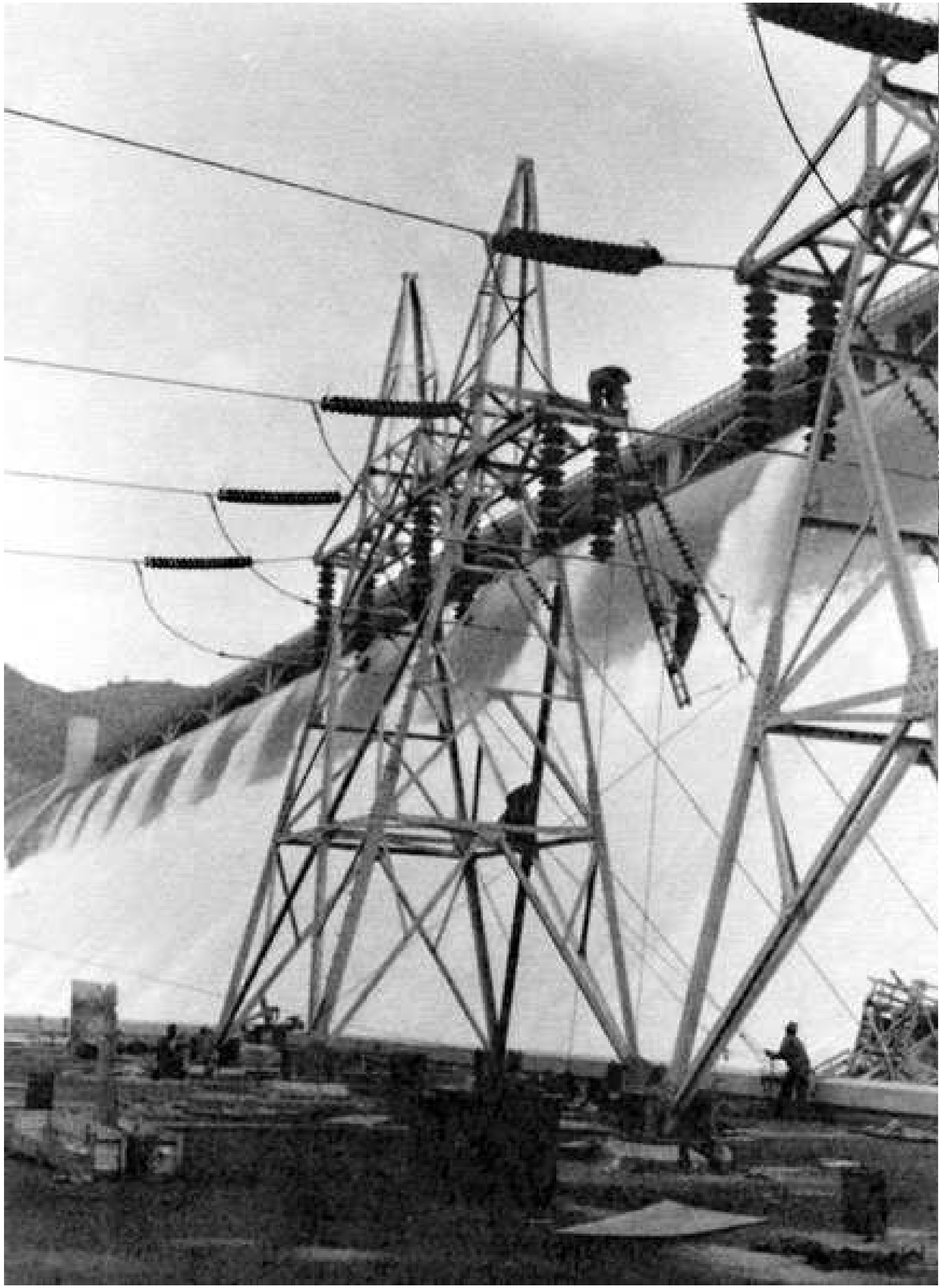
***"…Where, thirty months ago, lone ranchers waited for an antiquated ferry to take them across the Columbia River, ninety-two miles southwest of Spokane, Wash., engineers are today pouring concrete for the greatest dam of all time, the Grand Coulee. Named after an old channel of the river, to which the Columbia was diverted by glacial action perhaps half a million years ago, this project will eventually transform 1,200,000 acres of practically desert land into a region of immense fertility. And it will set the pace of the new electrical era which scientists and industrialists agree, will first dawn for the average man in the Pacific Northwest…"***

***Popular Science,*** **February 1936**

**Above: caption: "Early farming operations in eastern Washington often ended in failure due to the lack of rainfall"**

**Above L&R: caption: “Another dream, and another failure…and another”**

**Left: caption: “Homesteaders who settled here at the turn of the century were forced to leave the land when their crops failed”**

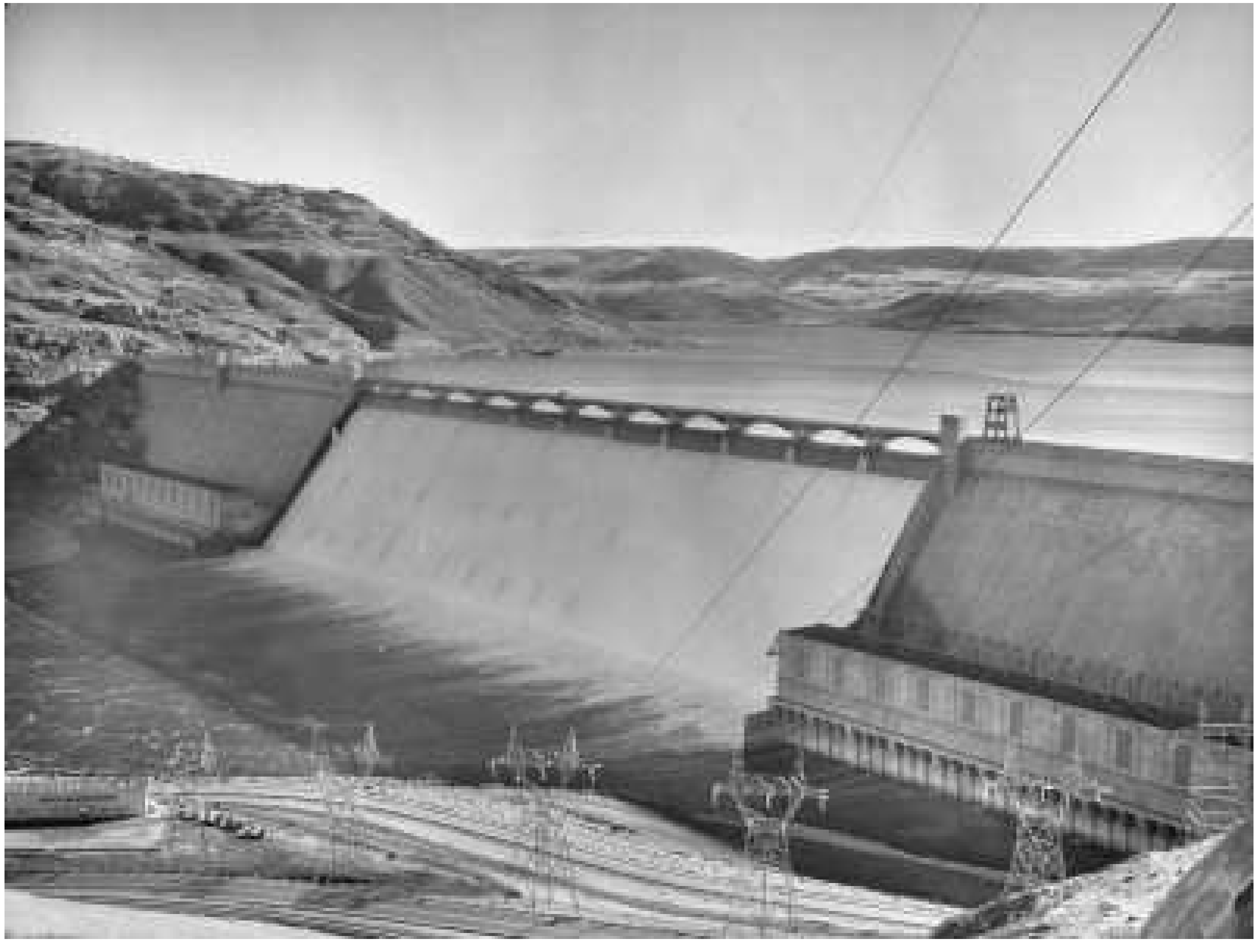


***"…The improvements in equipment, perfection of materials, and research into many fields have made possible the Grand Coulee dam, a structure much larger than any ever before attempted by man…"***

***U.S. Bureau of Reclamation* (1935)**

**Above: caption: "View of the Grand Coulee Dam from the west side cliffs (ca. 1942)"**

**Left: caption: "Installing transmission lines from the west powerhouse to the 230 KV switchyard at Grand Coulee Dam (May 1943)"**

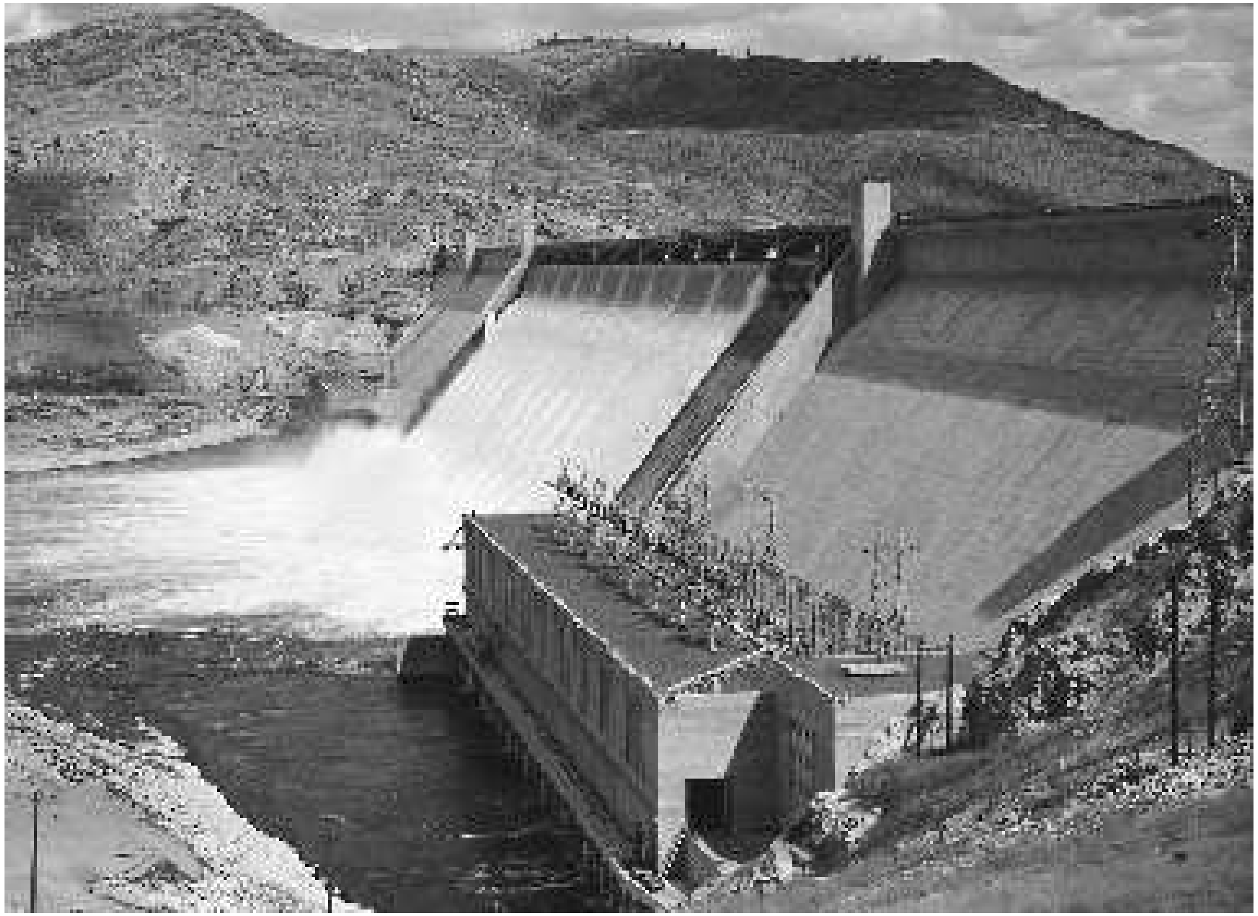


***"…A few decades ago, only earth-fill dams and such structures were possible. Little was known about the qualities of concrete. The transmission of power over long distances resulted in a loss so great as to make any such proposition infeasible. Electric generating equipment was comparatively inefficient, ranging up as high as 60 percent…"***

***U.S. Bureau of Reclamation* (1935)**

**<u>Top</u>: view of west powerhouse**

**<u>Bottom</u>: view of switchyard**



***"…Today, however, it is a different story. Researches into materials have revealed much about concrete, until the substance can be made almost as strong as granite. Long-distance power transmission is used every day with success, as far as 800 miles. Turbines can operate that will turn out better than a 90 percent efficiency***

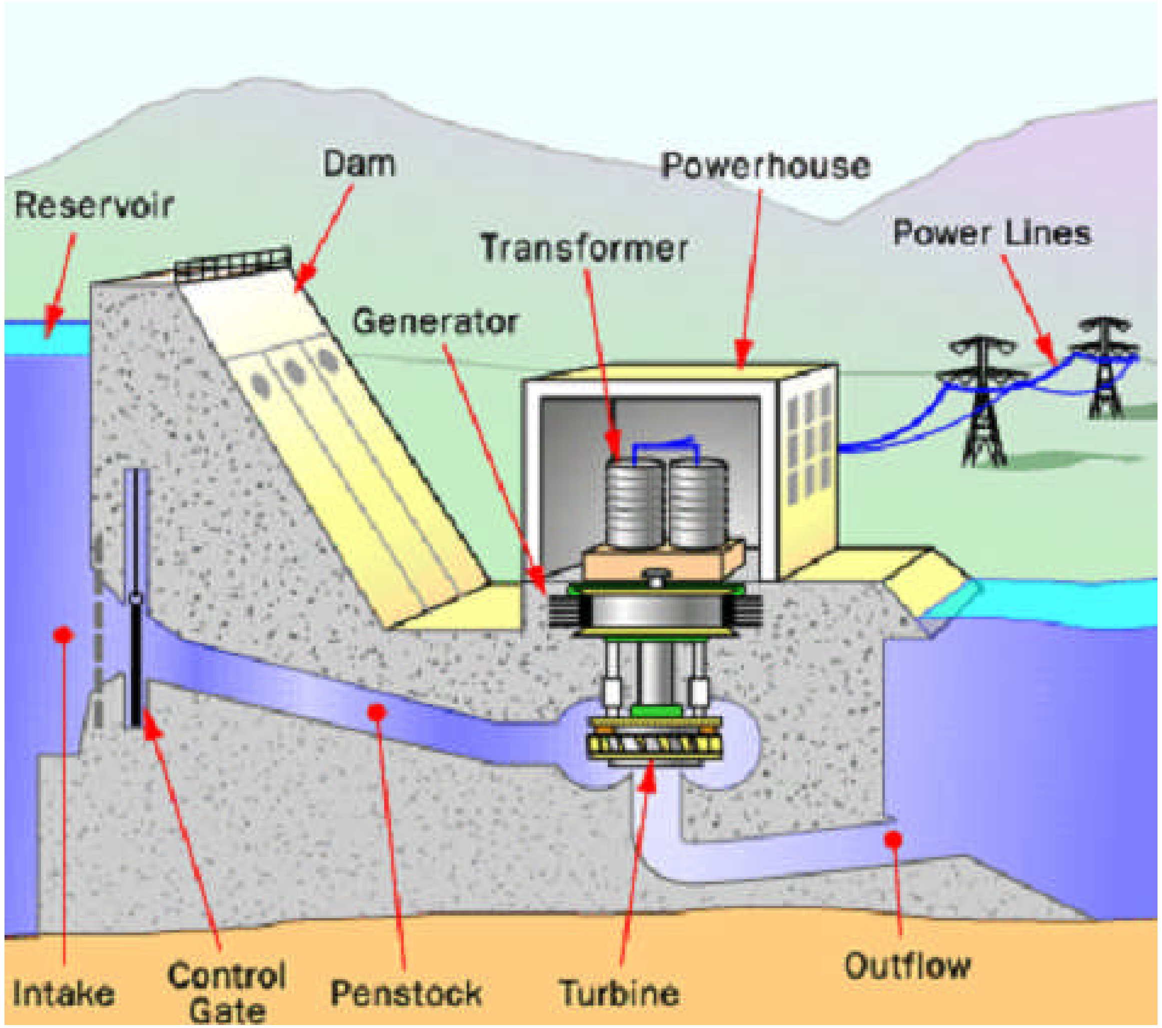
***U.S. Bureau of Reclamation* (1935)**

***"The first step toward preparations for the transmission of power from the Grand Coulee dam is under way it was learned today…A parcel of land north of the town site of Grand Coulee, a quarter-section wide, and of an indefinite length, has been approved by the Bureau of Reclamation, and notice has been served on the agent for the ground that it is acceptable to the government. On that site will be built the substation that will be the starting point for the distribution of power generated at the dam. At the peak of the development there will be eighteen generating turbines turning out electricity at the rate of from 13,000 to 22,000 volts. As that voltage is too low for efficient long-distance transmission of power, a substation will be necessary to step up the juice to about 220,000 volts. At this figure it easily can be sent over distances as great as 250 miles. Spokane is less than 90 miles airline, Seattle less than 200 and Portland but little further, making all those cities accessible for power from the project…"***

***Spokesman-Review,*** **May 3rd 1935**

***"…The federal government probably will buy enough land for the new regional right of way to the Grand Coulee dam to accommodate a power line as well, James O'Sullivan, secretary of the Columbia Basin Commission, said today…"***

***Spokane Chronicle*, May 1st 1934**


Dam
Powerhouse
Reservoir
Transformer
Power Lines
Generator
Intake
Control Gate
Penstock
Turbine
Outflow

# Part 2

# Blame it on the Glacier

# The Detour Less Traveled

***"It is now proposed to re-establish the ancient waterway through the great trench of the Grand Coulee. A mere trickle it will be, compared with the river of glacial times. Reinforced concrete will replace glacial ice; and a part, at least, of the west-flowing Columbia will again be detoured southward."***

***J. Harlen Bretz,* Geologist (1932)**



**<u>Above</u>: caption: "The Columbia River, from its left bank (ca. 1938)**

*“Grand Coulee Dam is positioned in an area which sits on the edge of two geologic zones - the Okanogan Highlands and the Columbia Plateau. The dam sits on the solid granitic rock of the Okanogan Highlands, making a perfect base for the dam. The Columbia Plateau to the South consists of layers of softer basalts. The Columbia River in the Grand Coulee region was carved between these two geologic zones. The landscape that is currently visible in the area is the result of the most recent Ice Age Floods which shaped this landscape approximately 13,000 years ago. Grand Coulee Dam is located in the shrub-steppe ecosystem. Plants in this area have adapted to hot dry summers and cold winters. Being in the rainshadow of the Cascade Mountain Range, the average precipitation is seven to ten inches per year. The shrub-steppe ecosystem supports a wide variety of plants and animals including the dominant sagebrush and bunch-grasses. The soil consists of rich loess that consists of glacial windblown clay, dust and silt. It is the loess, combined with an adequate amount of water supplemented by irrigation that makes the irrigation of the Columbia Basin Project productive.”*

***U.S. Bureau of reclamation* (ca. 2008)**

***"…The Grand Coulee Dam, principal and outstanding engineering feature of the project, is located on the Columbia River just below the head of the Grand Coulee, where for a short distance the river flows north. It is 94 miles north and west of Spokane, and 259 miles by highway east of Seattle. It is 151 miles downstream from the Canadian border, and about 600 miles above the mouth of the Columbia at Astoria. Although it is not at the narrowest point in the river's canyon, the site for the dam was chosen because, here, close to the head of the Grand Coulee, a granite barrier once lay across the river's course and extended from the Okanogan highlands far into the basalt plateau which farms the left bank of the river above and below the dam site. The remains of this granite barrier form exceptionally good foundation and abutments for the dam. Grand Coulee Dam is accessible by motorcar or bus, over excellent hard-surfaced roads connecting with U.S. Highway No. 10 at Wilbur, Almira, and Coulee City. An excellent hard-surfaced road, passing spectacular Dry Falls, Park Lake, Blue Lake, Lake Lenore, and Soap Lake, traverses the lower Grand Coulee between Coulee City and the town of Soap Lake, and connects with State Highway No. 7, leading to points west of the Cascades by way of Snoqualmie Pass, Chinook Pass, and Mt. Rainier, and the Columbia River highways…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Fossil Niagaras


***"…When the engineers selected the present site on the Columbia they took advantage of an event that happened millions of years ago. During the last great ice age a glacier flowed into the present river bed and damned the river as effectively as the modern concrete structure will. The impounded waters gradually filled the canyon and then over-flowed the walls, cutting out a new river channel to the south. For centuries the river flowed along its new bed and then, when the ice retreated, resumed its age-old path…"***

***Popular Mechanics,* April 1938**

**Top Left: caption: "The Columbia River, showing the site for the Grand Coulee Dam (ca. 1933)"**

**Top Right: caption: "This is the site of Grand Coulee Dam as it looked before the first contract for its construction was let on July 13, 1934"**

**Top Left: caption: “North End of Grand Coulee, Proposed Dam Site, 1916”**
**Top Right: caption: “Cattle, Grand Coulee, 1916”**
**Left: caption: “East view of dam site (ca. 1934)”**

*"Two 'Fossil Niagaras' that would make the mightiest waterfall now on earth a small trickle by comparison once roared through the Grand Coulee, a gorge halfway between Spokane and Seattle, Wash. This is the deduction of Prof. J. Harlen Bretz, of the University of Chicago, after studying lines of towering dry cliffs, all that remains of these extinct cataracts. The water that fed these giant falls came from melting glaciers of the ice age, Professor Bretz says, pointing out that immense quantities of water released by the glaciers, in hunting a new watercourse, pounded out the gorge now known as Grand Coulee…"*

***Popular Mechanics,*** **October 1932**

**<u>Top Left</u>: caption: "Alkali Lake in the Lower Grand Coulee"**

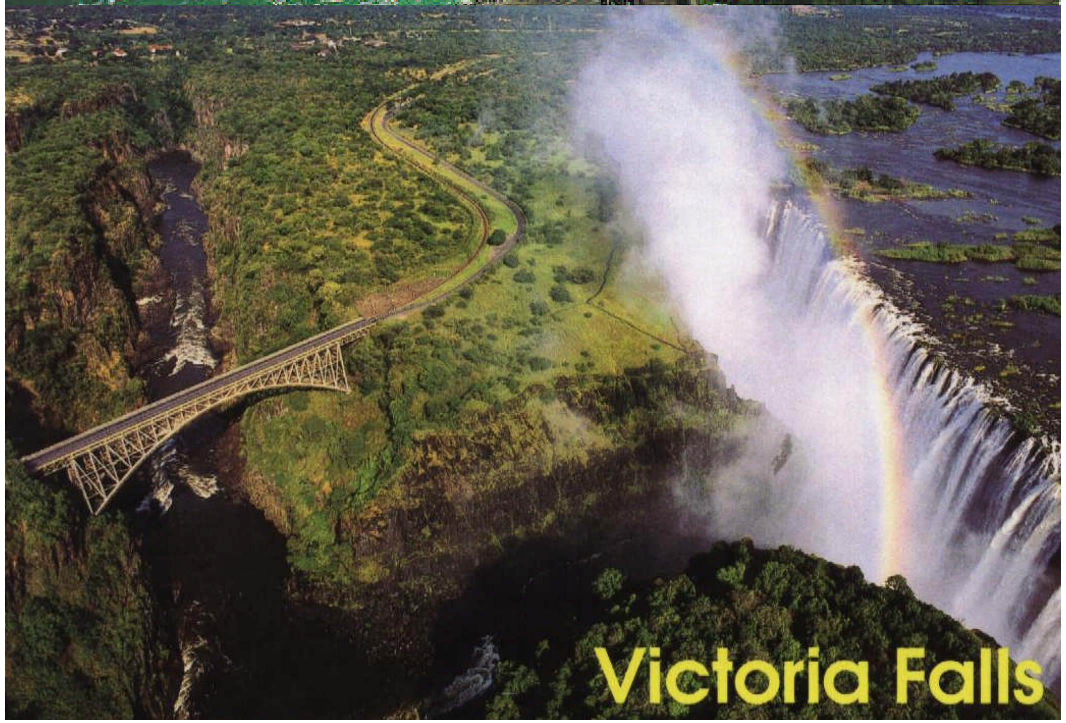
**<u>Top Right</u>: caption: "Upper Grand Coulee Basalt Cliffs and Banks Lake"**

**<u>Left</u>: caption: "On the floor of the Upper Grand Coulee"** 74

*"…This gorge is 1,000-feet deep, a mile wide at its narrowest point and fifty miles long. Enormous 'potholes,' 100-feet deep, and formed in solid rock only by the grinding and pounding of boulders kept in motion by falling water, led to Prof. Bretz' discovery. The Coulee contained two falls, the professor says, the lesser three and one-half miles long, nearly six times that of Niagara, with water thundering 400-feet from a cliff to the bottom of the course, a leap double that of Niagara and greater than that of Victoria Falls, in Africa, the highest falls known today. The larger of the 'fossil Niagaras' was a mile wider and it plunged 900-feet. When the glaciers retreated far enough for the water to flow down the present course of the Columbia river, the mighty falls vanished. Professor Bretz tells of a project to irrigate the Coulee by building a 200-foot dam across the Columbia, then pumping the irrigation water to the head of the gorge…"*

***Popular Mechanics,* October 1932**


NIAGARA FALLS


Victoria Falls

# Uniformitarianism vs. Catastrophism

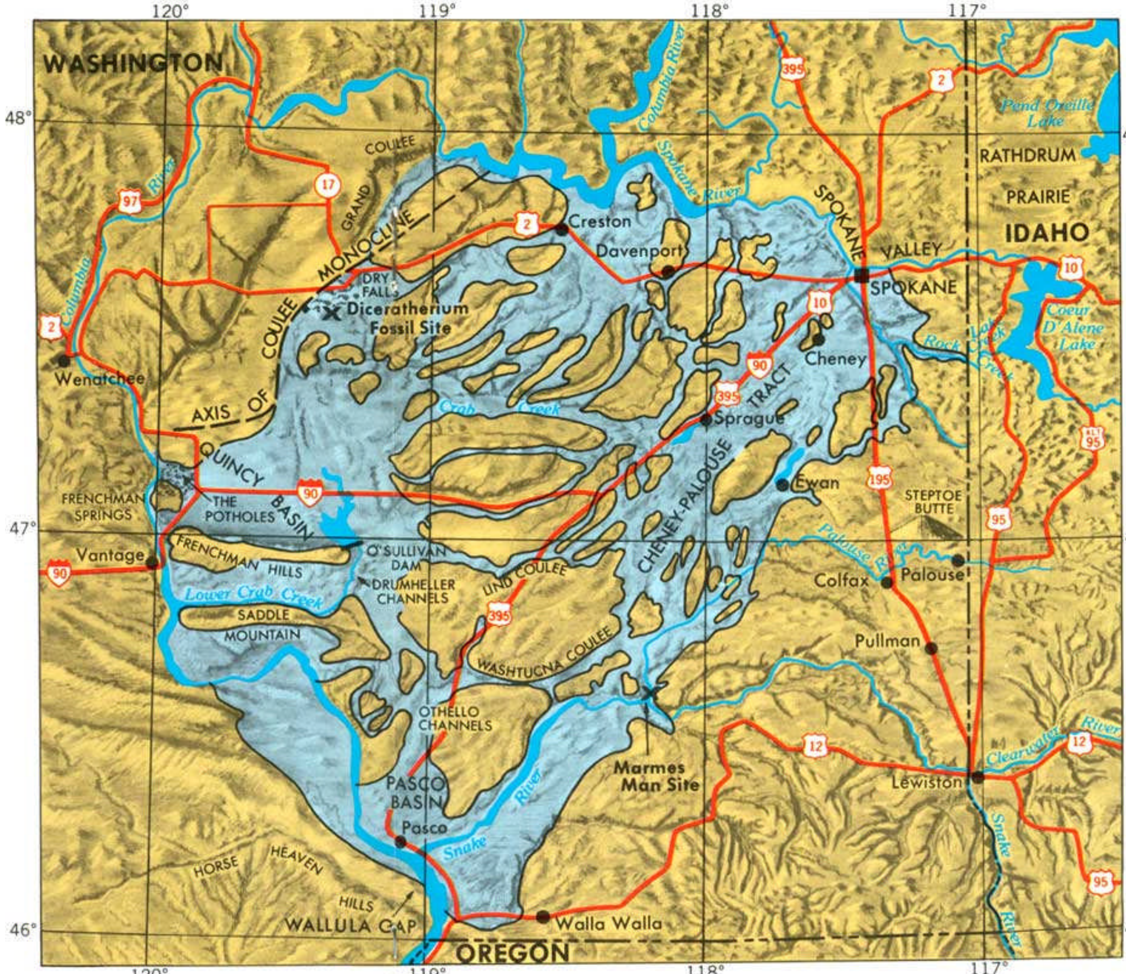
**<u>Left</u>: *J. Harlen Bretz* (1882-1981) was a geologist who launched one of the great controversies of modern science by arguing, in the 1920s, that the deep canyons and pockmarked buttes of the arid "Scablands" of eastern Washington State had been created by a sudden, catastrophic flood - not, as most of his peers believed, by eons of gradual erosion. It was a bold challenge to the prevailing principle of "Uniformitarianism" which held that the earth was shaped by processes that can be observed in the present. Since a flood of the almost Biblical proportions envisioned by Bretz had never been seen, the idea was dismissed as a throwback to the pre-scientific doctrine of "Catastrophism."**

**It was in 1910 that *J. Harlen Bretz* was introduced to the puzzling geology of the *Columbia Plateau*. The *U.S. Geological Survey* had just released a topographic map of the *Quincy Basin*, including the *Grand Coulee*. Bretz was intrigued by what he saw on the map: a huge dry canyon; big round holes; several cliffs that had once clearly been waterfalls - in a region where there wasn't any water, no less. Bretz spent a year on the faculty of the *University of Washington* after completing his graduate studies. He then accepted an invitation to return to his alma mater, the *University of Chicago*. He spent the rest of his career there as Professor of Geology (1914-1947). In the field, Bretz (above) often wore a construction worker's safety helmet, given to him during the construction of *Grand Coulee Dam*.**

***"The region is unique. Let the observer take the wings of the morning to the uttermost parts of the earth: He will nowhere find its likeness"***

***J. Harlen Bretz,* Geologist (1928)**

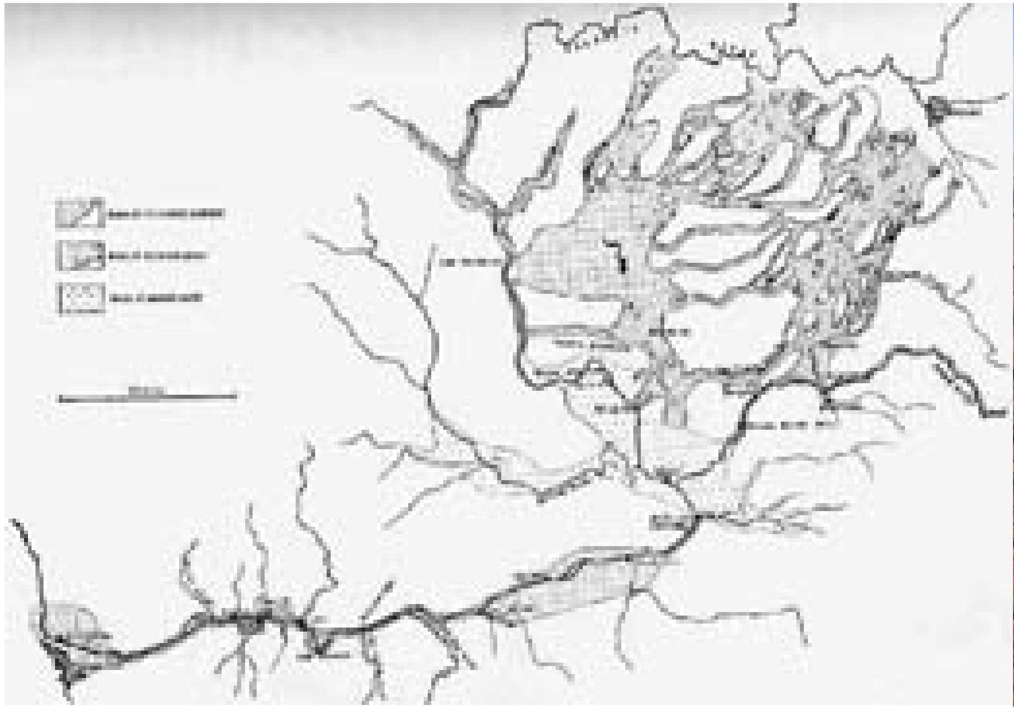
**RE: Bretz was a creative thinker, deeply interested in the world around him and a gift for eloquence, particularly in describing the landscape that he came to know so well. He began to explore the *Scablands* (so named because parts resemble partially healed wounds cut deep into the surface of earth) in the summer of 1922. He returned every summer for the next seven years, usually with his wife and children. Bretz had built a modest reputation as an expert on stream and glacial erosion by the time he turned his attention to the Scablands. He quickly became convinced that neither kind of erosion could account for what he saw there: huge, dry channels; great chunks of prairie stripped down to bare basalt; massive boulders of granite scattered in places far from any natural source of granite; circular divots in the earth that were so big, cattle could be hidden in them; cataracts (one five times as wide as *Niagara Falls*) that had once clearly been waterfalls, in an area that gets less rainfall in a year than Seattle does in a month. The depth of the channels, the fact that the channel bottoms were filled with coarse gravel carried in from outside the area, the scouring of the basalt bedrock, etc. To Bretz, all this suggested a sudden, violent flood.**




LEGEND

Present Drainage

Area of Deep Scour




***"All other hypotheses meet fatal objections. These remarkable records of running water on the Columbia Plateau and in the valleys of the Snake and Columbia Rivers cannot be interpreted in terms of ordinary river action and ordinary valley development. It was a debacle which swept the Columbia Plateau."***

***J. Harlen Bretz,*** **Geologist (1923)**

**RE: Bretz introduced his flood theory in a paper published in late 1923. He included a detailed geomorphic map of what he called "The Channeled Scablands," showing a network of branching and interconnecting channels that he concluded could only have been carved by a fast and furious flood.**

**Left: caption: "Map of Channeled Scablands drawn by J. Harlen Bretz, 1925"**

**Right: caption: "Drumheller Channels, ten miles south of Potholes Reservoir, are examples of Channeled Scablands"**

# An Outrageous Hypothesis

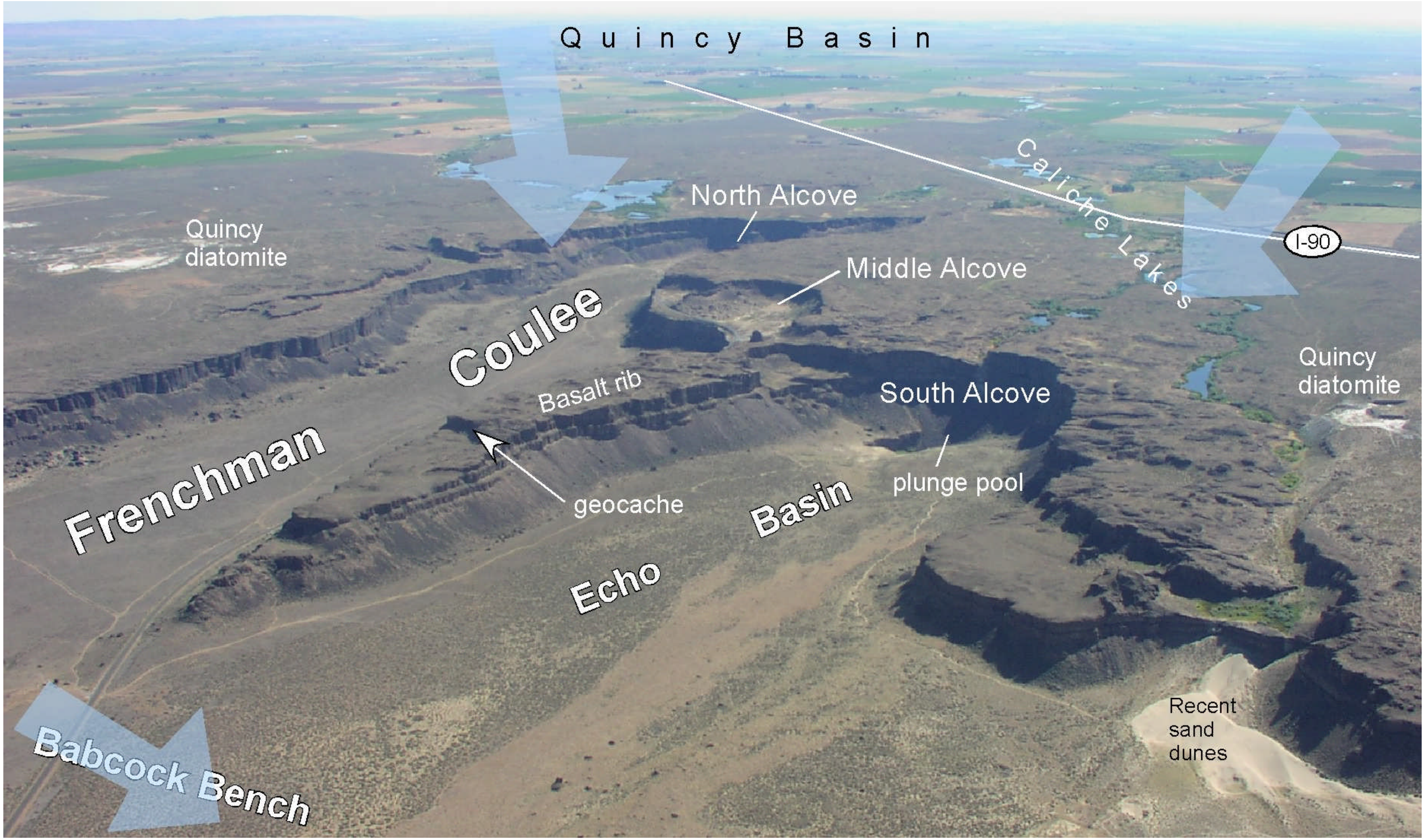
**The reaction from the geology community to Bretz's paper was biting. Since the 1790s, the science of geology had been framed by the principle of "Uniformitarianism" which emphasized the idea that geologic change in the past resulted from the same slow, steady processes at work today. Bretz's flood, with elements that suggested the Biblical story of *Noah*, seemed like a reversion to a superstitious, pre-scientific era. It was, said one critic, an "outrageous hypothesis." In 1927, Bretz was invited to defend his theory at a meeting sponsored by the *Geological Society of Washington D.C*. Six other geologists presented opposing viewpoints. Bretz disdainfully referred to the group as "the challenging elders." He was nearly 45yo at the time, a tenured professor at the *University of Chicago*, and supremely self-confident, comfortable in his self-appointed role as the champion of scientific truth. He once wrote: "*Understanding the Scablands involves imagination and courageous departure from accepted views.*"**

# Glacial Lake Missoula

***“He seemed singularly uninterested in finding the missing piece that would render his story coherent…stayed in the Scablands, while the answer sat in western Montana.”***

***Stephen Jay Gould*** **(1941-2002), Paleontologist**

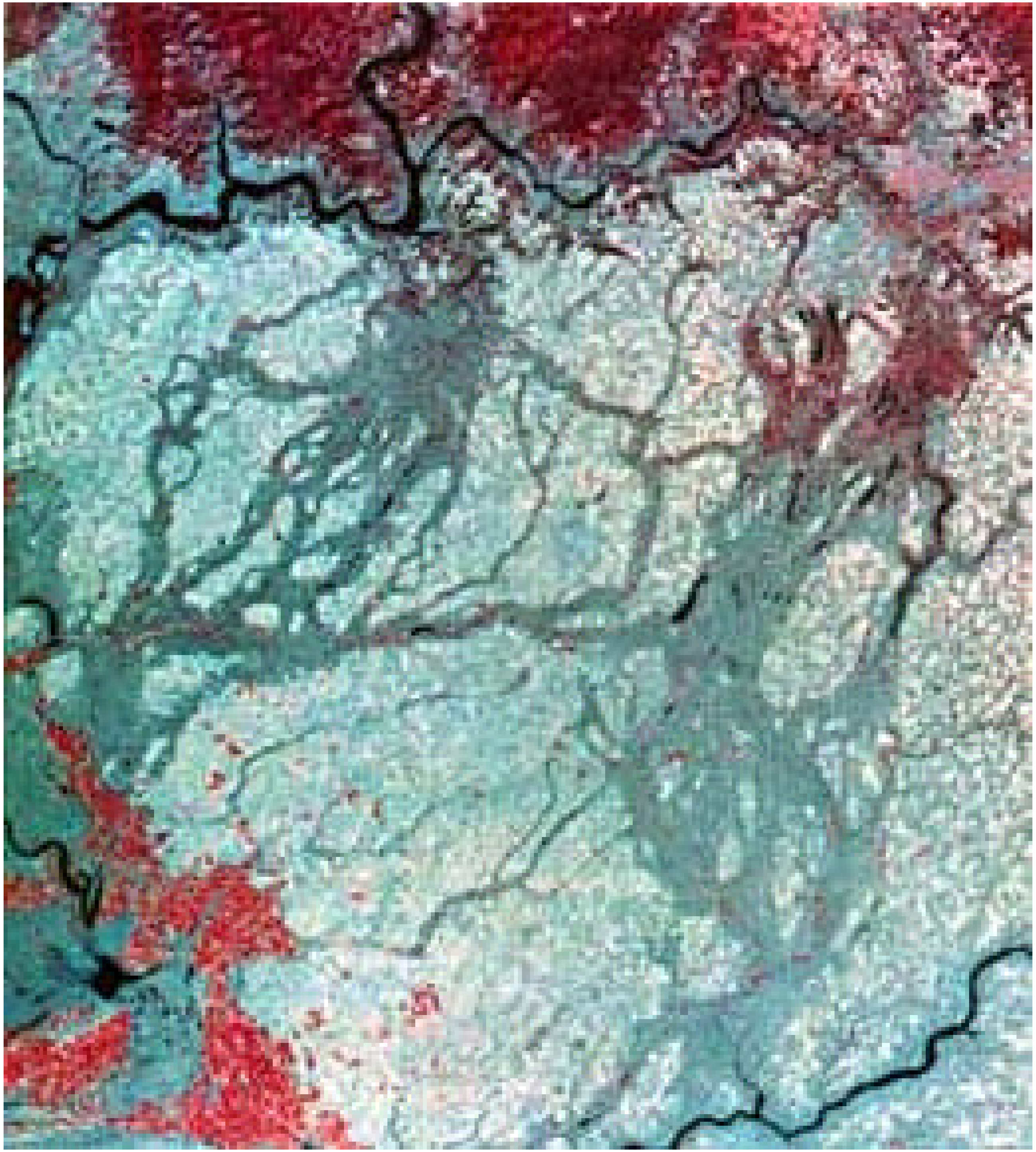
**RE: based on his original arguments, Bretz’s peers had good reason to doubt the plausibility of his catastrophic flooding theory. For one thing, he had ignored the crucial question of where the water for the flood could have come from. In a later paper, he suggested the source might have been a melting glacier somewhere near the present-day city of Spokane, but he offered no reasonable explanation for how that much ice could melt that fast. In fact, the primary source of Bretz’s flood had previously been identified; by a geologist named *Joseph Thomas Pardee* (1871-1960). It was *Glacial Lake Missoula*, created when the toe of an advancing glacier blocked the *Clark Fork River* in Idaho. The lake (named after the present-day city where it had been deepest) covered much of western Montana during the last Ice Age. Pardee described it in detail in a 1910 paper, but he did not make any connection between the lake and the scablands until many years later. However, in 1925, Pardee wrote to Bretz and suggested that a collapse of the ice dam holding back Lake Missoula would have unleashed a mighty flood. Bretz briefly mentioned the possibility in a 1933 paper, but did not otherwise pursue the suggestion.**


Quincy Basin
North Alcove
Caliche Lakes
I-90
Quincy
diatomite
Middle Alcove
Coulee
Basalt rib
South Alcove
Quincy
diatomite
Frenchman
plunge pool
geocache
Basin
Echo
Recent
sand
dunes
Babcock Bench

***"A half century ago J. Harlen Bretz, a University of Chicago geologist, suggested that the barren, heavily scarred region of eastern Washington had been made that way by a flood of phenomenal dimensions. While his proposal was long controversial, a photograph made from an earth satellite some 570 miles overhead has now provided clear evidence for the scope and nature of this prehistoric catastrophe."***

***The New York Times*, August 1974**

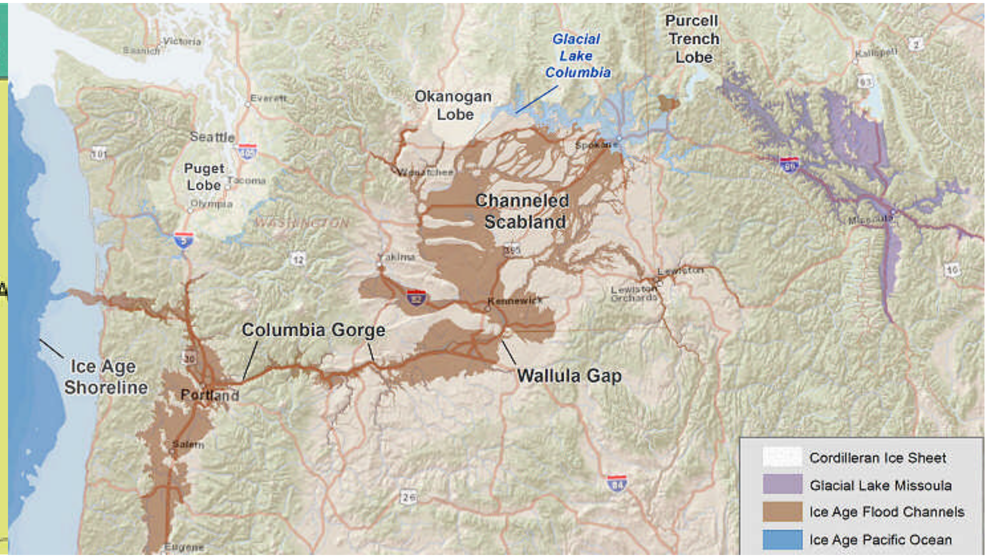
**RE: additional evidence in support of Bretz's flood theory had come earlier from aerial photographs taken by the U.S.B.R. in 1950 (in connection with the *Columbia Basin Irrigation Project*). They were intriguing enough that Bretz (then nearly 70yo and officially retired) returned to the Scablands for new field studies (in 1952). He found still more giant current ripples, so big and widely spaced that their significance could not be discerned from the ground. In all, he documented fifteen "ripple fields." Reviewing all the new data in 1959, Bretz concluded that there was now "adequate field evidence" to show that there had been several floods in the scablands, not just one, and that their source had been the repeated damming and draining of *Glacial Lake Missoula*.**



**Not until the 1940s did other geologists begin to present new evidence supporting the flood theory. Satellite imagery in the 1970s provided the final vindication. Bretz had the satisfaction of living long enough to see his once heretical ideas become the new orthodoxy. In 1979, at age 96, he received the *Penrose Medal*, geology's highest honor. He later reportedly told his son: *"All my enemies are dead, so I have no one to gloat over."***

**Left: caption: "Satellite view of the Channeled Scablands, August 1974"**

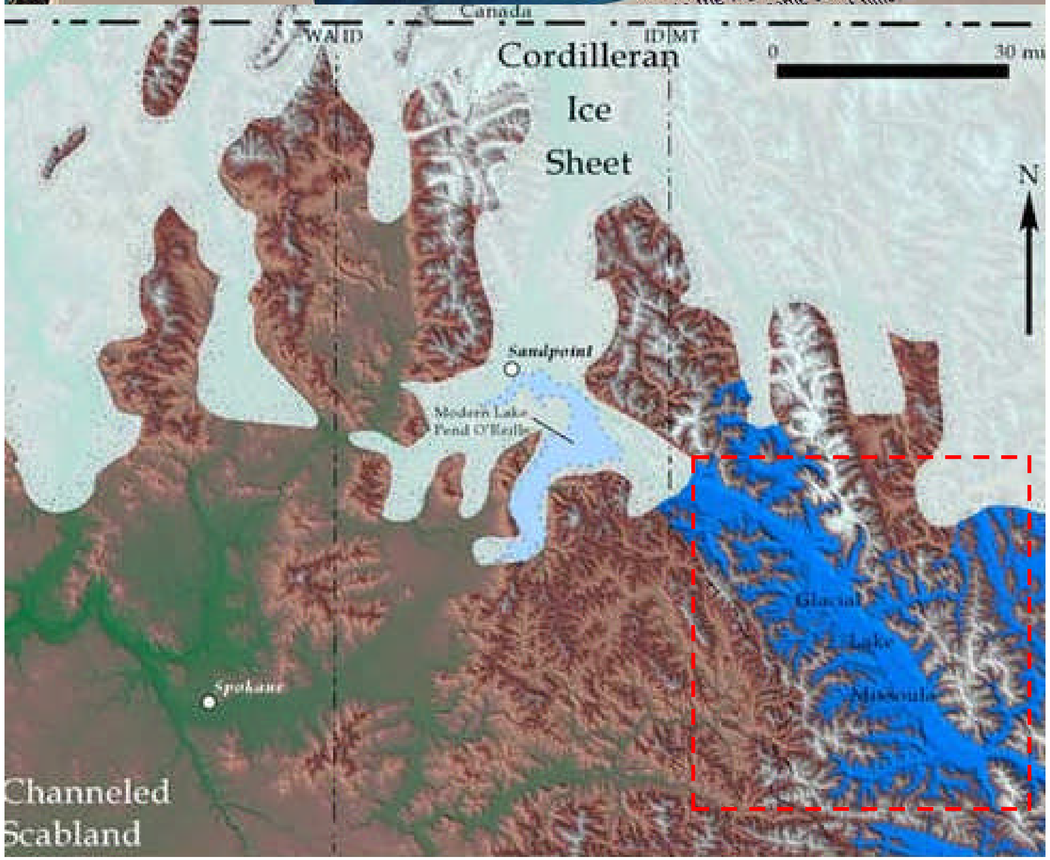

DEDICATED TO
J HARLEN BRETZ
WHO PATIENTLY TAUGHT US THAT
CATASTROPHIC FLOODS MAY SOMETIMES
PLAY A ROLE IN NATURE'S UNFOLDING DRAMA
"IDEAS WITHOUT PRECEDENT
ARE GENERALLY LOOKED UPON
WITH DISFAVOR AND MEN ARE SHOCKED
IF THEIR CONCEPTIONS OF
AN ORDERLY WORLD ARE CHALLENGED."
J HARLEN BRETZ, 1928
1994

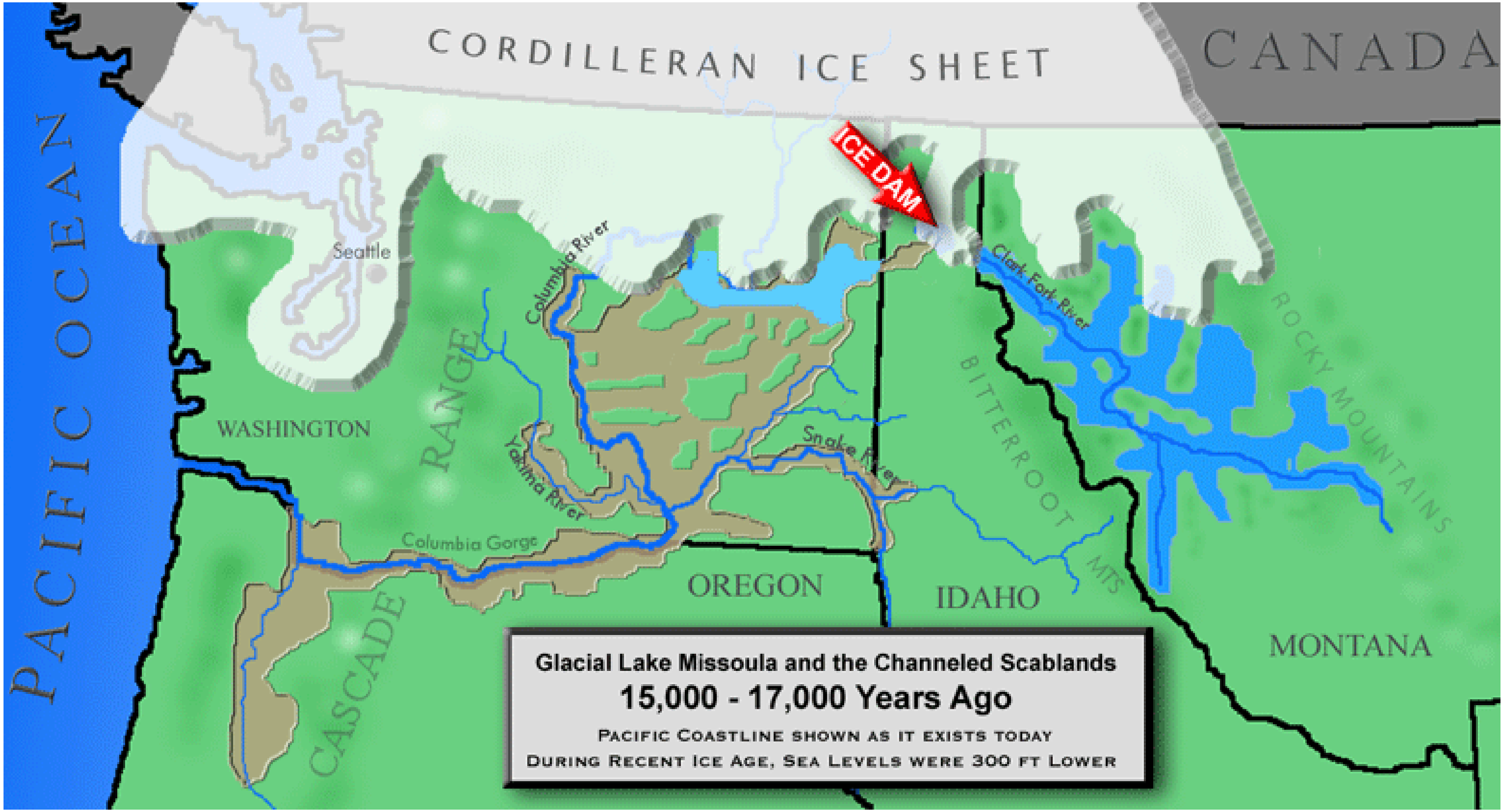



**During the last ice age, a lobe of ice at least a half-mile high blocked the *Clark Fork River* near the present-day Idaho and Montana border, creating an enormous natural reservoir: *Glacial Lake Missoula*. This ice dam failed, repeatedly, sending incredible volumes of water and ice rampaging across the land. The largest floods were equal to ten times the modern flow of all the rivers of the world combined. Each thundering torrent of water, ice and debris raced across the *Rathdrum Prairie* and into eastern Washington State, stripping away tons of soil and rock and carving a region known as the "Channeled Scabland." All the water released from *Glacial Lake Missoula* had to pass through *Wallula Gap*, where the *Columbia River* turns sharply west towards the Pacific. As flood waters backed up behind this narrow break in the *Horse Heaven Hills*, they filled up vast areas of the *Walla Walla, Pasco* and *Yakima Valley/s* creating a short-lived lake; *Lake Lewis*, which reached depths of more than 800-feet deep. Eventually, floodwaters forced their way through additional choke points in the *Columbia River Gorge* and *Kalama Gap*, filling the Columbia River Gorge and Willamette Valleys until, ultimately, reaching the coast and spreading out for hundreds of miles along the floor of the *Pacific Ocean*.**

**<u>Left</u>: caption: "Cordilleran Ice Sheet"**
**<u>Right</u>: caption: "Ice Age Floods in Washington"**


GLACIAL LAKE MISSOULA


Canada
WA ID
ID MT
Cordilleran
Ice
Sheet
0
N
Sandpoint
Modern Lake
Pend O'Reille
Glacial
Lake
Missoula
Spokane
Channeled
Scabland



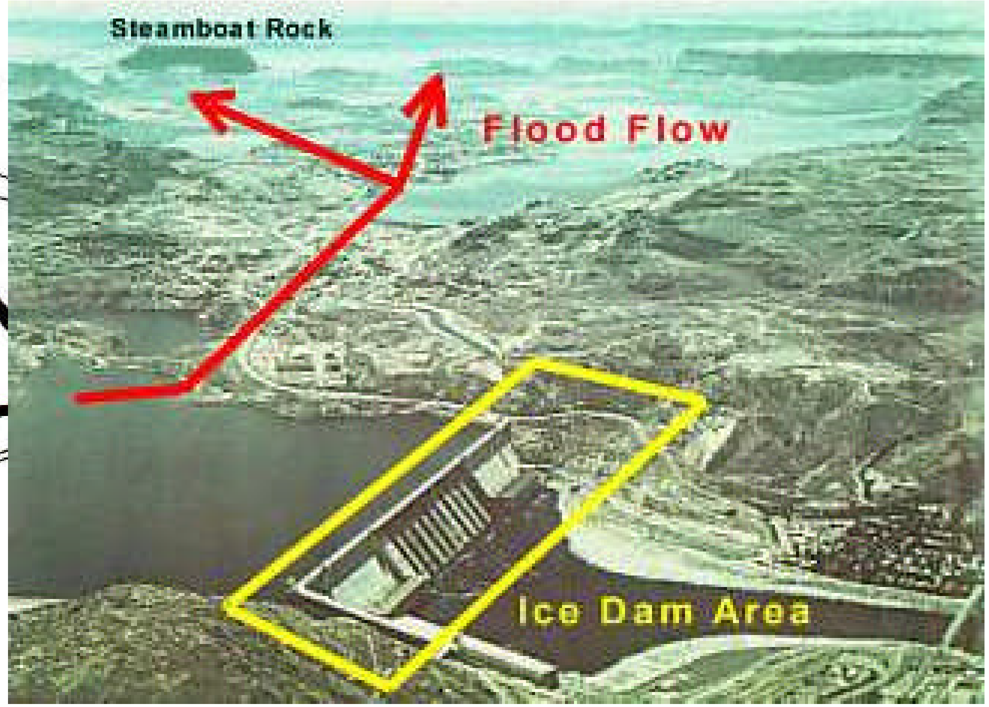

**<u>Above</u>: caption: "Glacial Lake Missoula impounded behind 'Ice Dam.' Another blockage occurred to the west where the Okanogan Lobe plugged the Columbia River's course creating Glacial Lake Columbia (body of water with a 500 square-mile surface area - at maximum fill)."**


***"And for 'him who in the love of Nature holds communion with her visible forms' the majestic Coulee tells a heroic tale of vanished power and glory far transcending that of Niagara and beggaring the leisurely story of the Yellowstone, the Yosemite, or even the Grand Canyon of the Colorado."***

***J. Harlen Bretz,* Geologist (1932)**

**<u>Above</u>: caption: "View of the Grand Coulee looking south from Steamboat Rock." *Grand Coulee* is the most spectacular of the valleys created by the ice-age floods, but 40-mile-long *Moses Coulee* also ranks as an impressive remnant, as do several smaller Coulees which provided direct outflows to the *Columbia River*: *Frenchman, Potholes and Crater Coulee/s*.**

# Ice Age Exposed

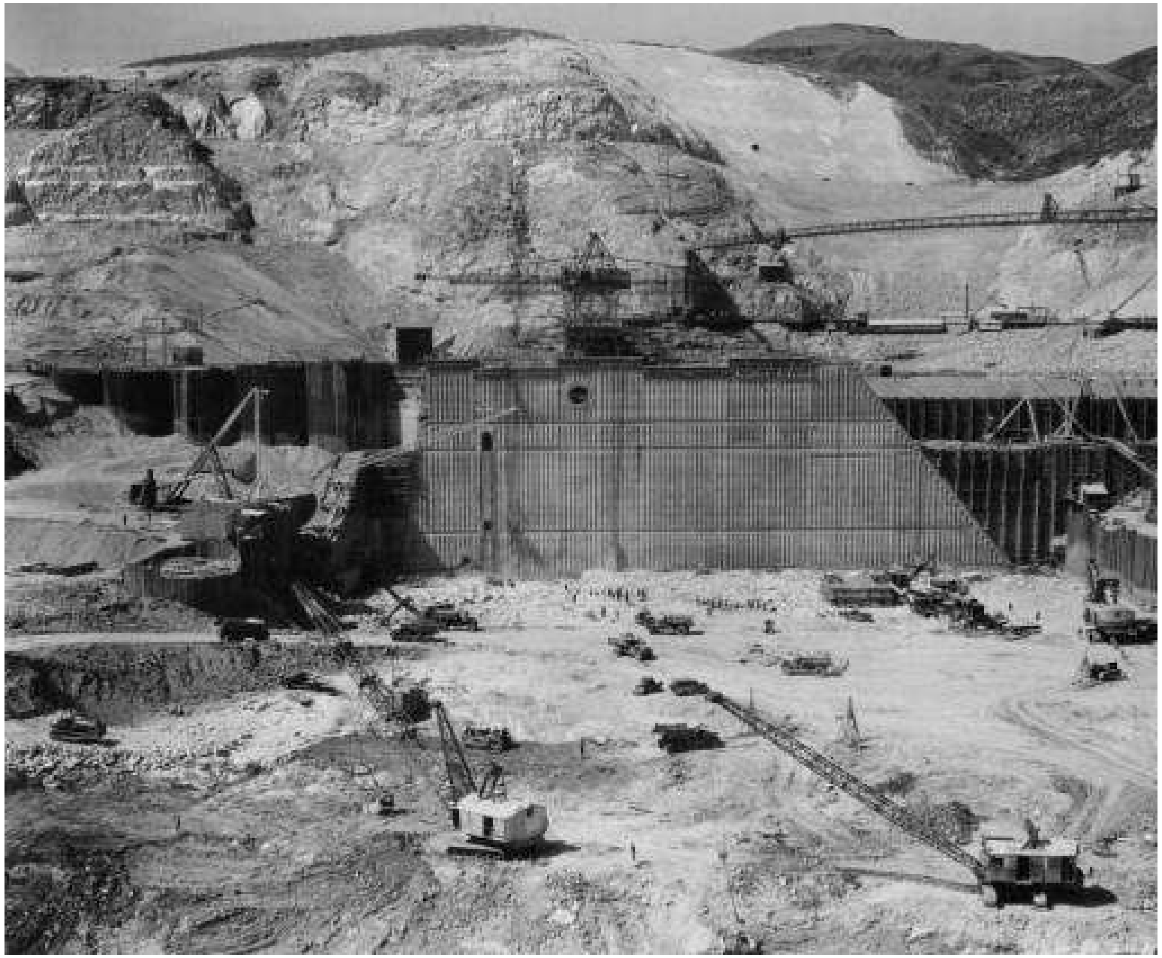



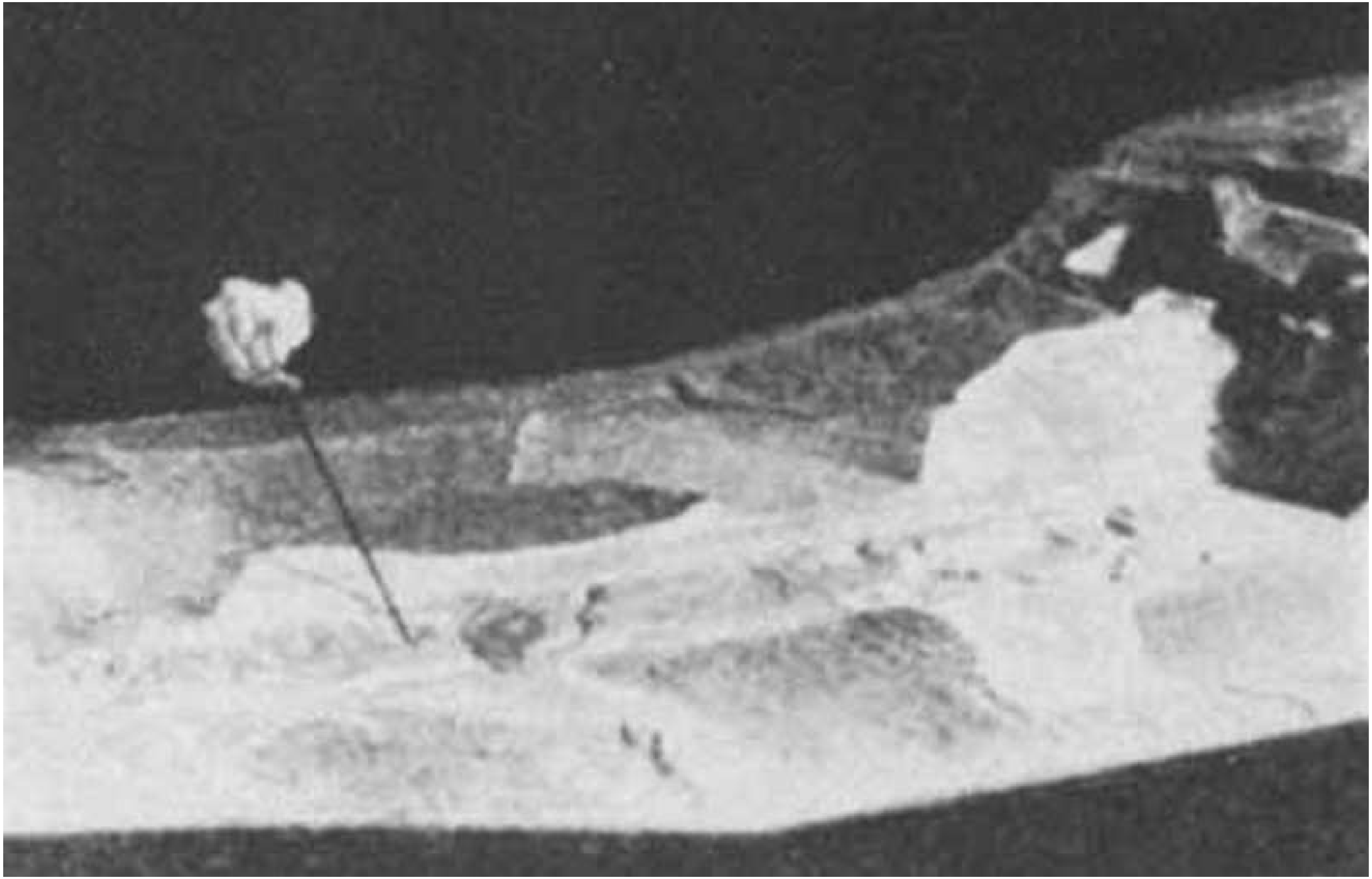

**When an ice dam blocked the *Columbia River*, *Glacial Lake Columbia* was formed. This is where *Grand Coulee Dam* was built. When the ice dam holding Glacial Lake Missoula broke, floodwaters could not get past this ice dam and flowed south creating the *Grand Coulee*. *Banks Lake* reservoir partially fills the coulee. Above, the aerial view of the area shows where the ice age floodwaters traveled to create the Grand Coulee. *Steamboat Rock* (upper left of photo) - a huge mass of layer-ed basalt, divides the channel in the channel of the eastern end of the Grand Coulee.**

*"…The 4,300-foot Grand Coulee dam is the largest structure ever built by man. It holds back the Columbia river, second in flow only to the Mississippi, at a point in central Washington where millions of years ago a glacier blocked the river and caused it to cut a temporary channel at right angles to its normal course…"*

***Popular Mechanics,*** **May 1942**

**Left: caption: "Bedrock in the old river channel, showing the natural water-worn rock surface as it is found under a bed of clay and boulders left in the canyon during the last ice age, and the operation of removing surface rock to provide for a firm and watertight connection between bedrock and the dam"**





**<u>Above</u>: caption: "Three deep gorges and numerous minor irregularities were found at the bottom of the 18-million-yard excavation"**

# Part 3

# What Dreams May Come

# A Great Trough

***"…That left a dry river bed high on the canyon wall, pointing away almost in the opposite direction from the great gorge of the Columbia. This dry river bed, or Grand Coulee, is a great trough two to five miles wide and fifty-six miles long. At the far end of this old channel lie 1,200,000 acres of the richest arid agricultural land in the country…"***

***Popular Mechanics,*** **April 1938**

**RE: "Coulee" is French for river valley, or ravine**

***"…The present idea is to pump billions of gallons of water up from behind the new dam into the extinct river bed and use twenty-three miles of this trough both as a canal and a balancing reservoir to carry part of the Columbia to the arid acres of the Big Bend country. It took daring imagination to plan such a tremendous project…"***

***Popular Mechanics,* April 1938**

**Left: caption: "A farmer outside of Pasco, Washington brings a portion of the Columbia to his water-starved crops, April 1950"**

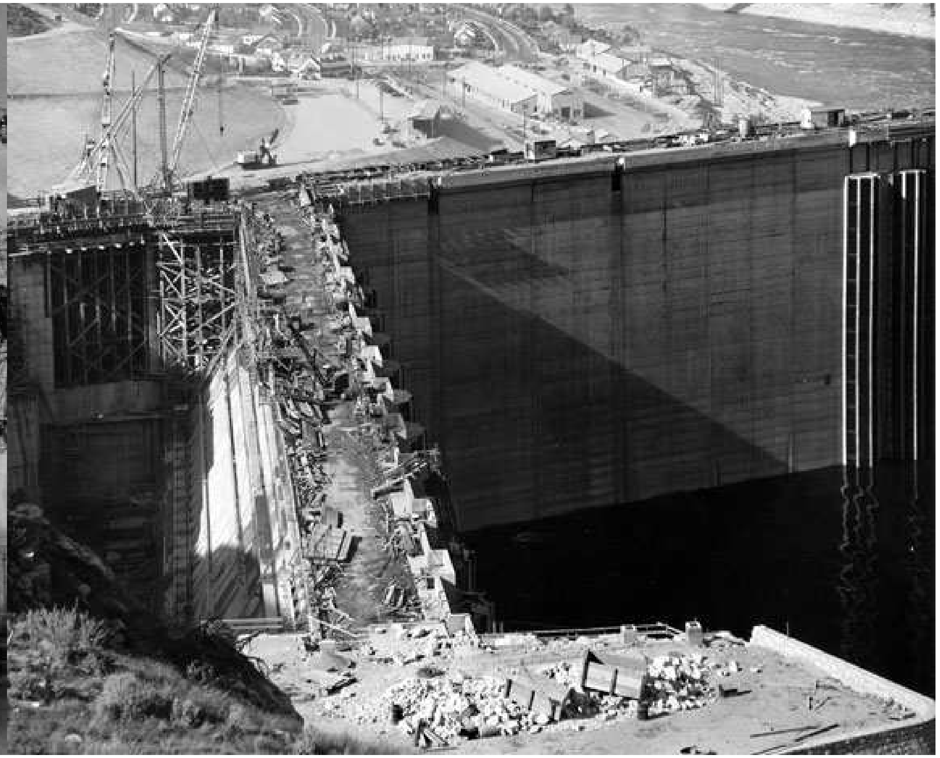
***"…The Bureau of Reclamation is rushing work on the irrigation distribution system of this development so that 400,000 acres can be irrigated and made ready for settlement by 1950 or 1951. Ultimately 1,000,000 acres of land will be supplied with water from the giant dam and its smaller helpers...In addition to supplying energy for hundreds of industries mushrooming in the region, Grand Coulee power will be used to operate 65,000-horsepower motors to drive pumps which will provide water for the project distribution system. Each pump will be capable of lifting 12,000 gallons of water per second to a height of 270-feet. Ultimately, twelve such giants will be placed in the pumping plant at Grand Coulee Dam. A battery of six pumps will be installed initially in this plant built on a rock shelf of the canyon wall, upstream from the dam. Each pump, with its motor installation, will be approximately 50-feet high. Ten of them operating simultaneously for nineteen minutes could pump the equivalent of a gallon of water for every man, woman and child in the United States…"***

***Popular Mechanics,* August 1947**

**RE: creating the irrigation program was as complicated as developing the dam. A massive pumping station was built to lift water 280-feet up into *Banks Lake*. From there, a network of more than three-hundred miles of canals and more than 3K miles of irrigation ditches provided water to an area twice the size of the State of Delaware.**

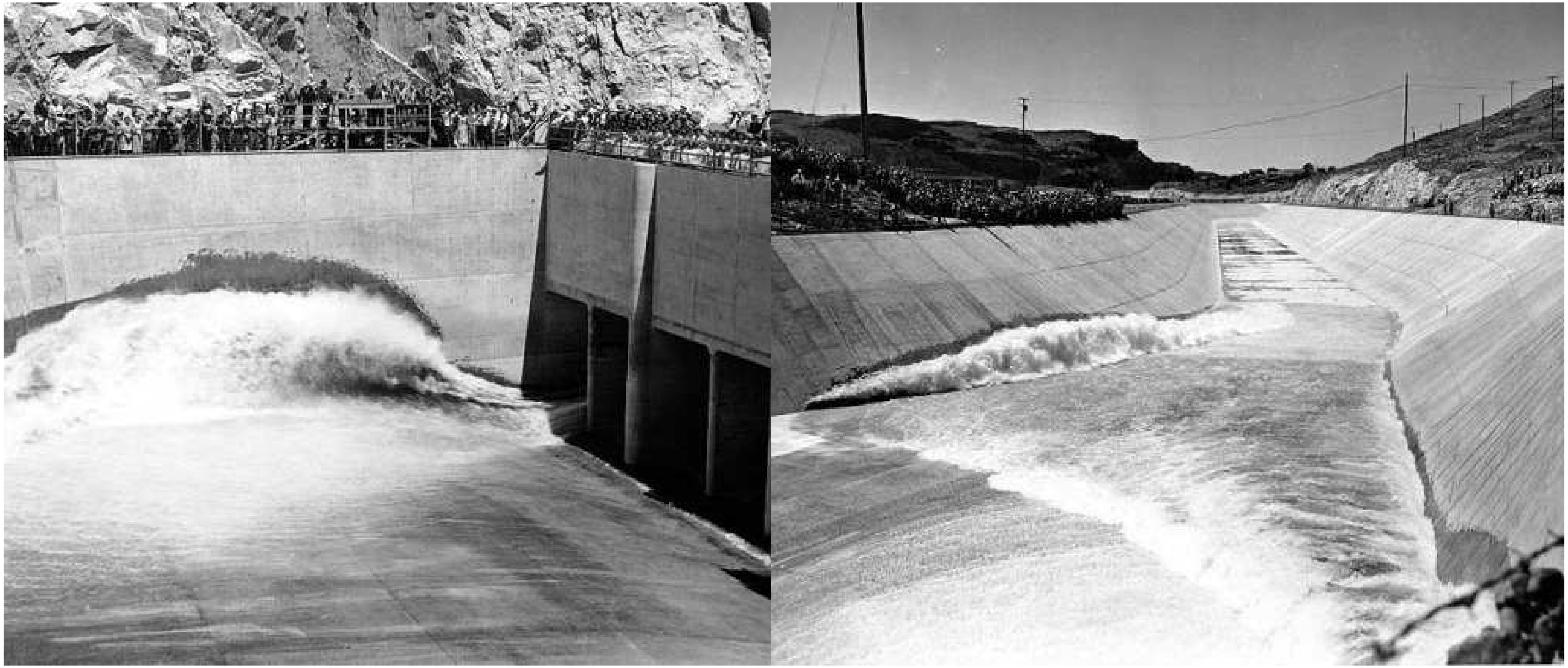
**Above: caption: “Water from Lake Roosevelt behind Grand Coulee Dam dumping into Banks Lake equalizing reservoir from feeder canal (May 1951)”**

**Left: caption: “Workers bend reinforcing bars for use in Dry Coulee Canal (May 1947)”**



**<u>Top Left</u>: caption: "Nine of the twelve discharge tunnels for the pumping plant seen here on the west side of Grand Coulee Dam (August 1938)"**
**<u>Top Right</u>: caption: "Pumping plant construction at Grand Coulee Dam (ca. 1943)"**
**<u>Left</u>: caption: "By 1950 work is almost complete on the irrigation pump system. In May 1951, the dam's pumps start to feed water into Banks Lake"**

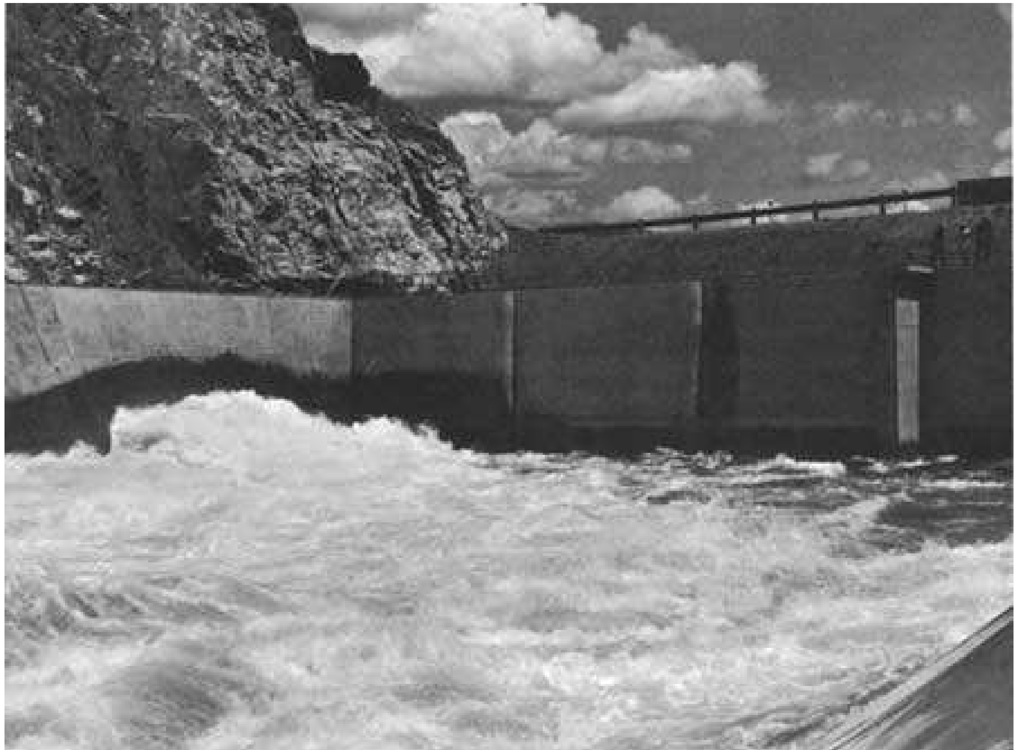
# Operation Bootstrap



***"Operation Bootstrap at Grand Coulee Dam is scheduled to start this summer. Power generated at the dam will be used to drive enormous pumps which will lift a river of water 280-feet up the face of a cliff on the Columbia River. From there the water will be distributed to irrigate a million acres of farmland., some of it 150 miles away. Each of the twelve giant pumps has a capacity of a billion gallons of water a day, enough for all the people of New York City. This year, all the canals, siphons and gates of the distribution system will be tested and primed. Actual irrigation will start in the spring of 1952."***

***Popular Mechanics,*** **August 1951**

**Above L&R: caption: "Ceremony for the first water delivery from the Grand Coulee Dam for the irrigation of the Columbia Basin Project lands, May 7, 1951"**



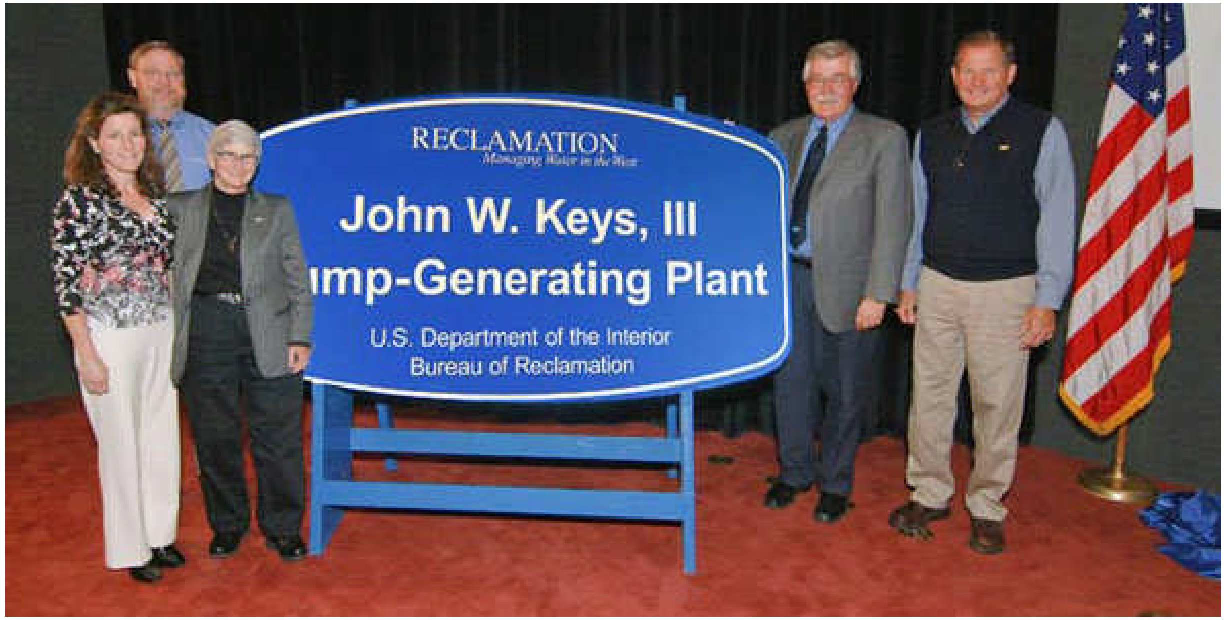
**The Columbia Basin Project's irrigation water begins its long journey to the land when it is pumped up over the lip of the canyon wall at *Grand Coulee Dam* and flows into *Banks Lake*. The pumps lift the water at a rate of 4,300,000 gallons of water per minute. Once in the Feeder Canal, the water flows along this 1.6-mile waterway to Banks Lake.**

**Left: caption: "Here the water from Franklin D. Roosevelt Lake, lifted by the pumping plant, begins its long journey to the irrigated portion of the project"**

**Right: caption: "The Soap Lake Siphon carries the waters of the West Canal across the lower Grand Coulee near Soap Lake. The siphon is almost 2-1/2 miles long and over 22-feet in diameter."**

***“Circumstances have played no small part in the successful scheduling of Grand Coulee’s workload. At about the time that the river starts its annual spring rise, the irrigation season begins. When the six powerful irrigation pumps just above the west end of the dam are operating, almost 10 percent of the average flow of the river is lifted over the rim of the river canyon wall 280-feet above the dam and begins its journey to the land and the crops of the irrigated portion of the project. Because of the higher water flow and consequently greater head in the reservoir at this time, there is surplus power available to operate the six irrigation pumps that handle this tremendous lifting job. Each of these pumps is powered by a 65,000-horsepower motor and will lift 1,600 cubic-feet of water a second, or 720,000 gallons a minute. It is estimated that these six pumps could provide enough water in three minutes to fill a glass of water for every man, woman, and child in the United States. By the time the irrigation project is completed, there will be a total of twelve of these pumps.”***

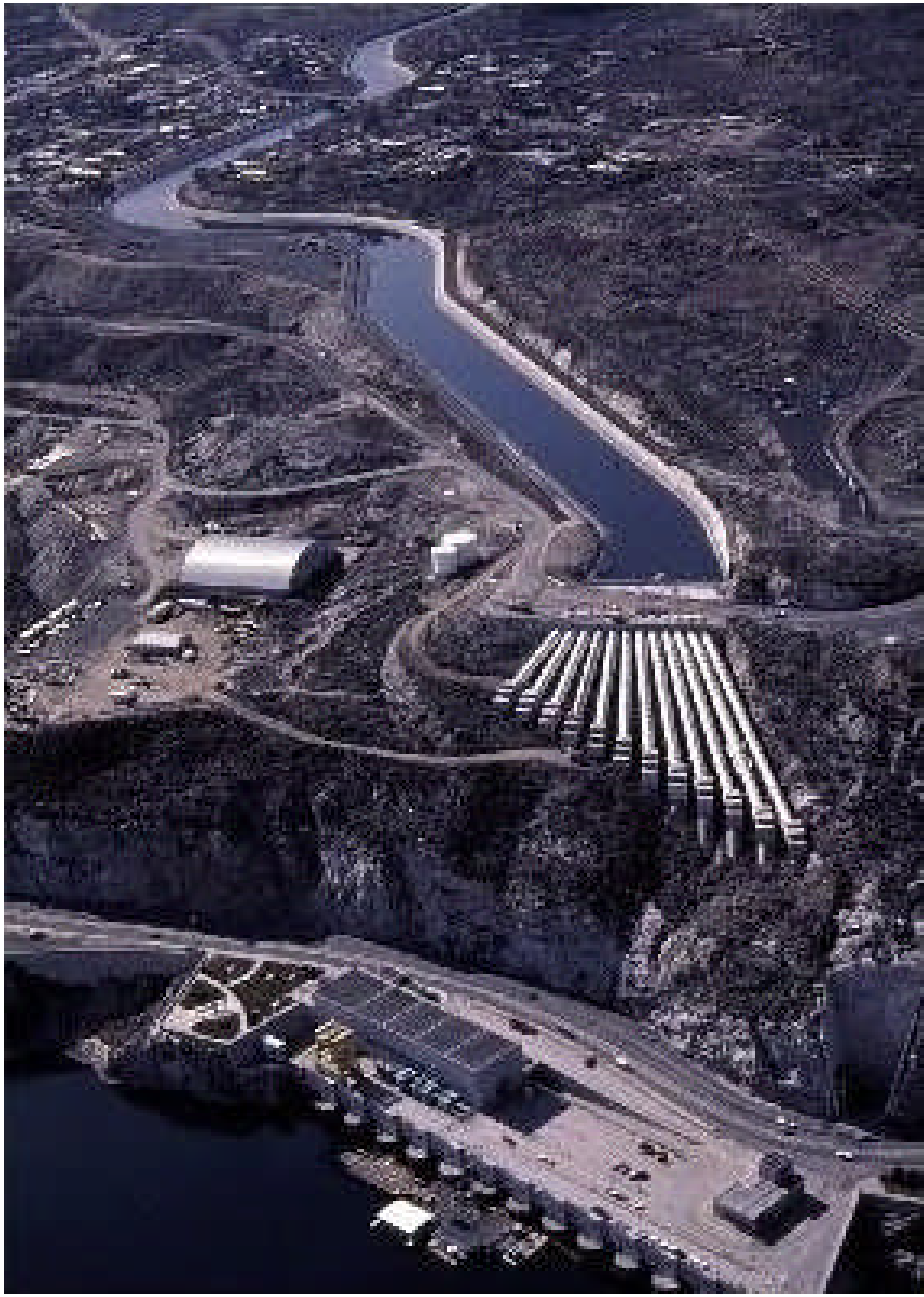
***U.S. Bureau of Reclamation*** **(ca. 1964)**




**Between 1967 and 1974, *Grand Coulee Dam* was expanded to add a third power plant. Original designs for the powerhouse had twelve smaller units but were altered to incorporate six of the largest generators available. After power shortages in the Northwest occurred during the 1960s, it was determined that the six remaining pumps be pump-generators. When energy demand is high, the pump-generators can generate electricity with water from the *Banks Lake* feeder canal adjacent to the dam (at a higher elevation). By 1973, the *Pump-Generating Plant* was completed and the first three pump-generators were operational. In 1983, two more went online and by January 1984. the final pump-generator was operational, cumulatively adding 314 MW to Grand Coulee Dam's capacity. In May 2009, the Pump-Generating Plant was officially renamed the "John W. Keys III Pump-Generating Power Plant" (above), after *John W. Keys III*, the U.S.B.R. commissioner from 2001 to 2006 (he died in a plane crash in Utah in May 2008).**

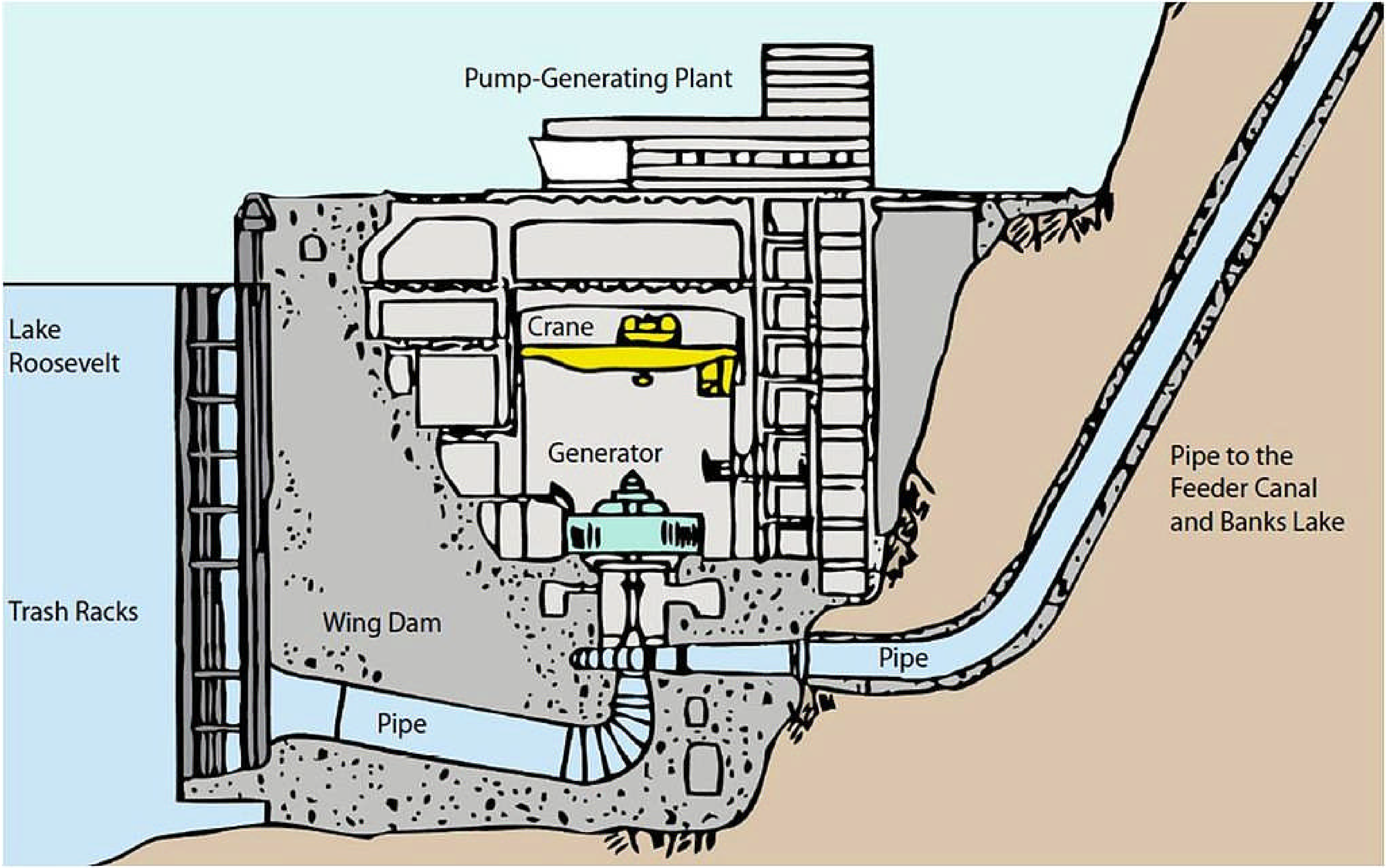

**<u>Left</u>: caption: “John W. Keys, III Pump-Generating Plant (ca. 2009)”**

**<u>Right</u>: the world’s largest pumps push water from *Lake Roosevelt* up the intake pipes . From there, the water goes into *Banks Lake* (in the *Grand Coulee*) and from there it travels another fifty miles through tunnels, siphons and canals to the farm country of the *Columbia Basin.***



Above: caption: “The Pump-Generating Plant at Grand Coulee Dam, pumps water uphill 280-feet from the reservoir behind Grand Coulee Dam to a canal that feeds Banks Lake. Two dams were built 27 miles apart in the Grand Coulee to hold irrigation water (Banks Lake). The system allows water to flow either direction in the feeder canal as the reversible pumps at the pumping station are also designed to generate power when demand is high.”

Left: caption: “Pump-Generating Plant and Roosevelt Lake at bottom, feeder canal to Banks Lake at top”



Pump-Generating Plant
Lake
Roosevelt
Crane
Generator
Pipe to the
Feeder Canal
and Banks Lake
Trash Racks
Wing Dam
Pipe
Pipe

# The Mysterious Force

***"When an object moves under water at high speed a mysterious force is brought into play that has baffled scientists for years…The mysterious force which acts as a brake on any speeding underwater object is known as cavitation. This bugaboo of hydrodynamics is something like the drag that limits the efficiency of airfoils in the atmosphere. A swiftly moving body creates a cavity in the water in the form of a blanket of low-pressure bubbles that appear, grow and collapse…"***

***Popular Mechanics,*** **July 1949**

**Left: caption: "Cavitating propeller model in a water tunnel experiment"**

**Right: caption: "Cavitation in a gear pump"**

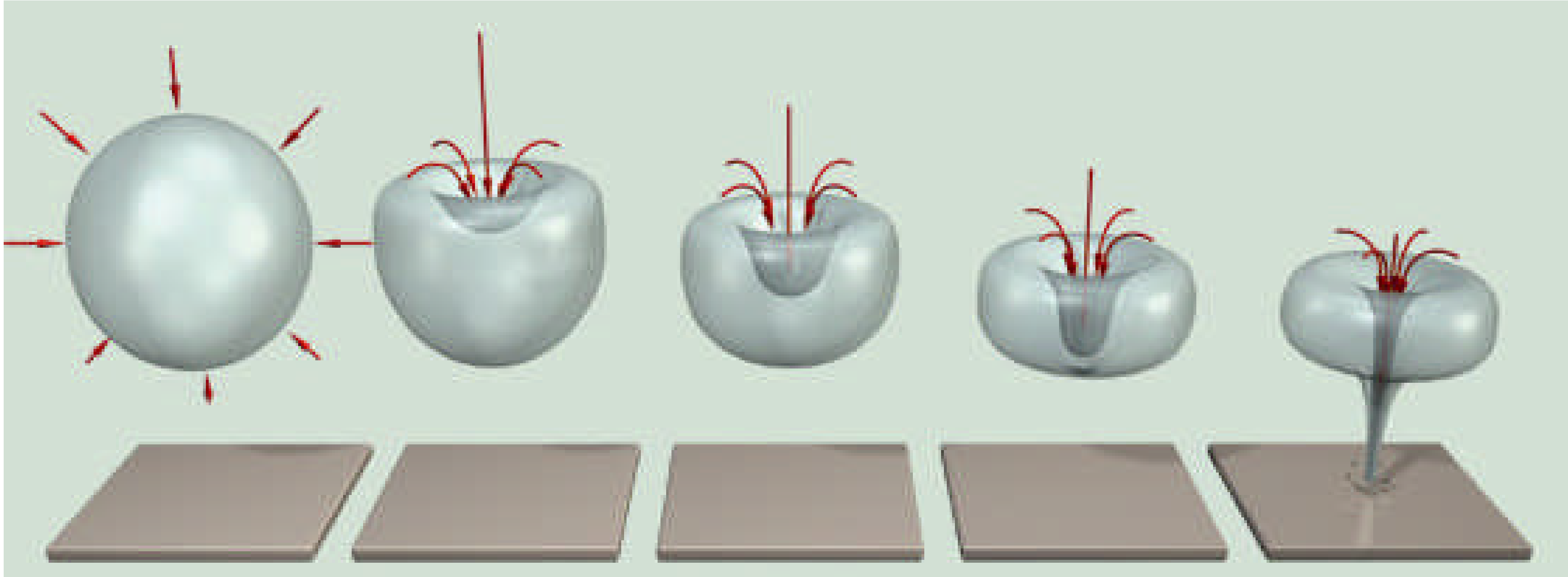
 

***"…The hammering of the water as the bubbles collapse creates vibrations, limits speeds and actually corrodes metal. Fast ocean liners must sometimes go into dry dock for repairs to propellers that have been eaten away by cavitation. Engineers know what causes cavitation and they know its harmful effects but they don't know for certain how it works…"***

***Popular Mechanics,*** **July 1949**

**Left: caption: "Cavitation damage on a valve plate for an axial piston hydraulic pump"**

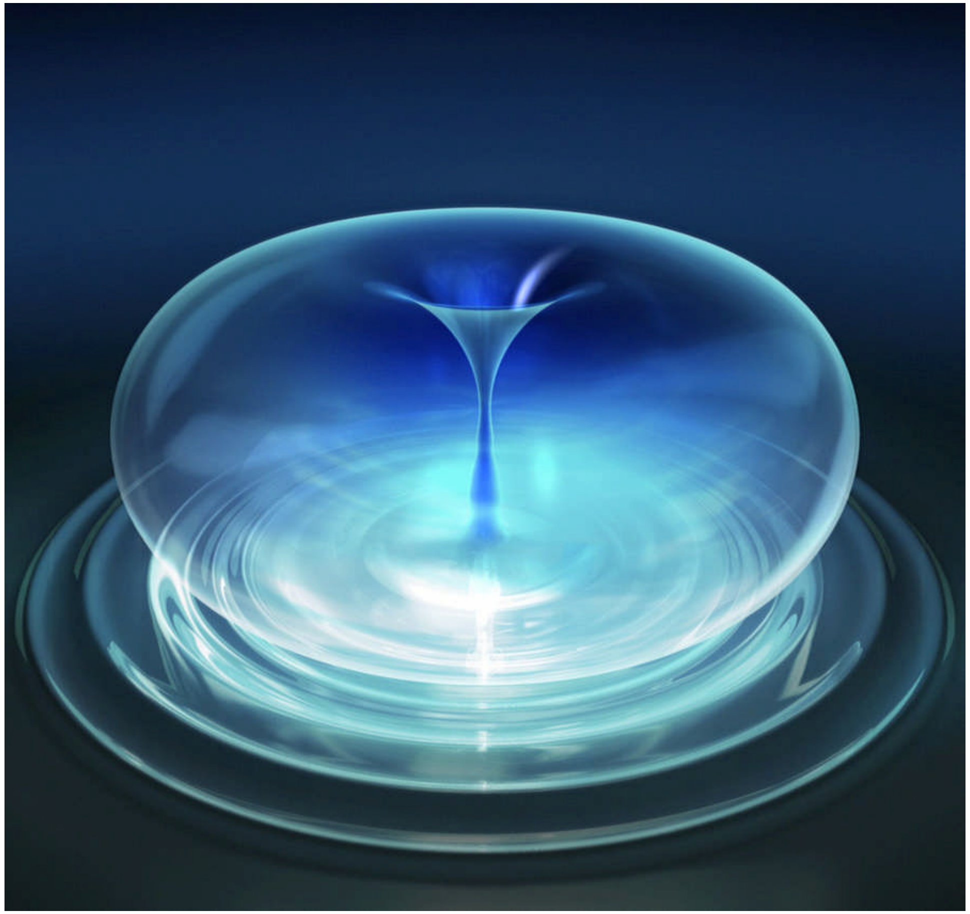
**Right: caption: "Cavitation damage to a Francis turbine"**

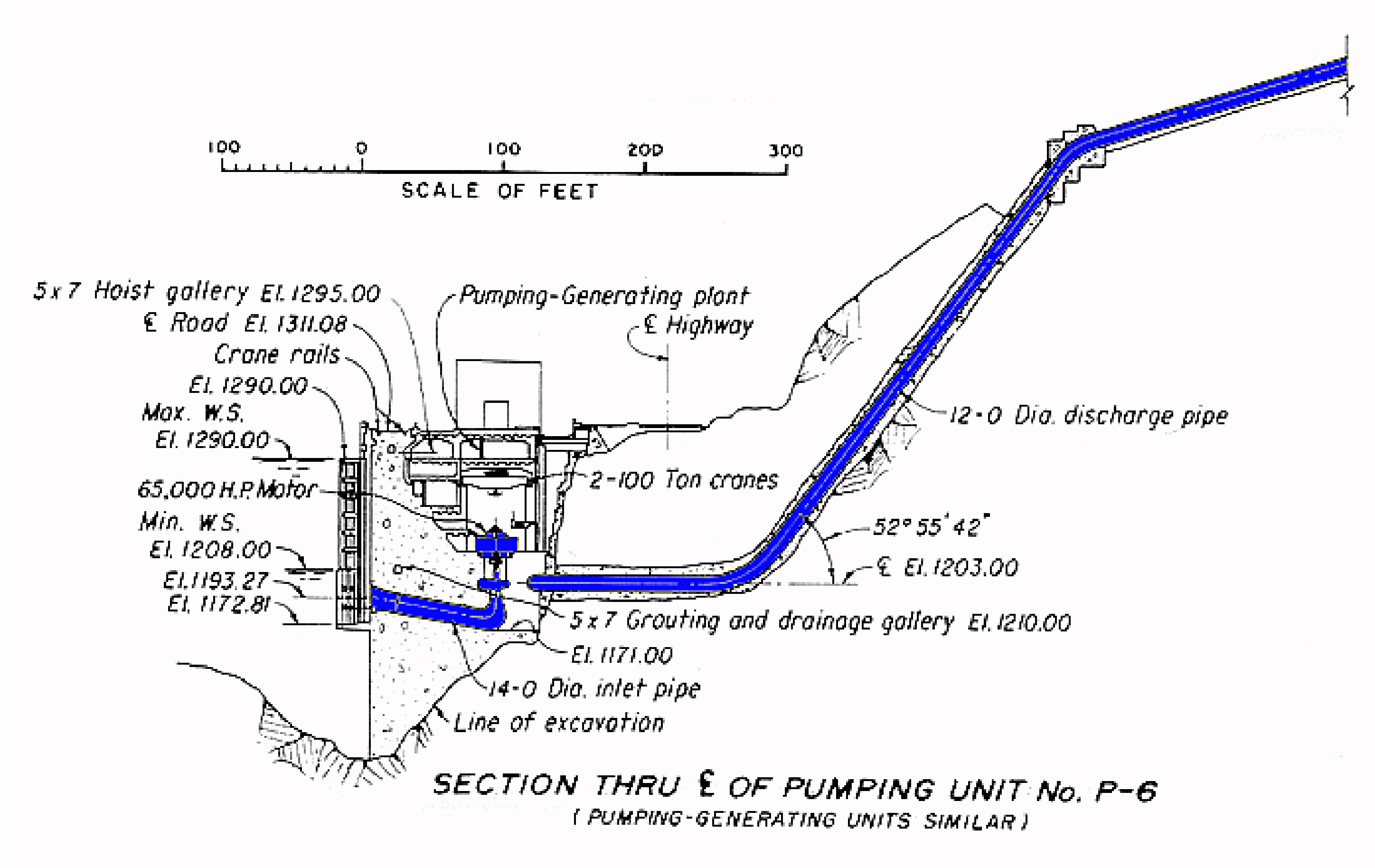


***"…'Cavitation limits the speed of underwater bodies and creates problems in controlling them,' says Dr. Robert T. Knapp, director of the California Institute of Technology's hydrodynamics laboratory. 'It limits the size and speed of turbines and causes loss of efficiency in pumps. It is a limiting factor to all types of hydraulic machinery.'…"***

***Popular Mechanics,* July 1949**

**<u>Above</u>: caption: "High-speed jet of fluid impact on a fixed surface. Cavitation bubble imploding close to a fixed surface generating a jet of the surrounding liquid."**






***"…Cavitation is also a costly factor in the design of the pumps that will lift part of the Columbia River up the side of a 300-foot cliff at Grand Coulee Dam for irrigation purposes. This job will be done by twelve giant pumps. Each has an impeller wheel 14-feet in diameter and a shaft that weighs 30 tons. Each will be driven by a 65,000-horsepower electric motor. Similar, faster pumps could do the job at less cost if it were not for cavitation…"***

***Popular Mechanics*, July 1949**



**<u>Above</u>: caption: "Section Thru Centerline of Pumping Unit No. P-6"**

***"…Hydrodynamicists have no expectation that they will double or triple the efficiency of water machinery. Many pumps are 90% efficient already and ships' propellers are 70 or 80% efficient. These figures apply to the 'designed speed' of which the blades will be operated most of the time. What scientists do hope for is to learn how to design smaller blades that will perform the same amount of work by operating at higher speeds, without harmful cavitation, and that will be more efficient over wide speed ranges…"***

***Popular Mechanics,* July 1949**

# Dream Realized

***"For much of its journey, the Columbia River carves through arid plateau lands. The dream that water from the river could be pumped up to irrigate the surrounding countryside fueled the development of the Grand Coulee Dam. That dream has been realized, and the Columbia Basin Project irrigates more than half a million acres. The annual value of crops raised on these lands is well over half a billion dollars. Farmers in the Columbia Basin grow high-value fruits and vegetables and specialty crops (i.e. mint and wine grapes). Agriculture-related industries account for 30-50% of all income in the area. The land irrigated by the Columbia Basin Project provides harvests like this every year."***

***U.S. Bureau of Reclamation*** **(ca. 2008)**

***“Wheat farming will give place, below the high-line ditch, to alfalfa growing and fruit raising. In the unclaimed or abandoned dry gravel soils sagebrush and bunch grass will vanish, and orchards will spread summer greenery over the gray landscape. This result, if it comes to pass, will be because of the Grand Coulee, product of the greatest torrent of which the earth bears record.”***

***J. Harlen Bretz,* Geologist (1932)**


**The "ideal" irrigation system has no runoff, however, this ideal is seldom achieved, particularly in a project the size of the CBP (some irrigated lands were badly over-watered). *O'Sullivan Dam* was completed in 1949 to impound *Potholes Reservoir*, which was intended to serve as an equalizing reservoir that also would capture return runoff from a network of "wasteways" and drains. Ultimately, the CBIP included about 3,500 miles of these channels to remove excess water. Since some of the land earmarked for irrigation was at higher elevations than nearby canals, a network of 241 pumping plants had been installed by the early 1980s. The *Columbia Basin Development Program* has brought 671K acres under cultivation - short of the 1.2 million acres originally conceived. *New Deal* officials had envisioned a reclaimed region filled with small family farms of no more than eighty acres each. By the mid-1950s, when irrigation water was widely available, three times that acreage was necessary to operate a family farm on an economically sustainable basis.**



**<u>Above</u>: caption: "Columbia Basin green pea harvest"**

***“You know, people ask an awful lot of this old river. We stopped floods. We evened out the flow to spread the power around. We made the desert bloom. And people will be asking even more of the river. When Congress set up Grand Coulee, they authorized a million acres of irrigation. Only half that land’s been watered. Now there’s talk of irrigating more…I don’t know. Maybe a little bit at a time. People these days are more aware of the river’s limits, too.”***

***Grand Coulee Dam* Tour Guide (ca. 2013)**

# Part 4

# A Shave and a Haircut

# Bunyanesque

***"Eleven million dollars for a shave and a haircut seems like a lot of money, yet it's about what Uncle Sam's Reclamation Bureau is paying for the biggest tonsorial job on record out in the Columbia river valley of Washington…"***
***Popular Mechanics,* February 1941**
**Left: caption: "Columbia river valley one mile south of Rice, Washington, May 1941"**

***"…The three thousand men who have been on the job for two and a half years haven't been cutting the hair shaving the whiskers of the timber giant, Paul Bunyan, but their task is big enough to have delighted this mythical man of the Northwest who liked things on the grand scale. They have been clearing the way for the longest man-made lake in the world…"***

***Popular Mechanics,*** **February 1941**

**Left: caption: "Sawing a Yellow Pine across the river from Camp Gifford, 1940"**

***"…Clearing crews have cut down and trimmed merchantable timber, twe-nty million feet of it. They still have sixteen million feet to cut. This timber is floated down river to a private sawmill which has a contract with the govern-ment…***

***Popular Mechanics,*** **February 1941**

**<u>Left</u>: caption: "Felling tree, across from Camp Gifford caught half-way in descent, this yellow pine is being felled at approximately the 1,250-foot level. Trees in background are above high water of the rising Coulee lake, 1940."**

__Above__: caption: "Placing dynamite at the stump of a felled tree, 1940"
__Left__: caption: "Tractor clearing logs at Oropo-them Creek, 1940"


***"…This lake, which is backing up for 151 miles behind Grand Coulee dam on the Columbia river, for sheer water volume is second to Lake Mead behind Boulder Dam in the Southwest. Lake Mead has a capacity of 30,500,000 acre-feet; Lake Columbia, 10,000,000 acre-feet…At the start, the lake bed included 17,000 acres of brush and 30,000 acres of timber which had to be cleared…"***

***Popular Mechanics,*** **February 1941**

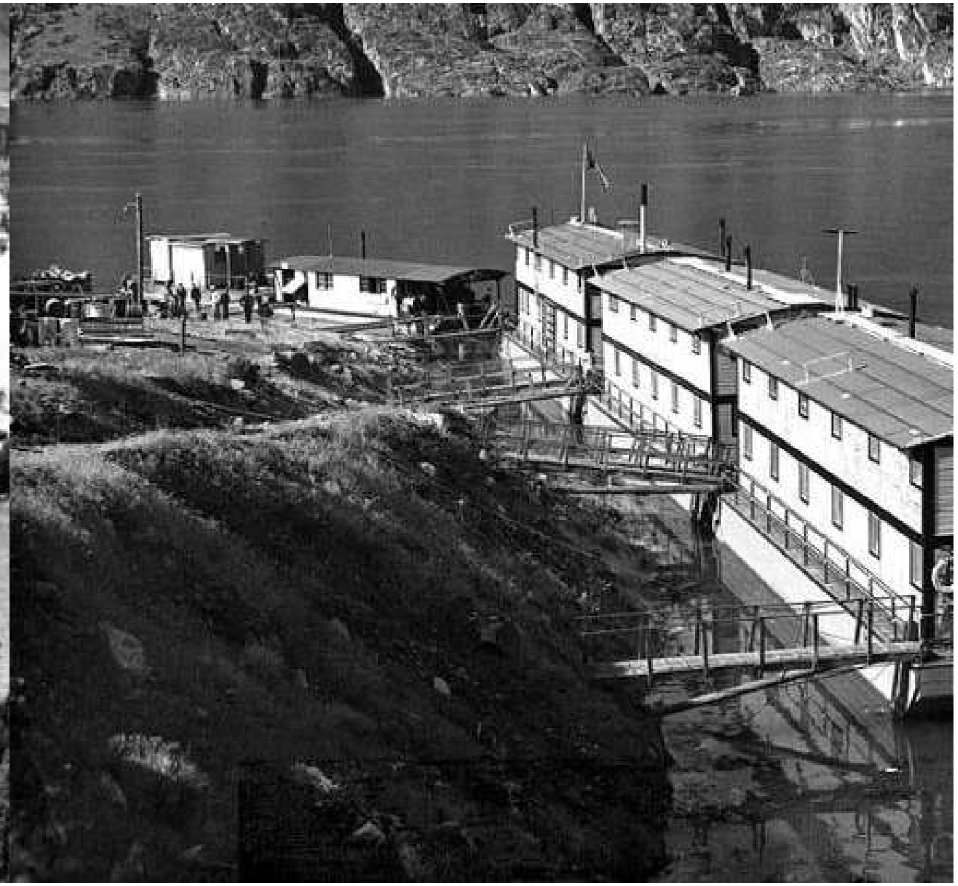
**Top Left: caption: "General view of clearing activities in reservoir area above dam. Everything is burned except merchantable timber 6-inches and larger in diameter. This is transported to sawmills and cut into lumber (November 1939)**

**Top Right: caption: "WPA cleared lake bottom looking east on Spokane river, near Detillion, showing a part of the Grand Coulee reservoir which WPA crews have cleared of all trash and debris. Water is slowly creeping up the banks of the river and will soon cover the entire bottom to the tree line on either bank (ca. 1941)"**

***"…The crews, living on floating and in mobile camps, also have chop-ped and burned brush and weeds, cut down fruit trees and dismantled buildings. There were six-hundred farms in the valley. Fence posts and utility poles were pulled out. Miles of fence and wire were rolled up. Cattle and stock were moved to higher ground…"***

***Popular Mechanics,* February 1941**

**Left: caption: WPA work crew lines up for lunch, 1940"**

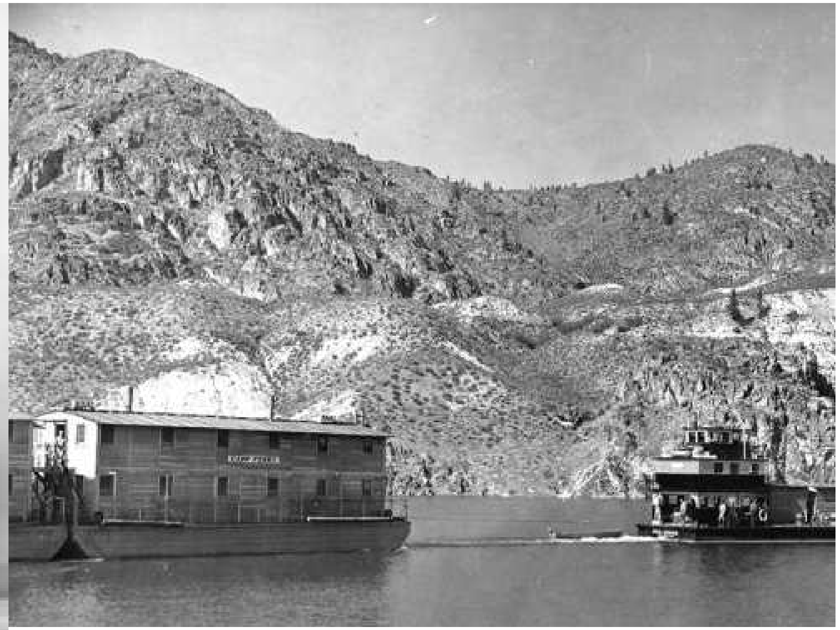


***"…Because some of the river land was inaccessible from existing roads, engineers built floating barges on which camps were established…"***

***Popular Mechanics,* February 1941**

**Top Left: caption: "Camp Gifford, second-largest of the six WPA cantonments, 1940"**

**Top Right: caption: "Camp Ferry, May 1940"**



***"…These camps were then towed up and down the river at will, and men could be taken directly to working locations. One towing barge is appropriately named Paul Bunyan, and another the Blue Ox…"***

***Popular Mechanics,* February 1941**

**<u>Above</u>: caption: "The tugboat 'Paul Bunyan' towing Camp Ferry on the Columbia River, ca. 1940"**

**<u>Left</u>: caption: "Camp Ferry, ca. 1940"**

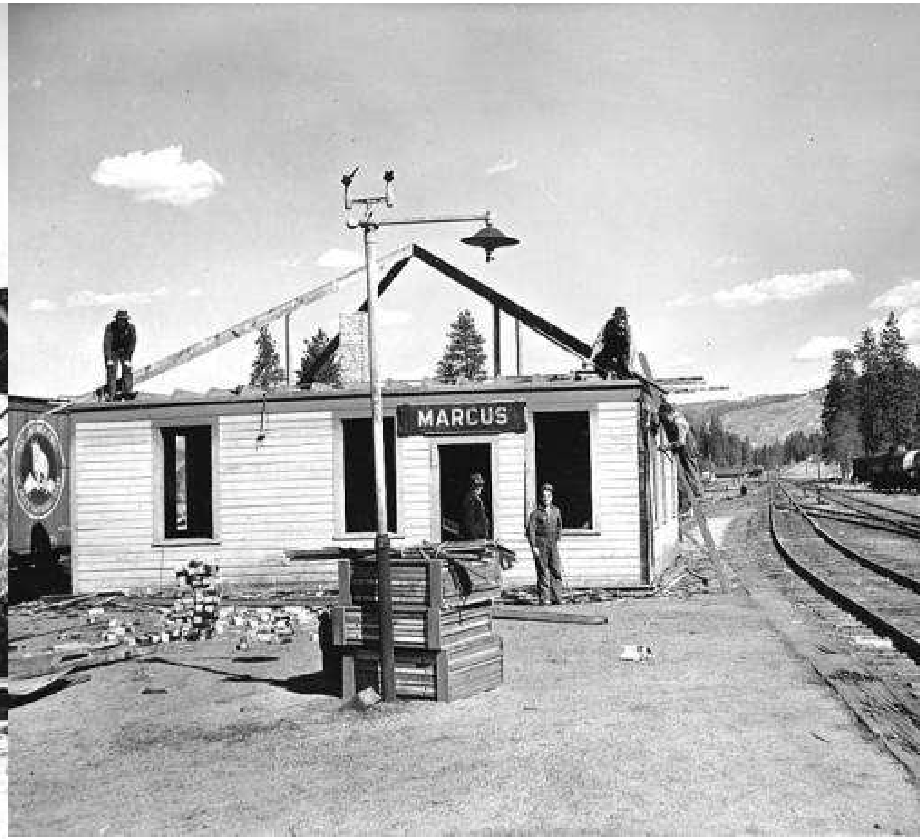

BLUE OX

<u>Left</u>: caption: ‘The Little Falls hydro-electric plant of the Washington Water Power Company at Little Falls is the approximate upriver boundary of WPA clearing operations of WPA crews toward Camp Little Falls. The reservoir along the Spokane river combines with Columbia river back-water behind Grand Coulee dam and will eventually come up to approx-imately this point.”

**The federal government paid property owners the market value of their land but did not cover moving and/or relocation costs. This was standard policy until 1958, when Congress authorized payment for moving expenses. Some homeowners sold their property (land and improvements) to the government, then bought the house back for salvage at much lower cost. They then lived in the building until required to evacuate because of rising water and paid the moving expenses if they wished to relocate the house. These costs could be high. For example, house movers charged about $125 to move a home from old Marcus up to the new town site less than a mile away (on the bench). However, the U.S.B.R. did pay for the moving of some buildings, such as the *U.S. Forest Service Kettle Falls Ranger Station* and *Great Northern Railway* facilities.**

**Top: caption: "Dismantling Great Northern's ice house in Marcus, Washington, 1941"**

**Bottom: caption: "Moving a house in Marcus, Washington to a new location above the high water line, 1941"**




**Top Left: caption: “One of the most unique moving jobs in Marcus is the removal of the second story of the former Leon Qurzburg home to Colville. Concrete block walls and the partitions of the lower floor will be removed to allow the entire upper part of the house to be lowered on multiple wheeled carriages to be hauled away by truck”**

**Top Right: caption: “Dismantling the Immigration Station in Marcus, Washington, 1941**

**Left: caption: “Abandoned building in the cleared area, ca. 1941”**

# Free at Last

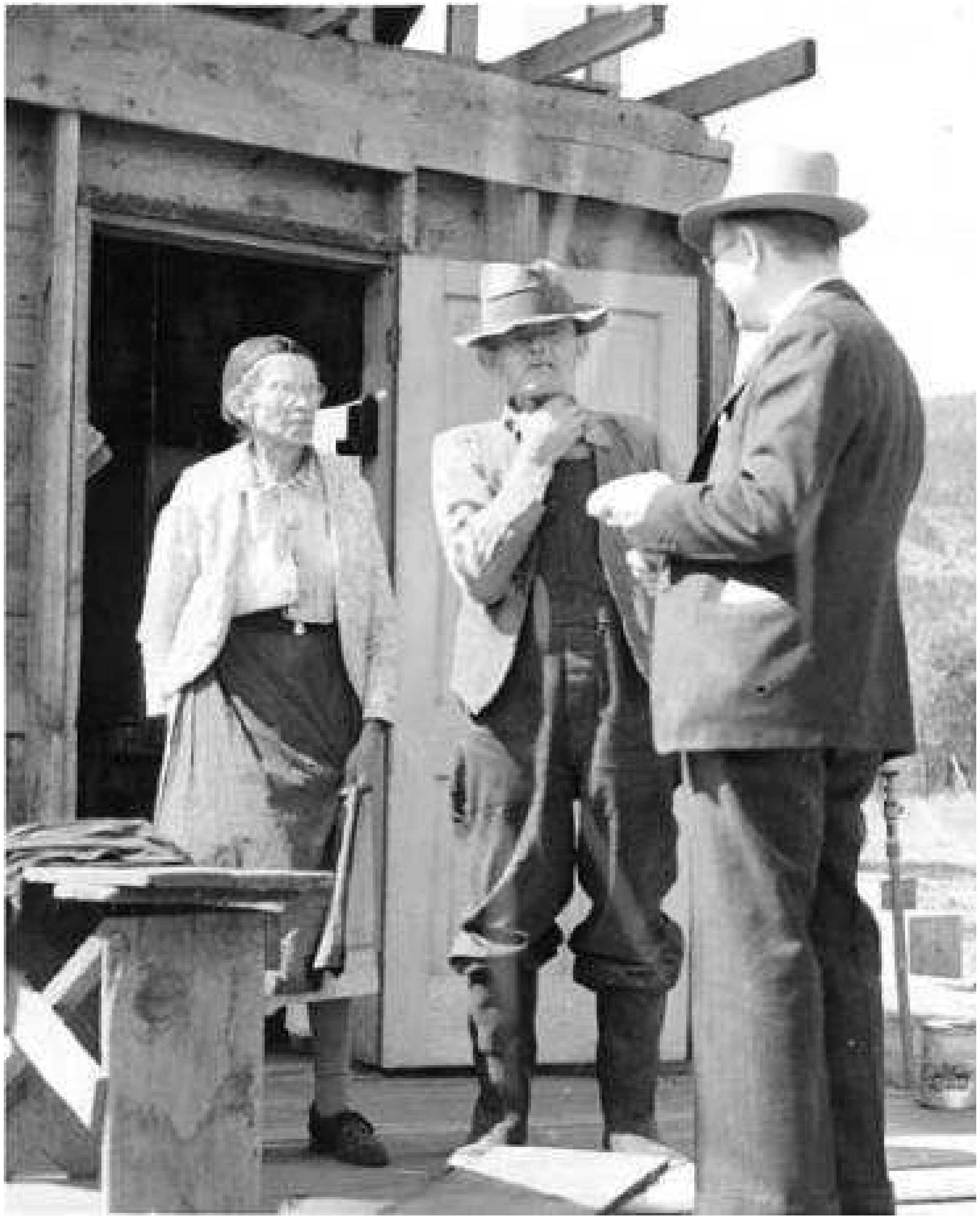
***"Most of the 3,000 persons who were forced to move accepted their fate philosophically…Many felt that this forced evacuation released them from a bondage that held them in the great canyon where tradition and custom bound them inevitably to a life of drudgery and poverty."***

**WPA Press Release, 1940**

**Top: caption: "The town of Peach and some of the orchards that gave the town its name, ca. 1920. Both the town and the trees were flooded by Lake Roosevelt."**

**Bottom: caption: "Toward Hawk Creek, site of former town of Peach, now inundated"**

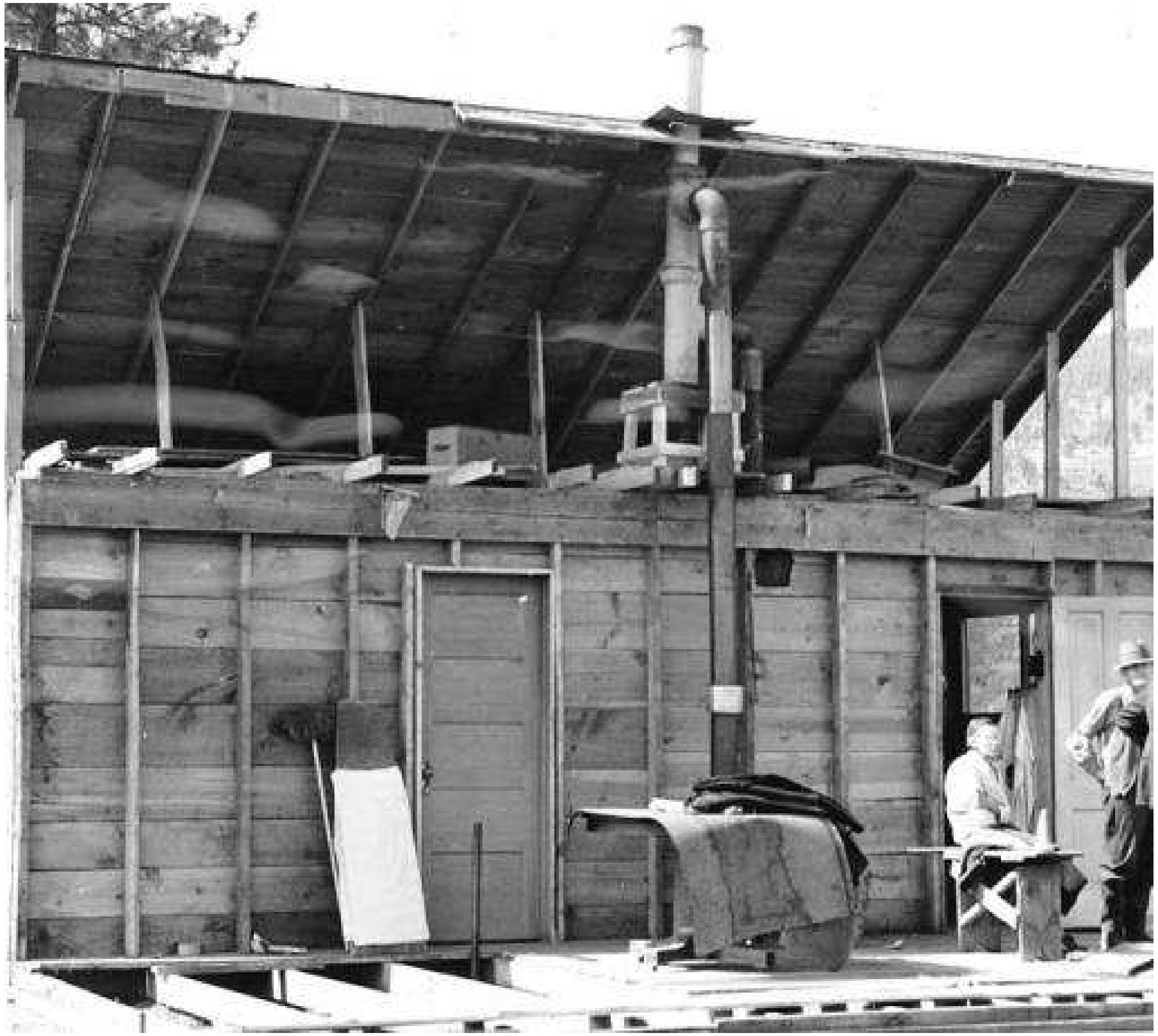
**Above: caption: "The Dave Lewis farm in the Upper Grand Coulee will be flooded by the equalizing reservoir from Grand Coulee Dam (November 1946)"**
**Left: caption: "July 19, 1941. The last tree is cleared to make way for the reservoir."**



*"…One of the most unusual jobs in engineering records, the clearing of this 84,000-acre reservoir in Washington was supervised by the Bureau of Reclamation. The job was started in 1938. It has to be finished before mid-summer of 1941. It includes such individual performances as digging up and re-burying the bones of more than a thousand Indians; buying out and moving four or five thousand people; dismantling ten complete towns and villages; moving thirty-five miles of railroad and constructing a new terminal; replacing 125 miles of highway and completing 840 land transactions with two thousand owners. In addition, bridges are being moved and re-built, timber disposed of, brush burned, and debris of all sorts moved out of the way of what is becoming a lake…"*

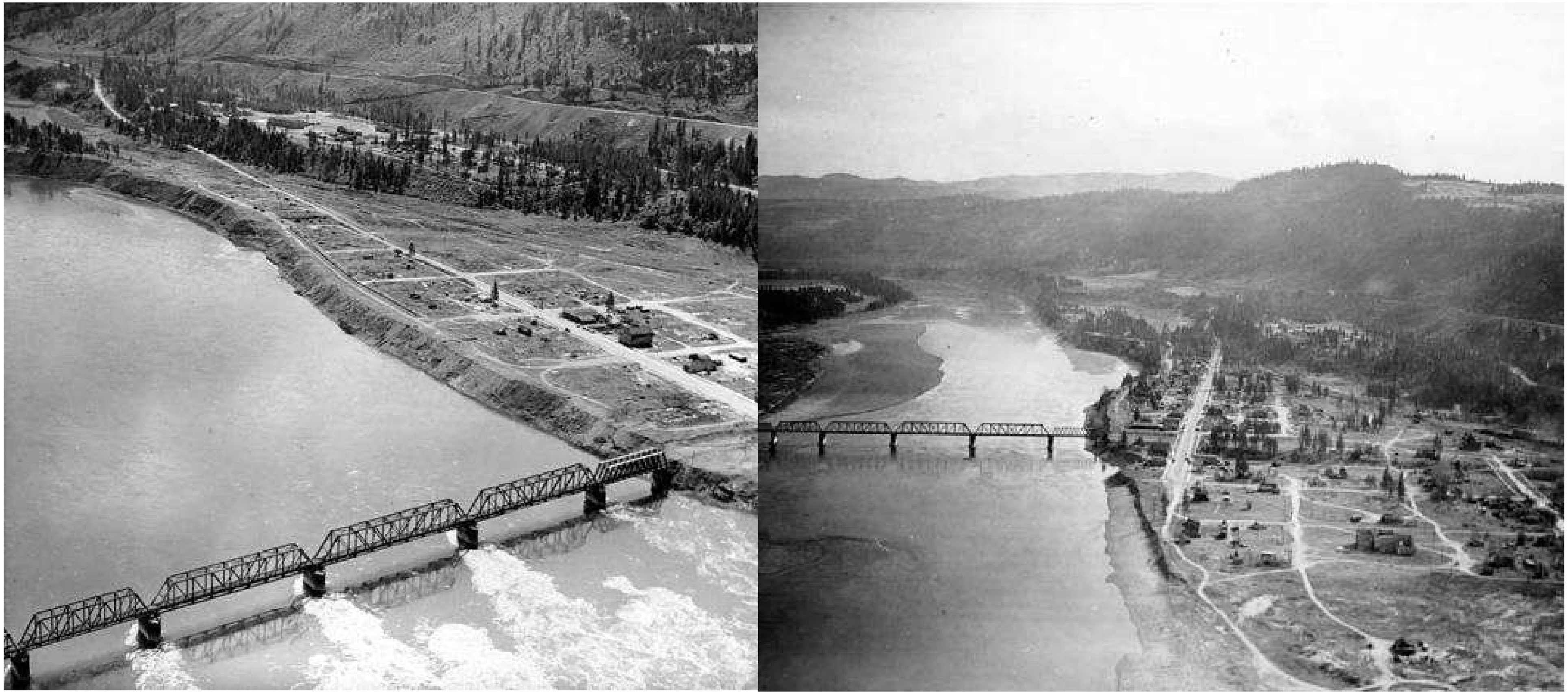
***Popular Mechanics,* February 1941**

**Left: caption: "A.H. Smythe and wife with WPA administrator, Kettle Falls, April 1939"**



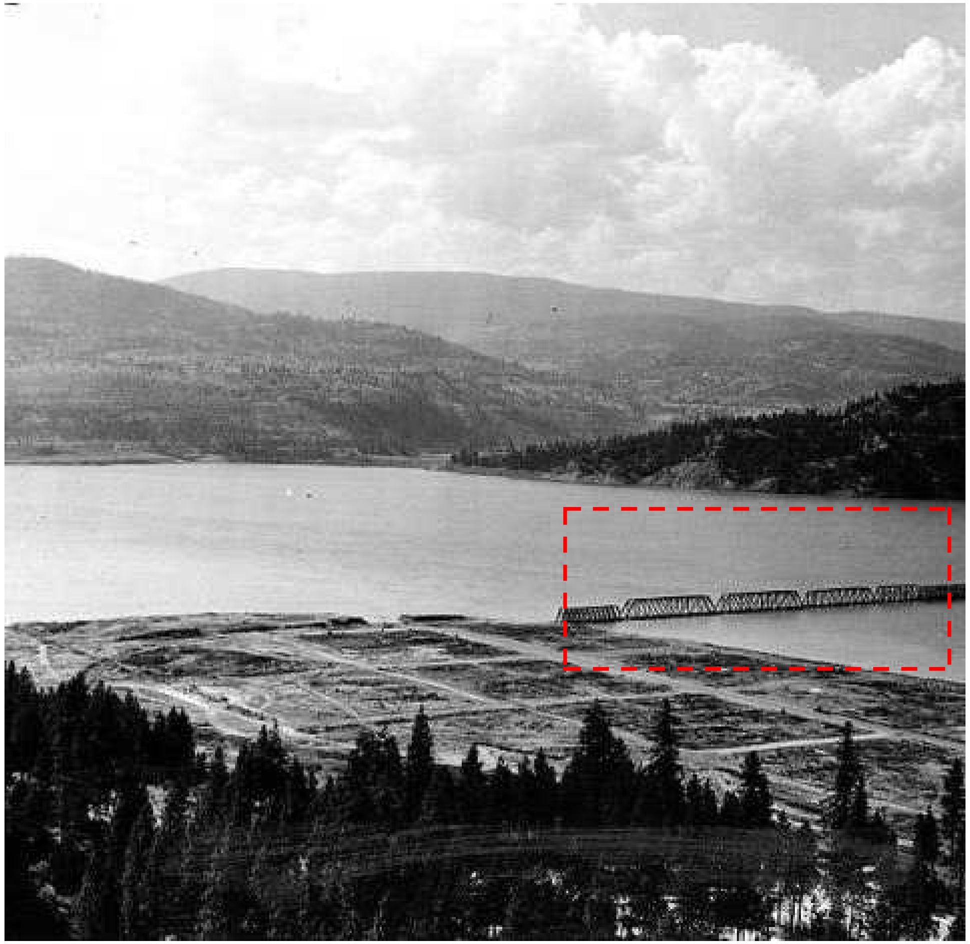
**<u>Above L&R</u>: caption: "Moving a house above the high water line, Marcus, Washington, 1941"**

**<u>Left</u>: caption: "WPA preparing Marcus house in too poor a condition for moving or salvage purchased by the Bureau of Reclamation for burning, 1941"**



**Above L&R: caption: Air photos of old and new Marcus, looking northward. At a point above the southern part of old Marcus, the evacuating town is seen below the bench on which new Marcus is developing. Long street in center is Main street. Low long line on hillside at right is the new highway in the building and above, the new railroad (ca. 1940).”**

# Heading South



***"Its usefulness ended by the rising waters of the new lake above grand Coulee Dam which would soon overflow it, the 1,340 foot-long railroad bridge in Marcus, Wash., contained steel and other material which could be used to good advantage in a large storage and fabricating plant to be erected at Grand Coulee Dam, 113 miles away. Engineers of the Bureau of Reclamation…decided to mount sections of the bridge on barges and float them down the reservoir to Grand Coulee…"***

***Popular Mechanics,* July 1942**

**Left: caption: "Townsite of Marcus and Great Northern Railway bridge under water, July 1941"**



Above: caption: “The motor barge Paul Bunyan moving barges into Marcus bridge. The bridge spans were moved, one at a time, to Coulee Dam, to salvage the wood and steel in them. 02/18/1942.”

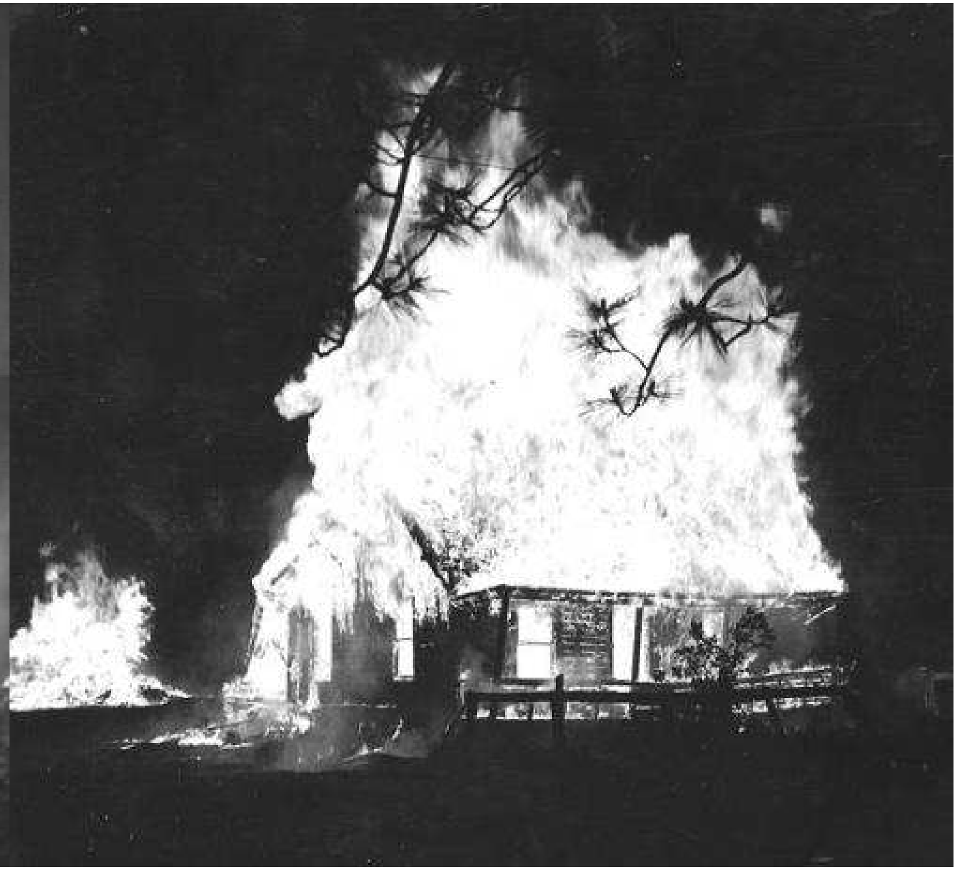
Left: caption: “Pumping out barges under a steel span of the abandoned Great Northern railroad bridge at Marcus in order to float the span off the piers. The high water mark of the preceding season is shown by the white coating on steel. 02/19/1942.”

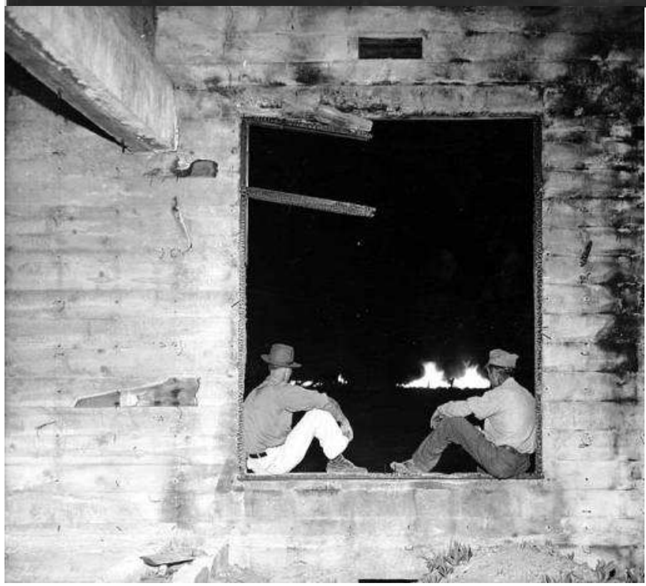
**Top Left: caption: "A wooden span from the Marcus bridge arriving at the Coulee Dam under tow by the power barge 'Paul Bunyan.' 02/12/1942."**

**Top Right: caption: "A steel span of the Marcus bridge just leaving its position, in transit to dam. The two-deck barge is the workmen's living quarters. The tug 'Blue Ox' is shown in rear of the house boat. 02/19/1942."**

**Left: caption: "Landing a Marcus bridge span from barges, in specially prepared slips at Coulee Dam. 02/21/1942."**

# Burning Down the Town





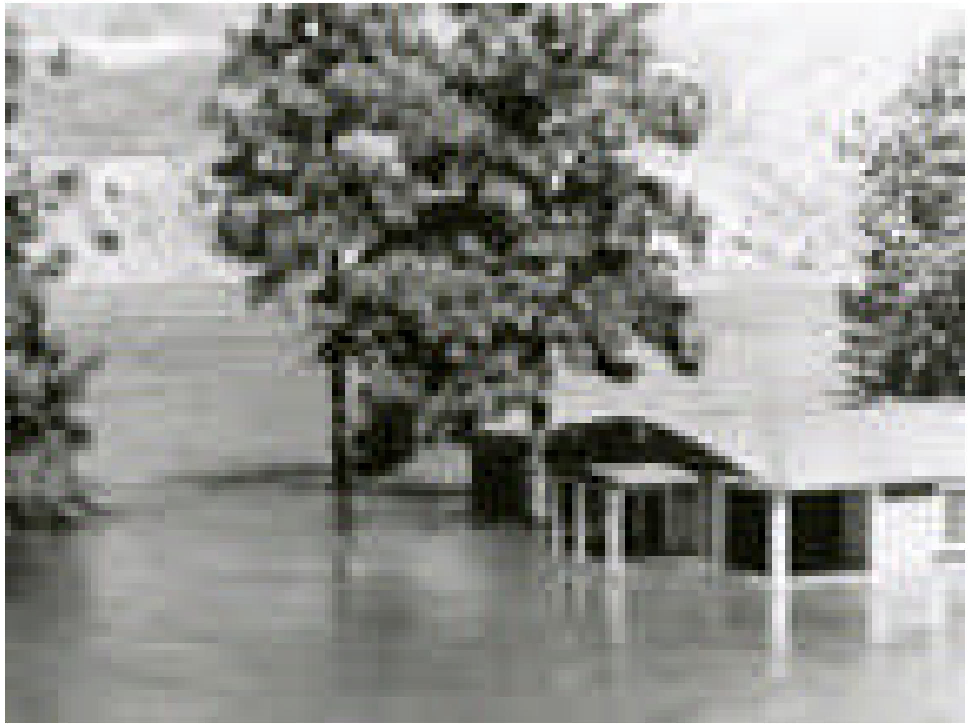
**<u>Above L&R</u>: caption: “Burning the town of Marcus, Washington, 1941**
**<u>Left</u>: caption: “Watching Marcus, Washington burn, 1941”**

***"…Whole communities simply disappeared. You can ride in a launch now on water a hundred feet over former farms, villages and homes…"***

***Popular Mechanics,* February 1941**

**Left: caption: "'There will always be a Marcus,' F.E. 'Sunny' Horn, Mayor of Marcus since 1932, wants you to know. He points to the town's new site on a bench well above high water mark of the lake being formed behind Grand Coulee dam on which there is already a new grade and high school, a church in the building and a dozen homes moved up from old Marcus which is seen in the background, a water company's well and land cleared for a super-market."** [163]

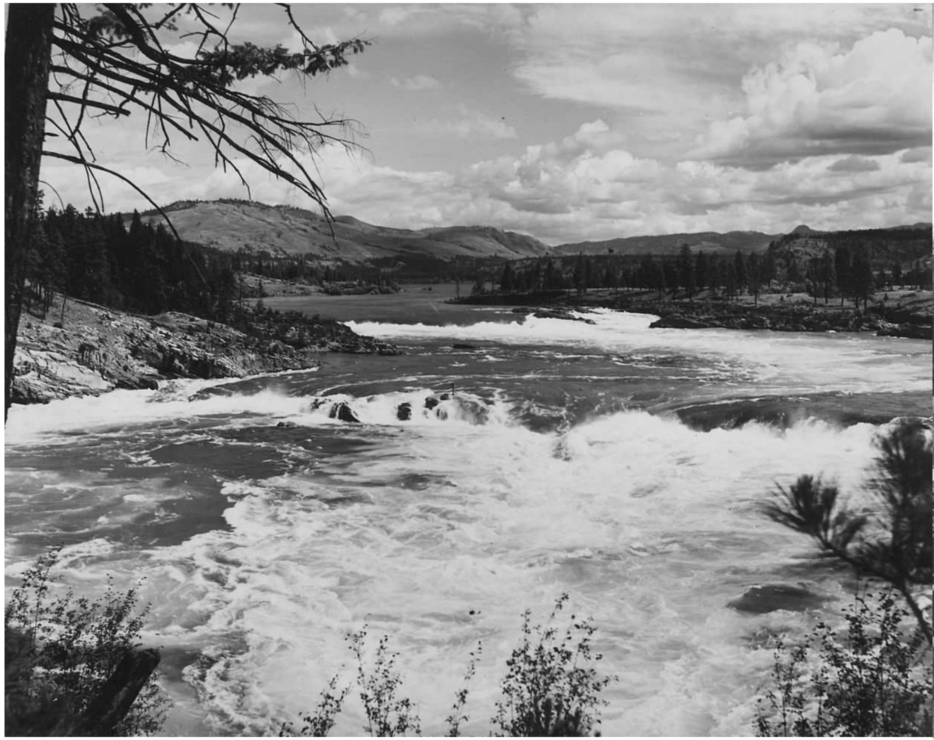
**Right: caption: "New Catholic Church in new Marcus, 1941"**



***"Sometimes I just can't help but wonder if things might have been better up here if they hadn't built the dam. I think about it every spring when the water is down and I see that old town down there. It's not a pretty sight."***

***Ed Frostad*, former resident of old Marcus, 1985**

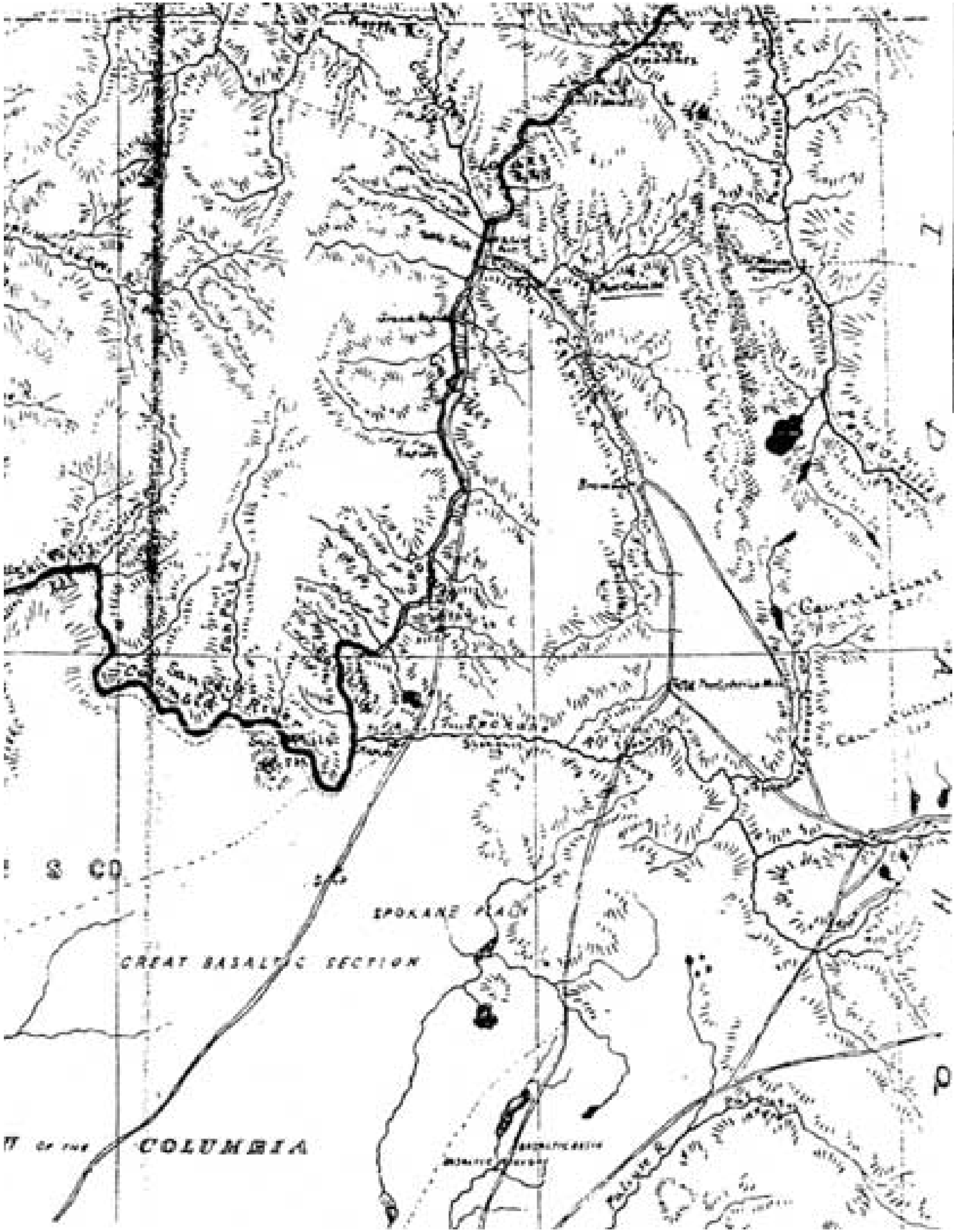
# The White Man’s Lake Cometh

***"…A hundred miles up river from the dam is a stretch of white water known as Kettle Falls. A rocky island splits the channel and the river tumbles over rocks and falls on either side. Kettle Falls will disappear beneath a hundred feet of water, and with it will disappear the island, which to Indian tribesmen of the region is hallowed ground. In the shallow soil of this island were buried hundreds of red men. Some were buried before the coming of white men to the valley, and others in more recent years…"***

***Popular Mechanics,*** **February 1941**

**<u>Above L&R</u>: caption: "Kettle Falls was an important salmon fishing site on the Columbia River, and a place of great sustenance for indigenous peoples"**

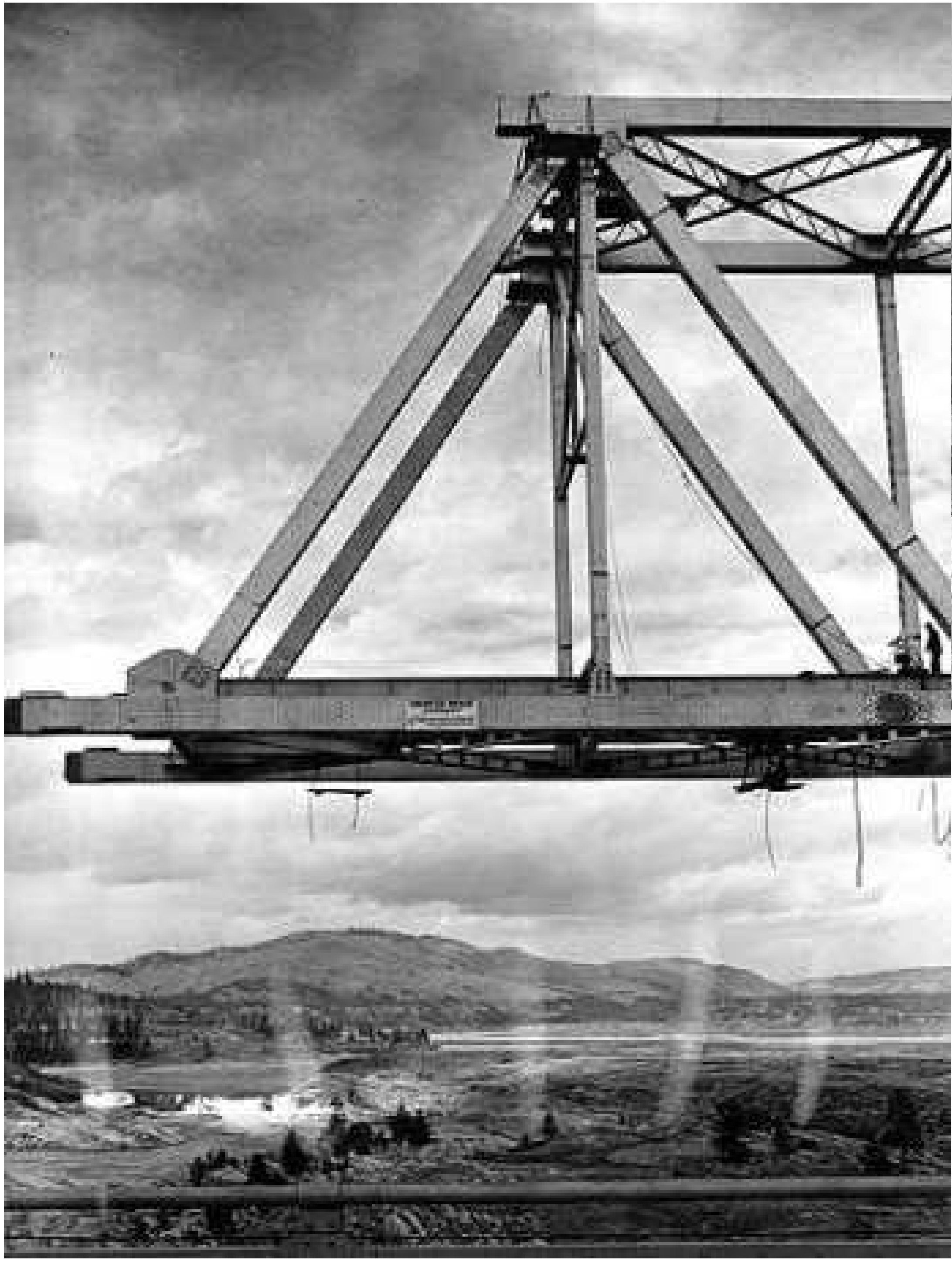




**Above**: caption: "Fort Colville buildings, no date. Note the post-and-sill construction of the log structures."
**Left**: caption: "Portion of map of upper Columbia River area showing position and strength of Indian tribes, 1871. Note gold mines, HBC Post, Fort Colville, and Old Presbyterian Mission."

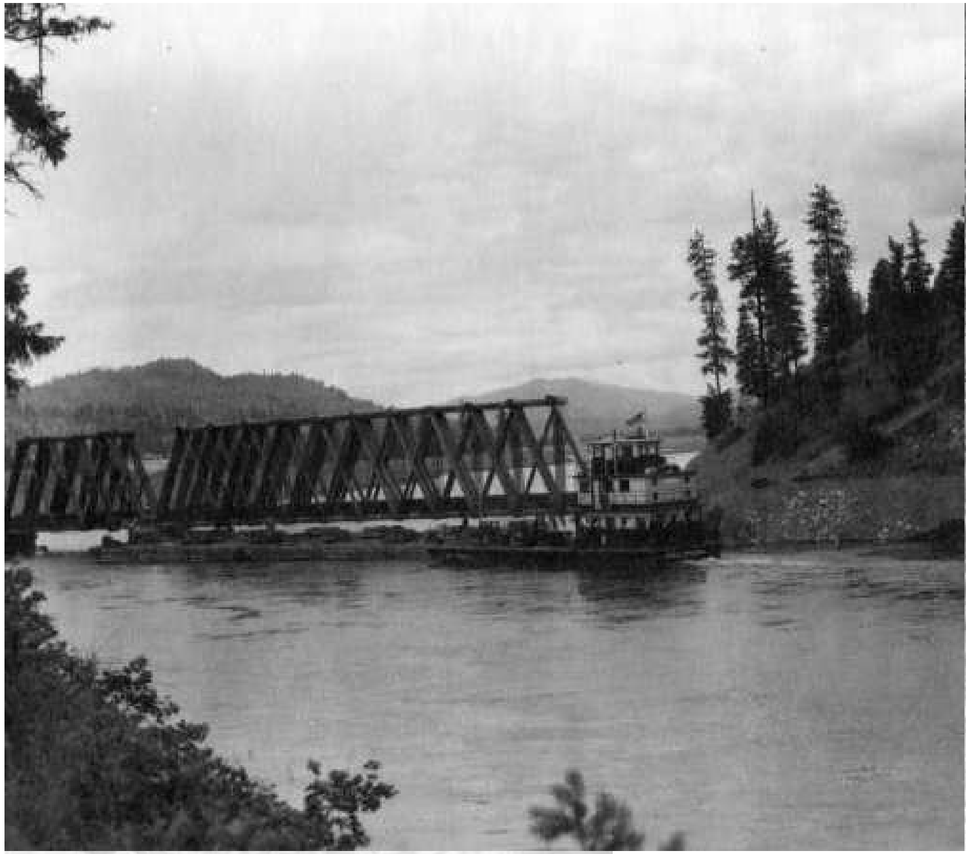
***"…There was a cry of dismay among the Indians when they learned that the bones of their ancestors were to be washed out or covered by the white man's lake. In other secluded benches and nooks along the stream were still more burial grounds. Cries of the Indians were heeded by the Reclamation Bureau. A contract was let for digging up the bones and for reburying them in selected plots above the rising water…the government contract was for removal of six-hundred graves, but before the bureau called a halt, 1,200 had been uncovered…"***

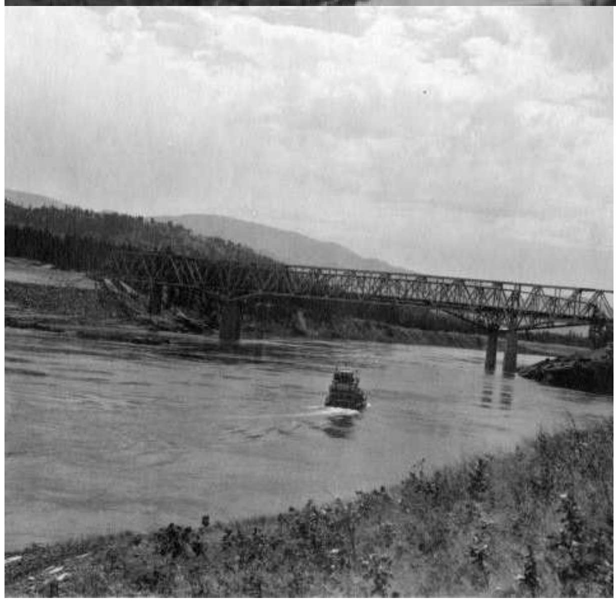
***Popular Mechanics,*** **February 1941**



**<u>Above</u>: caption: "Old and new bridges near Kettle Falls, Washington, April 1941"**

**<u>Left</u>: caption: "Kettle Falls Railroad Bridge construction, ca. 1941"**

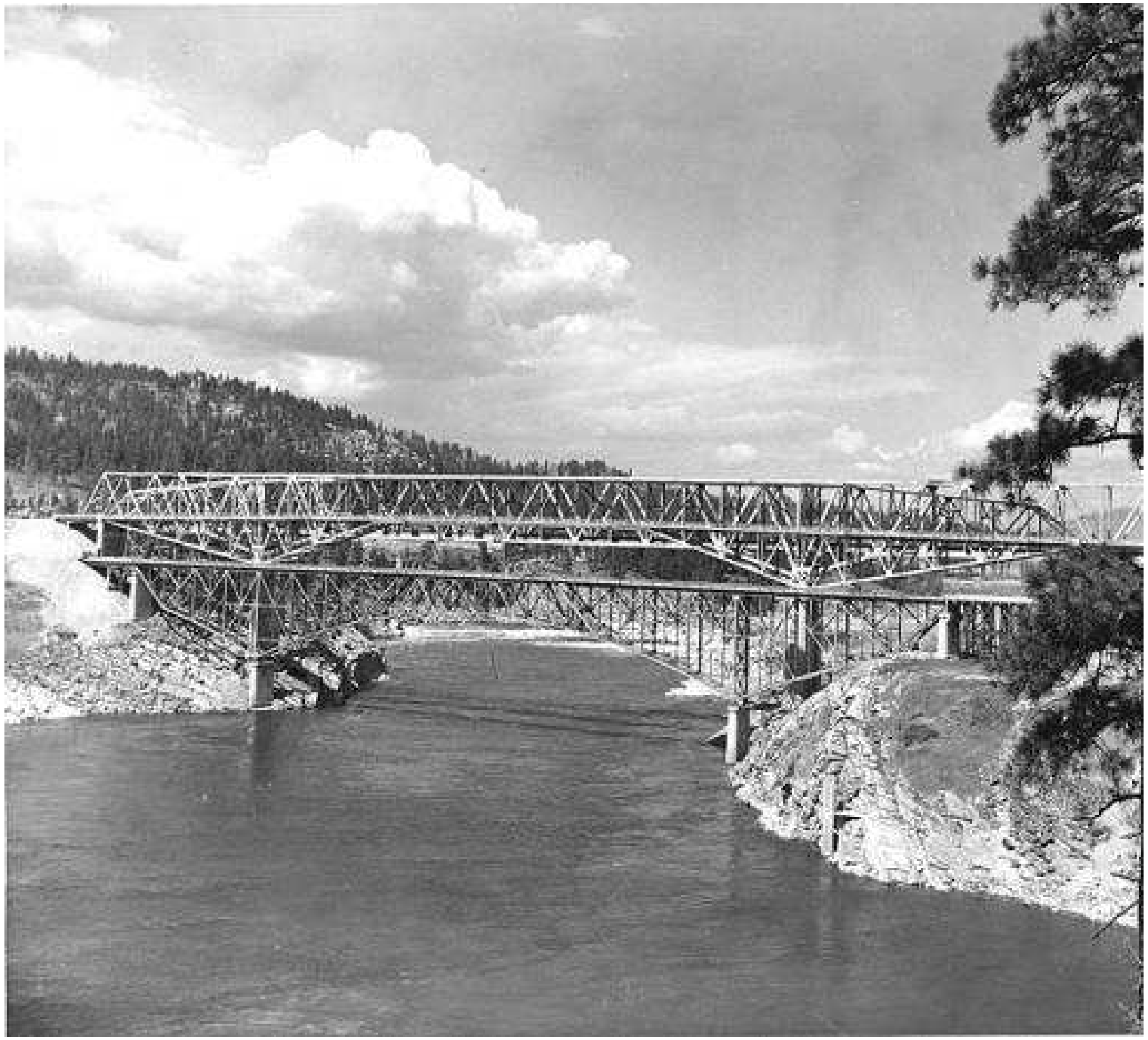




**<u>Top Left</u>: caption: "Great Northern Railway Relocation - Removing old railroad spans over Kettle River, near Boyds. Placing a barge under one of the spans. 06/07/1942."**

**<u>Top Right</u>: caption: "Great Northern Railway Relocation- Removing old railroad spans over Kettle River, near Boyds. View of 'Paul Bunyan' coming down Kettle River gorge, upstream from the new county and railroad bridge crossings. 06/08/1942."**

**<u>Left</u>: caption: "Paul Bunyan boat passing over the submerged site of Kettle Falls. New highway and railroad bridges completed. 07/19/1941."**



***"…This was our country. God created this Indian Country, and it was like he spread out a big blanket, and he put the Indians on it. The Indians were created here in this country, truly and honestly, and that was the time our rivers started to run. Then God put fish in the rivers, and he put deer and elk in the mountains and buffalo upon the plains, and roots and berries in the field, and God made laws through which there came the increase of fish and game. When the Creator gave us Indians life, we awakened and as soon as we saw the fish and the game we knew that they were made for us. For the men God gave the deer, the elk and the buffalo to hunt for food and hides; for the women God made the roots and the berries for them to gather, and the Indians grew and multiplied as a people, and gave their thanks to the Creator. When we were created we were given our ground to live on, and from that time these were our rights…"***

**RE: statement of Colville and Okanogan Chiefs, 1925**

**Top: caption: "Indians fishing from platform and rocks at Kettle Falls"**

**Bottom: caption: "Interior Salish Indians in camp, ca. 1935"**

***"The river was the central and most powerful element in the religious, social, economic, and ceremonial life of my people. Suddenly, all of this was wiped out. The river was blocked, the land was flooded. The river we had known was destroyed. Our homesites were gone. The fordings were made impossible. The far banks were beyond our reach. The root-digging prairies were cut off. The salmon came no more, and with the disappearance of the salmon, our traditional economy was lost forever."***

***Jim DeSautel*, member, *Colville Confederated Tribes* (CCT), 1977**

# High and Dry


**The reservoir flooded eleven towns that had post offices. Daisy, one small town that was relocated, had three stores, two churches, a blacksmith shop, a creamery, a saloon, a highway department garage, and a high school. The school was rebuilt in a new location, but only the store and the service station were relocated. The town of Kettle Falls found a novel solution to its problem. Unable to obtain land adjacent to St. Paul's mission, their first choice for a new town site, Kettle Falls residents annexed the nearby higher town of Meyers Falls and a strip of land along the state highway connecting the two communities. The residents of both towns, after some political maneuvering, then voted to abandon the old town site and the strip. They gave the old town of Meyers Falls the new name of "Kettle Falls." Many residents of Meyers Falls resented this forced merging of their town with their relocated neighbor. Marcus, with a population close to six-hundred in 1940, was the largest town that had to be relocated. It was moved to a bench about 145-feet above the former town.**

***"…Kettle Falls, an old town, had to move out of the way of the rising water. The people like their town's name, and yet they couldn't legally take the name along. So they voted to extend the city limits for four miles to take in the little high and dry community of Meyers Falls. Myers Falls didn't like it but they were not incorporated and they were outnumbered, so they lost their identity. Meyers Falls is now Kettle Falls, although the names of some of the stores and buildings still read 'Meyers Falls.'…"***

***Popular Mechanics,* February 1941**



**Above: caption: "Town of Kettle Falls, ca. 1938"**


MEYERSFALLS MARKET

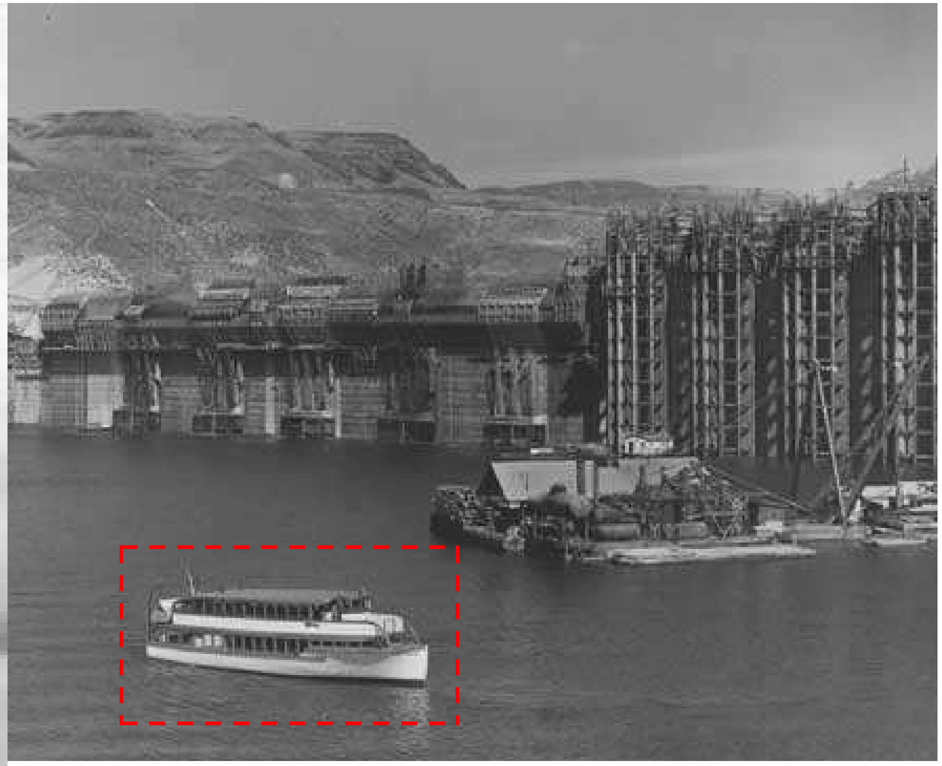
# A Sportsman's Paradise

***"…On weekends and holidays, excursions are run from the dam up the new lake in streamline Diesel-powered launches…Substitution of a placid lake, five miles wide in places, for a turbulent river, opens a vast new field for recreation in central Washington. Sportsmen, with the aid of state and federal agencies, will stock the water with game fish. Docks and harbors are to be built. When the dam is completed and rapids have vanished for the entire 151 miles, it will be possible to make boat trips into the scenic Arrow Lakes country of British Columbia in Canada. And because the Reclamation Bureau intends to keep the level of the lake nearly constant through regulation of the flood water run-off and subsequent irrigation pumping, there will be year around use of the lake's smooth surface…"***

***Popular Mechanics,*** **February 1941**

**Top: caption: "Back water rising along the Colville River outlet, 1941"**

**Bottom: caption: "Beach at Lake Roosevelt (just above the dam) created by Grand Coulee Dam, Washington, ca. 1968"**

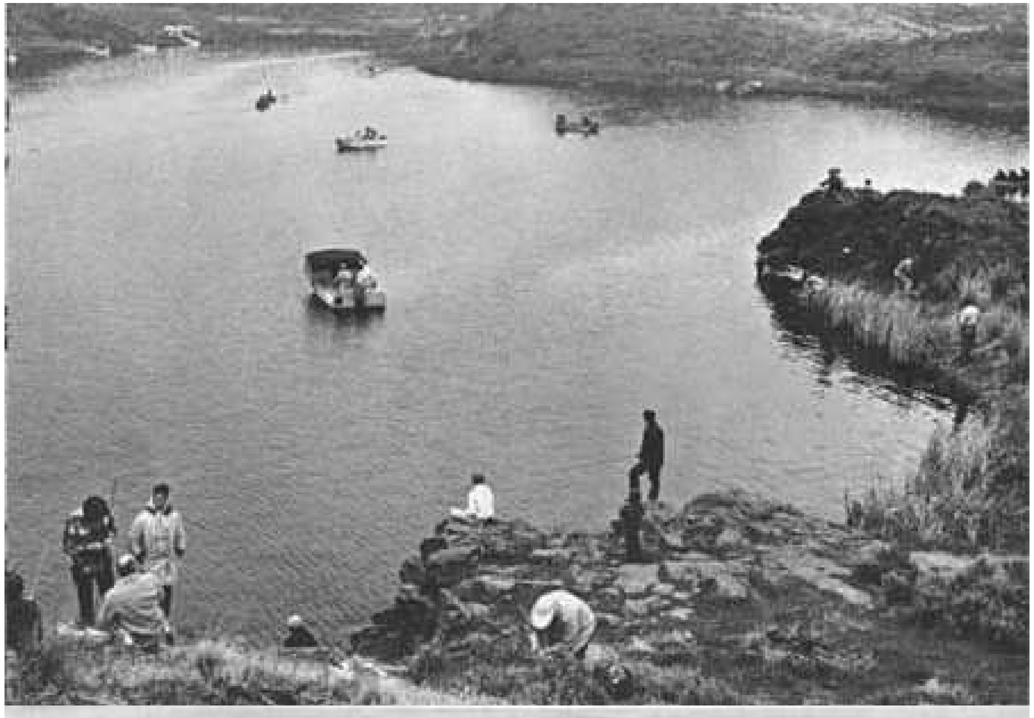


**Above: caption: "Miss Coulee brings tourists close to the construction work at Grand Coulee Dam, 1940"**
**Left: caption: "View of the Excursion Boat *Miss Coulee* – Lake Roosevelt"**

**<u>Top Left</u>: caption: "Grand Coulee Dam and Lake Roosevelt in Summer"**

**<u>Top Right</u>: caption: "Five-passenger Beechcraft float plane taking off from North Marina, 1946"**

**<u>Left</u>: caption: "Water skiing on Lake Roosevelt, ca. 1959"**



The original seventeen lakes in the *Columbia Basin Project* area have been joined by a host of new lakes. These lakes rose out of the ground as irrigation water in the area caused the water level in the soil to rise and this higher water table enlarged some of the old lakes, formed new ones and caused still others to merge into larger bodies of water. As each new lake appeared it was carefully studied and a plan worked out for its development. If the water was deep enough, it was stocked with trout (mostly rainbow). Waters which were infested with "rough fish" were poisoned and later planted with game fish. Plantings were not confined to fish. The Washington State game department also releases game birds (i.e. pheasants) each year in the irrigated portions of the basin.

**Top: caption: "Corral Lake is one of the many project-created lakes which make up the majority of the more than 100 bodies of water in the Columbia Basin."**

**Bottom: caption: "Hunters on the project's Potholes Reservoir near Moses Lake reap a harvest of waterfowl attracted by the many project waterways, seep lakes and reservoirs"**

# Paul Bunyan Scale

***"…The Columbia is a big river, bigger than many people realize. Its flow ranges from a maximum of 700,000 cubic second feet in flood stage to less than 50,000 second feet in winter. It raises and lowers as much as fifty feet between high and low-water stages. The problems of handling this volume of water in a storage pond were, therefore, on the Paul Bunyan Scale…"***

***Popular Mechanics,* February 1941**

**<u>Left</u>: caption: "Rising backwater at Oro-pothem Creek, ca. 1941"**

***"…There are numerous smaller streams and rivers emptying into the Columbia between Grand Coulee and the boundary, and each of these channels and valleys had to be cleared ahead of rising water. In one instance, the Spokane River will be backed up twenty-eight miles, bringing a new fresh-water lake to within twenty-five miles of this inland empire metropolis…"***

***Popular Mechanics,* February 1941**

**<u>Left</u>: caption: "Tugboat NESPELEM with a barge on the Spokane River, 1941"**

# Paul Bunyan’s Pond

***"…Land and property purchases in the reservoir amount to three million dollars and there are a few scattered condemnation cases yet to be decided. One involves the power site at Kettle Falls. Clearing expenses make up the rest of the $11,300,000 total lake bed cost. People of the Northwest call it Lake Columbia but engineers on the job call it Paul Bunyan's Pond."***

***Popular Mechanics,*** **February 1941**

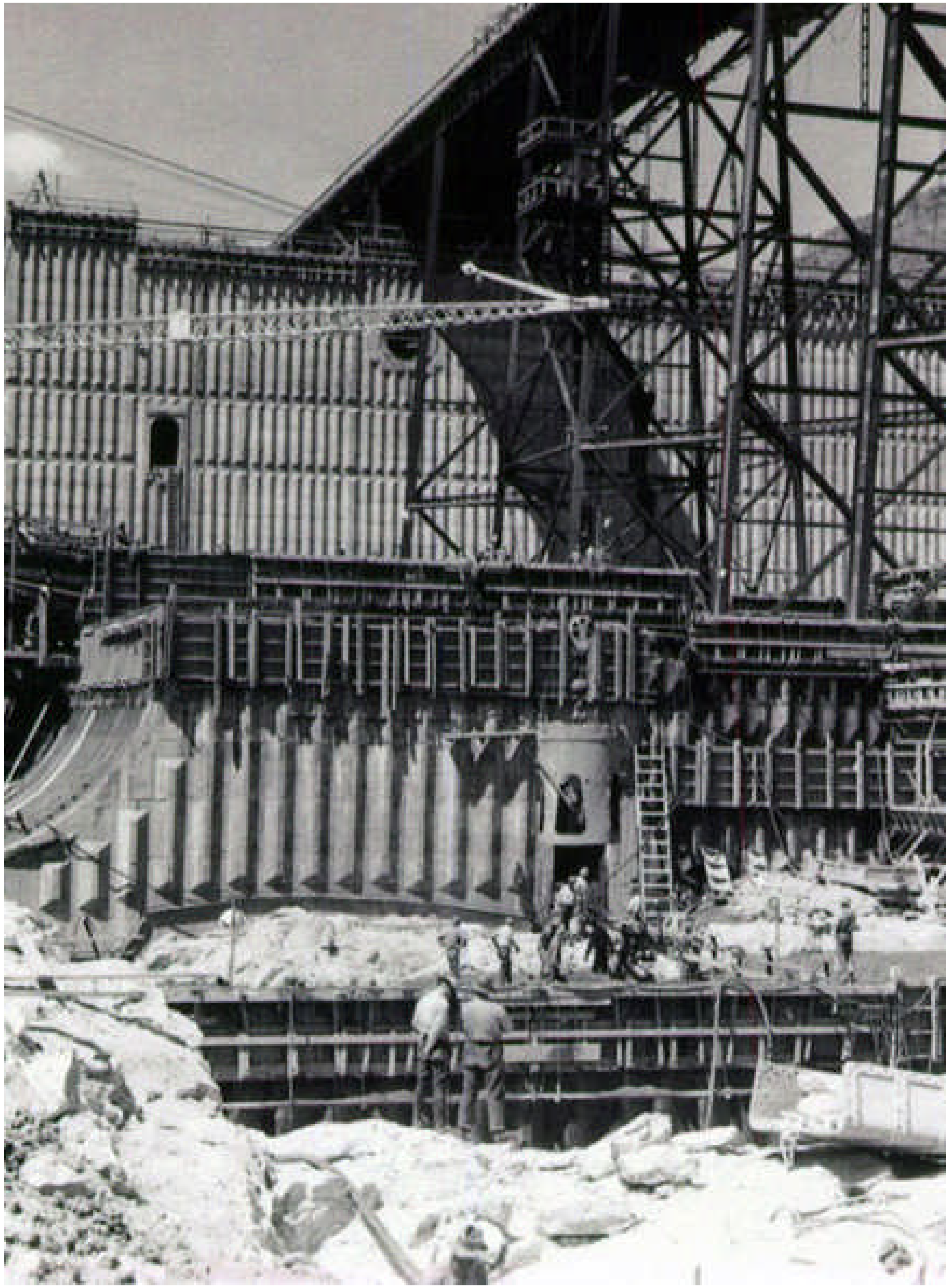
# Part 5

# On a Grand Scale

# To Stagger the Imagination

***"…The Grand Coulee Dam will be the largest in volume, second in height to only the 726.4-foot Boulder Dam. Even the base of the dam, covered by the Mason-Walsh-Atkinson-Kier contract, completed in the winter of 1937-38, was the biggest man-made structure on earth, far surpassing the great pyramid of Cheops, which for thirty centuries was man's biggest structure, until the Boulder Dam was built. The finished dam will occupy more space than the entire population of the United States - men, women, and children - and will weigh more than twice as much…"***

***U.S. Bureau of Reclamation*** **(ca. 1940)**



***"…Comparisons with other engineering achievements, as well as with the wonders of nature, are so awe-inspiring as to stagger the imagination. Not until you have actually seen its immensity, its day-by-day development, can you realize how far the Grand Coulee Dam surpasses even the Boulder Dam project on the Colorado River…."***

***Popular Science,* February 1936**

**<u>Left</u>: caption: "In a year, over 1.8 million yards of concrete is poured. And this is just for the foundation!"**

***"Grand Coulee dam, the federal project on the Columbia river, will be the largest single structure ever built by man, according to present plans. Containing three million, six hundred thousand cubic yards of concrete, it will rank first, the Great Pyramid of Egypt second and Boulder dam third. If the dam is increased in size, as suggested, its nine million cubic yards of concrete would be three times the size of the largest pyramid. These figures were given by Francis Donaldson, chief engineer for the Mason-Walsh-Atkinson-Kier company which holds the contract for the first unit of the dam."***

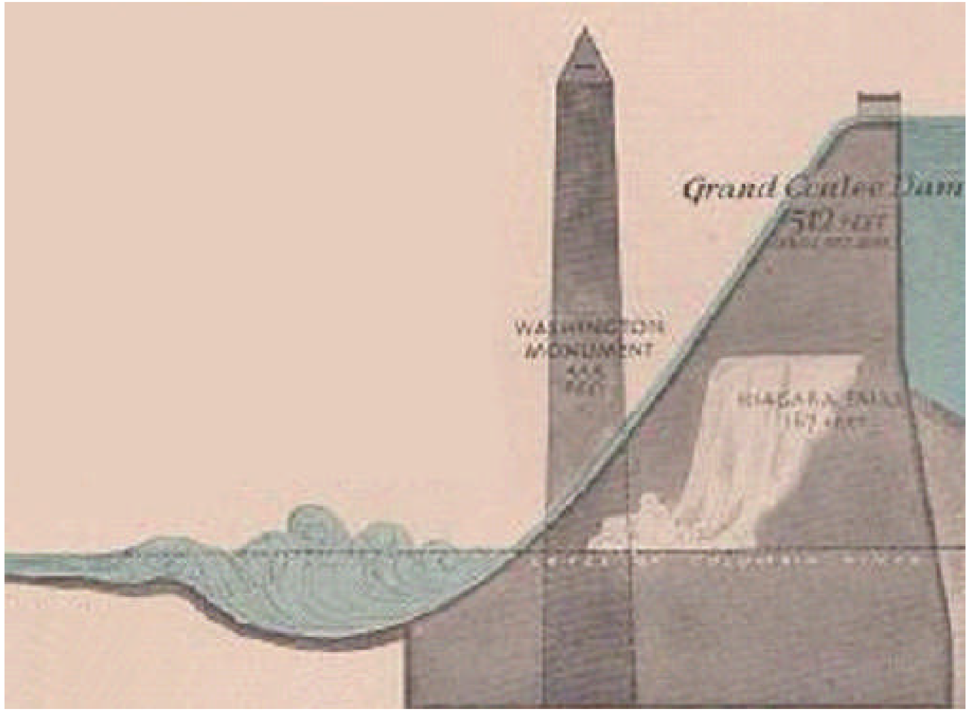
***Popular Mechanics,*** **April 1935**

***"The public provided a seemingly insatiable appetite for statistics about 'the eighth wonder of the world.' People loved to hear how many pancakes the 3,000 to 6,000 workers ate each morning at breakfast or how many miles of tubes ran through the dam. They devoured pictures of the great structure, as high as a forty-six-story building, just five feet shorter than the Washington Monument, and they saw drawings of the 12.5 million barrels of concrete or envisioned them together in a train 500 miles long. Most popular were comparisons with the Great Pyramid of Egypt, or two, or three, or even four of them."***

***Paul Pitzer*, Author/Historian**



**Above: caption: "Five pyramids, each one as large as the famous one at Giza in Egypt, could be set in the masonry of the Grand Coulee Dam, as shown in the drawing"**




***"…Nearly twelve million cubic yards of concrete, more than three times that required for the Boulder Dam, will be used in constructing the dam, power plant, and appurtenant works – sufficient to build a monument as high as the Washington Monument and covering six average city blocks…"***

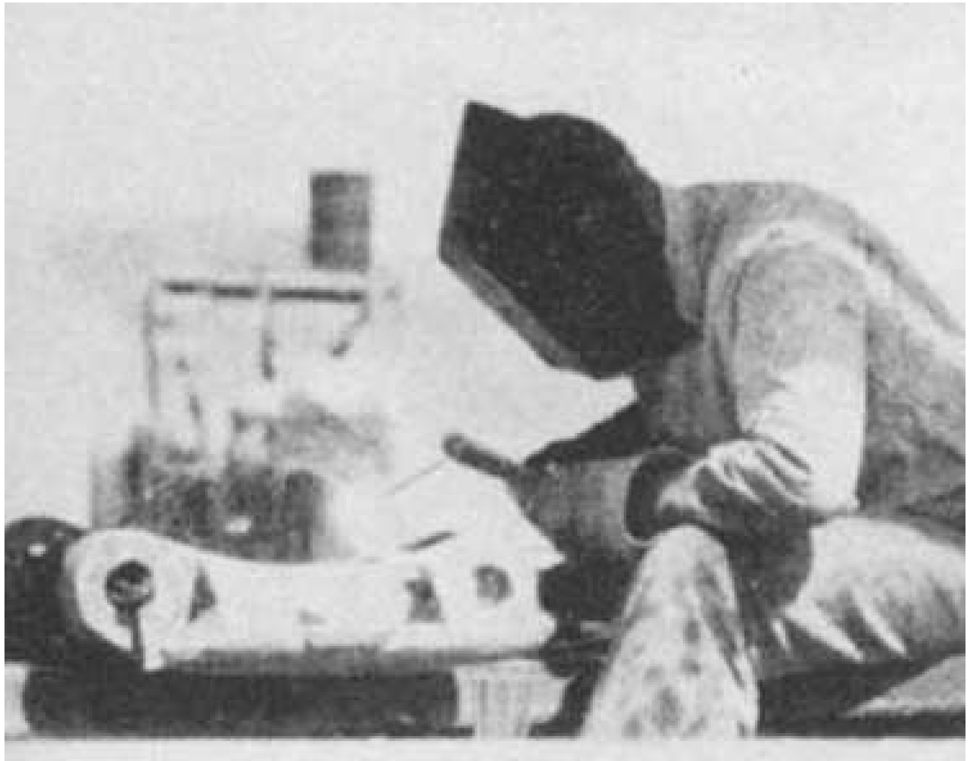
***U.S. Bureau of Reclamation*** **(ca. 1940)**

**Left: caption: "The Grand Coulee Dam compared with other marvels of engineering and nature. It will create a waterfall more than twice as high as Niagara."**

***"…Grand Coulee was begun in 1934 and will be completed in 1942. Everything about the great mass of concrete is fabulous. Eighty-three tons of welding rod are used in making the nine miles of welds required to complete the steel penstocks that will lead the water to the turbines.***

***Popular Mechanics,*** **April 1940**

**Above & Left: caption: "Installing a penstock section"**

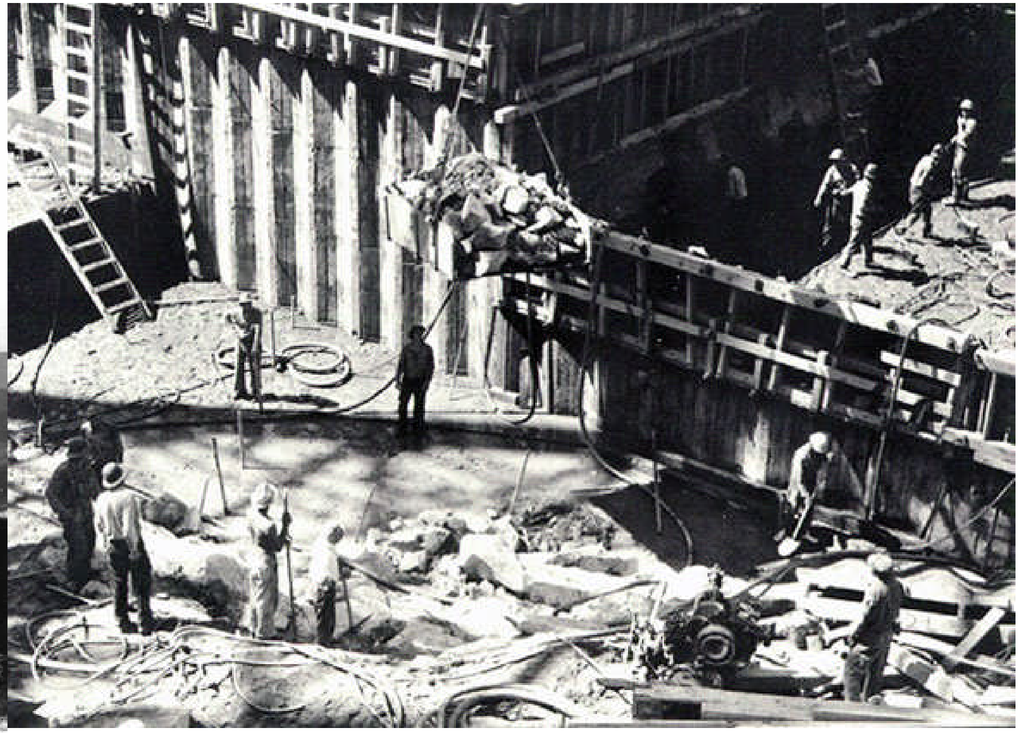


***"…Eleven miles of X-ray film will be exposed in the job of studying those welds. Rod-men making a topographic map of the irrigable area will walk 70,000 miles…"***

***Popular Mechanics,*** **April 1940**

**<u>Left</u>: caption; "A hundred and fifty-seven welders. cutters, and helpers were employed at one time on re-pairs and construction"**

# Bigger Than Ever Before

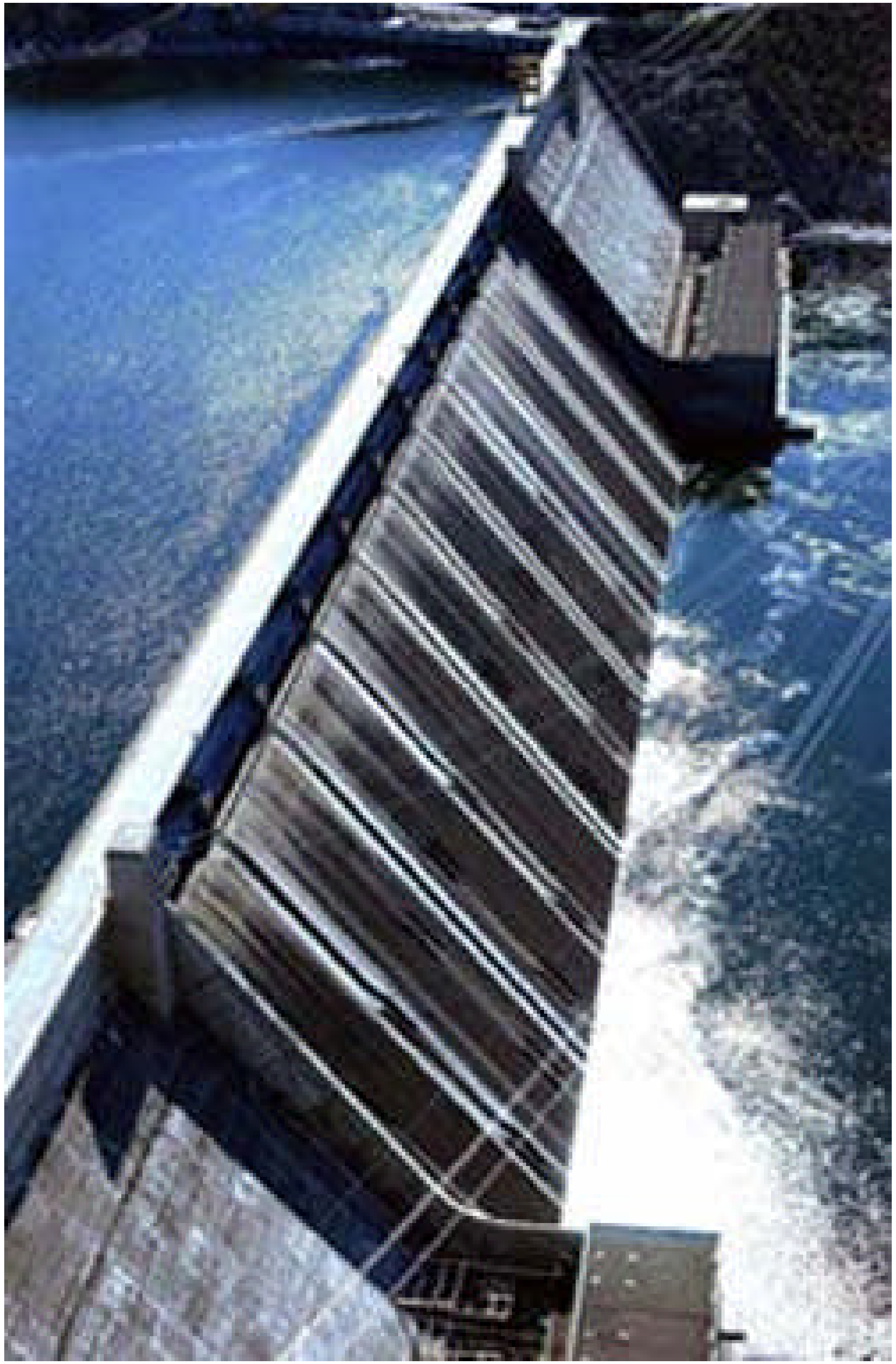
***"…Everything about the Grand Coulee dam is 'bigger than ever before.' Never before has a river the size of the Columbia been damned, or a steel cofferdam 3,000-feet long been sunk to bedrock to hold back the swirling waters while work was started. Never before had it been necessary to excavate and carry away 20,000,000 cubic yards of material to scratch down to bedrock…"***

***Popular Mechanics,* April 1938**

**<u>Left</u>: caption: "Constructing the west cofferdam, 1935"**

**<u>Right</u>: caption: "Over fifteen million cubic-yards of earth and rock were removed from the dam site"**

# The Biggest Thing on Earth



***"Boulder dam is the largest structure ever built by man, yet it could be buried in the base alone of a concrete colossus which engineers are raising above the Columbia river in Washington. Called the 'biggest thing on earth,' the Grand Coulee dam, when finished, will be three times the size of Boulder, will develop one and a half times as much power, and will provide irrigation for an area one and a half times the size of Rhode Island…"***

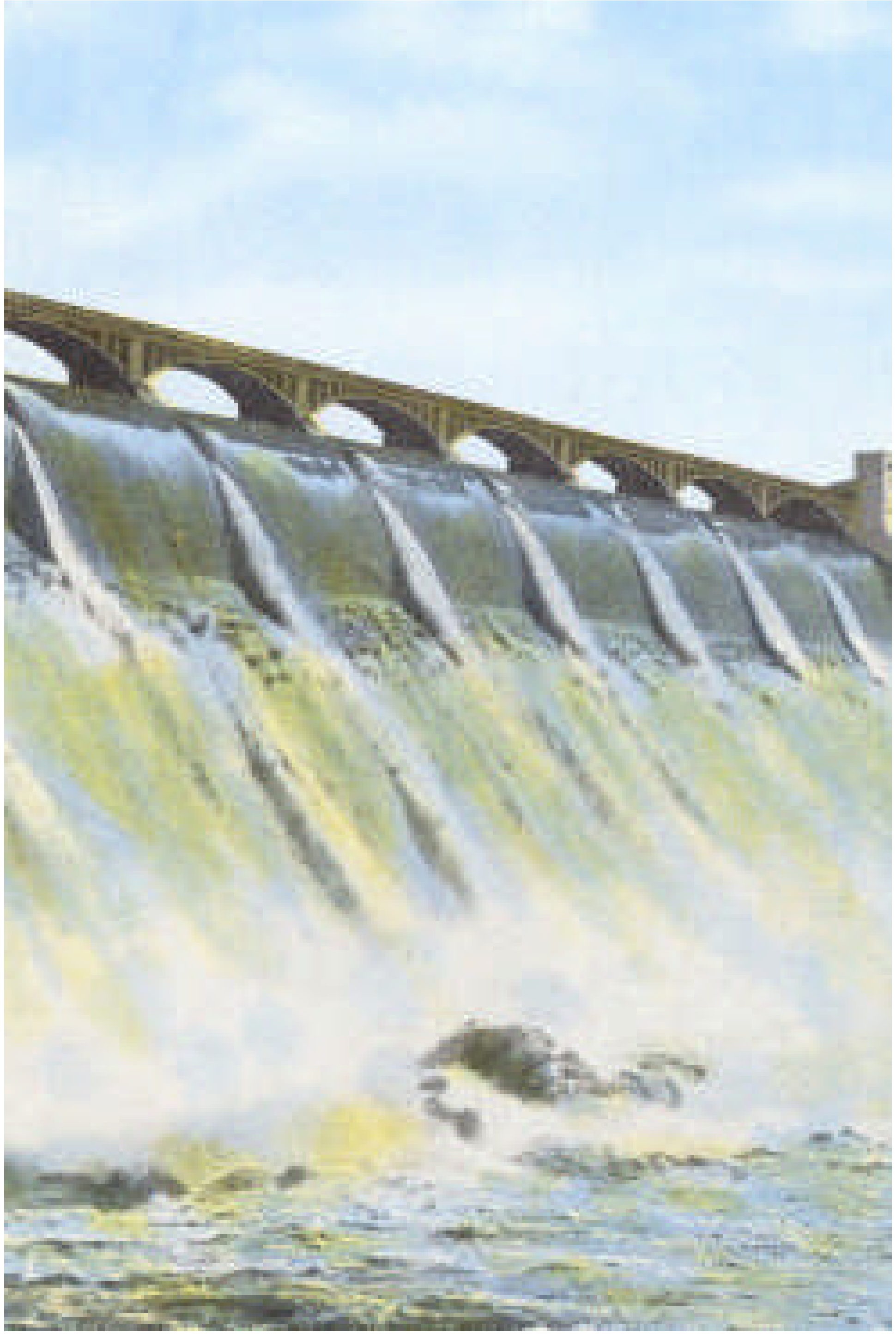
***Popular Mechanics,* April 1938**

***"According to U.S.B.R. officials over 4,000 tons of steel have already been built into the gigantic Grand Coulee dam foundations. Before the MWAK Company finishes its present contract, about 12,000 tons of steel bars will have been used to reinforce the concrete work. Altogether, the entire dam, when completed, will contain about 30,000 to 50,000 tons of steel."***

***Marcus Columbian,* November 20th 1936**

**Left: caption: "Installing rebar during the construction of the powerhouse"**


LIFE



***"…The dam will be as high as a forty-six-story building and as long as fourteen ordinary city blocks. Its bottom will be as thick as the length of a six-car train, and four vessels the size of the 'Queen Mary' could be spaced along its top. The twenty-three million tons of concrete will bulk four times the volume of the Great Pyramid and would require a train 500 miles long, from New York to Detroit, to move at one time. It could be used to build a solid monument one city block square and three times the height of the Empire State Building. When finished, the entire population of the United States, every man, woman and child in the country, could be placed inside its dimensions with room to spare…"***

***Popular Mechanics,* April 1938**


Grand Coulee Dam, Grand Coulee Dam, Wash.

***"The significance of the dam is not found alone in the magnitude of its dimensions, nor in the workmanship that has gone into its construction. It lies rather in the ends which are to be served."***

***Harold L. Ickes*, U.S. Secretary of the Interior (1933-1946)**

***"The easiest way to describe those figures is to say that this is the largest structure, so far as anybody knows, that has ever been undertaken by man in one place. Superlatives do not count for anything because it is so much bigger than anything ever tried before."***

***Franklin Delano Roosevelt*, POTUS, August 1934**

**<u>Left</u>: caption: "FDR eating lunch at Mason City, near Grand Coulee Dam, October 2, 1937"**

***"It was a good salesman who sold this to Franklin"***

***Eleanor Roosevelt*, August 1934**

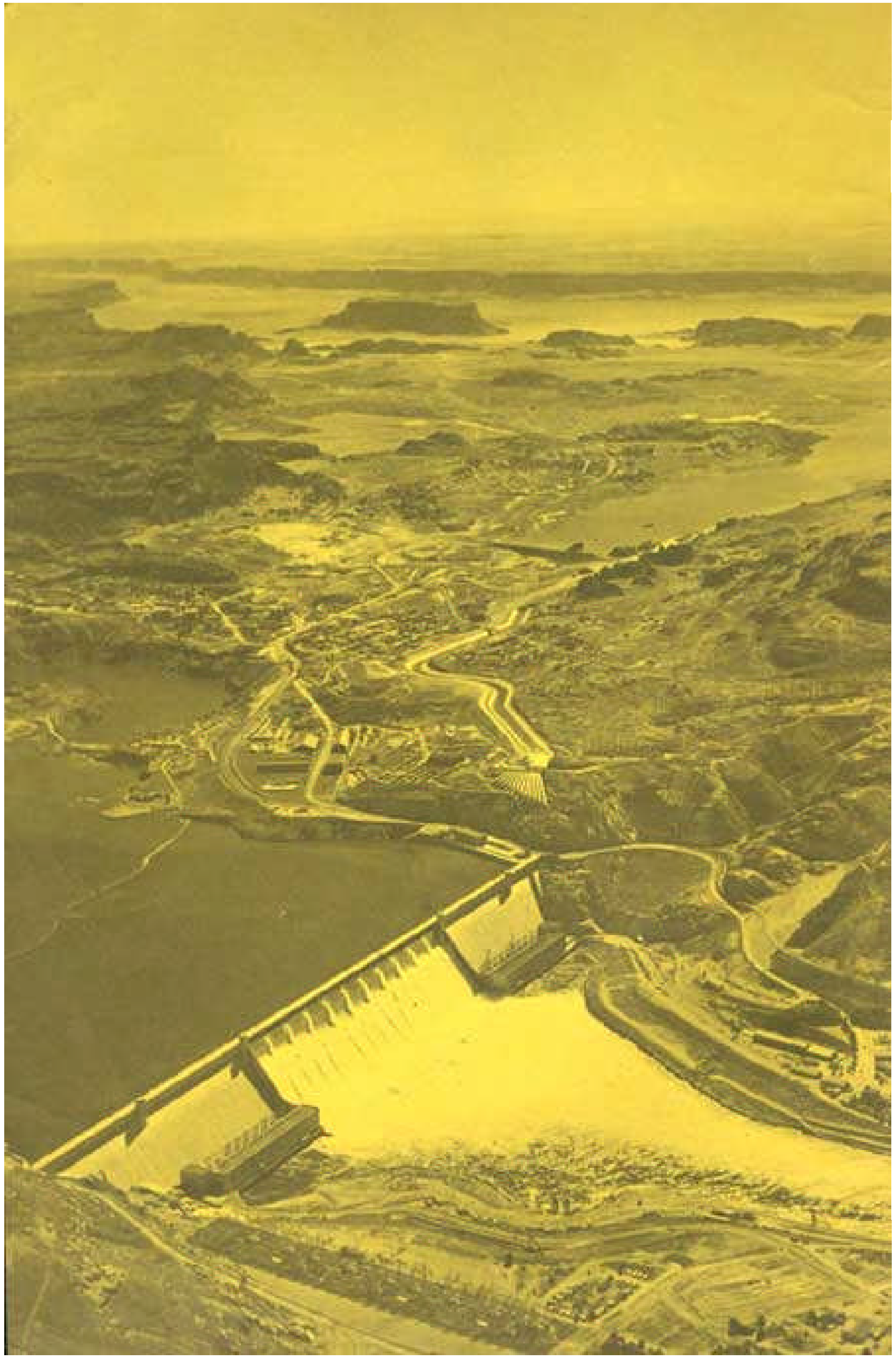
**RE: comments upon seeing *Grand Coulee Dam* for the first time (while accompanying FDR). Despite her reservations, she saw the value of the project for providing power, irrigation and much needed employment to thousands of unemployed men during the dark days of the Depression.**

# Magic in the Making

***"…Here are a few facts that can serve merely to outline the magic that is in the making, under the supervision of the United States Bureau of Reclamation, in what was actually a desert a few years ago:***

- ***The completed dam will create a waterfall more than twice as high as Niagara;***
- ***It will call for three times as much concrete as Boulder Dam, a total of 9,500,000 cubic yards;***
- ***Rock, sand and gravel are being produced at the dam site by the largest plant of its kind ever assembled, electrically driven…"***

***Popular Science,*** **February 1936**



**<u>GRAND COULEE DAM DATA</u>:**

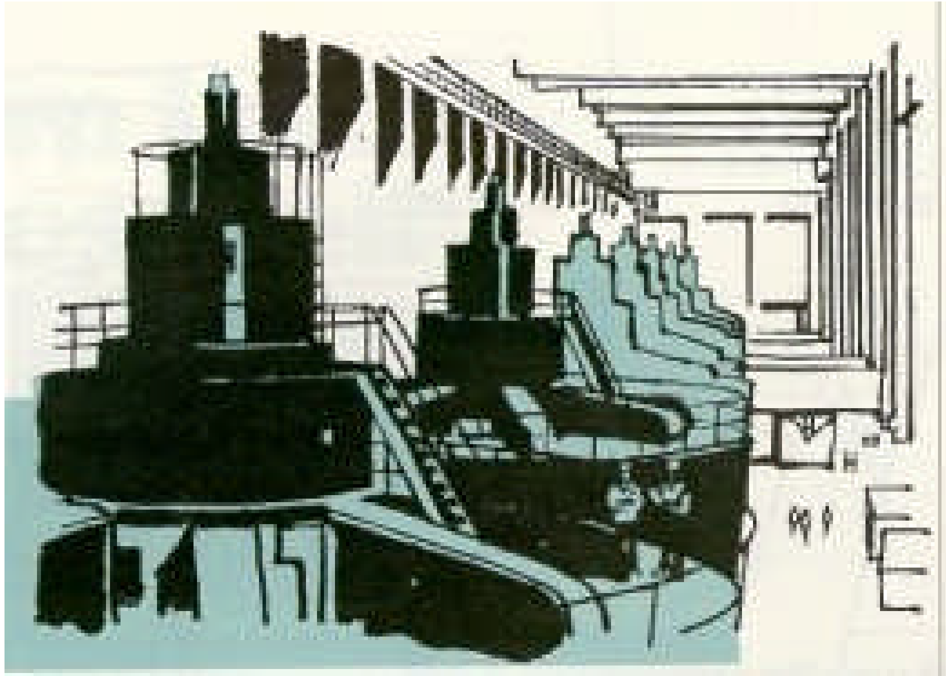
| | |
|---|---|
| **Length at crest** | **4,173-feet** |
| **Height above lowest bedrock** | **550-feet** |
| **Height above downstream water level** | **350-feet** |
| **Pump lift to Feeder Canal** | **280-feet** |
| **Spillway width** | **1,650-feet** |
| **Concrete content** | **10,585,000 cubic-yards** |
| **Excavation for dam, common** | **20,535,422 cubic-yards** |
| **Excavation for dam, rock** | **2,095,557 cubic-yards** |
| **Maximum concrete pour, one month** | **536,264 cubic-yards** |

<u>Left</u>: caption: "Concrete Mixing plant on the site of the Grand Coulee Dam, ninety-two miles west of Spokane, in the State of Washington. The first pouring of concrete was made in December 1935, and pouring was continued at an average rate of 5,714 cubic yards a day. The dam is by far the greatest of all concrete structures. It is designed to raise the upstream level of the Columbia River by 355-feet, thus creating a reservoir with a surface area of 128 square-miles."


***"…Although the estimated cost of the Grand Coulee Dam and its power plant is only about $190,000,000, a total expenditure of $393,000,000 will be required to build and put into full operation the reclamation program which is expected to provide ultimately 30,000 highly modernized, fully electrified, forty-acre farms. These are expected to furnish ample resources, with crop rotation and the building of at least four major industrial communities, to support an additional population of 1,500,000 people…"***

***Popular Science,*** **February 1936**

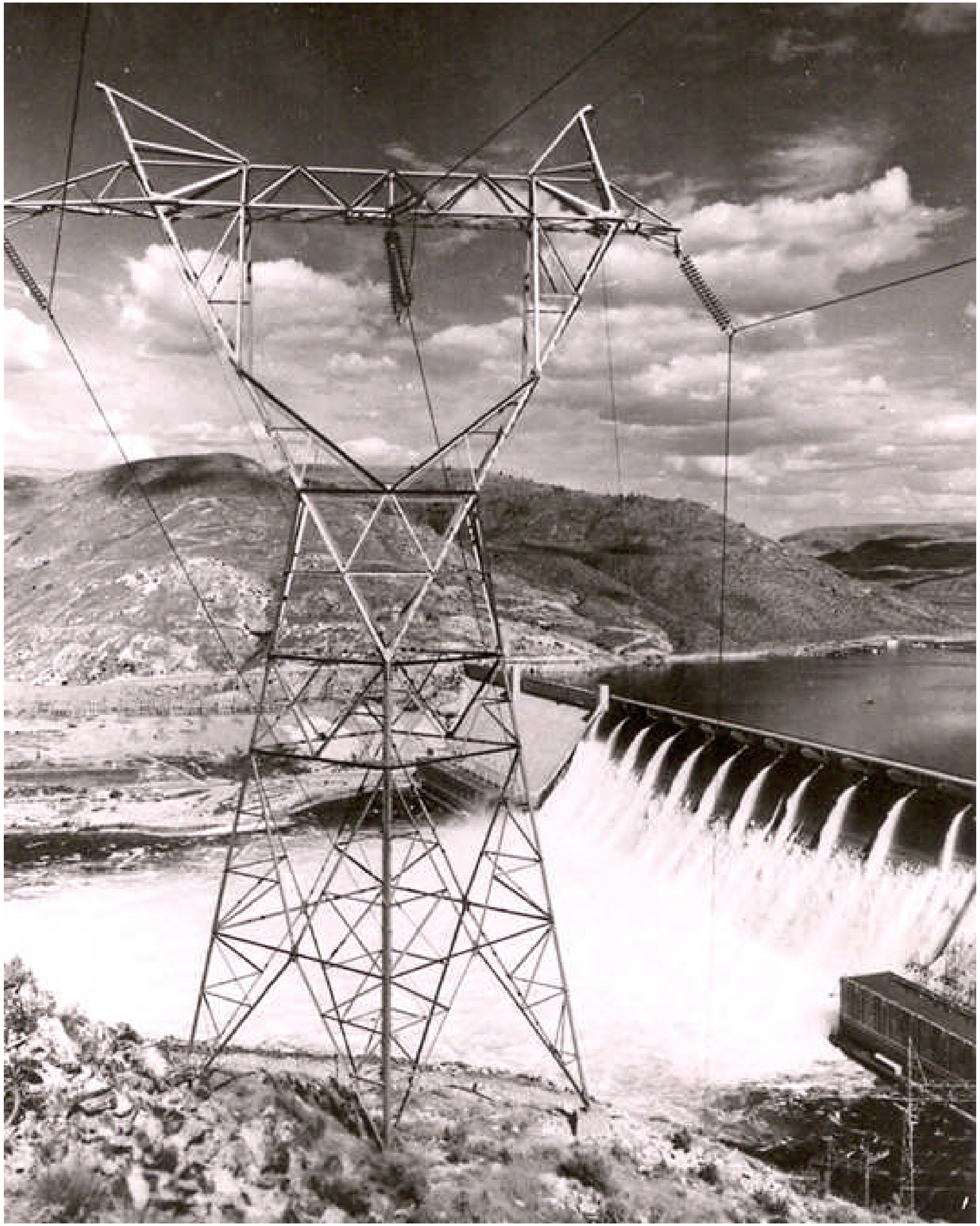
**<u>Above</u>: caption: "This map shows the area in which 30,000 forty-acre farms will be provided by the reclamation project, supporting a population of 1,500,000"**



***"…This program will require the installation of eighteen generators with a horsepower rating of 146,000 each, or a total of nearly three million. These giant units, operated on sealed phosphor-bronze bearings, are expected to be capable of being maintained without more than minor servicing for from forty to fifty years, because of the fact that the intakes will admit water that is practically free from suspended minerals, grit, and other elements that would tend to wear out the machinery…"***



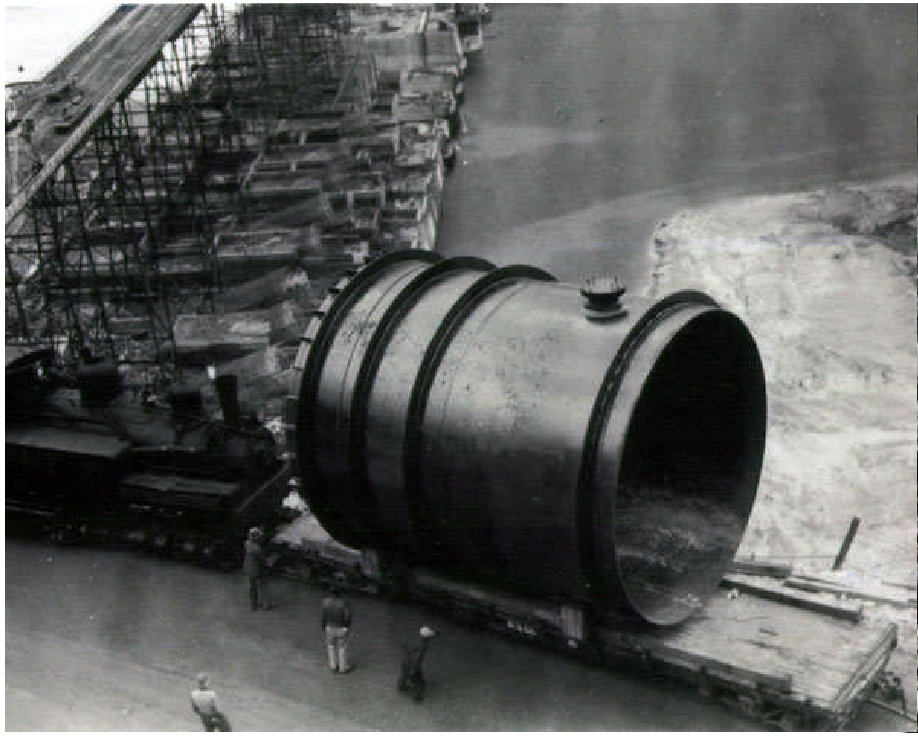
***Popular Science*, February 1936**

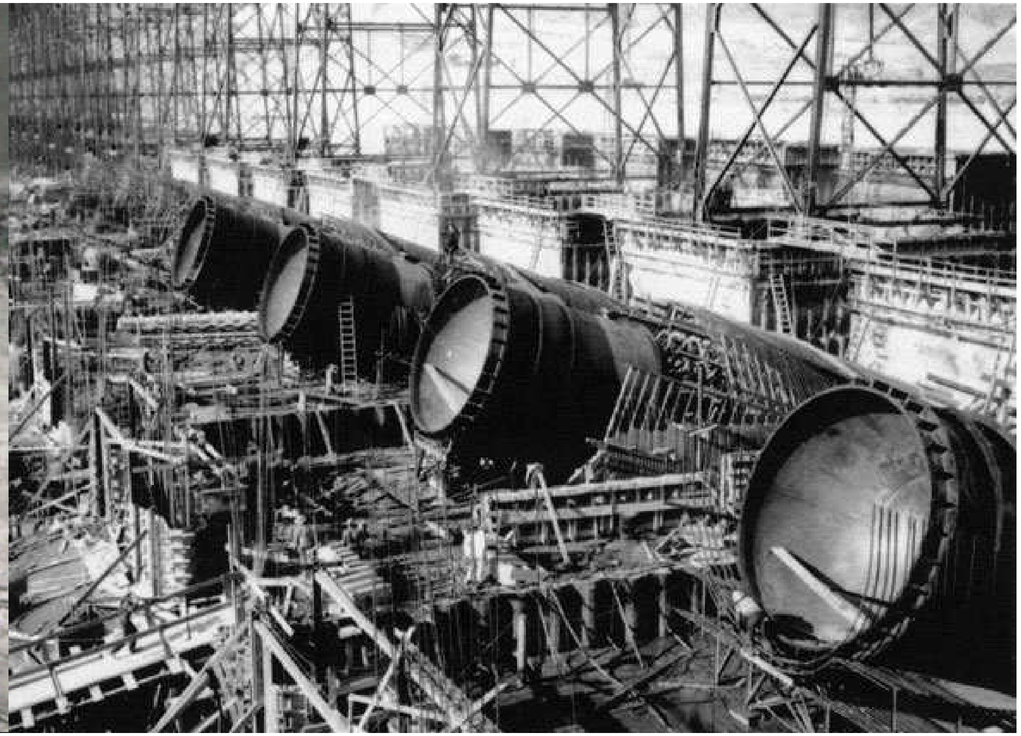


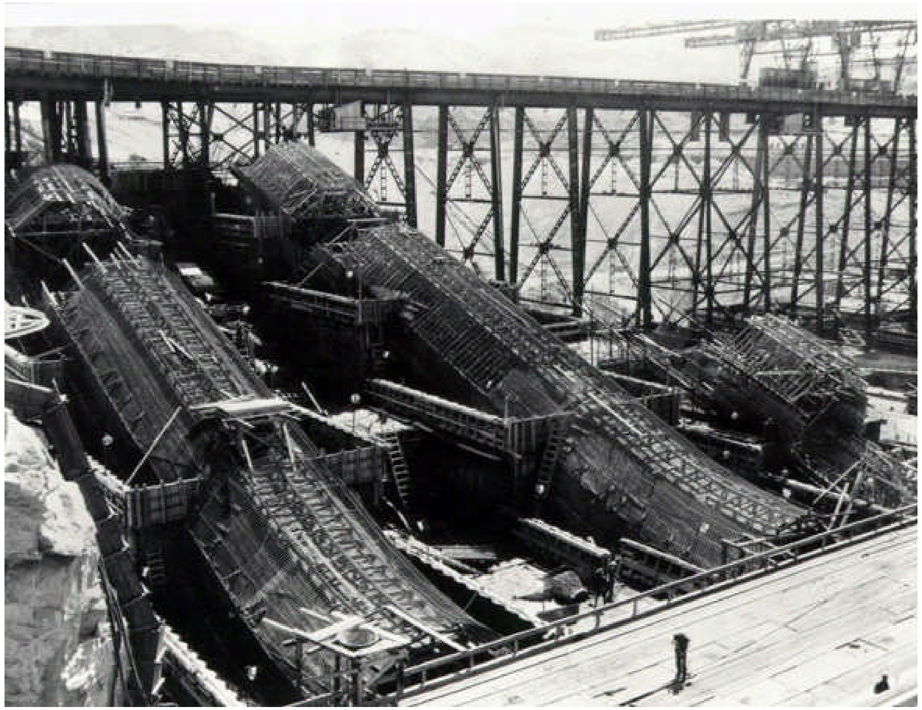
***"…It is estimated that all of this power will be absorbed within fifteen years. Sale of the power is expected to liquidate the cost of the dam and power plant in fifty years, after which power sales will bring an estimated return of $15,000,000 per year…"***

***Popular Mechanics,*** **April 1940**

**Left: caption: "World's largest hydro-electric power plant, with a rated capacity of approximately 2,000,000 kilowatts, is located at Grand Coulee Dam in central Washington"**



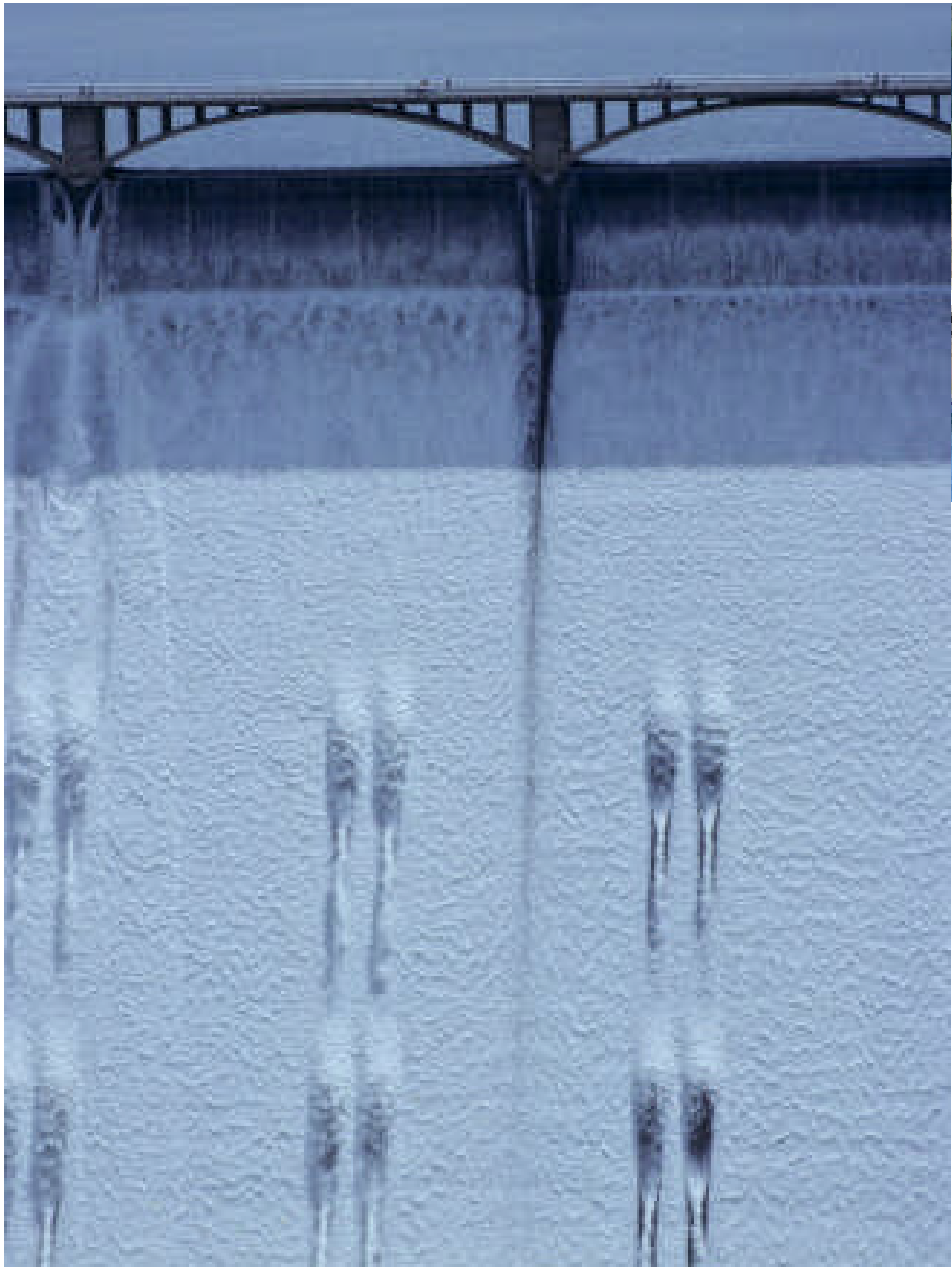


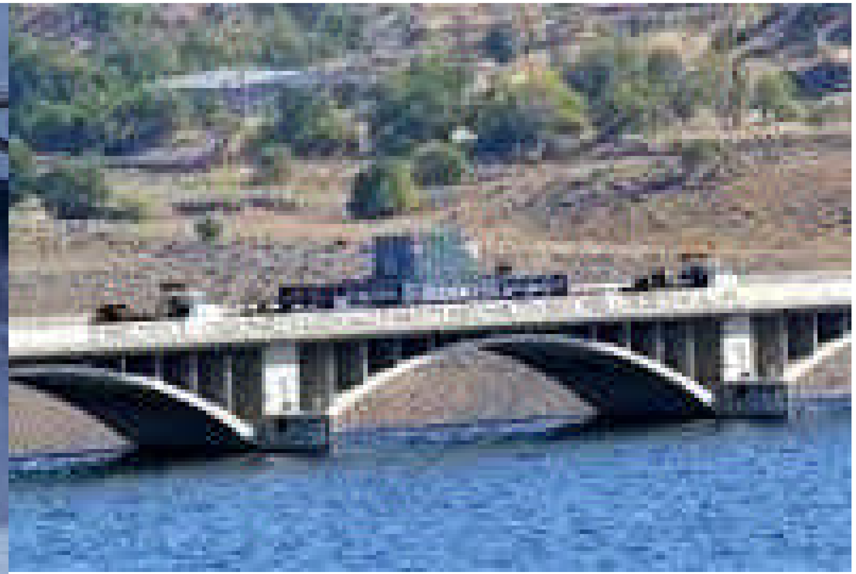


**<u>Top Left</u>: caption: "An 18-foot diameter penstock section brought by train from the fabricating plant in Electric City to Grand Coulee Dam (October 1938)"**

**<u>Top Right</u>: caption: "The first 18-foot diameter penstock liner sections at Grand Coulee Dam (November 1938)"**

**<u>Left</u>: caption: "Construction of underground pipes"**



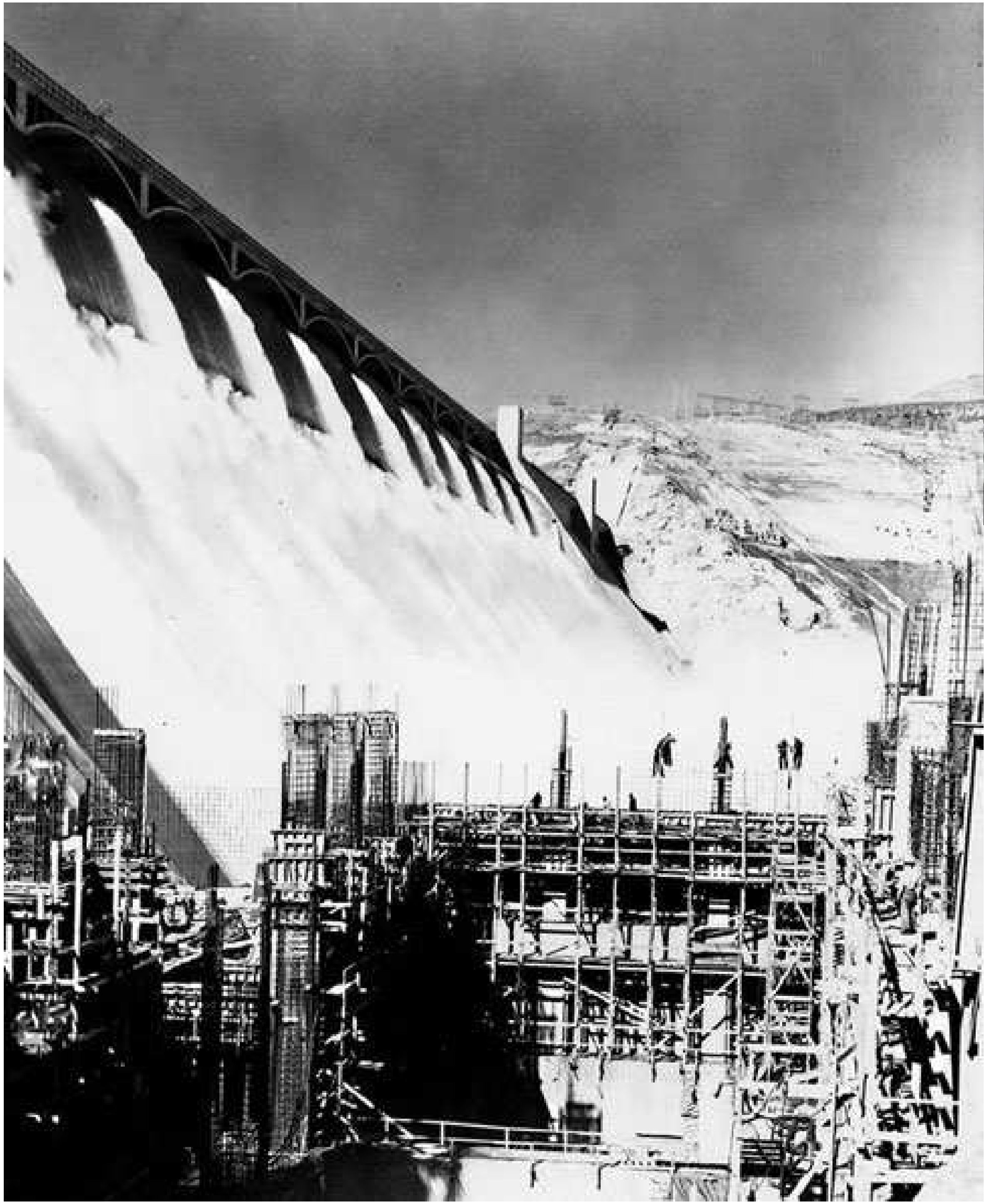


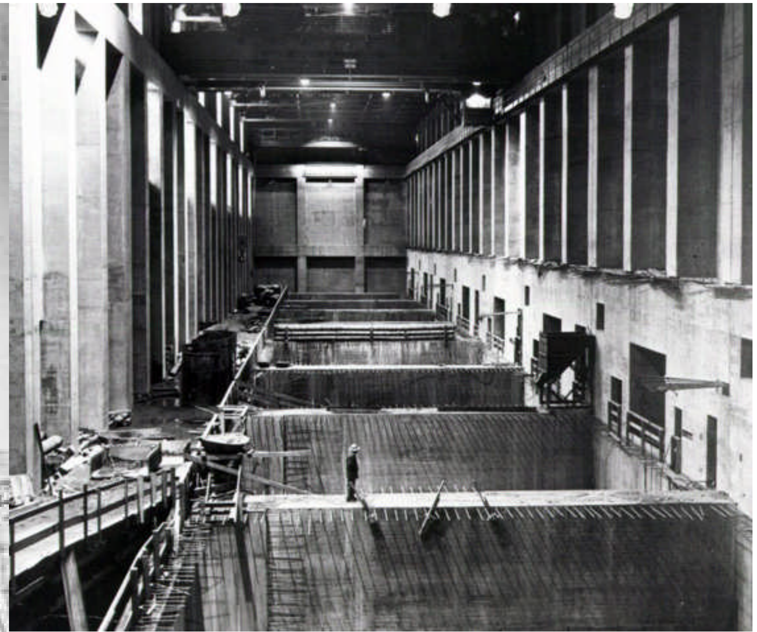
***"…River water not used to spin the turbines will pour over a 1,650-foot long sp-illway at the top of the dam, creating a waterfall twice as high as Niag-ara…"***

***Popular Mechanics,* April 1940**


Grand Coulee Dam, Washington

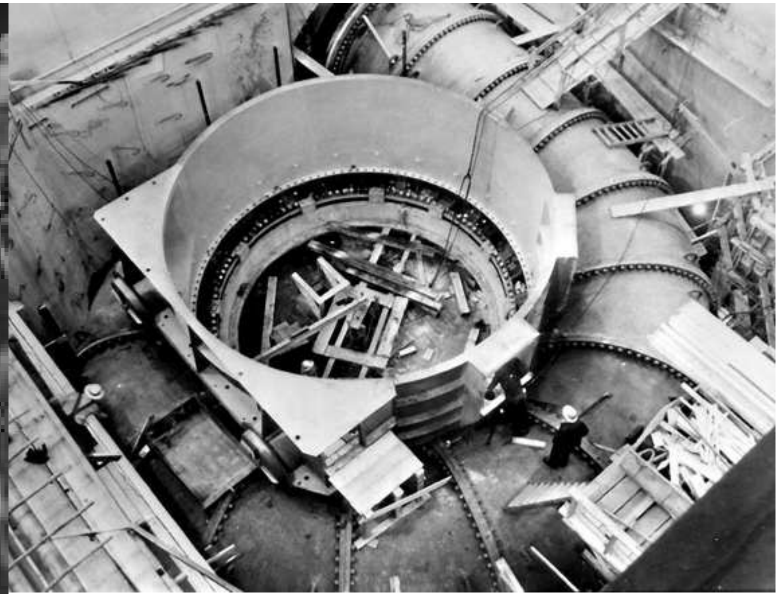

GRAND COULEE DAM





**<u>Above</u>: caption: "By 1941, the dam is essentially completed, the left power plant is constructed, and the foundations are in place for the right power plant and pumping plant"**

**<u>Left</u>: caption: "The east side powerhouse at Grand Coulee Dam (ca. 1942)"**



**<u>Above</u>: caption: "Scroll case ready for concrete in L-9 turbine pit at the west powerhouse of Grand Coulee Dam (December 1947)"**

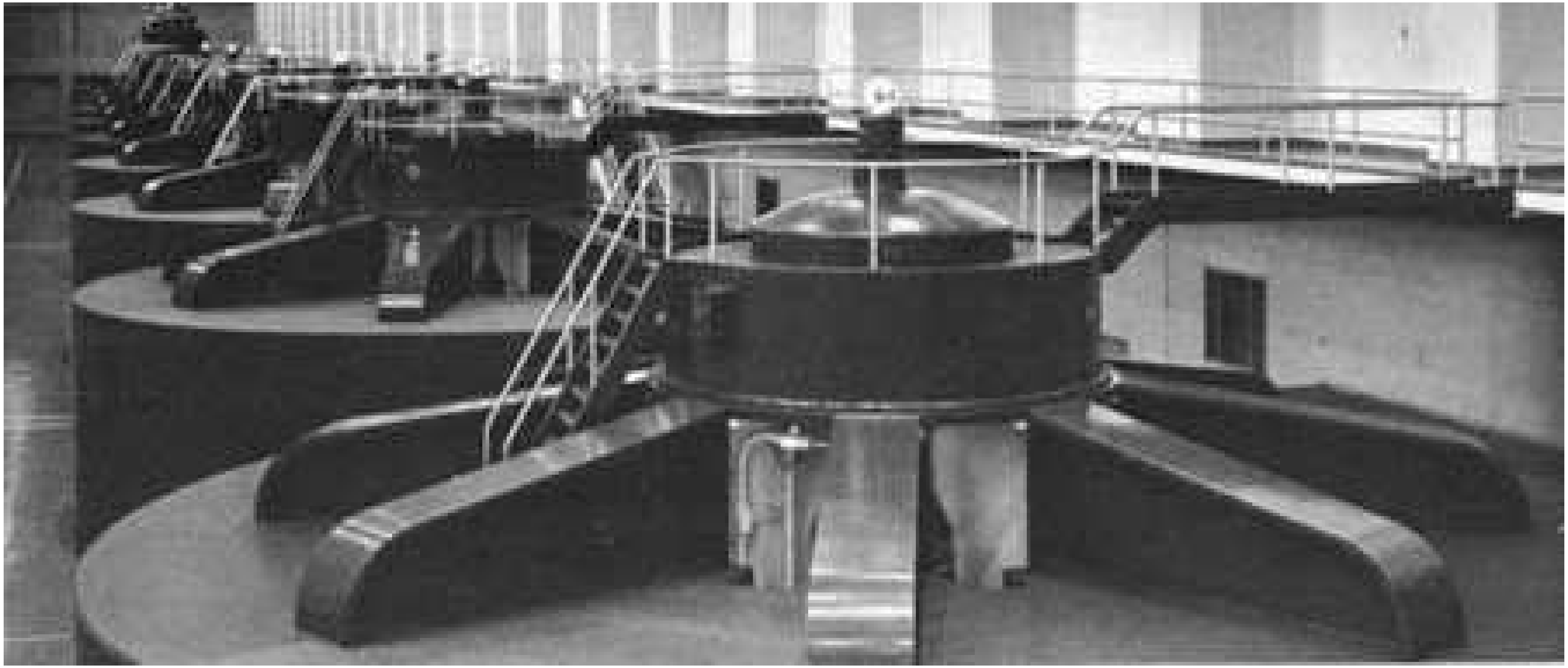
**<u>Left</u>: caption: "The two 14,000 h.p. station-service turbines at the left powerhouse are embedded in concrete to elevation 951, the generator floor level, August 1940"**

***"…A steel shaft 44-inches in diameter connects the turbine with the electric generator above it. These power-manufacturing units are Westinghouse 3-phase, 60-cycle, 13,800-volt generators rated at 108,000 kilowatts. Each is enclosed in a housing 45-feet in diameter and is cooled by circulated air. The rotor turns at 120 revolutions per minute and the peripheral speed of its outer rim is 130 miles per hour. The entire rotating assembly, including the water wheel below, weighs 1,000 tons and is suspended from a thrust bearing on top of the generator. The stator frames are 37-feet in diameter and nearly 10-feet tall…"***

***Popular Mechanics,* May 1942**

**Left: caption: "Rotor for one of the Grand Coulee generators weighs 587 tons and is 31-feet in diameter. Turning at 120 revolutions per minute, the speed of its outer rim is 130 mph."**

**Above: caption: “Interior of the west powerhouse at Grand Coulee Dam (December 1943)”**
**Left: caption: “Shaft of generating unit, interior of power plant at the Grand Coulee Dam, ca. 1951”**



***"…Grand Coulee's power plant, which began operation during the war, is now proving its worth as a peacetime producer in the Pacific Northwest. In the five years the plant has been in operation its energy output has reached 20,000,000,000 kilowatt-hours - equal to the work performed by 1,000,000 men laboring eight hours daily every day for seventy-nine years…"***

***Popular Mechanics,*** **August 1947**

**<u>Above</u>: caption: "These are the nine generators in the left powerhouse at Grand Coulee. Nine more generators are located in the right powerhouse. Each generator has a rated capacity of 108,000 kilowatts." (ca. 1964)**

***“In every 24-hour period at Grand Coulee there are periods of ‘high’ and ‘low’ power demand which reflect the dining, reading, working, television-viewing, and eating habits of a large portion of the people and industry of the Northwest. The efficient operation of the hydroelectric plants at the dam to meet these power demands calls for a continuous flow of water to the generating units and sufficient ‘head’ or depth of water in the res-ervoir behind the dam to turn the generating units. However, the Col-umbia River fluctuates a great deal from peak flow during the summer snowmelt to a low during the winter months, and the operation of the dam must be carefully planned to regulate water use and reservoir capacity in order to reap the greatest benefit from the river’s power. In the winter months water stored in the reservoir is used for power generation at Grand Coulee and at the downstream dams below Grand Coulee which have comparatively small storage reservoirs. In the spring when the Columbia River begins its annual rise, 80-feet of empty storage depth in the reservoir is available for use as a safety valve to partially absorb the force of potential spring floods. This flood-control operation of Grand Coulee has prevented a great deal of downstream property damage.”***

***U.S. Bureau of Reclamation*** **(ca. 1964)**

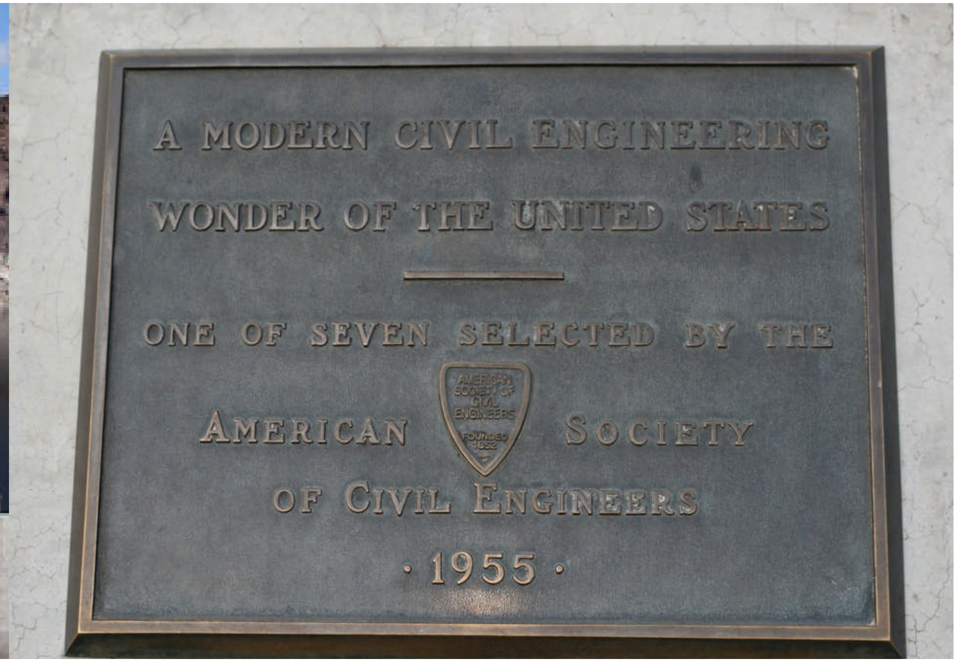
# Everyone in America

## *“Everyone in America has heard of Grand Coulee”*

***Richard L. Neuberger*, Journalist (1942)**

**RE: the press had, interchangeably, dubbed *Grand Coulee Dam*: “The Greatest Structure in the World,” “The World’s Greatest Engineering Wonder,” “The Eighth Wonder of the World” and/or “The Biggest Thing on Earth.” All through the 1930s and ‘40s, the dam generated nationwide publicity. However, few Americans knew much about the *Columbia Basin Project*, then or now. The irrigation network Grand Coulee Dam made possible is the largest single reclamation project ever undertaken in the United States. In all, the project area (+2.5 million acres) is roughly twice the size of the State of Delaware. Grand Coulee Dam (at one time the largest concrete structure on earth) is its key feature, but only one piece of the puzzle. In all, the total includes 333 miles of main canals, 1,993 miles of laterals (smaller distribution canals) 3,498 miles of drains and wasteways and four large dams (besides Grand Coulee). In addition, there is an enormous pump-generating plant beside *Franklin D. Roosevelt Lake* - the reservoir formed by Grand Coulee Dam. Taken together, the irrigation features of the CBP represent an infrastructure construction project much larger than the dam itself.**

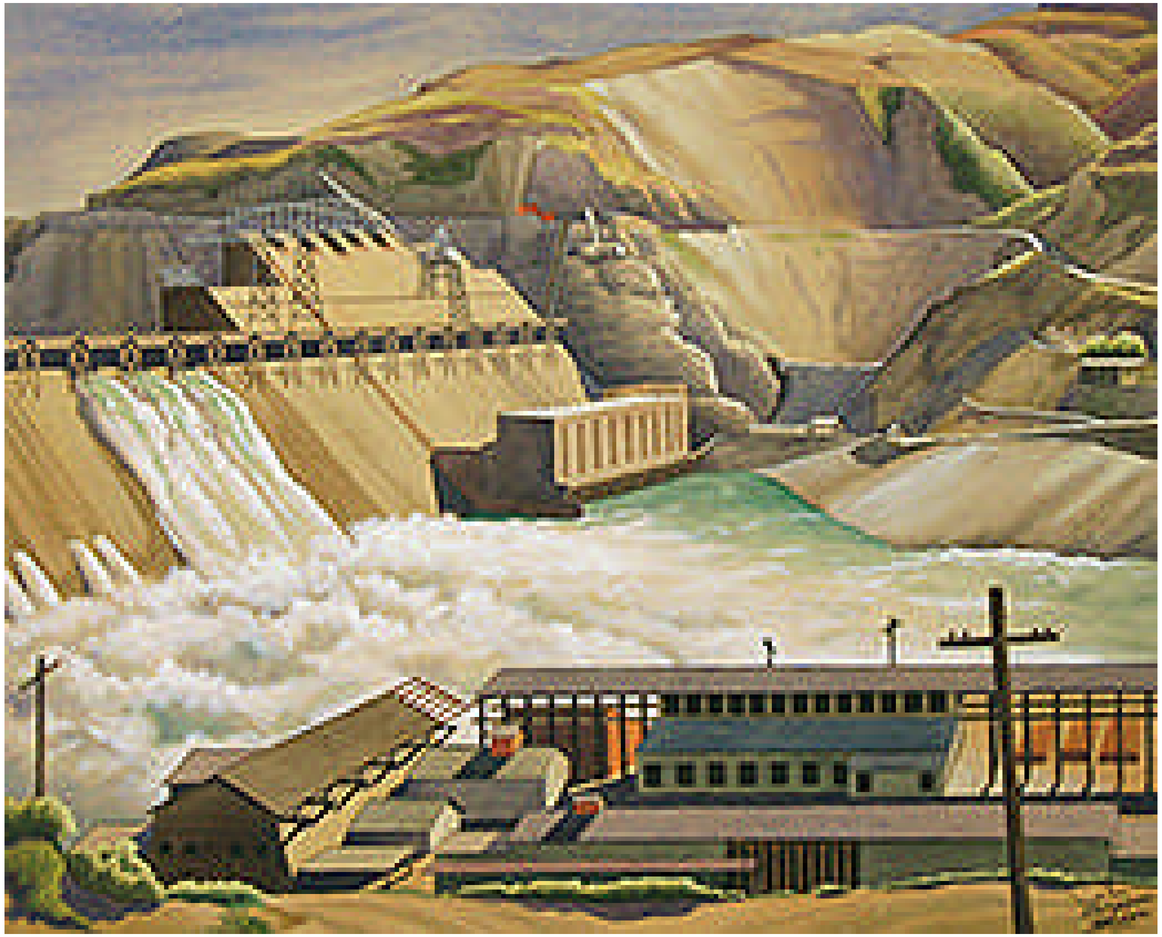
# An Engineering Wonder




**In 1955, the *American Society of Civil Engineers* (ASCE) identified seven "Civil Engineering Wonders of the United States." The election committee members considered uniqueness and pioneering design as their main criteria. Chicago's *Sewage Disposal System*, *Colorado River Aqueduct*, *Empire State Building*, *Panama Canal*, *San Francisco-Oakland Bay Bridge* and *Hoover Dam* all made the cut. Also included was *Grand Coulee Dam*, part of the *Columbia Basin Irrigation Project* (CBIP).**



**<u>Above L&R</u>: ASCE "Seven Wonders" plaque at *Hoover Dam***



# Part 6

# Water is Life

# A National Undertaking

## *“…A National Undertaking…”*

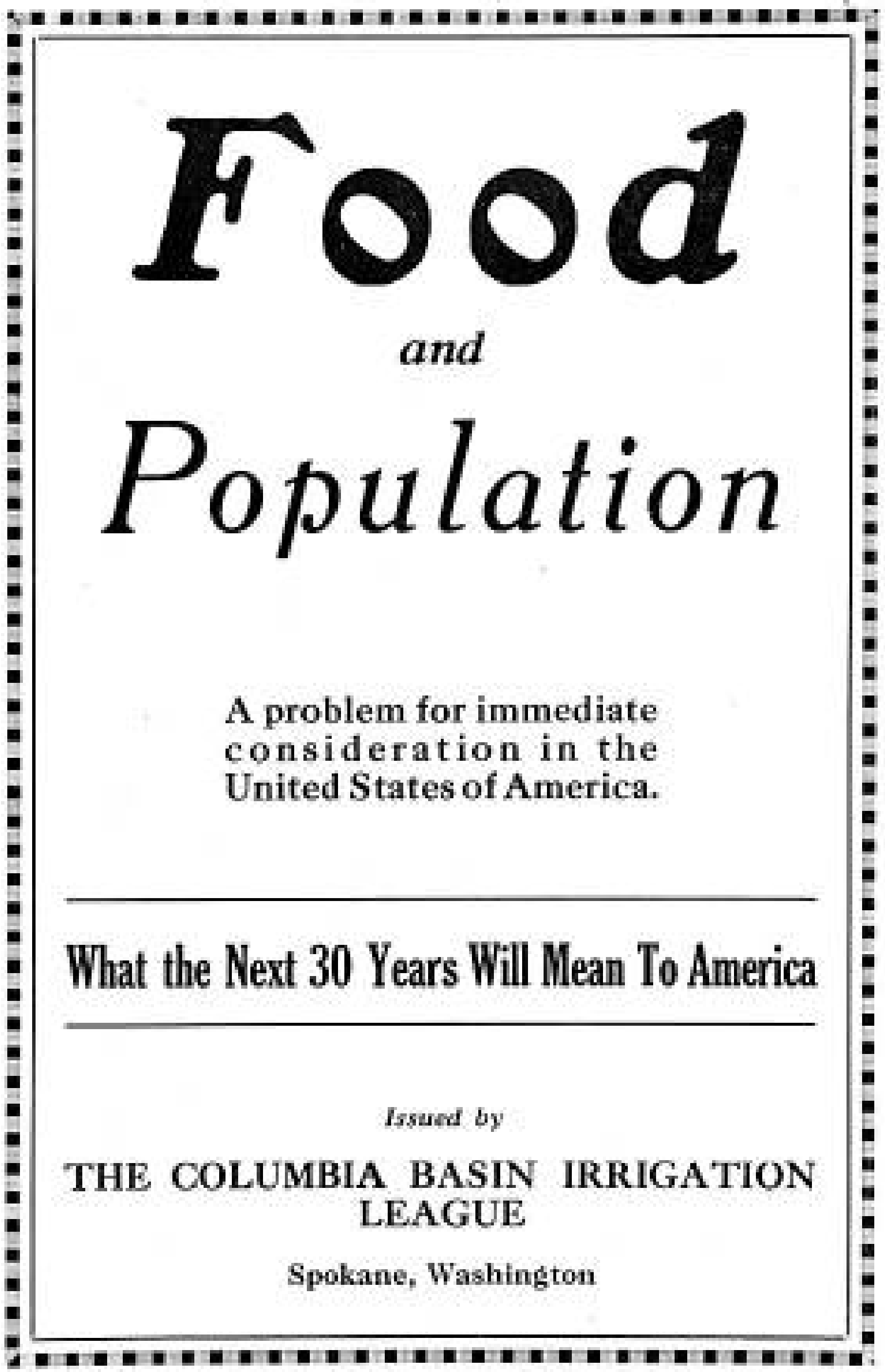
***Franklin D. Roosevelt*, President of the United States(ca. 1933)**

**RE: work on *Grand Coulee Dam* began in the summer of 1933 near the height of the *Great Depression*. Newly-elected POTUS *Franklin Delano Roosevelt* (above) promised the nation a “New Deal” and launched public construction projects that employed millions of workers. Grand Coulee Dam was one of the biggest. It was so big, many doubted the region would ever be able to use all the electricity it could produce and/or populate the arid land it would irrigate.**

***"There is much opposition in the east to the Grand Coulee project and the entire program of western reclamation, but I have no doubt as to the outcome"***

***Knute Hill,*** **Congressman (Washington State)**

**RE: excerpt from a speech he made on October 16th 1936 to the *Greater Grand Coulee Chamber of Commerce.* The effort to build *Grand Coulee Dam* was played out against the background of that bitter fight in the inter-war years of the 1920s and 1930s. Congressional opposition that annually confronted funding was only one battle in a much larger war. The debate encompassed a number of issues. Aside from the public vs. private power debate, it included reclamation and the wisdom of opening up more agricultural land at a time of food surpluses. As well, Grand Coulee would give New Deal opponents a chance to denounce big government spending while allowing the western states a forum whereby they could voice their resentment over the intrusion of eastern politicians in their affairs. Although the project's boosters eagerly sought federal financing to build their agricultural/industrial empire, they resented any restriction imposed by their benefactors.**


# Food

*and*

# Population

A problem for immediate consideration in the United States of America.

What the Next 30 Years Will Mean To America

*Issued by*

THE COLUMBIA BASIN IRRIGATION LEAGUE

Spokane, Washington

***"The United States is soon to face the problem of supplying food-stuffs for an overwhelming population. How that problem shall be met in order to sustain the American standard of living has in recent months become a subject of profound study. Statements in the American Congress are giving the matter serious study as it relates to agriculture and the apparent necessity for not only making every available acre of present day farms produce to the limit, but for reclaiming waste and desert lands against the day (only 72 years distant) when the United States will have attained a population of more than 184,000,000 according to the Pearl-Reed theory, or 322,000,000 if the annual increase of population is maintained at 1.4 percent…"***

***Food and Population*** **(ca. 1930)**

### FUTURE POPULATION OF THE UNITED STATES

| *Year* | *At 1.4 Percent* | *At Lowest Estimate* |
|---|---|---|
| 1930 | 121,500,000 | 121,400,000 |
| 1940 | 139,700,000 | 136,300,000 |
| 1950 | 160,500,000 | 148,700,000 |
| 1960 | 184,500,000 | 159,200,000 |
| 1970 | 212,100,000 | 167,900,000 |
| 1980 | 243,700,000 | 174,900,000 |
| 1990 | 280,100,000 | 180,400,000 |
| 2000 | 322,000,000 | 184,700,000 |

***"Anyone who has an interest in the future of his nation <u>for even the existing century</u>, is called upon to recognize that we are faced with a problem of supreme difficulty, a problem to which publicists and economists may well give their profound attention. In the United States, from 1790 to 1860 the population increased at the uniform rate of about 3 per cent per annum., but, since then it has fallen off considerably."***

***Sir George H. Knibbs,*** **Fellow of the** ***Royal Anthropological Society***

**RE: excerpt from an article appearing in the October 1928 issue of *Scientific American.* Between 1910 and 1920, the U.S. population increased at a rate of 1.4% per annum (middle column above). A U.S. population in excess of 197,274,000 was considered unsustainable for maintaining the standard of living, at the time. Thus, by 1960 that threshold would be reached given the 1.4% growth rate.**

***“…Land utilization to the limit of our agricultural areas for the production of foodstuffs is the remedy that the United States Congress can apply as a wise and statesmanlike precaution against the demands of the people in the next few decades. Congressional action is being urged for the purpose of providing American farmers with a market that will make it profitable for them to farm the twenty million acres of land which have gone out of production since 1920. The next action, and of equal importance, is the reclamation by irrigation of every acre of desert land for which water is available in the West, and the drainage of swamp lands which may be redeemed to agriculture in the South…”***

***Food and Population*** **(ca. 1930)**

***"The farmer as a primary producer is not necessarily the main beneficiary of irrigation development. Local retailers of every kind, banks, public utilities (both power and railroads), labor, wholesalers, jobbers, manufacturers, and the general public are to a surprising degree dependent upon agricultural production, not only because of the food produced for direct consumption and the raw materials supplied to manufacturers, but because of the general business activity which is created"***

**Major *John S. Butler, U.S. Army Corps of Engineers* (1933)**

**RE: promoters of the *Columbia Basin Irrigation Project* argued that the taxpayer should foot the bill for the BCP believing that, eventually, the project would pay for itself through the sale of electrical power. However, the power subsidy has hidden the high price for irrigation water. The promoters used any argument that would support their cause including population growth and future needs for increased agricultural land. They emphasized the benefits to be realized including: abundant hydroelectric power, easing of chronic unemployment, flood control, recreation, navigation, conservation and, during WWII, national security. At a time when other nations chose military aggression to solve their financial and social problems, the U.S. government turned to large public works projects. New cities with industries powered by cheap electricity provided from publicly owned plants were planned. *Grand Coulee Dam*, with the jobs it created and the promise it held, convinced many Americans down on their luck that their government was, for the most part, still on their side.**

***"Reclamation of arid lands is not a local question but a national one. Yesterday I stood on a mountain and I could see a sea of arid land that would be fertile of it had water on it. I saw, too, laid off like squares on a checkerboard, areas that had been abandoned by the men farming them. It seems to me that Congress can well afford to provide credit that will enable that land to be flooded with water."***

***Nicholas Longworth*, Speaker - *U.S. House of Representatives***

# Every Drop of Water

***"Every drop of water that runs to the sea without yielding its full commercial returns to the nation is an economic loss which, in all its economic implications, an be computed in millions. The initiation and construction of the Columbia Basin irrigation project is inevitable. It should be undertaken at the earliest possible date. My observations have convinced me that the Columbia River basin should be embraced in a national program of major water improvement. It should not be delayed until we are overwhelmed with population in this country. In the upper stretches of this river there are two and one half million horsepower, and there is a possibility of adding 1,750,000 acres of land to intensive cultivation. By utilization of these great resources, the state's industrial development will be greatly promoted and its population increased one-half. Water today is our greatest undeveloped resource. Our streams and rivers offer us a possible total of 52,000,000 horsepower, and of this less than 11,000,000 has been developed. Our government has done effective work with water, but we have wasted vast sums of public money under political pressure and we have now skimmed off the easy jobs. Today it is the major engineering jobs and the opportunity of great national design which lie before us."***

***Herbert Hoover***

**RE: speech made in Seattle on August 21st 1926 while he was serving as *Secretary of Commerce* in the Coolidge Administration**

***"…For the future, low power rates should reduce the burden of the heavy users of power particularly those engaged in pumping for irrigation and should attract new industries, particularly those requiring large blocks of power. And as the irrigable lands are reclaimed, thousands of small farms should be established not for the purpose of one-crop farming to raise products of which there may already be a surplus, but for the purpose of establishing farm homes with such surroundings that families may live there in comfort largely from the products of their own farms under diversified farming methods that will also permit the marketing of sufficient products to meet the running expenses…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

***"…It has been the experience in the past that for every family on an irrigated farm there is also one in the towns that are developed on the project to serve the farming districts and still another in the more distant cities and towns engaged in the manufacturing and transportation of things that the farmer must buy. Benefits that flow from the construction of an irrigation project, such as this will be in the future, are far-reaching indeed…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

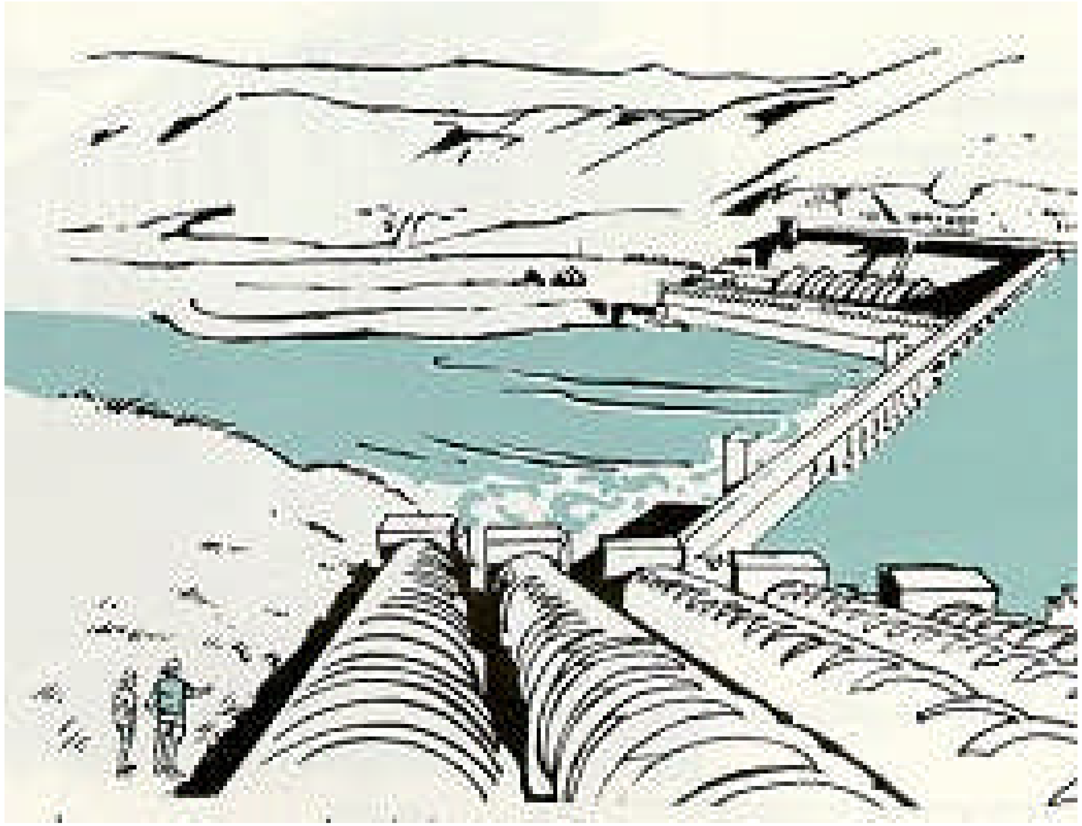
**<u>Left T&B</u>: caption: "The peaches and hops pictured were grown on the Yakima Federal Reclamation Project, across the river from the Columbia Basin Lands. Irrigation will duplicate these results on the Columbia Basin Project."**

# A Responsibility to Civilization

***"…are presenting to the people of the country the opportunity for extension of federal reclamation that will add more to the total capital wealth of the nation than can be added by projects in any other part of the nation. We in the state of Washington are particularly proud of our accomplishments in the field of reclamation and irrigation. We boast that the Yakima and Kittitas projects are models of efficiency from whatever standard they may be judged, I say to you who are meeting here, in the presentation of your arguments on behalf of the further activity of the federal government along the lines of irrigation and reclamation, carry with you always the understanding, and conviction and belief, that the work you are doing is a vital and important factor in the nation's fulfillment of its responsibility to civilization. There is no work that is more important. I urge an aggressive, vigorous and self-confident campaign on your behalf."***

***Lewis B. Schwellenbach,*** **U.S. Senator (State of Washington)**

**RE: excerpt from a speech he made on October 16th 1936 to the 24th annual meeting of the *Washington Irrigation Institute* concerning the *Roza* and *Grand Coulee* project/s**



***"…Secondary power will be employed to operate twenty giant pumps which will lift water 310-feet from the pool formed by the dam, through a canal nearly two miles long, into the Grand Coulee irrigation reservoir. Each of these pumps will be driven by a 33,000-horsepower motor, and, in effect, they will operate as so many generating turbines running in service…"***

***Popular Science,* February 1936**

**On May 1st 1948, three years before irrigation water was due to flow through the Columbia Basin Project's main canal to make large-scale irrigation possible, irrigation water reached some project lands via an irrigation canal from a pumping plant on the *Columbia River* at the southern tip of the project. Thus was the goal reached that project supporters had envisioned for years. But now that the land had water, it needed people to clear and level the land, enrich it and build and buy farm irrigation facilities to properly apply the available irrigation water. On July 20th 1948, *Public Announcement No. 1.1* was sent to 2,500 persons who had previously indicated an interest in the lands of this first irrigation block and, via the press wire services, the announcement was broadcast to the nation.**

# Irrigation Block One

**For the fifteen federally owned farm units in *Irrigation Block 1*, several hundred inquiries were received and one-hundred and sixty formal, five-page applications filed by war veterans from half of the states. Each applicant was expected to have farming experience, be physically and mentally fit and have good character references and a net worth of at least $3,700. All applications were carefully screened by a three-member examining board, consisting of a project farmer from the *South Columbia Basin Irrigation District*, a veteran well acquainted with veterans' affairs (veterans were given preference for farm units), and a representative of the U.S.B.R. About three months later, on November 15th 1948, a public drawing was held in the auditorium of the *Pasco Recreation Center*, where the applicants received priority numbers. After an interview with U.S.B.R. officials some time later, ten applicants selected their farms from the available land, signed a land sale contract with the Government and the land became theirs to develop.**

**Government-owned farm units on the *Columbia Basin Irrigation Project* (CBIP) were offered for sale to qualified applicants, like WWII veteran *Warren Clifford* who, having met the other criteria, received preference over non-veterans.**

**<u>Above& Left</u>: caption: "Mr. & Mrs. Warren Clifford on their Columbia Basin farm"**

***"The supply and distribution system for the project's irrigation water starts at Franklin D. Roosevelt Lake, the reservoir behind Grand Coulee Dam, and stretches south and west to the city of Pasco at the southern tip of the project, 160 miles away. A network of thousands of miles of waterways traverse the project area, bringing water to the fields and removing the excess…"***

***U.S. Bureau of Reclamation* (ca. 2008)**

**RE: although irrigation had been the primary goal of the promoters of *Grand Coulee Dam*, those benefits were slow in coming. The first deliveries of irrigation water came from an entirely different source - a pumping plant and canals near Pasco, WA., which entered service in 1948 and irrigated about 4,500 acres of cropland. To provide water from *Lake Roosevelt* for irrigation purposes required a pumping plant, 1.6 mile feeder canal and an equalizing reservoir at *Grand Coulee*. The equalizing reservoir would occupy a 27-mile stretch of Grand Coulee between the dam and *Coulee City* to the south. Filling the reservoir required two structures; *Dry Falls Dam* (at Coulee City) and *North Dam* (near Grand Coulee Dam). The result was *Banks Lake* (named for *Frank A. Banks*, the Chief Construction Engineer for the Grand Coulee Dam project. These facilities were completed in 1951.**

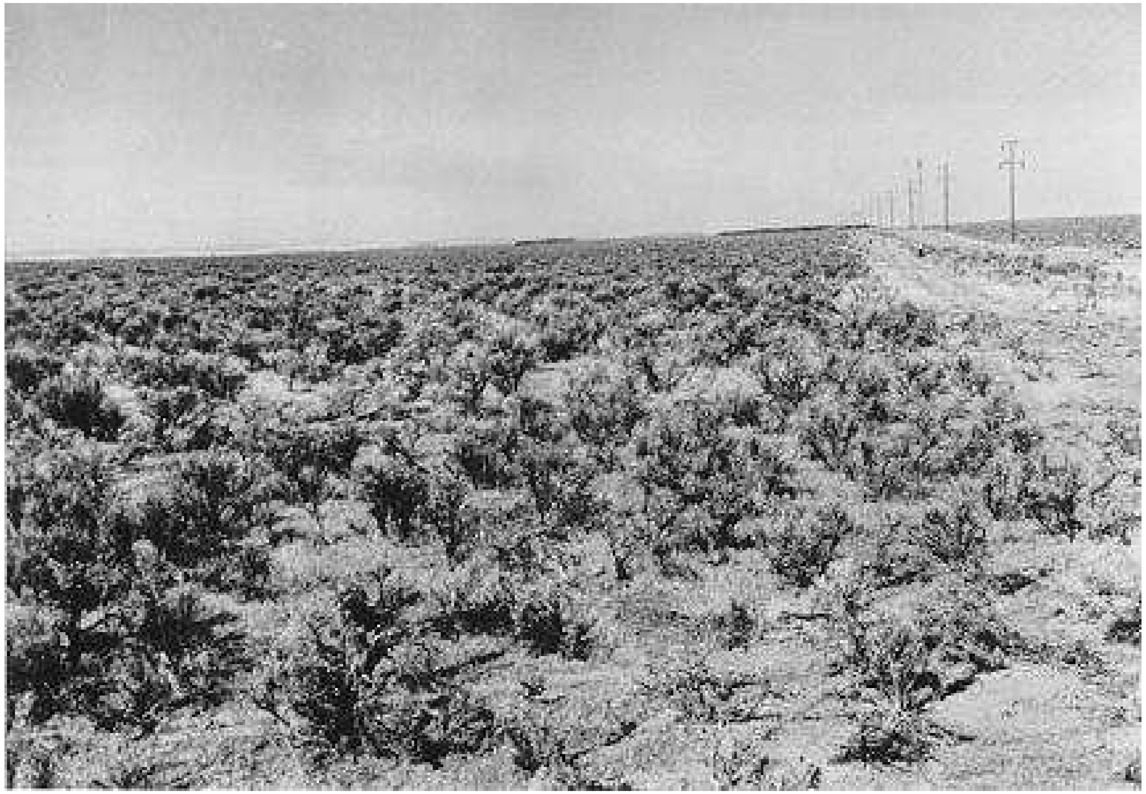
**<u>Above</u>: June pea harvest on Clifford farm in 2008. *Mr. & Mrs. Warren Clifford* were the first settlers to establish a home in the *Pasco Unit* of the CBIP in 1948**

# Farm-in-a-Day

***"On a windy day a few months ago, a cyclone of activity struck a plot of barren ground in the Columbia Basin of Washington. In twenty-two hours, a $75,000 farm grew from raw and rough land which had yielded only sagebrush, cheat grass and boulders the day before. This farm-in-a-day was complete with a furnished, seven-room home, machine shed, garage and shop, cattle loafing shed and chicken house; fences, young trees, shrubs and grape arbor; eighty leveled, fertilized, planted and irrigated acres, an array of gassed-up, greased-up machinery; a cow and baby chicks under a glowing brooder. And it all went as a gift to a lucky but deserving GI named Donald Dunn…"***

***Popular Mechanics,*** **December 1952**

**Left: caption: "Donald Dunn, winner of farm-in-a-day, and U.S. Representative (later Senator) Henry M. Jackson, with potato crop, 1952"**

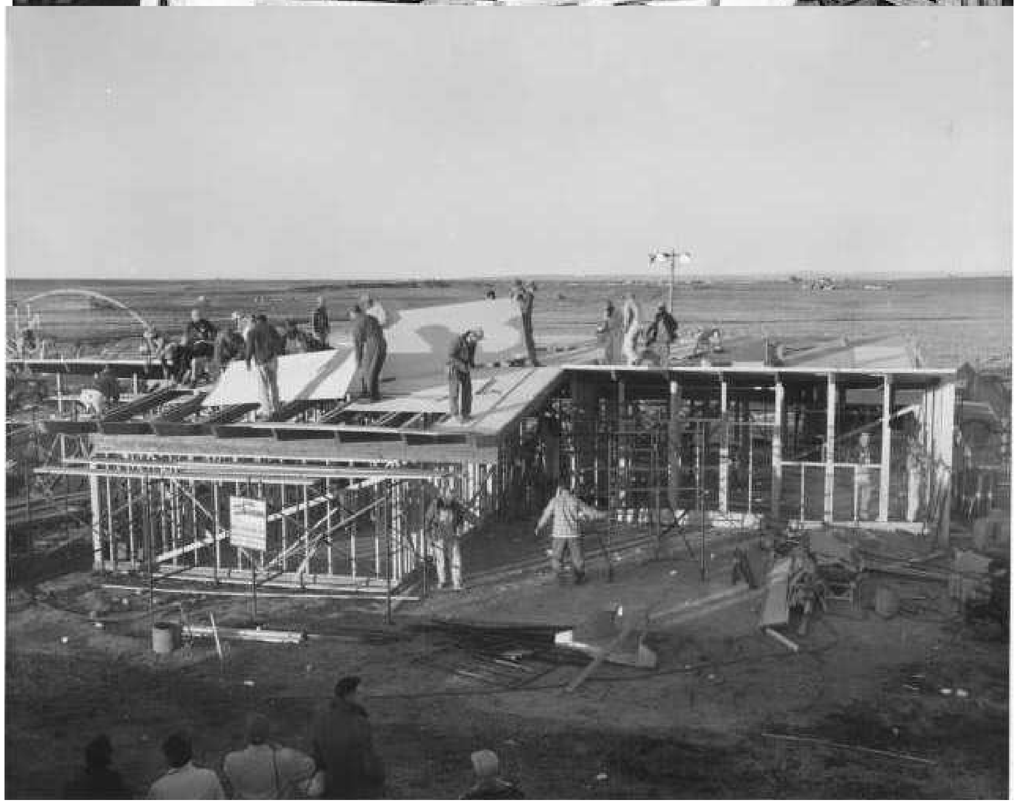


***"…'The native vegetation in these parts is mostly cheat grass,' explains D.M. Harris, former county extension agent in the basin. 'There's no lush growth such as that on virgin soil of the coast to return nitrogen. And where there is excessive heat and insufficient moisture, nitrogen escapes in the form of gas. What little nitrogen was in the basin's virgin soil the early wheat farmers took out in seven years. To grow a descent crop on arid soils such as we have here, a man should fertilize the land every year.'…"***

***Popular Mechanics,* December 1952**



**<u>Above</u>: caption: "Columbia Basin land before irrigation"**



***"…On the afternoon of April 11, 1952, a representative of the Veterans of Foreign Wars called at the little house the Dunns' had rented. He had a telegram. The telegram said that Donald D. Dunn had won the contest conducted through the nation by the VFW to select a worthy veteran of World War II to receive a farm to be built in a day. The farm was to celebrate the coming of water to the Columbia Basin from the vast new storehouse behind Grand Coulee Dam…"***

***Popular Mechanics,*** **December 1952**

***"…Behind the new farm was more than a year of expert, scientific planning. Five of the West Coast's top architects studied farmers' needs and habits before designing the model home. The entire farmyard was planned for convenience, serviceability and attractiveness. The crops planted were carefully selected as the best for the particular acres involved in Dunn's free farm…"***

***Popular Mechanics,* December 1952**

**Left: caption: "Construction during the 'Farm-in-a-Day' project at Moses Lake, WA. During a 22-hour period volunteers erected a complete 80-acre farm to celebrate the coming of irrigation with the Grand Coulee Dam."**

**Right: caption: "Two of Don Dunn's daughters enjoy two piglets housed in the new pig house that was included in the 'Farm-in-a-Day' at Moses Lake given to Donald Dunn, a decorated GI and top notch farmer who had been flooded out by the Cottonwood River in Kansas."**


***"…John L. Toevs, chief of the land development branch for the Bureau of Reclamation, adds: 'For years this land, without irrigation water, was good only for grazing cattle and sheep. As grazing land, it returned five or six cents an acre. As crop land, the returns will run better than $150 an acre.'…"***

***Popular Mechanics,*** **December 1952**

**<u>Left</u>: caption: "Communities throughout the basin held promotional festivals to herald the arrival of irrigation water. Moses Lake created 'Farm-in-a-Day.'" In spite of having tripled their *Moses Lake* holdings, *Donald Dunn* and his family returned to the Midwest after three years, unable to make a living.**

# Pump & Dump


**An extensive system of canals and subsidiary "lateral" canals was designed to feed irrigation water throughout the region. The *Main Canal* runs south from *Dry Falls Dam* for twenty-one miles and includes *Billy Clapp Lake* - a reservoir created behind *Pinto Dam*. South of Pinto Dam the canal splits in two. The eighty-eight mile *West Canal* runs through the *Quincy Basin* and south to the *Frenchman Hills*. The eighty-seven mile *East Low Canal* courses southward to Warden and then to near *Scootenay Reservoir*, where it divides into two branches; one of them ending near Eltopia and the other terminating at the *Columbia River* south of the *White Bluffs*, near Pasco. Most sections of these projects were completed by the mid-1950s. In all, more than three-hundred and thirty miles of major canals were supplemented by nearly 2K miles of lateral canals.**

**<u>Above</u>: Scabland north of Dry Falls Dam. The USB. lowered the level of Banks Lake** 
**in the fall of 2011 for dam maintenance exposing basalt normally inundated by Banks Lake**

***"A unique feature of the Columbia Basin irrigation project is that valley bottom lands will play almost no part except as drainage lines for escaping water…The glacial river channels, however, will afford excellent drainage and locally can be used for secondary reservoirs and channels."***

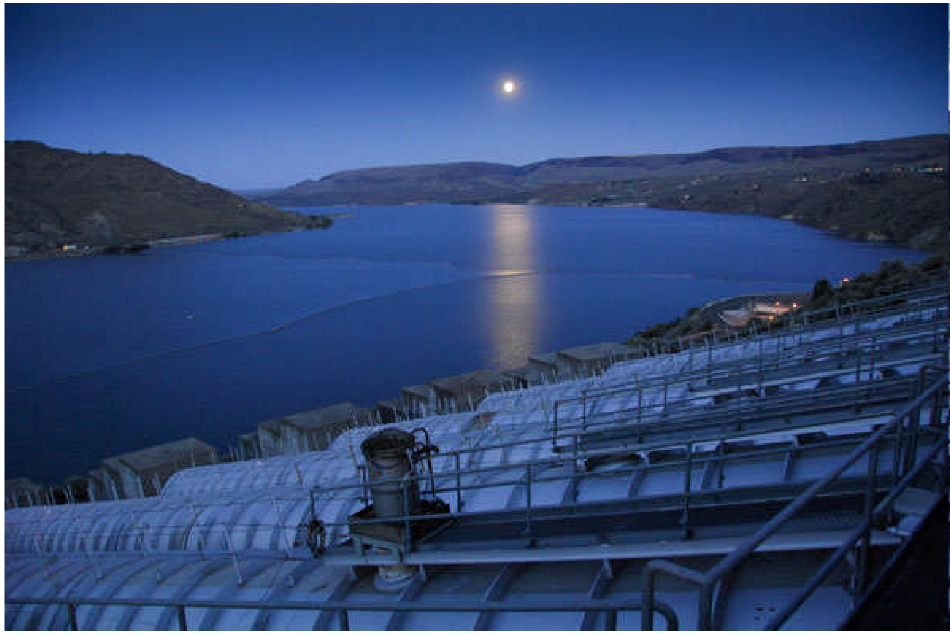
***J. Harlen Bretz*, Geologist(1932)**

**RE: many natural channels carved by the ice-age floods were used to move water through the project. In some areas the flood channels were at right angles to the designed path of the irrigation water. Huge siphons were used to cross these obstacles. To maintain elevation and take advantage of the storage opportunity at the site of *Billy Clapp Lake,* the *Bacon Tunnels* were bored east of *Dry Falls.* More than three-hundred miles of main canal were constructed.**

**<u>Top</u>: caption: "Concrete irrigation siphon under construction"**

**<u>Middle</u>: caption: "Tunnel construction"**

**<u>Bottom</u>: caption: "Canal construction and finishing"**

***"…The present development project includes a plan eventually to pump flood waters in excess of the Columbia's normal flow into the this old 'Grand Coulee' and from there distribute it to 1,200,000 acres of rich soil that now lie useless because of inadequate moisture. Power for pumping this water will be available from the billions of kilowatt hours that would otherwise go to waste during summer floods…"***

***Popular Mechanics,* May 1942**

***"…At present, there are more than 2,000 miles of canals on the project. Included in this 2,000 miles of waterways are sixteen large canal siphons and two tunnels, which carry the water of the Columbia across coulees and through barriers of high ground with little loss of elevation. The largest of these irrigation structures is the Soap Lake Siphon, which carries the waters of the West Canal across the lower end of the Grand Coulee. It is actually an inverted siphon which dips from the high ground to the east of Soap Lake, crosses the coulee in a semicircle around the northern end of the lake, and comes out on high ground to the west. This concrete tube is 12,883-feet long and has an inside diameter of 22-feet 4-inches for the major portion of the distance, with the remainder 25-feet in diameter. Though it will hold forty-one million gallons of water, engineers say the water in it will change every 16 minutes when the water in the canal is flowing at full capacity…"***

***U.S. Bureau of Reclamation*** **(ca. 1964)**

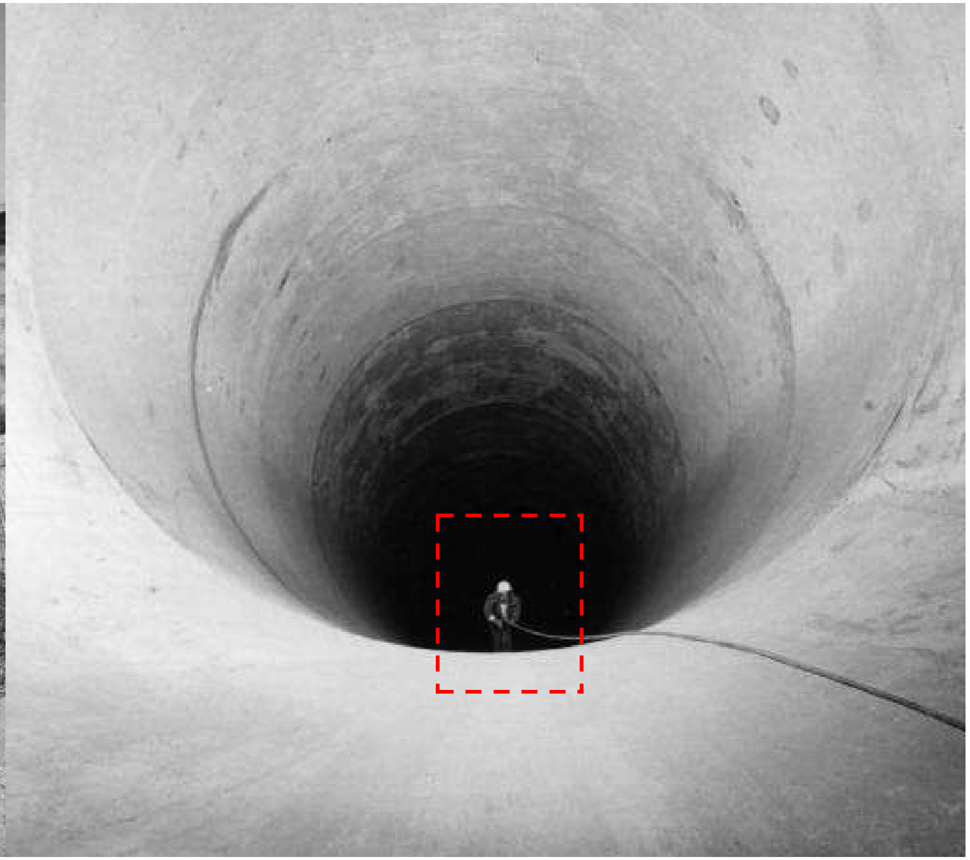
**Left: caption: "Winchester Waste-way - the floor pour is complete and the concrete finisher sets bolts in the fresh concrete, May 1950"**

***"…Banks Lake is an equalizing reservoir formed by sealing the north and south ends of an Ice Age channel in the Upper Grand Coulee. This 27-mile reservoir makes it unnecessary to regulate the pumping of water from Franklin D. Roosevelt Lake to meet daily irrigation requirements. Water can be pumped into this reservoir when both power and water are available and stored until needed for irrigation. The dam at the north end of the reservoir is an earthfill dam, 1,450-feet long and 145-feet high. The south dam, known as Dry Falls Dam, is an earthfill dam also, 9,800-feet long, 123-feet high, and comfortably supports a two-lane transcontinental U.S. highway across its top. The reservoir between these two dams is twenty-seven miles long with a total storage capacity of 1,275,000 acre-feet of water (an acre-foot is equal to one acre of water a foot deep, or 325,850 gallons). Of the total volume of storage capacity of the reservoir, about 60%, or 761,800 acre-feet, is considered 'active storage' - water which is above the lowest outlet of the dam. This is roughly 245 billion gallons of water, enough to cover the entire State of Rhode Island almost a foot deep. The 'active storage' of Banks Lake will be replaced seven to eight times a year when the project is completed, depending on such factors as the amount of rainfall the land receives, evaporation, and other conditions which govern the demand for irrigation water in the basin…"***

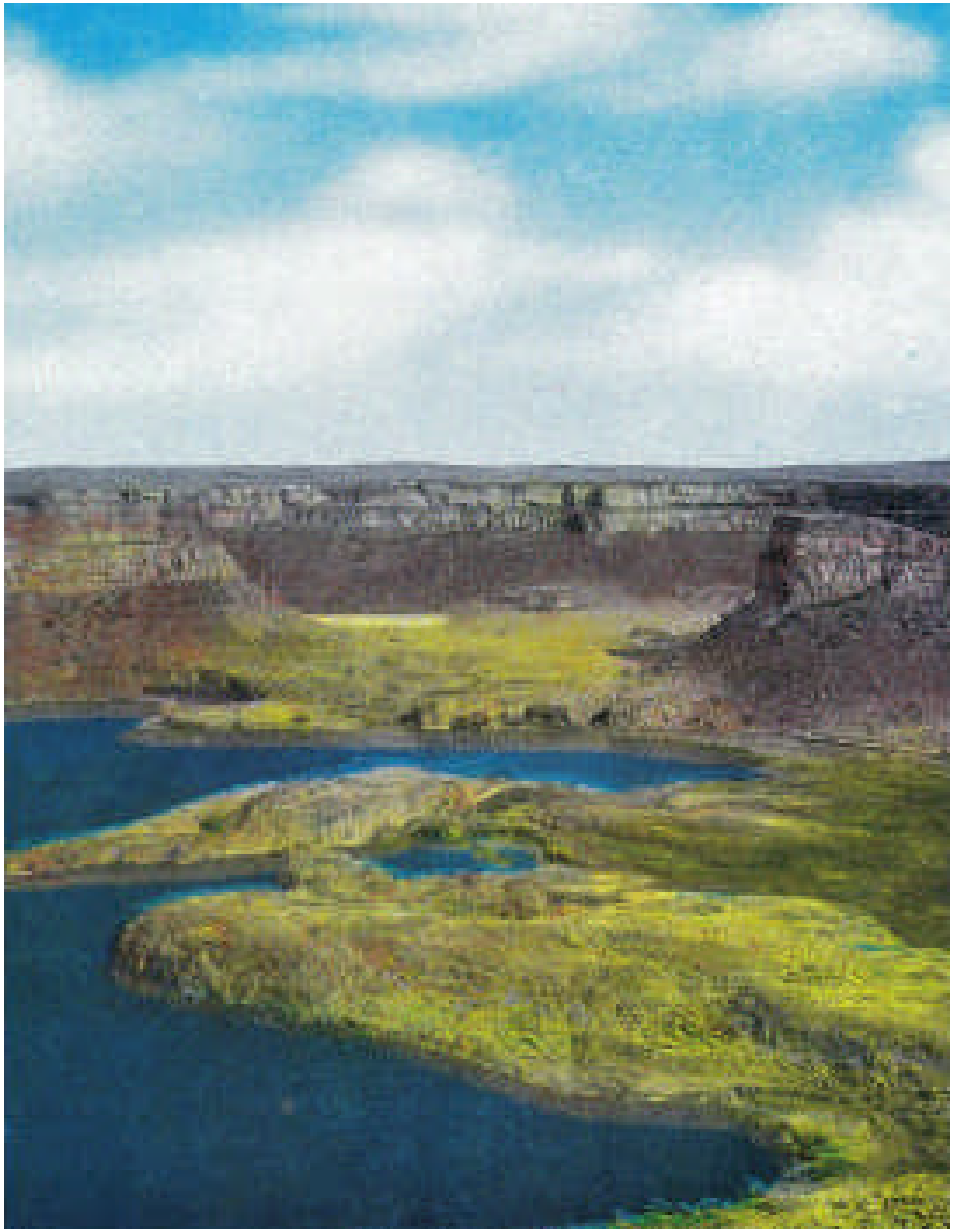
***U.S. Bureau of Reclamation*** **(ca. 1964)**

***"…Normally, pumping into the reservoir begins in May or June and continues intermittently through August or September. The final weeks of pumping build up a reserve of water which can be used during the early fall and the following spring before pumping is resumed. From the equalizing reservoir the water moves south through outlet gates in Dry Falls Dam near Coulee City, flows through two miles of main canal, crosses Bacon Coulee in the 1,038-foot-long Bacon Siphon, and enters the 10,045-foot-long Bacon Tunnel bored through a plateau of hard basalt rock. Pouring out of the tunnel, the water next flows through two ancient lake-beds, a concrete-lined canal, and the bed of a prehistoric river…."***

***U.S. Bureau of Reclamation*** **(ca. 1964)**

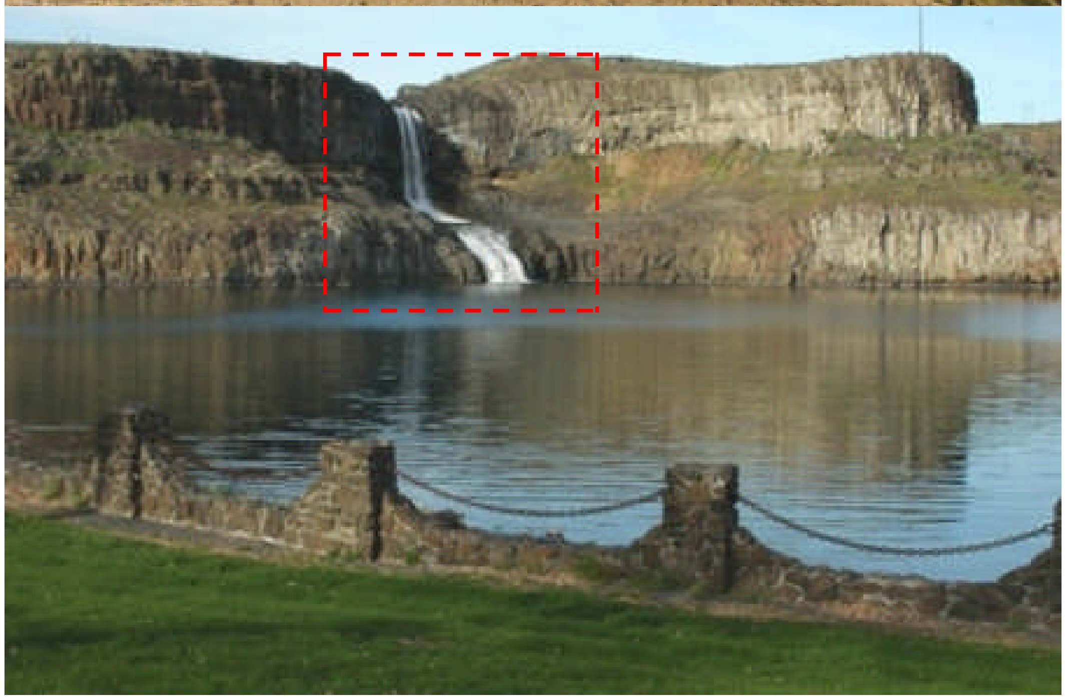
**<u>Left</u>: caption: “Columbia Basin Project, Irrigation Division, East Low Canal, Specifications No. 1422 - Utah Construction Co. and Winston Bros. Co., Contractor. Looking northeasterly over Crab Creek Siphon No. 1. Bifurcation works junction of Main, West, and East Low Canals is at the end of the siphon in left background. Fill over siphon beyond the form jumbo is crossing of P.S. Highway No. 7. Form stands at Section 95 and re-steel is in the place to Section 110 in foreground. August 1943.”**
**<u>Right</u>: caption: “Man gives scale to Bacon siphon (April 1950)”**



***"…Five miles below Bacon Tunnel, the water plunges 165-feet over a basalt cliff into the upper end of Long Lake Reservoir. Appropriately named 'Summer Falls,' the water pours over these cliffs only during the irrigation season. Normally, Long Lake Reservoir is used only as a waterway. However, if an emergency should call for a quick shutdown of the system, the reservoir can store water coming down the Main Canal until the system is in operation again or until the upstream head-gates can be closed…"***

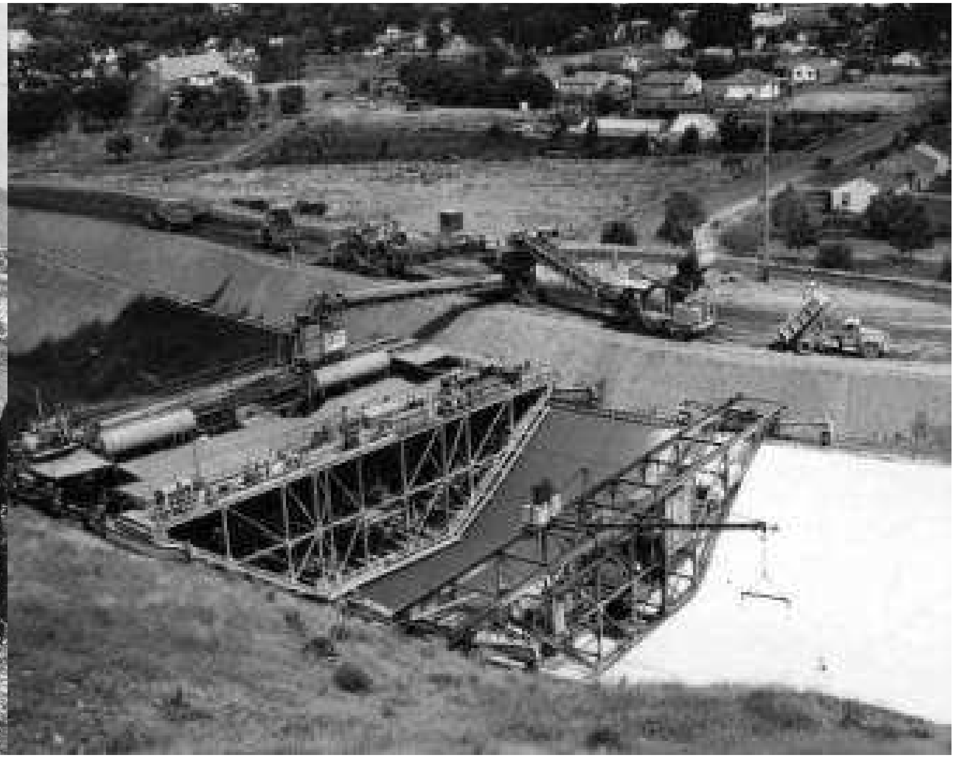
***U.S. Bureau of Reclamation*** **(ca. 1964)**

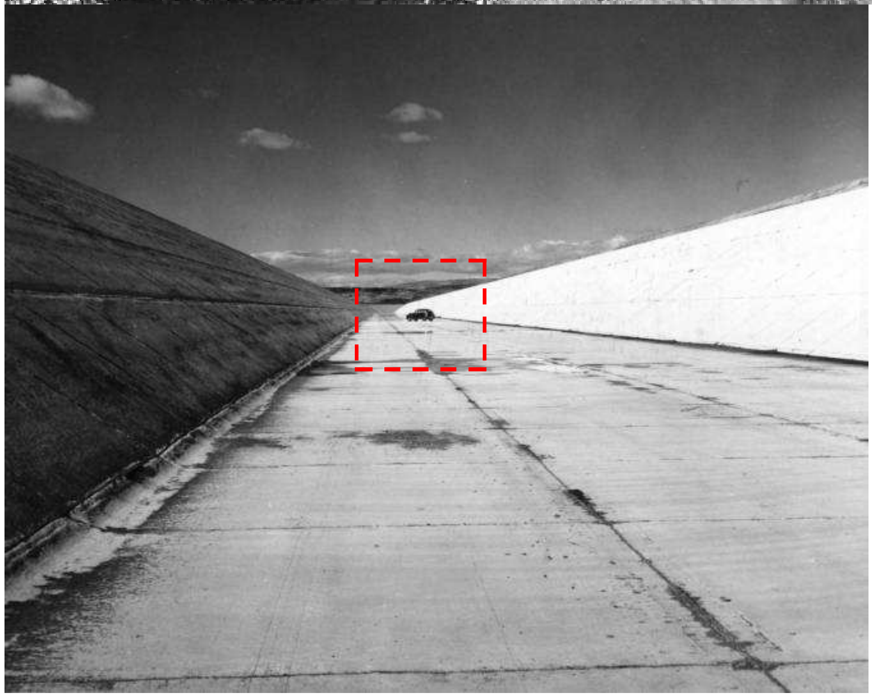
**<u>Left</u>: caption: "Dry Falls State Park, Washington"**



***"…Continuing on its journey to the farms of the Columbia Basin, the water enters the Main Canal at the edge of the irrigable land. At this point it has traveled fifteen miles from Banks Lake and is forty-four miles south of the pumps at Grand Coulee Dam. About 6-1/2 miles west and slightly south of Long Lake is the bifurcation works, where the Main Canal divides into the West Canal and the East Low Canal. The East Low Canal extends eighty-seven miles from the bifurcation works down the eastern edge of the project and empties into the Scootenay Wasteway, which flows into Scootenay Reservoir. From the bifurcation works, the West Canal travels south and west to Soap Lake, where it jogs around the lake and crosses the Lower Grand Coulee via the Soap Lake Siphon, ending finally near Lower Goose Lake, eighty-eight miles below the bifurcation works…"***

***U.S. Bureau of Reclamation*** **(ca. 1964)**





**Top Left: caption: "Excavation for the feeder canal at Grand Coulee Dam (December 1946)"**
**Top Right: caption: "Canal-lining equipment moves through Ephrata, Washington (July 1948)"**
**Left: caption: "Car parked in completed section of Main Canal, October 1949"**

***"Irrigation as practiced in the State of Washington may be studied in a two-day motor trip from Spokane. The trip would include wide reaches of the Columbia basin to be irrigated from the Grand Coulee…Continuing west from Quincy, the road drops into the valley of the Columbia to follow upstream to Wenatchee. A variety of side trips from Wenatchee gives the visitor a complete picture of the possibilities of irrigation in Washi-ngton…"***

***Spokane Chronicle,*** **May 23rd 1936**

**<u>Above</u>: caption: "A ditchrider travels the project's canals daily, turning water into the farmers ditches when needed and keeping an account of the amount of water used at each farm"**

***"…Much of the water in the Columbia Basin Project sees double duty before it returns to the Columbia River. It is used for irrigation, then drained off the land, recaptured by drains, wasteways, and natural channels, and then is used for irrigation a second time. Key structure in this economy operation is O'Sullivan Dam. This earthfill dam forms the Potholes Reservoir, directly south of Moses Lake in the center of the Columbia Basin. The dam is 3-1/2 miles long and rises 200-feet above bedrock. It has an 'active storage' capacity of 379,500 acre-feet and covers about forty-five square miles. From Potholes Reservoir, the Potholes Canal flows south-east about seven miles, then turns south to parallel the East Low Canal for about fifteen miles. It passes west of Othello, then swings east to the Scootenay Reservoir, where it joins the waters of the East Low Canal. At the south end of the reservoir, the Potholes Canal flows south and then southwest to supply irrigation water to thirsty lands before ending six miles north-west of Pasco…"***

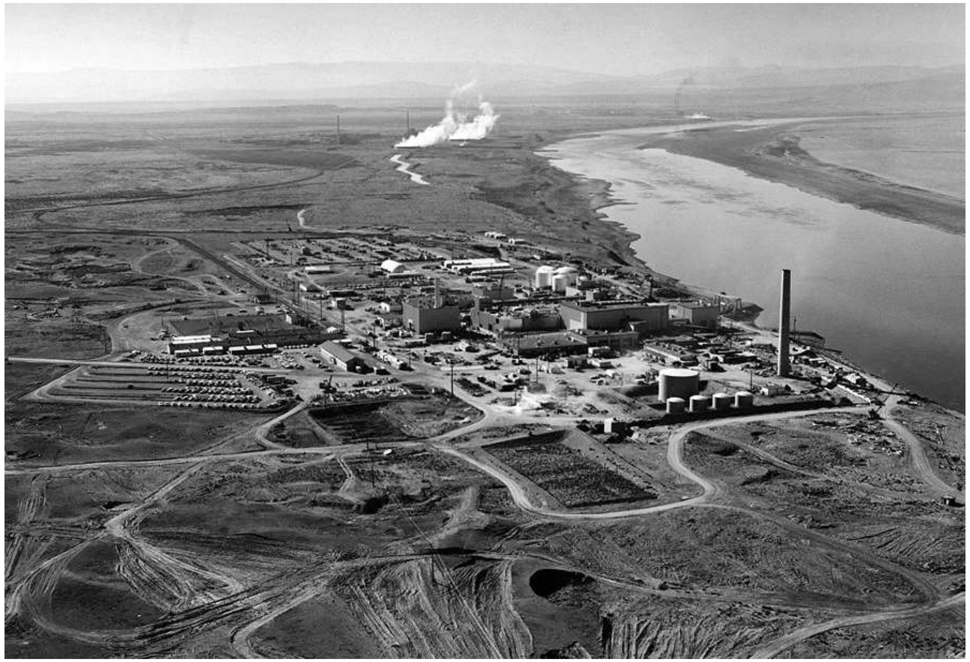
***U.S. Bureau of Reclamation* (ca. 1964)**

***"…The Wahluke Branch Canal diverts from the Potholes Canal six miles south of Othello and passes through the Wahluke Siphon to serve the lands of the Wahluke Slope. This area slopes south from the Saddle Mountains to the Columbia River. It is about forty miles long and varies from five to ten miles wide…"***

***U.S. Bureau of Reclamation* (ca. 1964)**



**Above: caption: "Wahluke Slope Vineyards"**



***“…About 25% of this land, or approximately 42,000 irrigable acres, is in the safety control zone maintained by the Atomic Energy Commission. The Hanford Atomic Works is located across the river from the slope, and the control zone is maintained for safety in case of an accident that would cause radiation danger in the area…”***

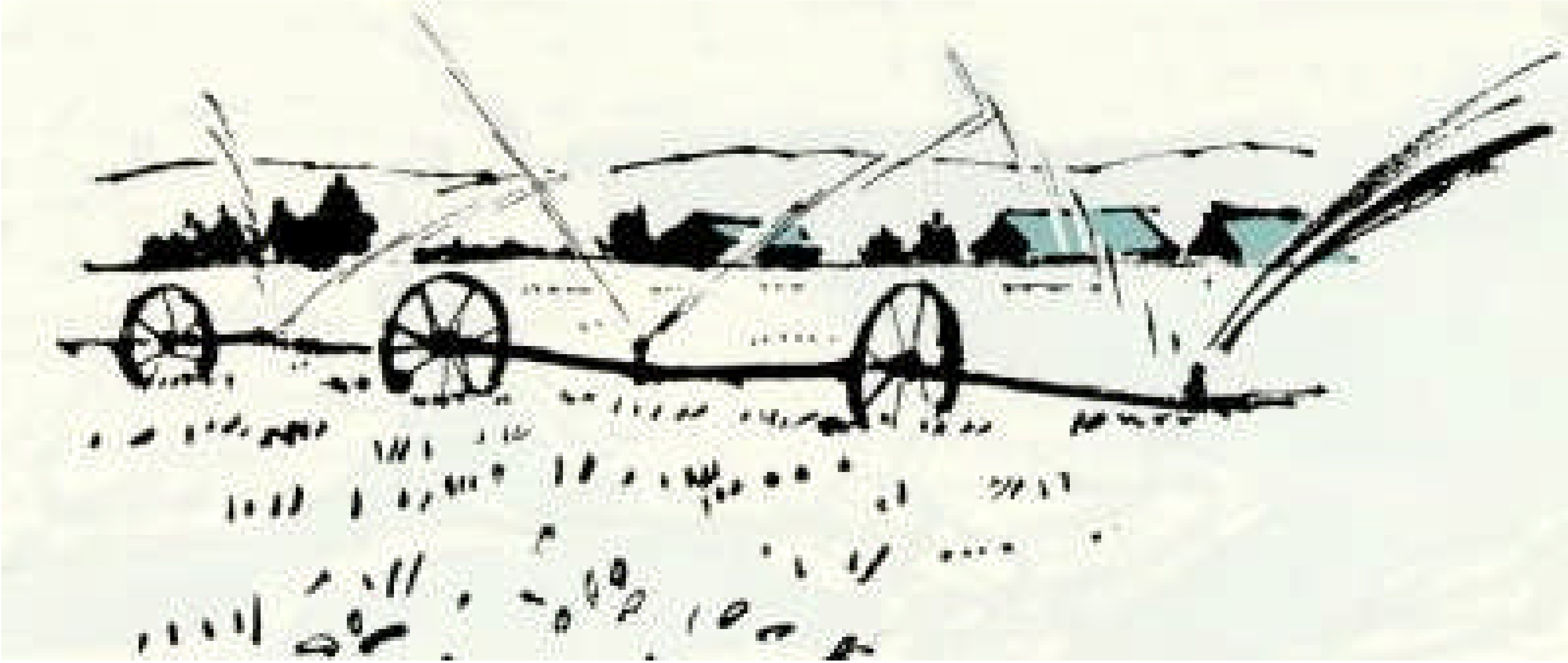
***U.S. Bureau of Reclamation* (ca. 2008)**

**Left: caption: “Nuclear reactors at the Hanford site along the river”**

***"…These are the canals and reservoirs that form the main network of waterways that can now deliver water to almost half of the irrigable acres in the project area. Before the full project can be developed, there is still much work to be done. The East Low Canal, which will furnish water to the south-eastern tip of the project, will have to be extended and the East High Canal, which will roughly parallel the East Low Canal and will serve water to the east of the area now irrigated by the East Low Canal, will have to be constructed. Also, many miles of main and secondary waterways and related irrigation structures will have to be built throughout the project area. The pumping plant at Grand Coulee Dam will require six more pumps to lift the greater water volume into the irrigation system in order to serve the full project. When completed, the total irrigated area of the Columbia Basin Project will be more than a million acres and will serve water to about 10,000 farms."***

***U.S. Bureau of Reclamation* (ca. 1964)**

# Lots of Life



***“Water is life. And Grand Coulee Dam spreads it around. Potatoes, sugar beets, wheat, vegetables…The water makes the brown land green. Without Grand Coulee Dam, you wouldn’t have big towns like Moses Lake, Ephrata, Othello. Lots of people, lots of life.”***

***Grand Coulee Dam* Tour Guide (ca. 2013)**

# Part 7

# Fish ‘gotta Swim

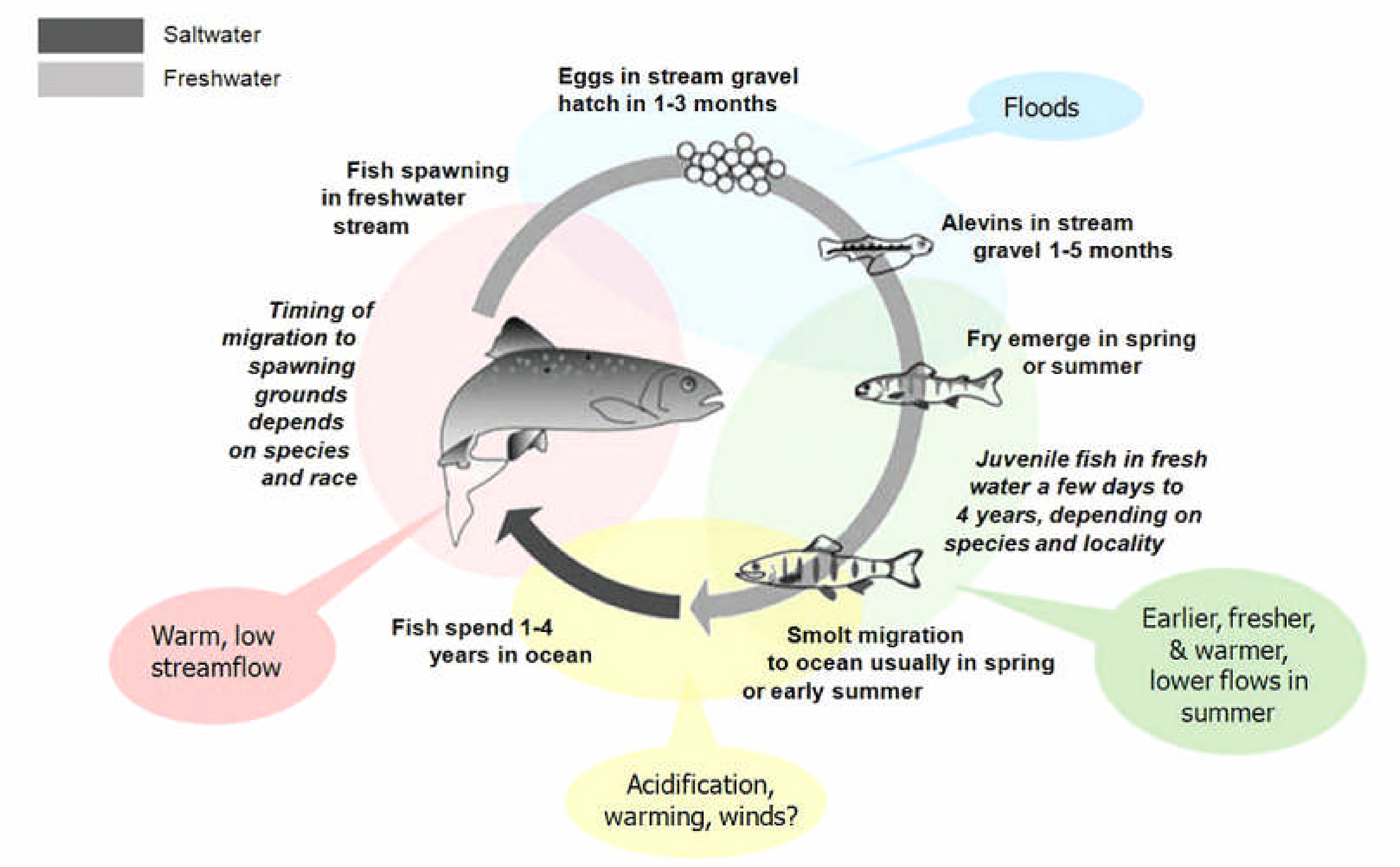
# Coup de Grace

***"…A unique problem has been what to do with the hordes of salmon that normally migrate to the headwaters of the river to spawn. The fish make their way past the Bonneville and Rock Island dams downstream by means of fish ladders and escalators, but Grand Coulee is too gigantic a mass for them to climb. No fish can get by the big dam. The salmon spawn in tributaries of western Washington rivers, beginning with those nearest the sea, after enormous numbers have been caught, and after those native to the lower tributaries have left the river. According to the Bureau of Fisheries estimates, about 4% of the Chinook (King) and 13% of the Blueback (Sockeye) fish that pass the Bonneville dam formerly went above the Coulee dam site, which is 600 miles from the sea. The propagating of fish as a substitute for natural spawning above the Coulee will increase the salmon run…"***

***Popular Mechanics,*** **April 1940**

**RE: because it had no fish ladders, *Grand Coulee Dam* completely blocked fish migration upstream of the dam after 1938. As a result, some twenty-seven thousand salmon and steelhead trout that had been part of the downstream commercial fishery could no longer spawn above the dam.**

**Four species of Pacific salmon: C*hinook, Coho, Sockeye* and *Chum* (as well as steelhead trout), are found in the *Columbia River*. These anadromous fish are born in freshwater, spend three to five years there as fry and juveniles, and then travel to the Pacific Ocean as smolts. There, they feed continuously until they make their way back upstream to mate and die where they were born. The salmon that once spawned above *Grand Coulee Dam* were of very high quality and were highly valued both by American Indians of the region and by commercial fishermen on the lower river. Intensive exploitation of the several species of salmon and of steelhead trout began with the establishment of the salmon canning industry in 1866. Besides salmon and steelhead trout, early fishermen also reported resident rainbow trout, cutthroat trout, and whitefish in the upper Columbia River.**




**<u>Above</u>: caption: "The life cycle of a Pacific salmon takes it from rivers to the ocean and back again. At every step, they face challenges of a changing world, shown in the shaded bubbles."**

**Of all the environmental impacts that caused extinctions of *Columbia River Basin* salmon and steelhead, dams were the most significant, and most significant of all the dams constructed (in terms of the number of known runs that were extinguished) was *Grand Coulee Dam*. The dam wiped out runs that spawned in tributaries that drained into the Columbia from that point (river mile 596) to the headwaters; a distance of 645 river miles. Adding the tributary miles where salmon spawned nearly doubled the distance.**

**<u>Top</u>: caption: "Seining salmon on the Columbia River, 1914"**

**<u>Bottom</u>: caption: "In their natural life cycle, salmon die shortly after spawning"**

***“Frank Bell, United States Commissioner of Fisheries, and a party of engineers were visitors to the dam site today on a tour of inspection of proposed sites for the fish trap and ponds which may be installed on the completion of the dam. Because of the height of the dam, fish would not be able to navigate an ordinary ladder, and Bell proposes to install traps and ponds where the fish will be stripped of eggs, at a site below the present ferry landings…”***

***Spokesman-Review,*** **October 23rd 1934**

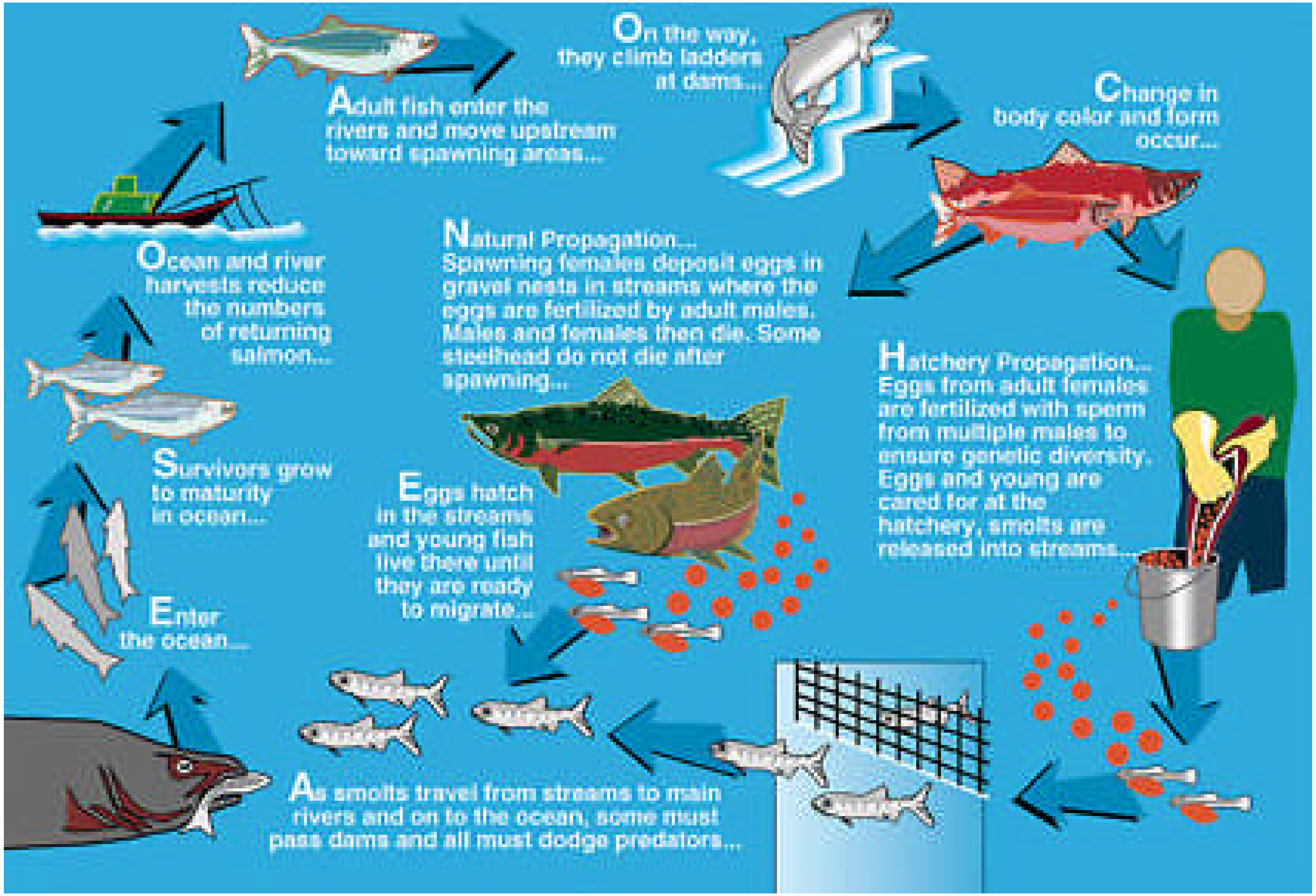
**RE: the U.S. Department of the Interior’s *Bureau of Reclamation*, builder of *Grand Coulee Dam*, and other governmental agencies were aware of the impact the dam would have on salmon and steelhead and took steps to compensate for the losses. However, this was complicated by the fact that the upper Columbia salmon runs had been in decline for years before the dam inflicted the *coup de grace*.**

# A Natural Asset

***"The fishery of the Columbia River has been decreasing slowly since the turn of the century. The constant inroads of civilization have continually worked to the detriment of fish populations. First irrigation diversions, then small hydroelectric dams on several tributaries, then more and larger irrigation diversions, over-fishing by the commercial interests, increasing sport fishing, gaffing of fish on the spawning grounds, and increasing industrial and domestic pollution bringing pressure constantly against the fish populations have slowly decreased their former abundance. So many factors were at work in so many ways, that the public's attention was never riveted for any length of time on the decreasing value of this enormous natural asset…"***

***B.M. Brennan*, Director - *Washington Department of Fisheries***

**RE: in 1938, the Dept. of Fisheries issued a report detailing the decline of *Columbia River* salmon from multiple causes. The report contained recommendations for preserving and relocating the salmon and steelhead runs entitled: *The North Central Washington Upper Columbia River Salmon Conservation Project*. The cost was estimated at $2.6 million to be paid from *Grand Coulee Dam* construction funds.**


Adult fish enter the rivers and move upstream toward spawning areas...
On the way, they climb ladders at dams...
Change in body color and form occur...
Natural Propagation... Spawning females deposit eggs in gravel nests in streams where the eggs are fertilized by adult males. Males and females then die. Some steelhead do not die after spawning...
Hatchery Propagation... Eggs from adult females are fertilized with sperm from multiple males to ensure genetic diversity. Eggs and young are cared for at the hatchery, smolts are released into streams...
Eggs hatch in the streams and young fish live there until they are ready to migrate...
As smolts travel from streams to main rivers and on to the ocean, some must pass dams and all must dodge predators...
Enter the ocean...
Survivors grow to maturity in ocean...
Ocean and river harvests reduce the numbers of returning salmon...

***"…A huge fish hatchery is planned below the dam to raise and distribute young salmon, since the hordes of salmon that normally travel to the upper reaches of the river will be unable to get by the dam…"***

***Popular Mechanics,* April 1938**

**<u>Above</u>: caption: "Salmon at Kettle Falls on the Columbia River, ca. 1933"**

**RE: the U.S.B.R. contracted with the *Washington Department of Fisheries* to assess the salmon runs and recommend a means of preserving them. The plan called for trapping adult fish at *Rock Island Dam* and transporting them in tank trucks to release points in rivers and streams below *Grand Coulee Dam* and, also, eventually to a hatchery that would be built at Leavenworth, on a *Wenatchee River* tributary called *Icicle Creek*. From there, juvenile fish eventually would be transported to release sites throughout north-central Washington.**

***"…In the first burst of enthusiasm that the whole Northwest felt at the culmination of its plans, the fact that the construction of this dam would strike a serious blow to the Columbia River fishery was overlooked by the general public. When the plans for the high dam finally were approved, it became apparent that salmon could not be put over a dam of this height as they had been at the much lower Rock Island and Bonneville dams. The stock of salmon spawning in some 1,100 miles of river and tributaries was to be permanently destroyed. Further study revealed that the alternative methods for preserving these runs would be extremely expensive, if they were possible. There was a feeling that the vast economic gains to be derived from this project should not be endangered by consideration of the fish. It was even felt in some quarters that the fish were not worth the money that it would take to preserve them…"***

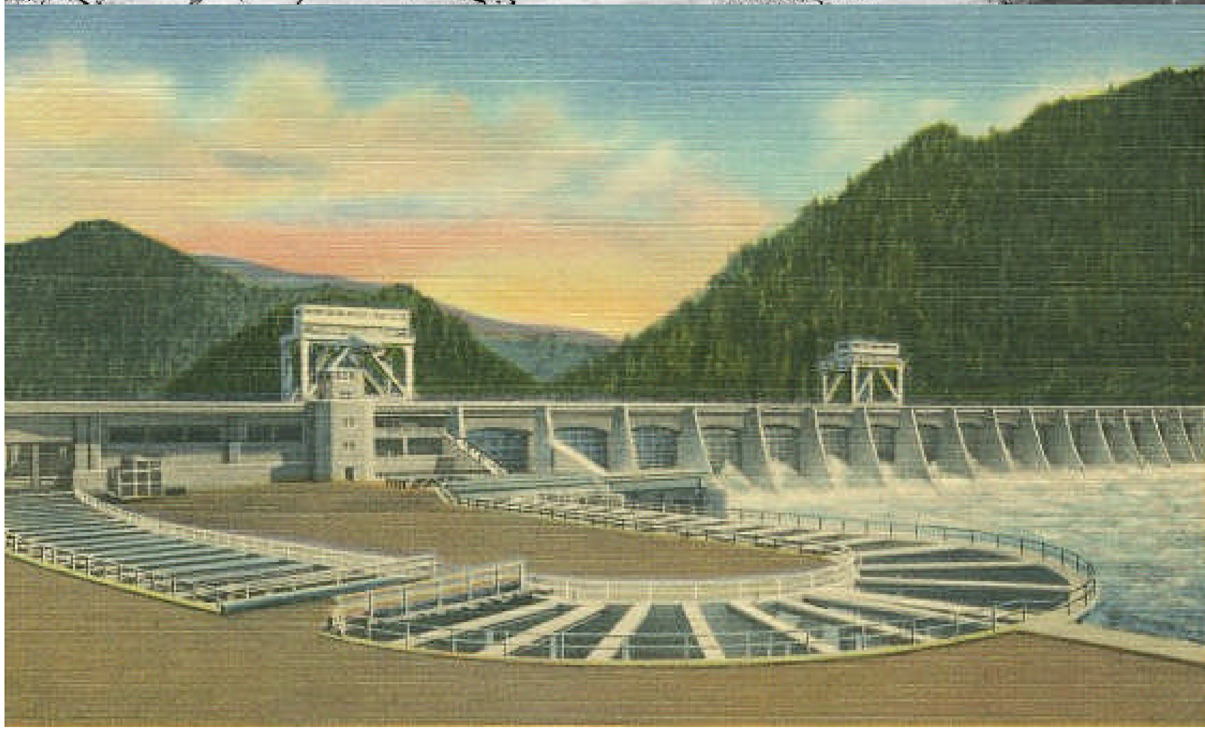
***B.M. Brennan*****, Director –** ***Washington Department of Fisheries***

**Though ambitious, the plan to save the *Columbia River* salmon did not appear attract broad public interest. In the report, Fisheries Director Brennan noted general public indifference regarding the plight of the Columbia's fish and, conversely, public enthusiasm for *Grand Coulee Dam* which, by 1938, had already blocked the river (above).**

***"…The irrigation and power developments in connection with the Grand Coulee project are confiscating valuable prior rights to the river held by the fish and therefore by the commonwealth to which the fish belong. It is only just that these developments pay compensation for these confiscations; that is, the cost for the apparatus necessary to perpetuate these runs should be included as a part of the capital investment of the dam and irrigation system, and the operation of this apparatus should be included in the operating costs of the irrigation and power developments…There had been a systematic progression of improvements up the river with the idea in mind of bringing back every portion of the Columbia River watershed under the jurisdiction of the State of Washington into its former condition of productivity…but Grand Coulee Dam completely upset a large share of these plans and work."***

***B.M. Brennan*, Director - *Washington Department of Fisheries***

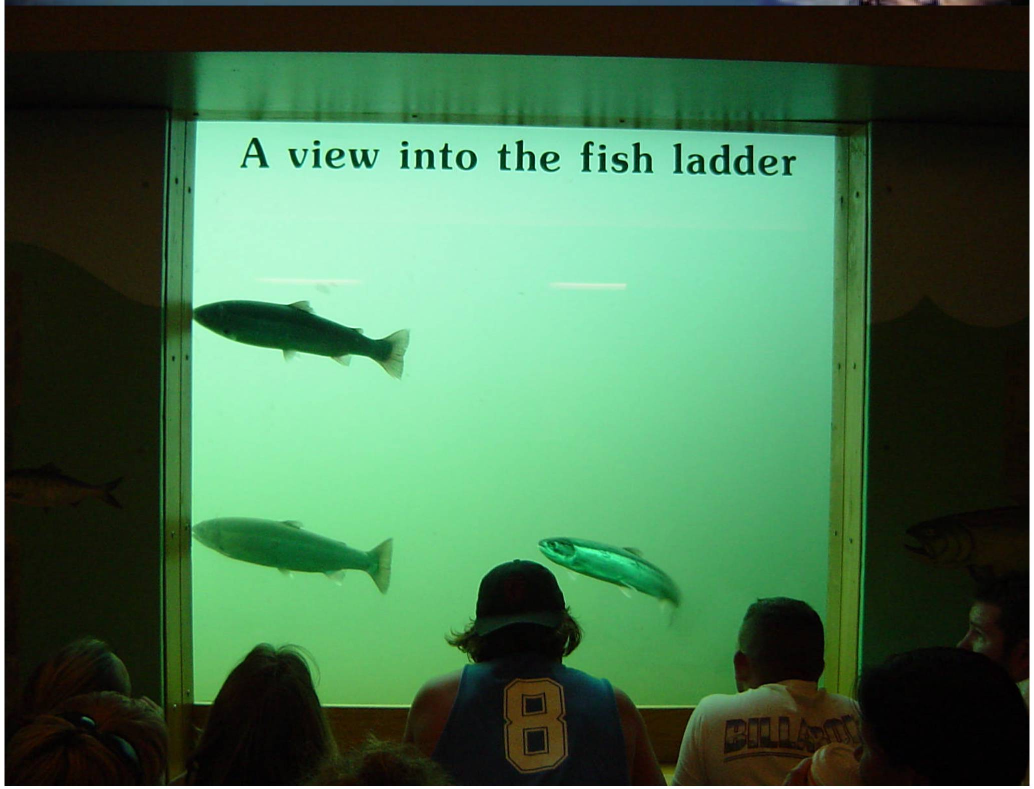
**RE: *Grand Coulee Dam* thwarted the grandiose plans Washington State had in mind to rebuild the *Columbia River* salmon fishery. According to Brennan, the pressure of public opinion forced the construction of fish protective devices four-hundred miles downriver at *Bonneville Dam*. The pressure of public opinion played a part in the decision of the U.S.B.R. to preserve some remnant of the salmon and steelhead that its dam at *Grand Coulee* would obliterate.**

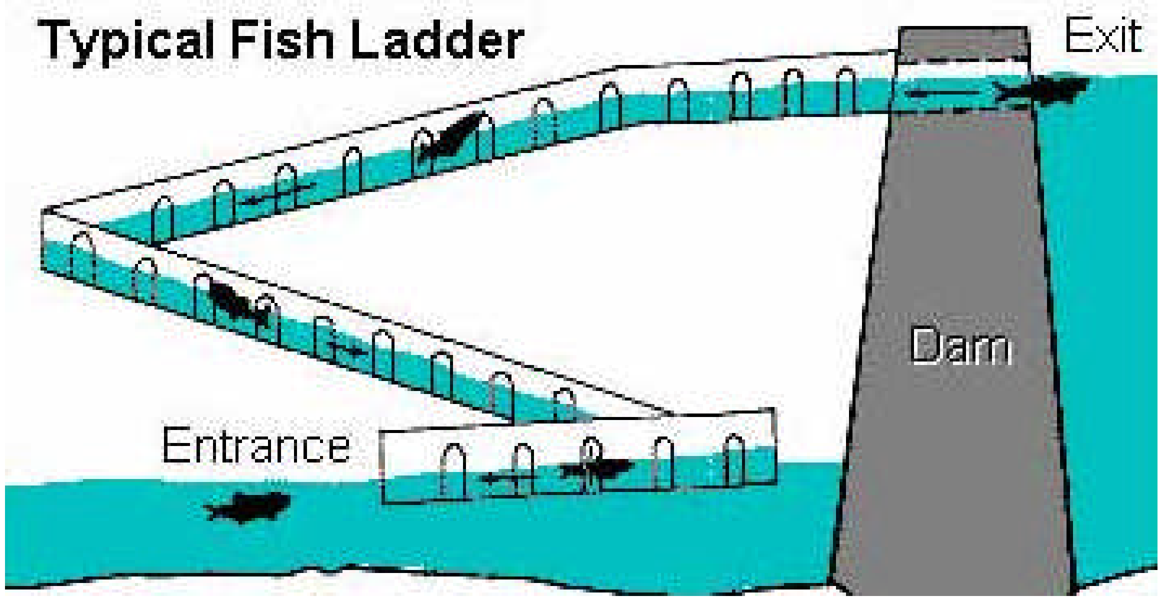



**<u>Top Left</u>: caption: "Construction of the first fish ladder on the Washington side of the Bonneville Dam began in the 1930s."**

**<u>Top Right</u>: caption: "Bonneville Dam Fish Ladder, ca. 1953"**

**<u>Left</u>: caption: "Fish Ladders, North Side Bonneville Dam, Washington-Oregon"**


A view into the fish ladder




**Brennan noted in his report: *“there was left the question of what was the best way to take care of the fish.”* An investigation was needed of fish behavior, migratory patterns, abundance, spawning locations, tributary water flow and temperature., etc. The U.S.B.R. gave the state $25K for a one-year investigation. However, the Dept. of Fisheries did not receive the stipend until the spring migration of juvenile salmon was nearly over. Thus, only six months of field study was possible.**

*“The construction of the low dam, as originally planned, would have presented no insurmountable obstacles to caring for the fish, but the present plan of constructing a dam with 350-feet of head completely alters this picture. For several reasons it is impractical, if not impossible, to put fish over a dam of this height and maintain a run with the project under its ultimate development…It will be a practical impossibility to screen these pump intakes with mesh fine enough to keep the young fish out. Large numbers of young salmon and steelhead would be pumped into the irrigation system to perish…a 400-foot slide down the concrete face of the dam…all or mostly all would be killed.”*

***B.M. Brennan*, Director - *Washington Department of Fisheries***

**Brennan cited five reasons why fish passage at *Grand Coulee Dam* would not work:**

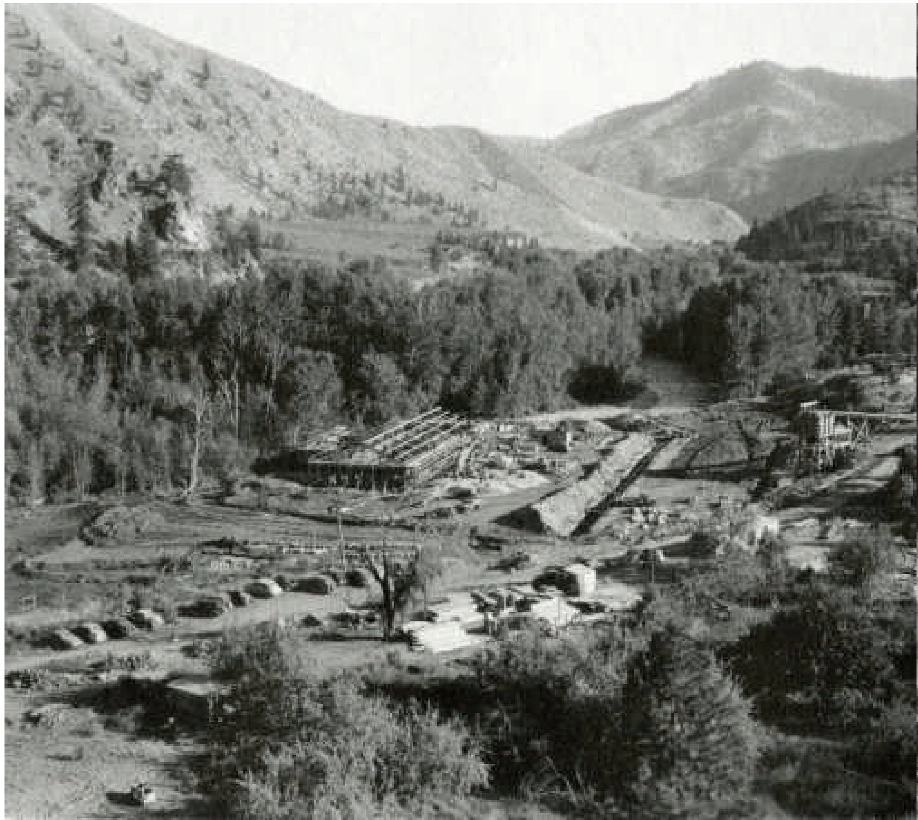
- **First, water immediately below the dam could be expected to fluctuate as much as forty vertical feet within periods of minutes, depending on power production. He reasoned it would be difficult to build a fish ladder that would operate efficiently in such conditions.**
- **Second, because the dam likely would be spilling water in the summer when the fish arrive on their upstream journey to spawn, the fish (which are attracted to agitated water), likely would not be able to find the ladder entrance.**
- **Third, in the spring and early summer when the juvenile fish are heading to the ocean, the giant irrigation pumps would be sucking up to 18K cubic-feet-per-second (cfs) from a spot directly behind the dam; an amount of water Brennan likened to the flow of the *Skagit River* in western Washington.**
- **Fourth, water would not spill over the dam all year round thus at certain times of the year (i.e. the fall) young fish would be stuck behind the dam, where there likely would not be enough food for their survival through the winter. In the spring, when the river is higher, young fish swept over the dam would have little chance of surviving.**
- **Fifth, even if the fish could be carried over the dam in a column of water and not touch the concrete (where they would be battered and de-scaled), they would probably not survive the fall.**

***"Instead of a natural crop of young fish from these four tributaries, it becomes necessary to produce an intensified crop far in excess of that which could be produced naturally. Such a program may offset the damage done by Grand Coulee Dam; ordinary hatching and liberation in the young fry stage cannot."***

***B.M. Brennan*, Director - *Washington Department of Fisheries***

**RE: besides the 350-foot high concrete wall at Grand Coulee Dam, there was another problem to consider. The problem was with the fish themselves; they did not spawn at the dam or anywhere near it. Some went all the way to the head-waters while most spread out into myriad tributaries in Washington and south-eastern British Columbia. Brennan's plan was to collect adult salmon and steel-head at *Rock Island Dam* and haul them by truck to release sites on the *Wen-atchee, Okanogan, Methow and Entiat River/s*. Ultimately, the Leavenworth hatch-ery would produce fish to supplement the runs in these rivers. Brennan knew it would be impossible to naturally produce as many fish in the 677 miles of those four tributaries below Grand Coulee as in the 1,100 miles of tributaries above the dam where most of the captured fish would have spawned. Thus, artificial (hatch-ery) production would supplement natural production. These fish would be differ-ent from other hatchery fish. They would be bigger - closer to the size they would have been had they been hatched above Grand Coulee and migrated to the sea naturally.**

**The trapping and hauling began in May 1939. Fish were trapped at *Rock Island Dam*, transferred to a tank truck and then transported to releases sites; two in the Wenatchee drainage (*Icicle Creek* and a spot on the main river called *Monitor*) and one each on the *Methow, Entiat and Okanogan River/s*. In the process, the biologists learned a great deal about salmon – they were hearty fish able to withstand significant stress during transport. In March 1940, the trapping and hauling began for the second year. Some of the fish were taken to the completed Leavenworth hatchery. On August 6th 1941, the first salmon reared at the hatchery, 50K fingerling *Chinook*, were trucked to the Entiat River and released. Later, other hatchery progeny were released into the Methow, Okanagon and Wenatchee river/s and by 1942, the adult progeny of fish that had been trapped and transported up to three years earlier began returning to spawn. The U.S.B.R. claimed victory in 1943 (the same year no salmon or steelhead showed up at the base of *Grand Coulee Dam* attempting to continue upriver) and sought to turn over the Leavenworth hatchery and its related facilities to the *U.S. Fish and Wildlife Service*. By 1949, ownership of the hatchery had been transferred to the U.S. Fish and Wildlife Service.**



**<u>Top Left</u>: caption: "Construction in progress on the Entiat hatchery on the Entiat River. 9/19/1940."**
**<u>Top Right</u>: caption: "Hatchery building and rearing pond area at Entiat Station for migratory fish control. 08/07/1941."**
**<u>Left</u>: caption: "Blueback salmon fry in rearing pond at the Entiat station. 08/13/1941."**

***"…Six trucks of radical design have been finished recently to transport salmon from the lower river to still water above Grand Coulee dam during the spawning season…"***

***Popular Mechanics,* September 1939**

**Above: caption: "Fish truck for transportation of fish trapped at Rock Island dam to fish hatchery"**

***"…Last year fish were trapped at a lower dam and were transported in aerated and cooled tank trucks to tributary rivers below Grand Coulee where they were confined to their new spawning territories by weirs placed in the streams. The 1940 run is being transported to a great fish hatchery and the new crop of fingerlings is to be planted in rivers below the dam, after which it is expected that the fish will return to spawn in the streams in which they were planted…"***

***Popular Mechanics,* April 1940**

**<u>Left T&B</u>: the Leavenworth, WA Fish Hatchery**

***"Had Grand Coulee construction not been started when it was, the dam never would have been built for two reasons: one, because the fish people were just coming to life with the realization that hundreds of miles of fish spawning streams would be cut off from the great annual Columbia River salmon migrations and, two, because the private power companies had started construction of a low dam at Kettle Falls and would have proceeded with this. Either one would have stopped Grand Coulee."***

***Kirby Billingsley*** **(1962)**

**RE: in 1909, the federal government enacted legislation allowing the states to protect the watersheds of navigable streams. Along with this, the creation of the *Federal Power Commission* (in 1920) enabled construction of dams on both the *Colorado* and *Columbia River/s*. In the 1930s, the federal government and the project's backers attempted to preserve the salmon, but were forced to make a choice in favor of the dam and reclamation. At the time, the benefits of reclamation outweighed any environmental concerns.**

***"…The great question of the seventies is, shall we surrender our surroundings, or shall we make our peace with Nature and begin to make the reparations for the damage we have done to our air, our land, our water?...Clean air, clean water, open spaces - these would once again be the birthright of every American…"***

***Richard M. Nixon*, POTUS**

**RE: excerpt from his 1970 *State of the Union* speech. As is often the case regarding endangered or threatened species of a particular region, a specie will come to the fore, often because of its social symbolism. In the 1970s, many environmentalists joined forces with Native Americans to preserve the salmon as a symbol of Pacific Northwest. As such, the salmon have been the focus of many river debates in the region. Fish hatcheries, such as the one at Leavenworth, WA, are recognized as giving the salmon the best chance for survival and restoration of their natural river habitat.**


**Problems with the relocation of the fish runs surfaced in the 1940s, including high mortality of adult salmon in the hatcheries and natural holding areas. More recently, it has been recognized that hatchery fish damage wild fish productivity through competition for limited food and habitat, transmission of disease, and loss of genetic integrity through interbreeding. They also perform poorly in the wild. Hatcheries, it is now widely believed, are a poor substitute for natural river conditions. However, In the 1950s and '60s, hatcheries were still seen as an excellent tool for enhancing sport fisheries. Some of the problems at the hatcheries improved in the 1960s as scientists began to understand the nutritional needs of young fish better. Production of resident trout was undertaken at the three federal hatcheries and, beginning in 1965, thousands of pounds of resident trout were stocked annually on the *Colville Reservation* as partial mitigation for the tribes' fish losses (these hatcheries switched back to salmon production in 1974).**

***“The architects of the new Columbia river have been nearly constant in their protestations of concern for salmon, but they have quite consciously made a choice against the conditions that produce salmon. They have wanted the river and its watershed to say electricity, lumber, cattle, and fruit and together these have translated into carp, shad, and squawfish instead of salmon. If ever a death could be unintended and overdetermined, it is the death of the wild runs of the Columbia River salmon.”***

***Richard White*, Author**

**RE: excerpt from *Organic Machine* (1995). During the 1940s, fishing at *Lake Roosevelt* was extremely poor. The *Washington Department of Fish and Wildlife* tried to establish *Kokanee* salmon (landlocked *Sockeye* salmon) by stocking the lake (between 1942 and 1945) with almost 7.5 million Kokanee and rainbow fry. This effort was a failure, although some Kokanee did migrate into the lake in the late 1940s from tributary streams and from *Arrow Lakes* in British Columbia. Many of these were injured or killed as they went over the dam. As at other new reservoirs, the fish populations grew quickly after the reservoir was filled but then slowed down after a couple of years when nutrients were exhausted. A new reservoir generally has far fewer fish species than its predecessor river did. The most abundant species in the newly formed Lake Roosevelt were those considered “scrap fish” such as squawfish, carp and suckers.**

**Sport fishing on *Lake Roosevelt* (above) began to improve noticeably in the early 1960s because of an increased walleye population. The original source of Lake Roosevelt’s walleye is not known for certain. One plausible theory is that a Minnesota man planted them in the late 1940s. They tend to do well in the lake because they spawn at times of stable or even rising water levels. The general air of pessimism about Lake Roosevelt’s fishing potential began to shift in the mid-1960s as walleye began to attract fishermen. Local newspapers and the *National Park Service* promoted the walleye to good effect. It took native Washington fishermen a while to get used to walleye, but by 1974 locals were heading for the lake after work in search of walleye (so much so, that the state had to impose a limit).**

**As the fishery improved in the 1960s, the state and the tribes became more interested in the lake's potential as a sport fishery. In 1972 and 1975, the *Washington Department of Fish and Wildlife* planted approximately 1.8 million C*hinook* sal-mon in *Lake Roosevelt*, but the success of these and later plantings was negligible. These plantings were reportedly done at the request of the *Colville Confederated Tribes* (CCT). The *Spokane Tribe of Indians* (STI) requested and received a plant of about 300K walleye in the *Spokane Arm* above the *Little Falls Dam* in 1976. Non-game fish such as squawfish, carp, sucker, shiner and chub continued to be well adapted to conditions in *Lake Roosevelt* that included drawdowns, low food availability and siltation resulting from landslides. By the early 1980s, walleye comprised over 90% of the catch on Lake Roosevelt, with rainbow trout and yellow perch about 3% each.**

# Ceremony of Tears

**In mid-June 1940, American Indians from around the Pacific Northwest gathered at the site of St. Paul's mission above Kettle Falls for a final three-day "Ceremony of Tears" to mourn the loss of the ancestral fishing grounds. A crowd estimated at eight to ten-thousand people attended the gathering. Chief *Peter Joseph* of the *Kalispel* tribe commented that the government should reimburse the tribes for the loss of their fishing grounds. U.S. Senator *Clarence C. Dill* of Washington State pledged his support for a measure to accomplish this.**

***"This is where people met, got married, had babies, settled disputes"***

***Patti Stone*, member of the *Colville Confederated Tribes* (ca. 2002)**

**RE: on June 14th 1940, Native Americans from throughout the Northwest gather at *Kettle Falls* for a three-day "Ceremony of Tears" (above L&R) to mourn the loss of their ancestral fishing grounds, soon to be flooded by *Grand Coulee Dam.* Kettle Falls was second only to *Celilo Falls* (which was inundated by the *Dalles Dam* in 1957) as a fishing and gathering place for Native Americans along the *Columbia River*. Salish speakers called it "Shonitkwu," meaning roaring or noisy waters. European settlers in the late nineteenth century named it "Kettle Falls," after the great depressions (a/k/a "kettles") carved by the pounding of water on the huge rocks on the edges of the river. For centuries, Indians had come together at the falls to fish, trade and/or socialize.**

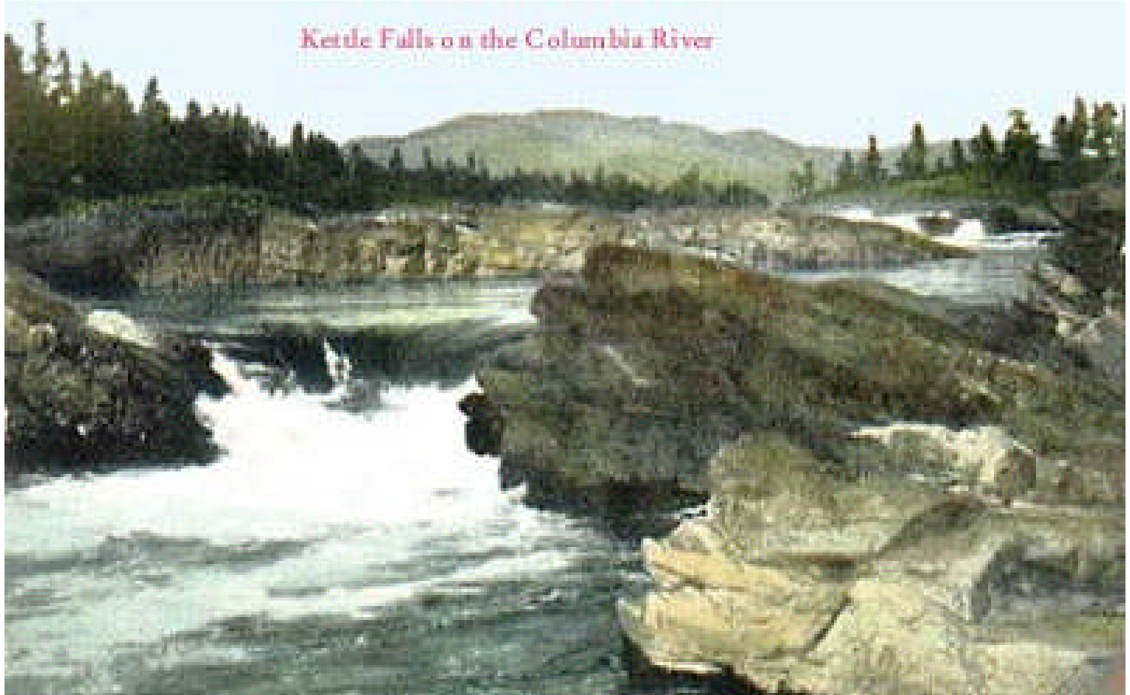
**Huge numbers of fish began arriving in late June, continuing through October, en-route to their spawning grounds upriver. Fishing here was dangerous, because of the rushing water and slippery rocks, and required a high degree of organization. A salmon chief, (a/k/a "Chief of the Waters") opened the season by spearing the first fish. He also supervised the building of scaffolds that were cantilevered over the water (above & left), and the placement of large J-shaped basket traps alongside the rocks. At the end of the day, he divided the catch among the families. Fishermen speared and netted up to 3K fish in a single day.**

***"…The Indians have fished here for thousands of years. They love this spot above all others on their reservation because it is a source both of food and beauty. We should see to it that the electricity which the great dam at Grand Coulee produces shall be delivered to all the people without profit, so that the Indians of future generations, as well as the white men, will find the change made here a great benefit to the people"***

***Homer Bone*, U.S. Senator (Washington State) June 14th 1940**

**RE: with *Grand Coulee Dam* nearing completion in June 1940, the *U.S. Department of Interior* ordered the closure of the *Kettle Falls* fishery. On June 14th 1940, members of tribes from the *Colville Reservation* in Eastern Washington, *Tulalips* from Western Washington, *Blackfoot* from Montana, and *Nez Perce, Yakimas, Flatheads, Coeur d'Alenes* gathered at the site to mark the end of a way of life that had developed over thousands of years. Six chiefs from the Colville Reservation addressed the crowd in their native language with the assistance of a loud speaker system. They mourned not only the loss of the fishery but the destruction of thousands of acres of food-producing bottomlands, source of the roots and berries that were an important part of their traditional diet. Congress formally authorized the acquisition and clearing of Indian lands along the river on June 29th 1940. About 2K members of the *Colville Confederated Tribes* and about 250 members of the *Spokane Tribe* had been forced to leave their homes weeks earlier. Within a year, Kettle Falls would be 90-feet below the surface of *Lake Roosevelt*.**

**<u>Top Left</u>: caption: “Kettle Falls near Colville, 1910s”**
**<u>Top Right</u>: caption: “One of the Kettles at Kettle Falls (ca. 1933)”**
**<u>Left</u>: caption: “Former site of Kettle Falls, now Lake Roosevelt (ca. 2005)”**




***"When fish were running, Kettle Falls was a place of excitement and festivity, drawing more than a thousand people annually. The camps bustled with activity - a rich assortment of families sharing the work of fishing by day and the pleasure of singing, dancing and gambling at night."***

***William Layman,* Author**

**<u>Top</u>: caption: "Kettle Falls on the Columbia River"**

**<u>Bottom</u>: mural depicting Kettle Falls (at the *Kettle Falls Historical Center*)**

***"We had a beautiful way of life. We were rich. The dam made us poor. The way they treated us, they tried to make us less than human…We Indians trust the day is past when the nation will approve of what the government did when they built the dams, which back in those days caused one of our people to say, 'The promises made by the government were written in sand and then covered with water, like everything else.'"***

***Lucy Covington*, member of the *Colville Confederated Tribes* (1977)**

**RE: a specific concern of local Native American tribes in subsequent years has been the high cost of electricity to tribal members living on the reservation. The rates are much higher on the *Colville Reservation* than in the town of Coulee Dam, for example, even though the *Bonneville Power Authority* (BPA) had assured the tribes that electricity would be extremely cheap as a result of the dam. The BPA response was that they sell power at the same rate to electrical utilities; the difference in users' costs is due to the varying cost of distribution, so rural residents face higher bills than people living in towns.**

# Part 8

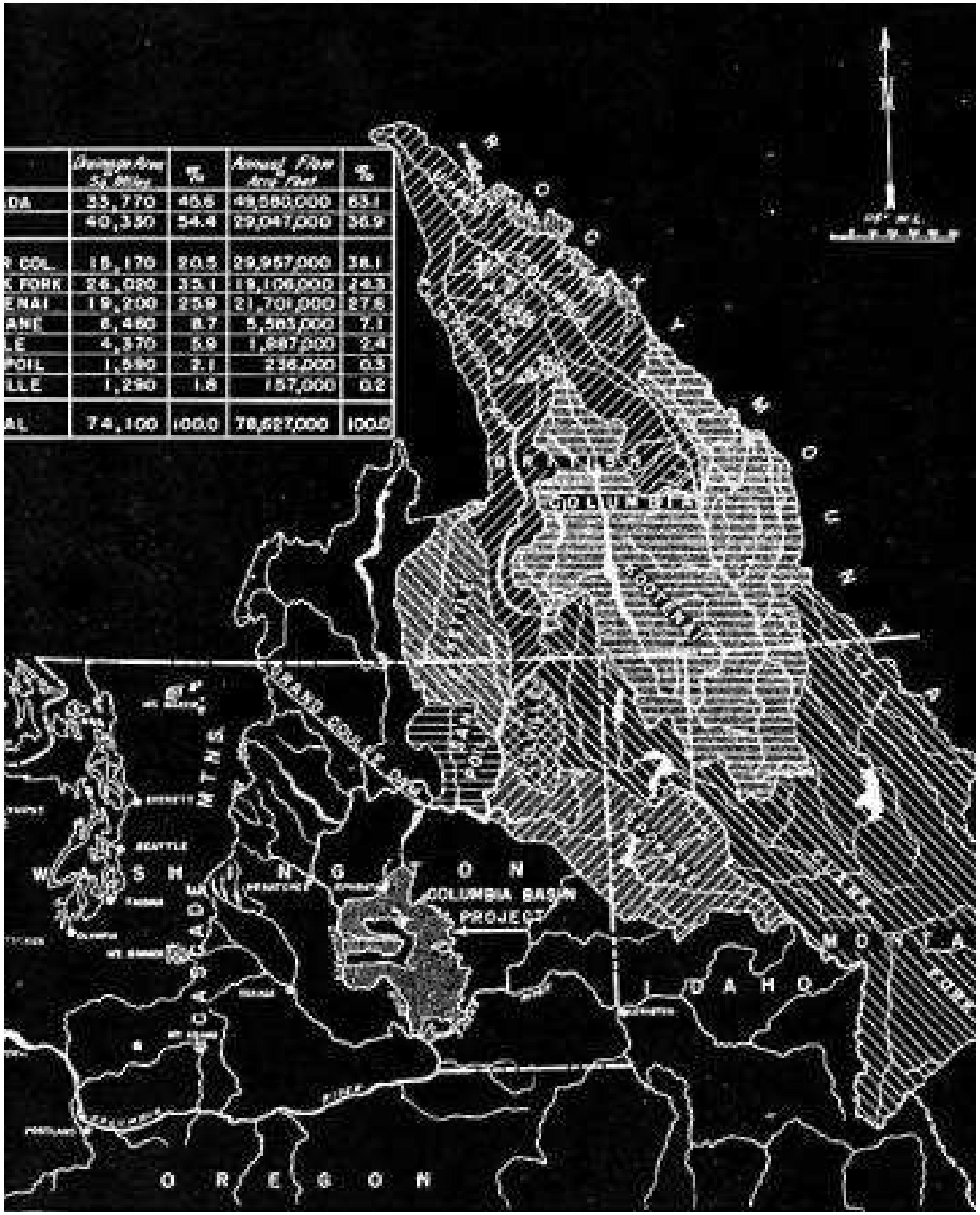
# To Harness a River

# Four Great Projects


***"…President Hoover, before he took the oath of office as President of the United States, said there were four great projects which he hoped could be started in his first term. One was the Mississippi Flood Relief, the second was the Boulder Dam, the third was the Columbia Basin and the fourth was the St. Lawrence River development…"***

***Rufus Woods,*** **Newspaper Publisher/Editor (ca. 1929)**

***“Just as sure as time passes the Columbia Basin Project will be built…There is water in sufficient quantity, demonstrating that you have the first requisite for irrigation of the proposed great Columbia Basin Project”***
***Hubert Work,*** **former U.S. Secretary of the Interior**




**<u>Left</u>: caption: "The Columbia River's Remarkable Watershed – One of the most remarkable things about the Columbia is that most of the water comes down in the summer when it is most needed for irrigation and for power irrigation. There is fifteen times as much water as will ever be needed to take care of the arid lands in the State of Washington. The annual flow is 78,627,000 acre-feet. The greatest amount that will ever be needed for irrigation is 5,000,000 acre-feet and it is possible that one-half that amount is all that will be necessary." (ca. 1933)**

***"…In the West, the outstanding plan for expanding agri-culture through irrigation is the Columbia Basin Irrigation Project in the State of Washington, which, after Congress adapts it as a federal project, will require from 25 to 30 years to construct and settle with farmers - by which time the United States will be struggling with the problem of feeding at least 157,000,000 people. Foodstuffs in large quantities can-not begin to go out from the Columbia Basin inside of 30 years. By that time 731,000,000 more people will have been added to the world as a whole, and other countries will be begging the United States to send them shiploads of such foodstuffs as America can spare…"***

***Food and Population*** **(ca. 1930)**

***"…The Columbia Basin Irrigation Project embraces 1,883,000 acres of arable desert land in South Central Washington. Less than one-third of the wasting water of the upper Columbia River will irrigate it. Thirty years will be required to construct and people it with farmers. When completed it will provide a market annually for $180,000,000 of Eastern manufacturers. The project has been declared feasible by four sets of engineers, and has been endorsed by numerous conservative organizations, among them the Investment Bankers' Association of America."***

***Food and Population*** **(ca. 1930)**


COLUMBIA BASIN PROJECT.
DEVELOPING 2,000,000 H.P. FOR SALE - IRRIGATING 2,000,000 ACRES IN UNITS
GRAND COULEE DAM AND POWER PLANT
GRAND COULEE RESERVOIR
MAIN CANAL
WENATCHEE
SPOKANE
COLUMBIA BASIN LANDS
GRAND COULEE DAM
FORE BAY
YAKIMA
PASCO

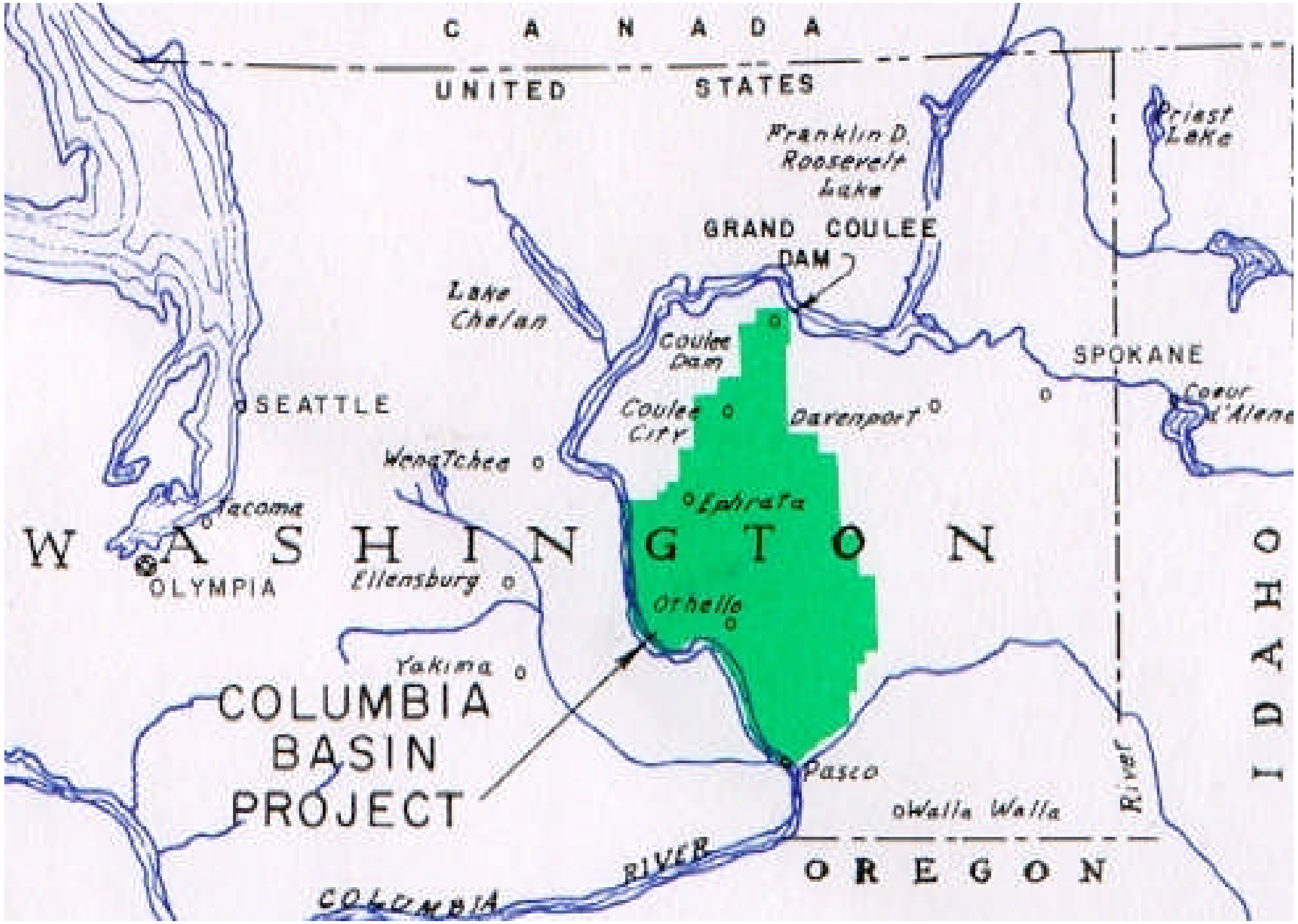
***"The project fits ideally into President Hoover's plan. What a pity it could not have been ready for the first of the year to give work to some 50,000 people! When it is started in a big way and the necessary financing is arranged, it will be a tremendous employer of labor. It would be much better to spend federal money on a project like the reclamation of the Columbia Basin than on roads and public buildings. Those involve expenditures and no adequate return. The Columbia Basin project will pay large and increasing dividends…We must look ahead. We are making enormous strides every decade with occasional temporary set-backs as at present. But things change quickly in this country and in two or three years, we will need what the Columbia Basin can produce. This is not a static country like those of Europe. We must look to the future."***

***B.C. Forbes*, Publisher – *Forbes* magazine**

**RE: on July 19th 1930, Forbes made a personal inspection of land and water contained in the *Columbia Basin Irrigation Project***

***"The Columbia River in Washington and the large body of semiarid but exceedingly fertile lands of the Big Bend country adjacent thereto - together constitute the Columbia Basin Project. Rising in the Canadian Rockies and crossing the international border into the State of Washington near its northeast corner, the Columbia River, the second largest in the country in point of run-off, then flows for 750 miles through the State and along its southern border to the Pacific Ocean. On its way it falls 1,300-feet and earns for itself a distinction of being by far the largest river in the United States in point of potential power, susceptible of economic development…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**



C A N A D A
UNITED STATES
Franklin D. Roosevelt Lake
Priest Lake
GRAND COULEE DAM
Lake Chelan
Coulee Dam
SPOKANE
SEATTLE
Coulee City
Davenport
Coeur d'Alene
Wenatchee
Tacoma
Ephrata
W A S H I N G T O N
OLYMPIA
Ellensburg
Othello
I D A H O
Yakima
COLUMBIA BASIN PROJECT
Pasco
Walla Walla
River
COLUMBIA RIVER
O R E G O N

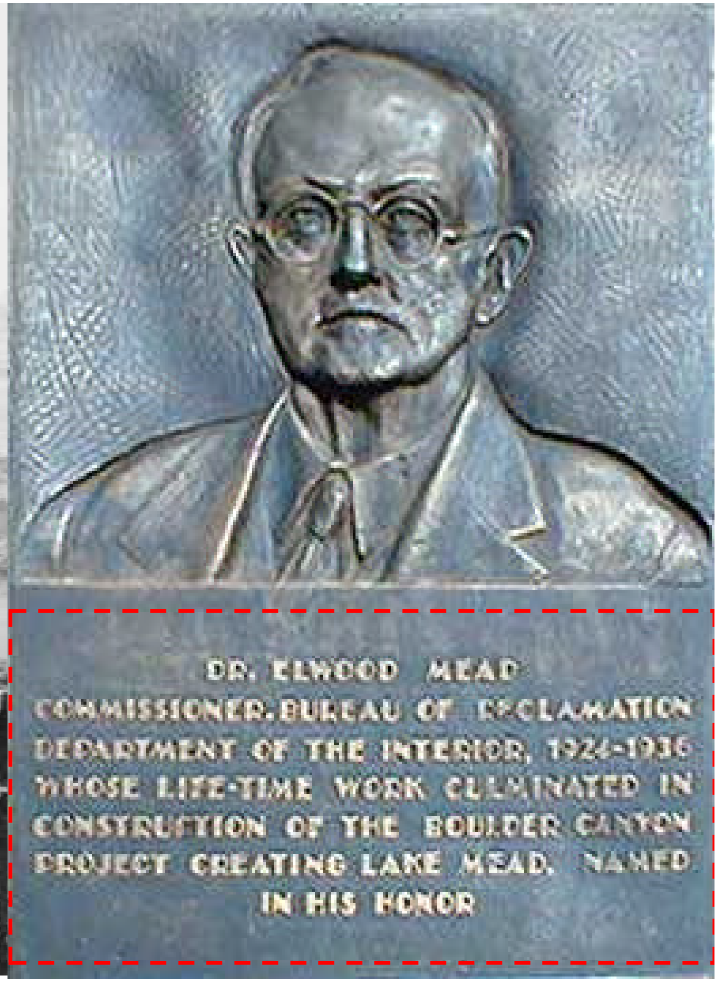
***"…Adjacent to this river in central Washington is a tract of 1,200,000 acres of what has been designated many times as the finest body of undeveloped land in the world. Unproductive and of little value in its present arid state, this land when irrigated will produce a great variety of agricultural, horticultural, livestock, dairy, and poultry products in abundance and it will provide homes, employment, and business for a vast agrarian and urban population. The combination of these great resources - water, power, and land - for the creation of the Columbia Basin Project has been the goal of the people of Washington for thirty years and more…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

***“We’ve got to save these towns, these homes, these people. The Columbia Basin Project is not only feasible, but it can be done more cheaply now than it could five years ago. Industries, factories, commerce are growing in every way here in the Northwest and that means an immense increase in population in the far West. You will provide the market for everything you can possibly raise.”***

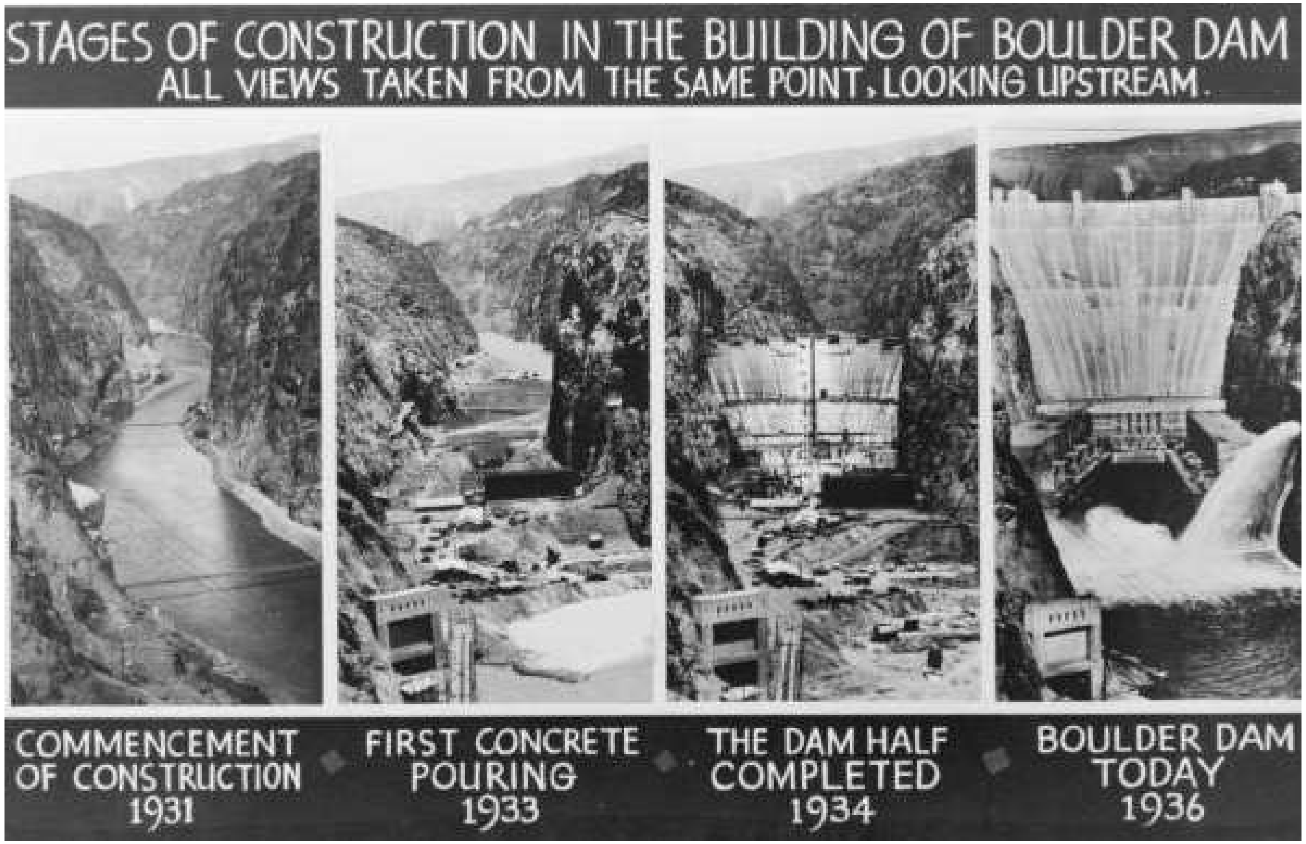
***Dr. Elwood Mead,*** **U.S.B.R. Commissioner**

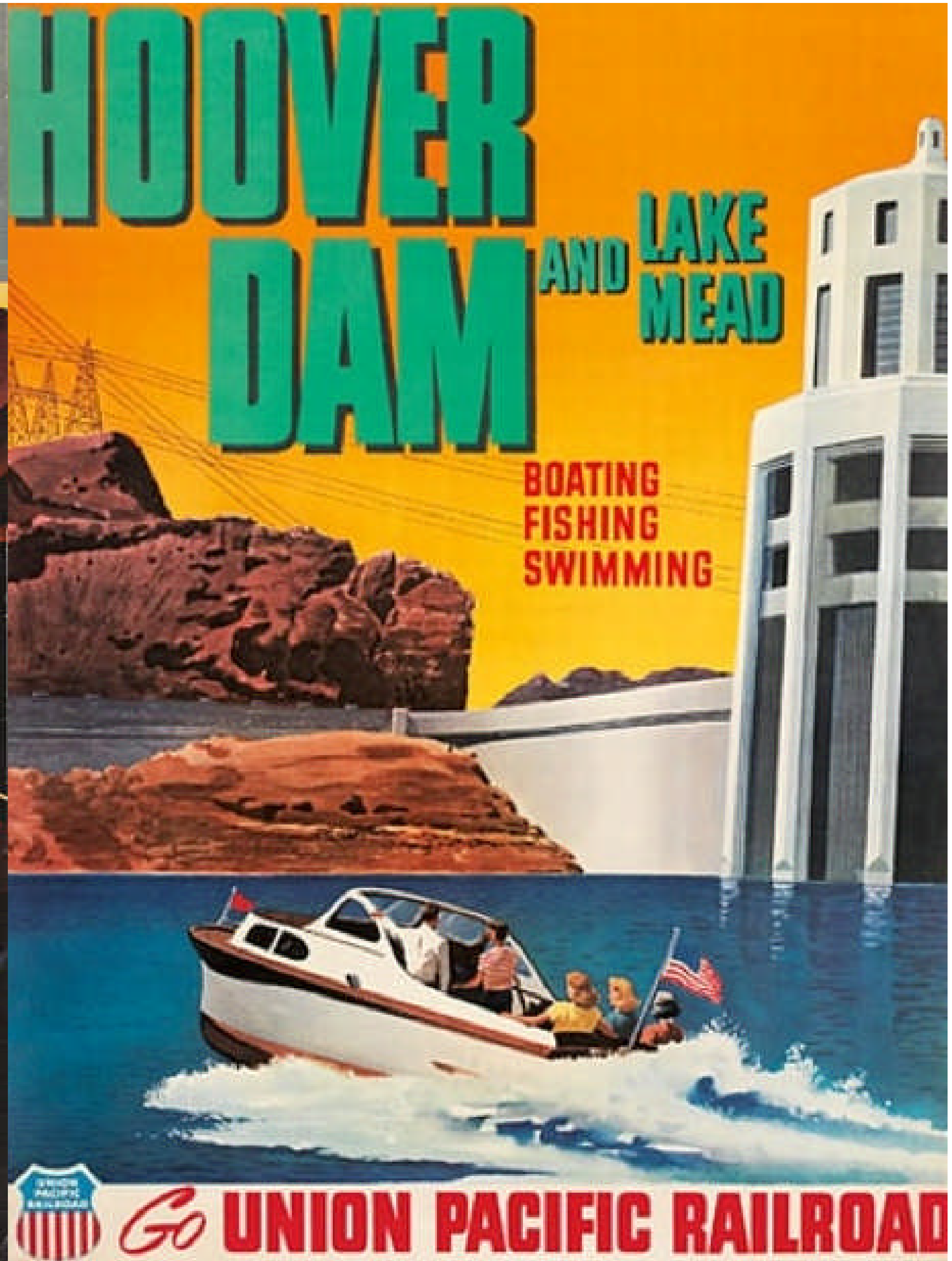
**RE: from August 1-4, 1930, Mead (left), accompanied by the U.S.B.R. Chief Engineer *R.F. Walter* and others of the U.S.B.R. staff made an inspection of the *Columbia Basin Irrigation Project. Lake Mead* - the artificial lake (reservoir) created by *Hoover Dam,* was named in his honor.**





**Dr. Elwood Mead**
**Commissioner, Bureau of Reclamation**
**Department of the Interior, 1924-1936**
**Whose Lifetime Work Culminated in**
**Construction of the Boulder Canyon**
**Project Creating Lake Mead, Named**
**In His Honor**


STAGES OF CONSTRUCTION IN THE BUILDING OF BOULDER DAM
ALL VIEWS TAKEN FROM THE SAME POINT, LOOKING UPSTREAM.
COMMENCEMENT OF CONSTRUCTION 1931
FIRST CONCRETE POURING 1933
THE DAM HALF COMPLETED 1934
BOULDER DAM TODAY 1936


**RE: in 1947, President Truman ended the controversy over the dam's name, officially naming it "Hoover Dam"**

***“…The principle features of this plan include the Grand Coulee Dam for raising the water surface of the Columbia River 355-feet, thereby creating a usable storage capacity of more than 5,000,000 acre-feet; the power plant for the generation of 1,890,000 kilowatts of electrical energy for irr-igation pumping and commercial use; the pumping plant for raising 16,000 cubic-feet of water per second a vertical distance of 280-feet into the Grand Coulee; the Grand Coulee Reservoir, with a usable capacity of 340,000 acre-feet, to regulate the flow of irrigation water to the project lands and permit the use of secondary power for pumping purposes; and the distribution system consisting of the East and West Main Canals, secondary pumping stations and laterals for conveying water to 1,200,000 acres of land…”***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

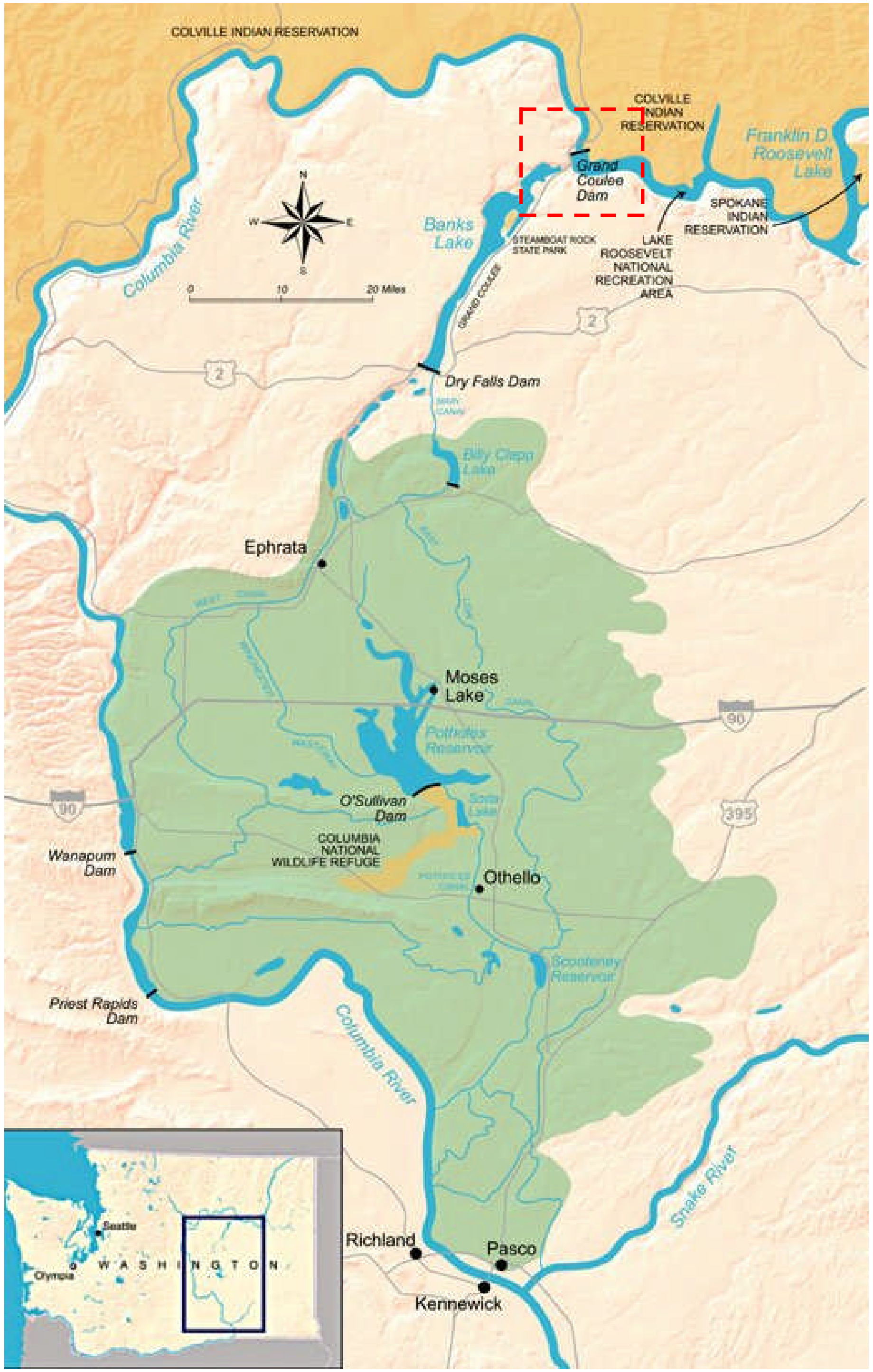
***"…we know that one second foot of water falling a little over eight feet will produce one horsepower. And we know that one second foot going over a dam 320-feet high would produce 40 horse-power…and we know that a dam 300 or 350-feet high will produce two million primary horsepower besides an unlimited amount of secondary power during the first five months of the irrigation season…"***

***Rufus Woods*** **(ca. 1929)**

**RE: Woods (left), publisher/editor of *The Wenatchee Daily World* newspaper, was instrumental in promoting and securing legislation for the *Columbia Basin Project***

***"…The comprehensive long-range plan for the development of the Columbia River as worked out by the Army engineers contemplated the construction of ten dams to utilize 92% of the available fall in the river between the International Boundary and the Pacific Ocean. By far the largest and most important of these is the Grand Coulee Dam. It is largest in that it utilizes 355-feet or 27% of the total available fall and includes a hydroelectric installation of 1,890,000 kilowatts capacity, which is larger than any existing development in the world. It is most important in that it creates a storage reservoir exceeding 5,000,000 acre-feet of usable capacity at the highest possible point on the river in the United States and affords the most feasible and practical means of diverting the waters of the Columbia River out of its canyon and on to any considerable area of arid land…"***

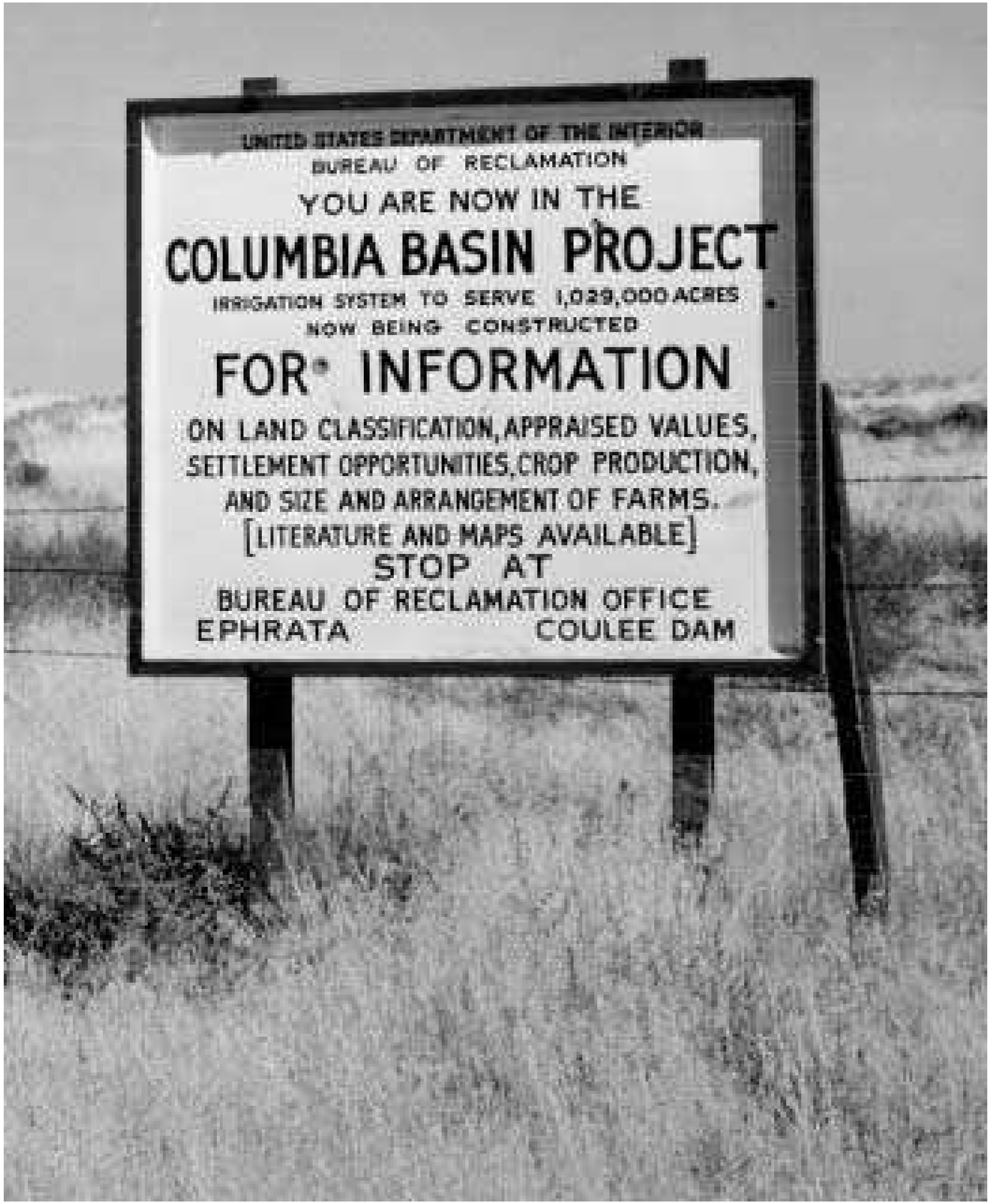
**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**




***"…Following the clue given by the forces of Nature, it is now proposed to raise the water level of the river 355-feet by the construction of the Grand Coulee Dam and then to pump 16,000 second-feet, or one-seventh the average flow of the river, 280-feet higher and Grand Coulee will be used in regulating and supplying the life-giving waters of the river to the lands of the Columbia Basin Project…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

**<u>Left</u>: caption: "Map of the Columbia Basin Project. Green denotes land irrigated by the project. Grand Coulee Dam near top-right"**




***"…Settlement of the Columbia basin area will not start before 1942 and authorities think that it will take from twenty-five to forty years to irrigate and settle the region. Farmland speculation is being prevented. Crops that are non-competitive with those of rainfall areas are to be selected…"***

***Popular Mechanics,*** **April 1938**

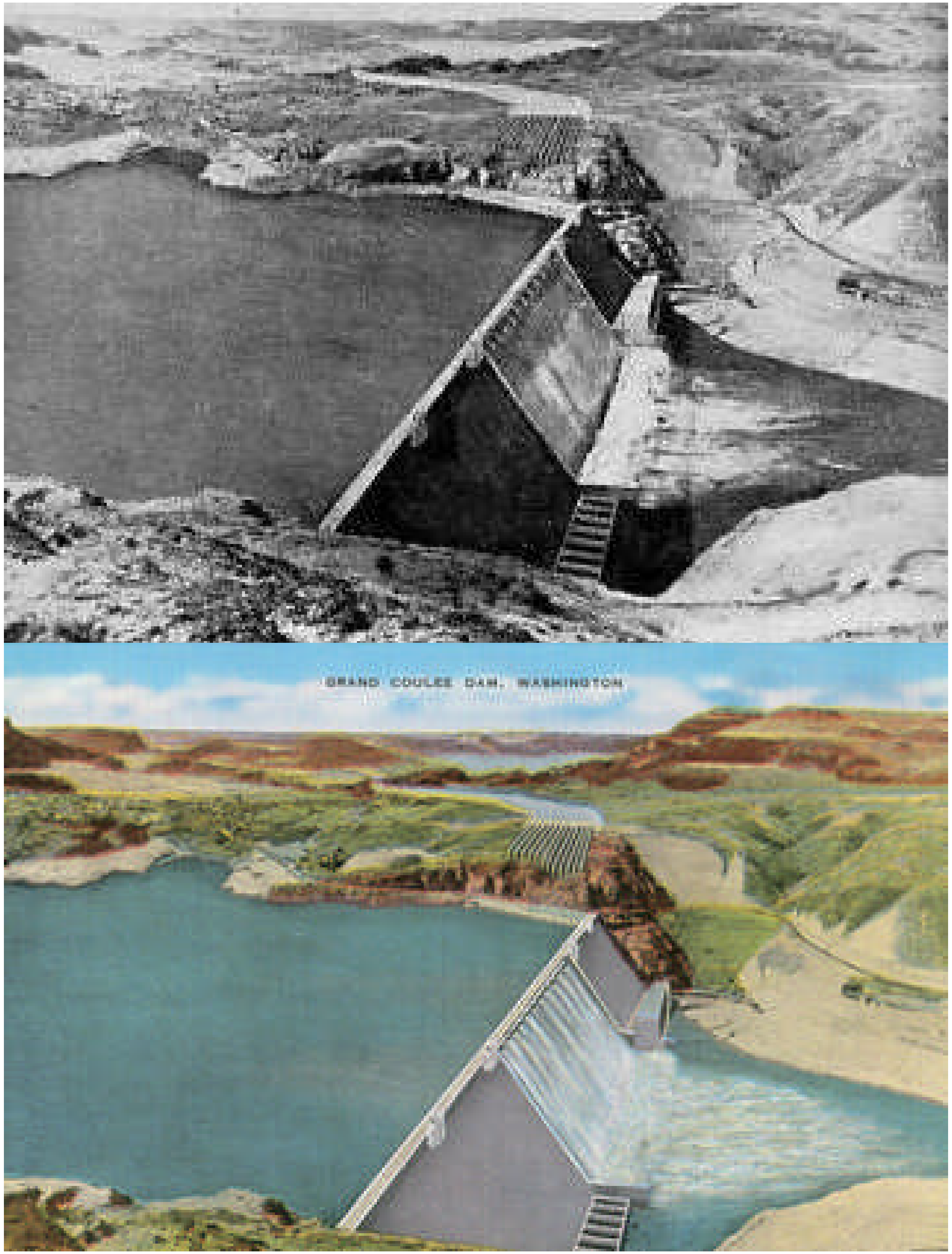
***"…The cost of this work including camp, railroad, highway, right-of-way, materials, etc., will be about $60,000,000. The cost of the completed structure is estimated at $186,000,000, and the irrigation features of the project at $208,000,000 making a total capital outlay for the ultimate project at $394,000,000, but the maximum investment in the project is estimated at around $260,000,000, depending on how rapidly the irrigation features are developed and how soon the power revenues may become sufficient to take care of the cost of the future construction…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

# The Key

***“…The Grand Coulee Dam is the ‘Key’ structure in the comprehensive plan for the development of the Columbia River. The importance arises from the fact that it will create a reservoir extending to the Canadian border, a distance of 151 miles, thereby adding a corresponding amount to the navigable inland waters of the State, and providing the master store of water for regulating the flow to other dams to be constructed in the system. The release from the stored waters from this reservoir during periods of low flow not only will increase the maximum navigable channel depths by two-feet below Bonneville Dam and by 4.5-feet below Grand Coulee Dam with corresponding increases at intermediate points, but it also will double the amount of firm power that can be developed at the six power sites on the Columbia River between Grand Coulee Dam and the point where the Snake River joins the Colorado, and will increase by 50% the firm power that can be generated at the various sites, including Bonneville, below that junction…”***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

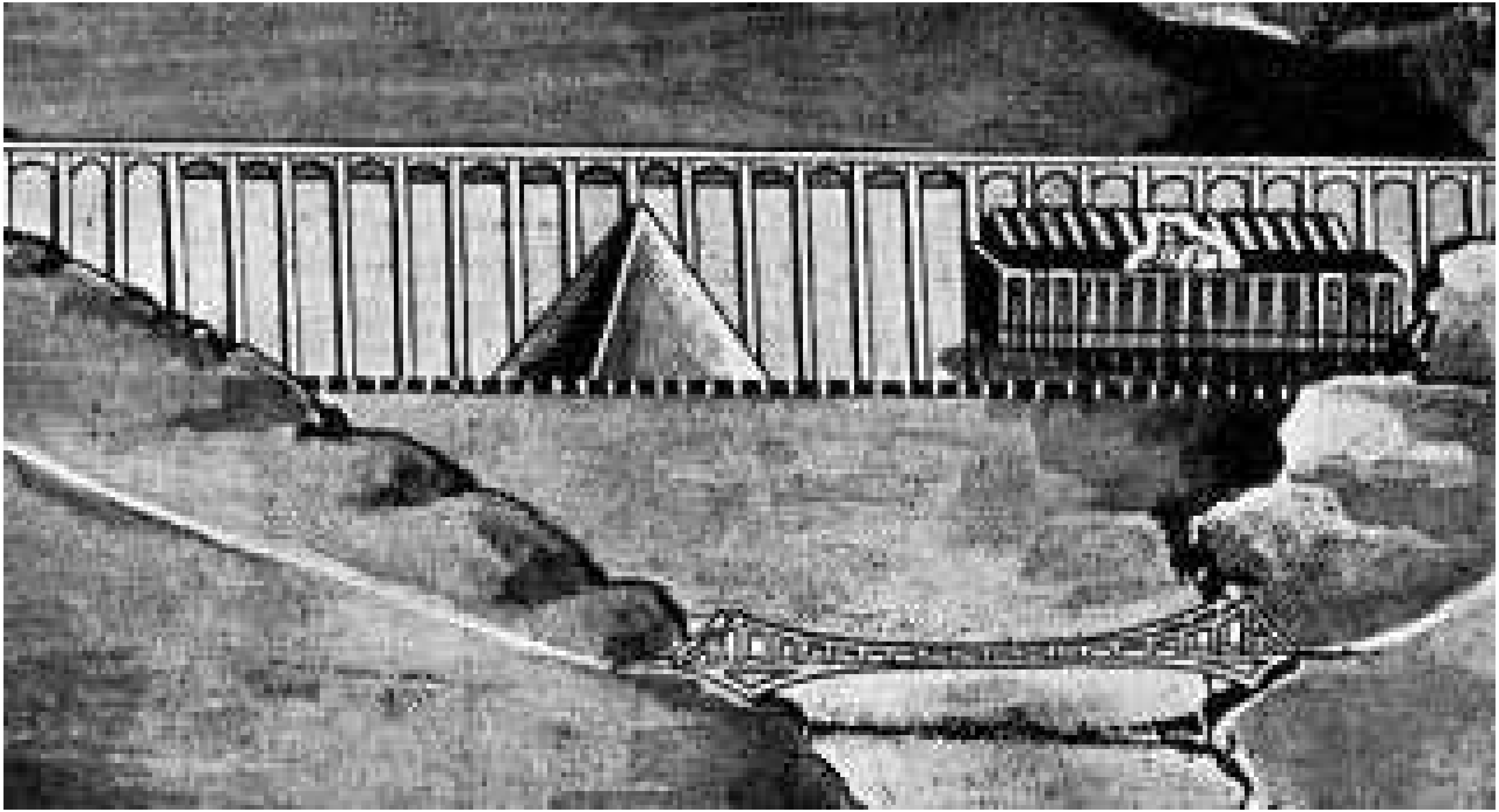



***"…Even the base of the dam, completed in the winter of 1937-30, was the biggest man-made structure on earth, far surpassing the great pyramid of Cheops…Nearly 12 million cubic yards of concrete, more than three times that required for the Boulder Dam, will be used in constructing the dams, power plant, and appurtenant works - sufficient to build a monument as high as the Washington Monument and covering six average city blocks…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Top: caption: "Artist's conception of Grand Coulee Dam"**

**Bottom: caption: "Grand Coulee Dam, Washington"**



***"…With the same quantity of concrete a 20-foot pavement could be built about a quarter of the way around the earth, or two times from coast to coast. It would make a pyramid two blocks square and eight blocks high, more than three times the volume of the great pyramid of Cheops…"***

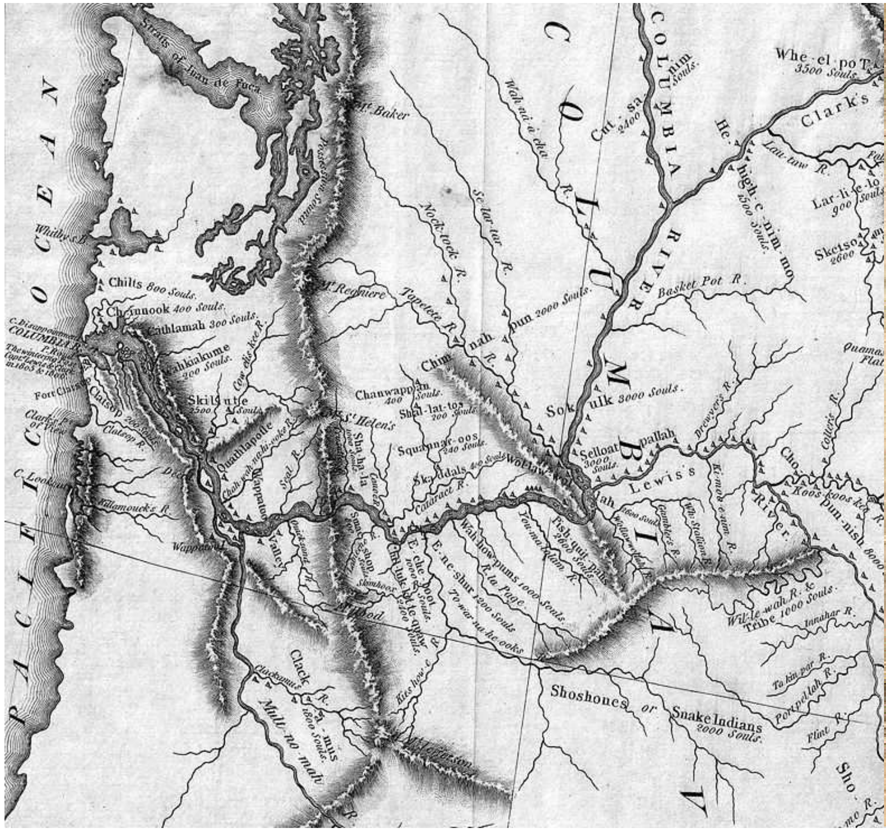
***U.S. Bureau of Reclamation* (ca. 1937)**

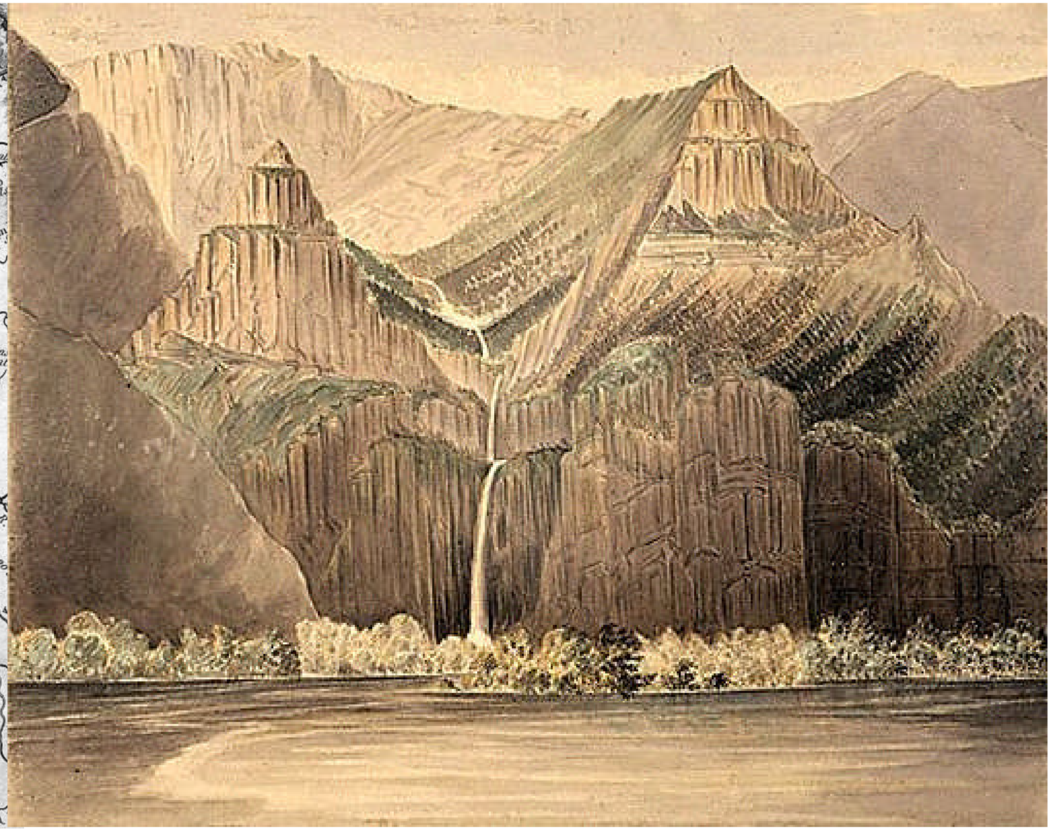
**Above: caption: "As the Great Pyramid of Giza would compare with the face of Grand Coulee Dam"**

# Turning Back the Wheels of Time

***“…In other words, the mighty Columbia, thrashing and thundering its way more than 1,200 miles from its source in British Columbia to its mouth at Astoria, Ore., will be so harnessed in this deep-carved, granite-walled gorge that it will literally turn back the wheels of time at least 300,000 years. It will lift itself back into that tremendous canyon where it once flowed, blotting out little settlements, covering worn and dusty upland roads…”***

***Popular Science,*** **February 1936**





**<u>Left</u>: detail from the *Lewis and Clark* expedition map. The *Willamette River* is shown as the "Multnomah," while the *Snake River* is "Lewis's River."**

**<u>Right</u>: caption: "Painting entitled: 'Multnomah Falls,' by James W. Alden (1857)"**

***"…The Grand Coulee Dam is located in the solid granite canyon of the Columbia River just below the point where the river once was diverted temporarily from its normal channel by an advancing glacier and forced to cut a new channel. The new channel, now high and dry, known as the Grand Coulee, 52 miles long, 600 to 800-feet deep, and 2 to 5 miles wide. As the glacier receded, the Columbia returned to its normal channel and left the Grand Coulee with its bottom 600-feet above the ordinary water level of the river…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

**Above: caption: "Grand Coulee as it was drawn in 1846 from a survey made for the U.S. Pacific Railroad"**

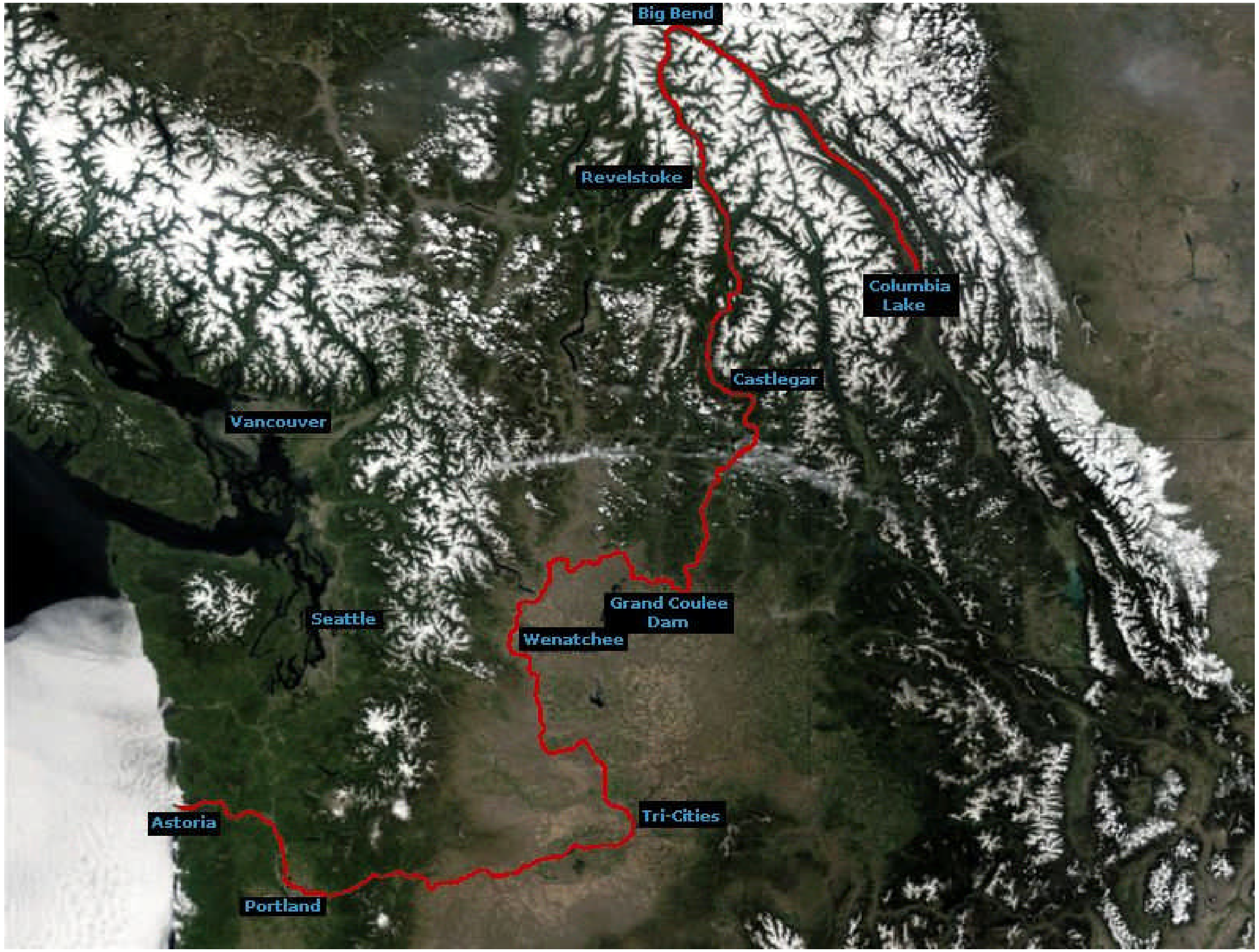
# Greatest Power Stream


***"…When you realize the annual run-off at the mouth of the Columbia is ten times that of the Colorado, which the Boulder Dam controls; its drop 2,650-feet from its source to the sea, you can understand why the river once mis-named by a poet 'the mighty Oregon' is the greatest power stream in the civ-ilized world…"***

***Popular Science,*** **February 1936**

**Above: caption: "Columbia River, Cascade Mountains, OR, by Vincent Colye (1876)"**

**Left: caption: "Columbia River Drainage Basin"**


Big Bend
Revelstoke
Columbia Lake
Castlegar
Vancouver
Seattle
Grand Coulee Dam
Wenatchee
Tri-Cities
Astoria
Portland

***"…The gorge of the Columbia river is too big to permit an arch-type dam. Grand Coulee must depend upon its massive weight alone to resist the pressure of the water it will back up. At the dam site the river is 700-feet wide and at times seventy-feet deep, flowing fourteen miles an hour, and has an annual average runoff of 79,000,000 acre-feet, five times that of the Colorado at Boulder dam…"***

***Popular Mechanics,* April 1938**

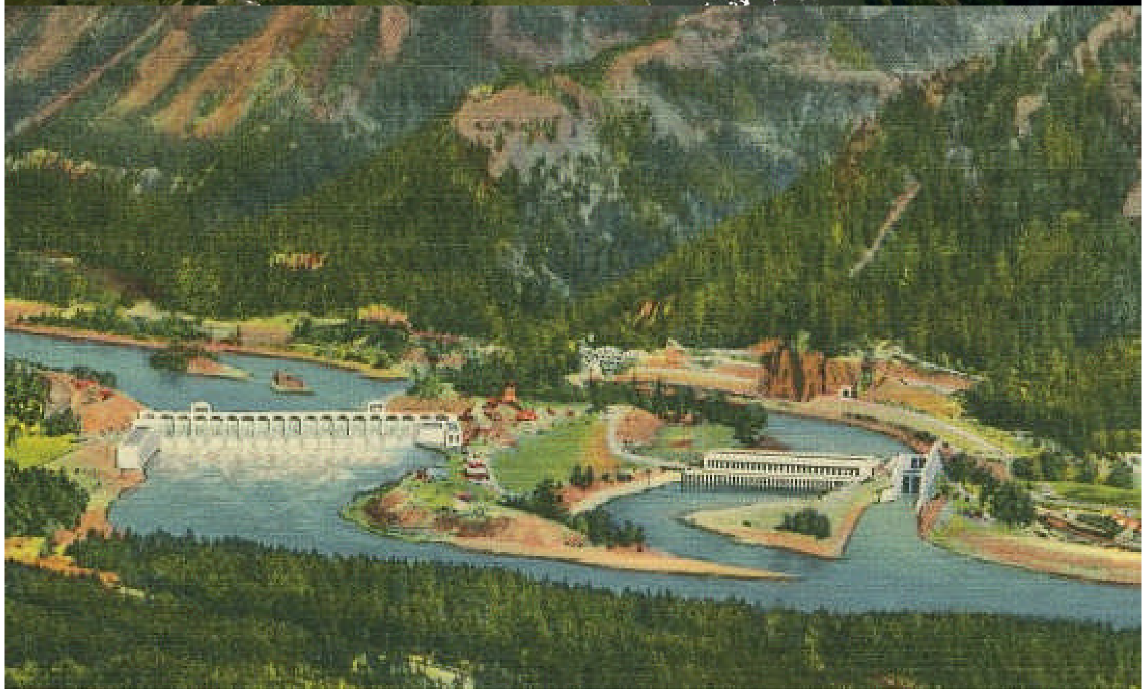
**<u>Above</u>: caption: "Panoramic view of Columbia River Gorge from Dog Mountain in Washington"**

***"…In the section between the Canadian line and its mouth, where the net fall is 1,300-feet, this stream, without harnessing any of its tributaries, can be made to generate one third as much electric power as was produced in the United States for all purposes in 1930!..."***

***Popular Science,*** **February 1936**

**<u>Left</u>: the mouth of the *Columbia River* is just past Astoria, OR. Ships must navigate the treacherous *Columbia Bar* (near the horizon in the picture) to enter or exit the river.**

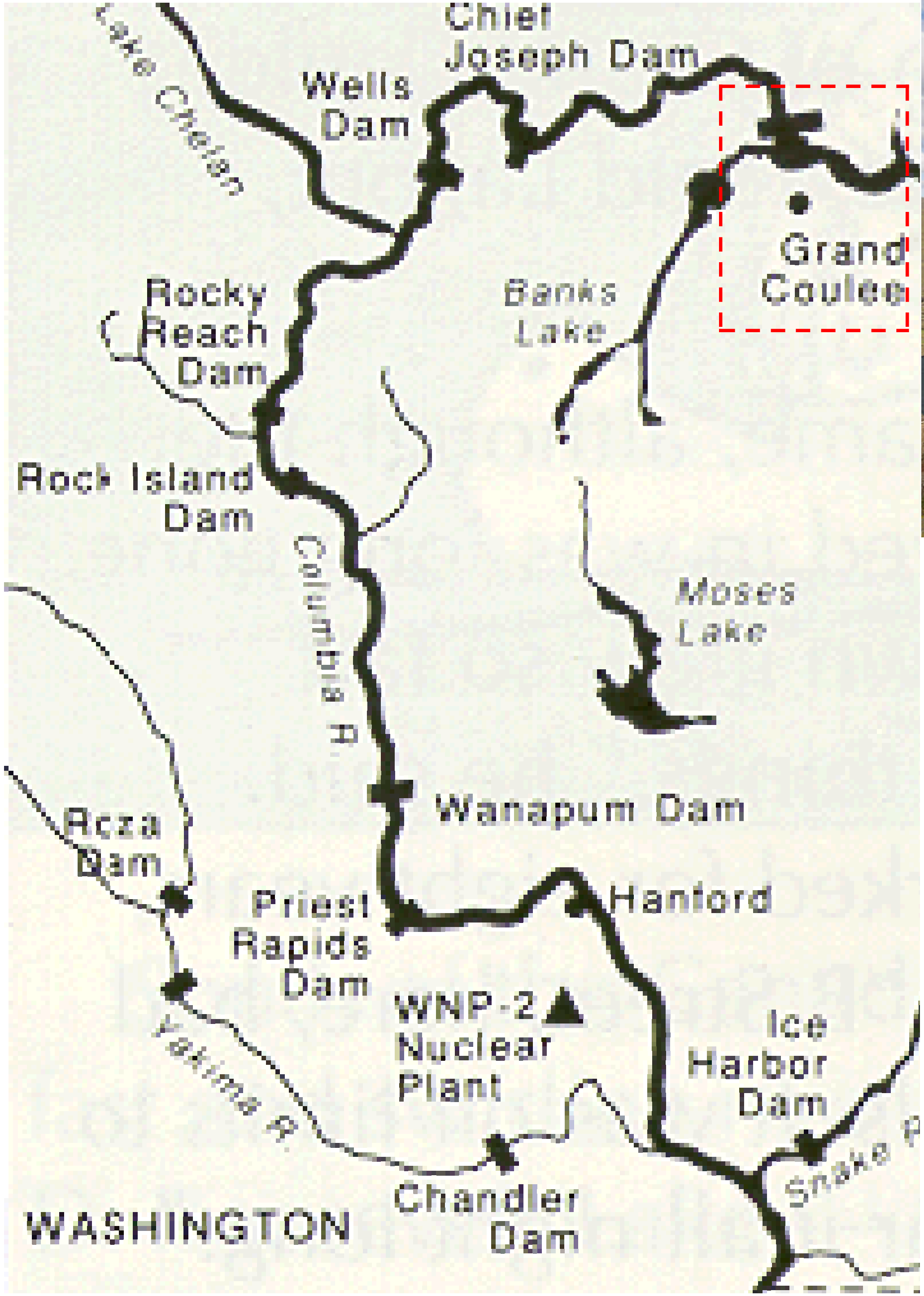
**<u>Right</u>: the *Columbia River Gorge*, facing east toward *Beacon Rock***



***"…It is estimated that potentially this one river alone, exploited under a huge ten-dam program of which the Grand Coulee is one and the Bonneville dam now being built 300 miles downstream is another, can turn up energy amounting to more than half the total hydro-electric power developed in the United States today…"***

***Popular Mechanics,*** **April 1938**

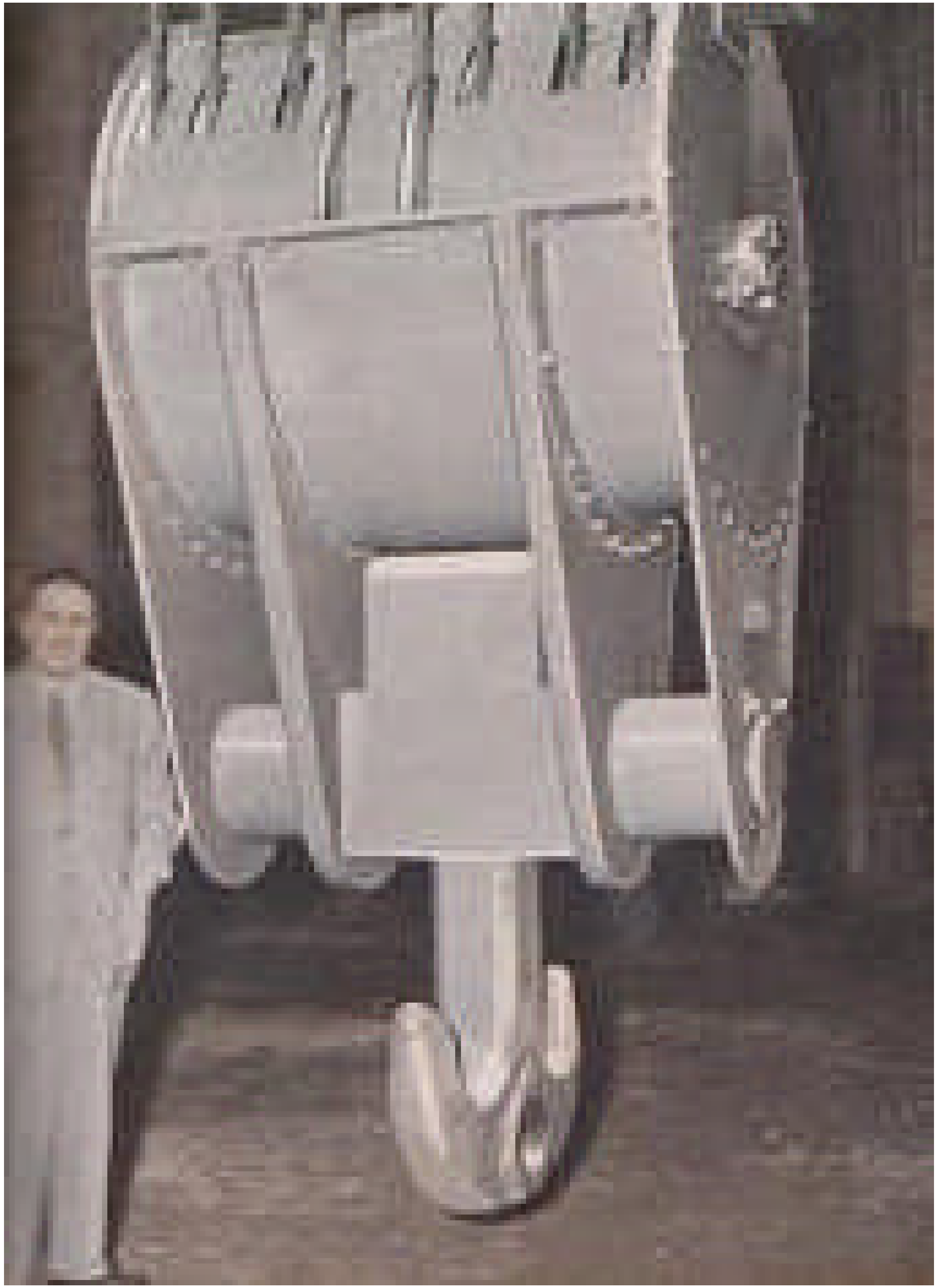
**<u>Left T&B</u>: *Bonneville Dam,* in the *Columbia River Gorge***




**<u>Above</u>: caption: "Dams on the Columbia have transformed the river into a series of slackwater pools, such as this one between Bonneville and the Dalles, as seen from Rowena Crest"**

**<u>Left</u>: caption: "Dams of the Columbia River Basin"** [369]

# A Few Comparisons



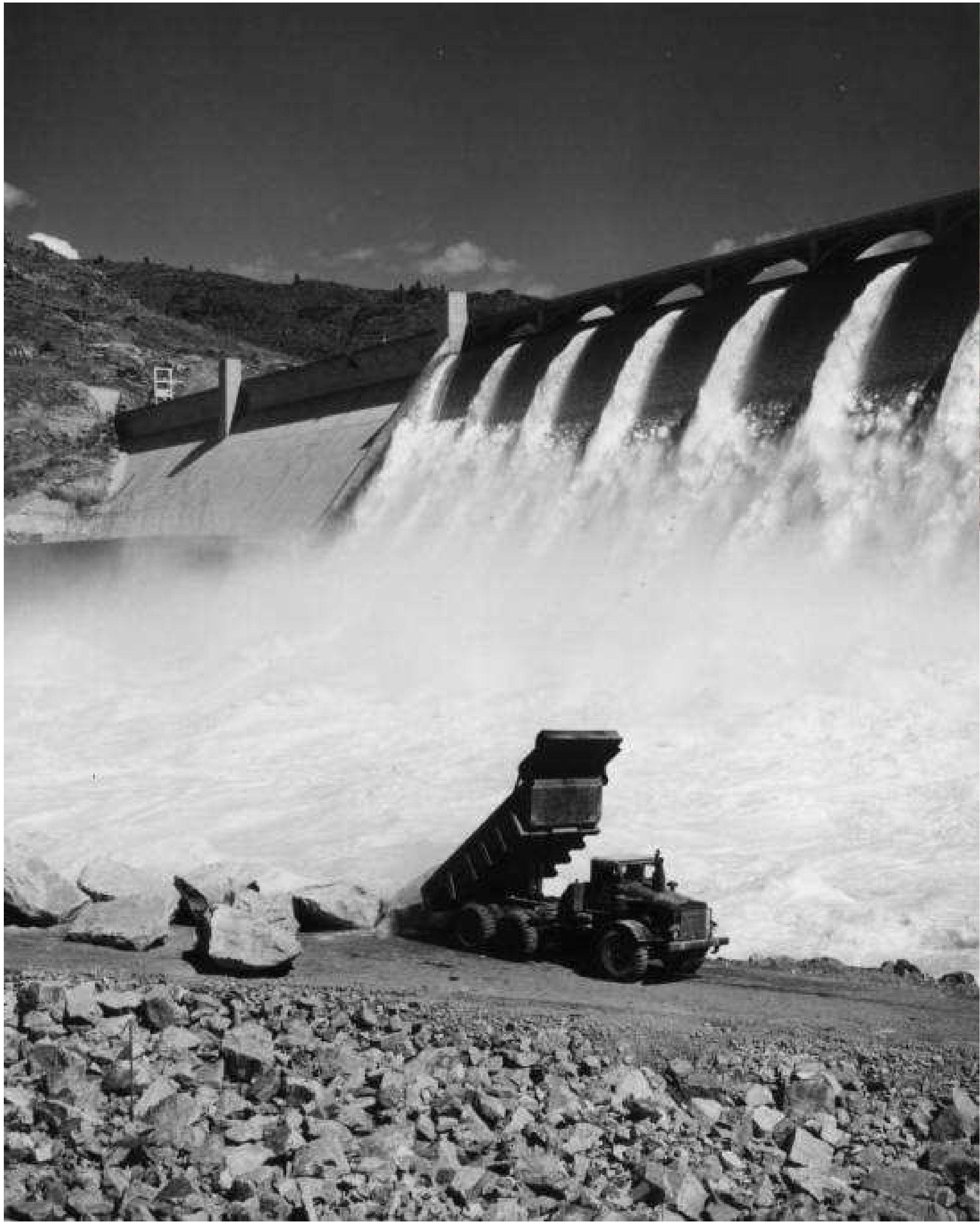
***"…Considering this, a few comparisons with the job man has done at Boulder Dam, and of the tremendous tasks for which the latter and the Grand Coulee are intended, are none the less startling. Although Grand Coulee will not be so high, by 230-feet, as Boulder Dam, it will have a crest length of 4,100-feet, nearly four times that of the Colorado River project. Its const-ruction will require 16,000,000 cubic yards of excavation, as compared with 7,000,000 at Boulder Dam. It will develop a total of 2,646,000 horsepower, against the 1,835,000 horsepower load to which the turbulent Colorado River will be yoked…"***

***Popular Science,*** **February 1936**

**<u>Left</u>: caption: "This is one of the 175-ton crane hooks for moving equipment in one of Grand Coulee's powerhouses. In man's most massive structure, everything is built in gigantic scale."**

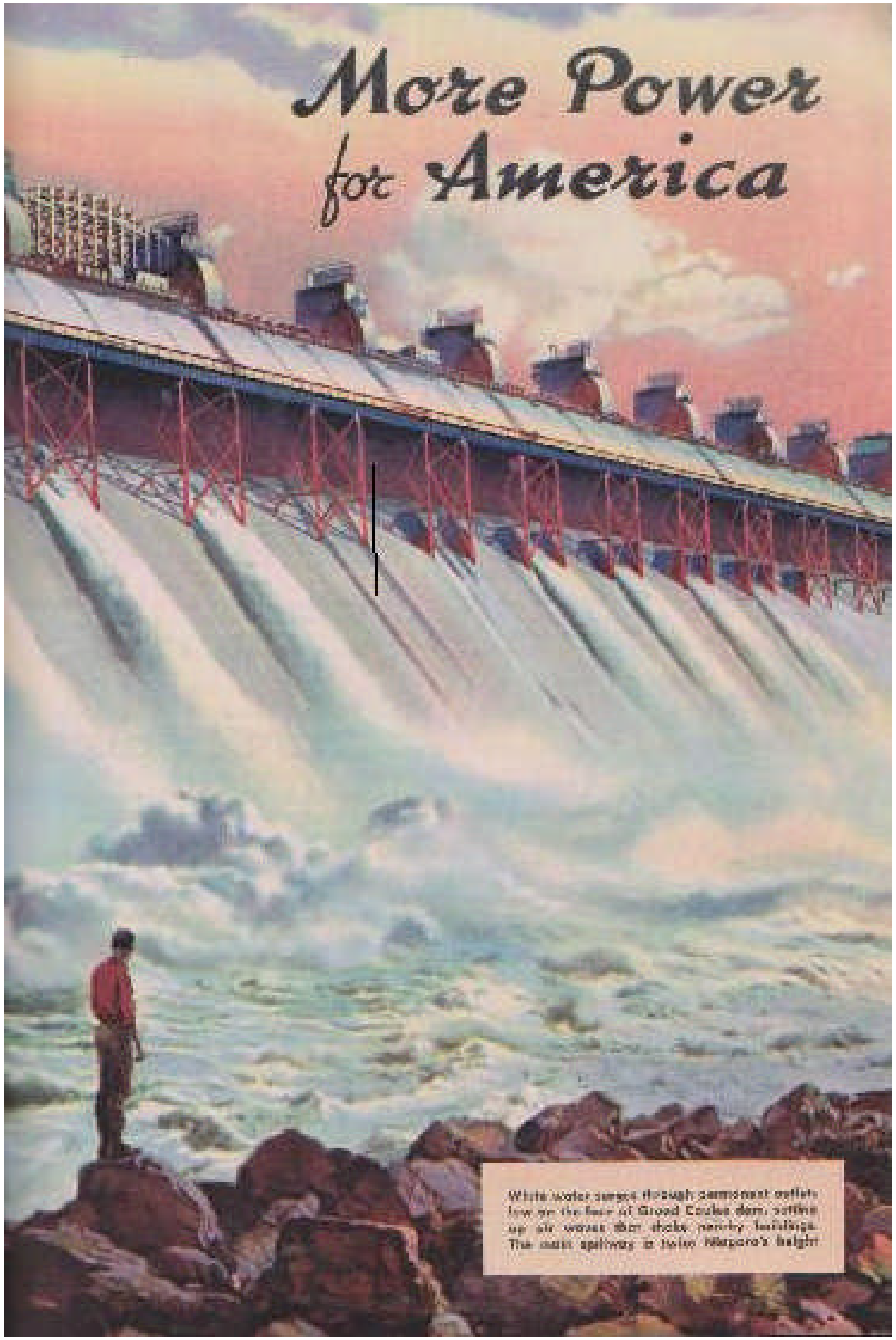
***"...The dam will be 4,300-feet long, 550-feet high above the lowest bed rock and 500-feet thick at the base. It will have a spillway 1,650-feet long capable of handling a one-million-second-foot flood. The volume of concrete required will be 11,000,000 cubic yards or two and one-half times that required for Boulder Dam. The power installation symmetrically placed on each side of the spillway, which will be in the center of the dam will amount to 1,980,000 kilowatts, of which 800,000 kilowatts will be for the generation of firm continuous power and the balance for secondary power for irrigation pumping and for standby service. Present contracts call for the completion of the foundation for the dam and power house to an average elevation 50-feet above low water and involves, among other things, the excavation of fifteen million cubic yards of earth and rock and the placing of 4,200,000 cubic yards of concrete…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**



**<u>Above</u>: caption: “Aerial view showing flood waters being re-leased from the lake piling up behind Grand Coulee Dam. In foreground a small city has grown up.”**

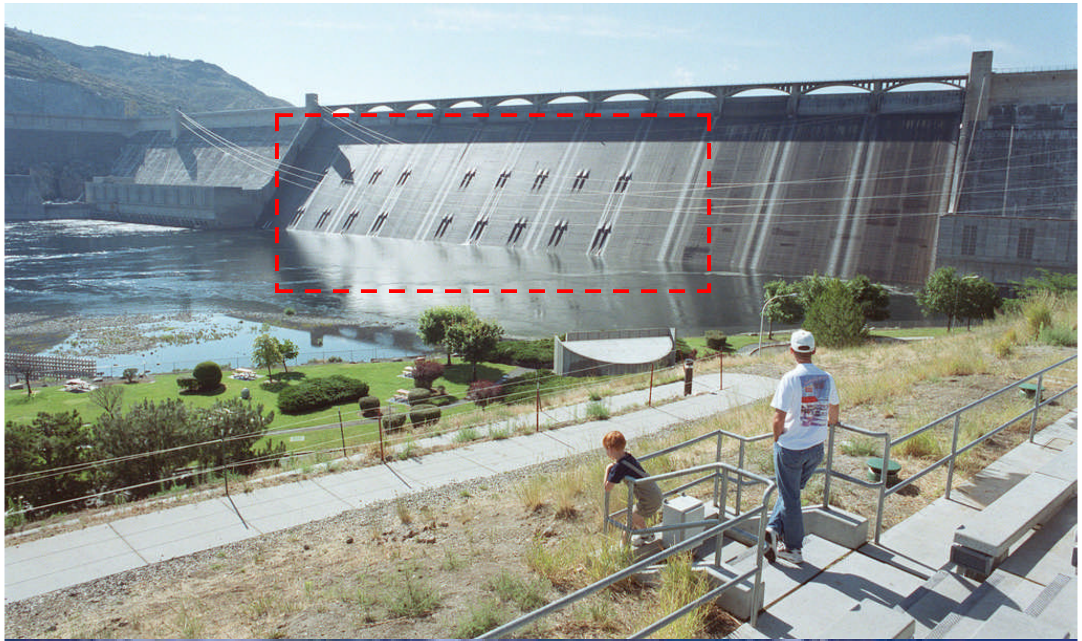
**<u>Left</u>: caption: “Tons of granite boulders were trucked in to the site to prevent the erosion of the riverbanks caused by the Columbia’s 350-foot fall over the Grand Coulee spill-Way, July 1950”**

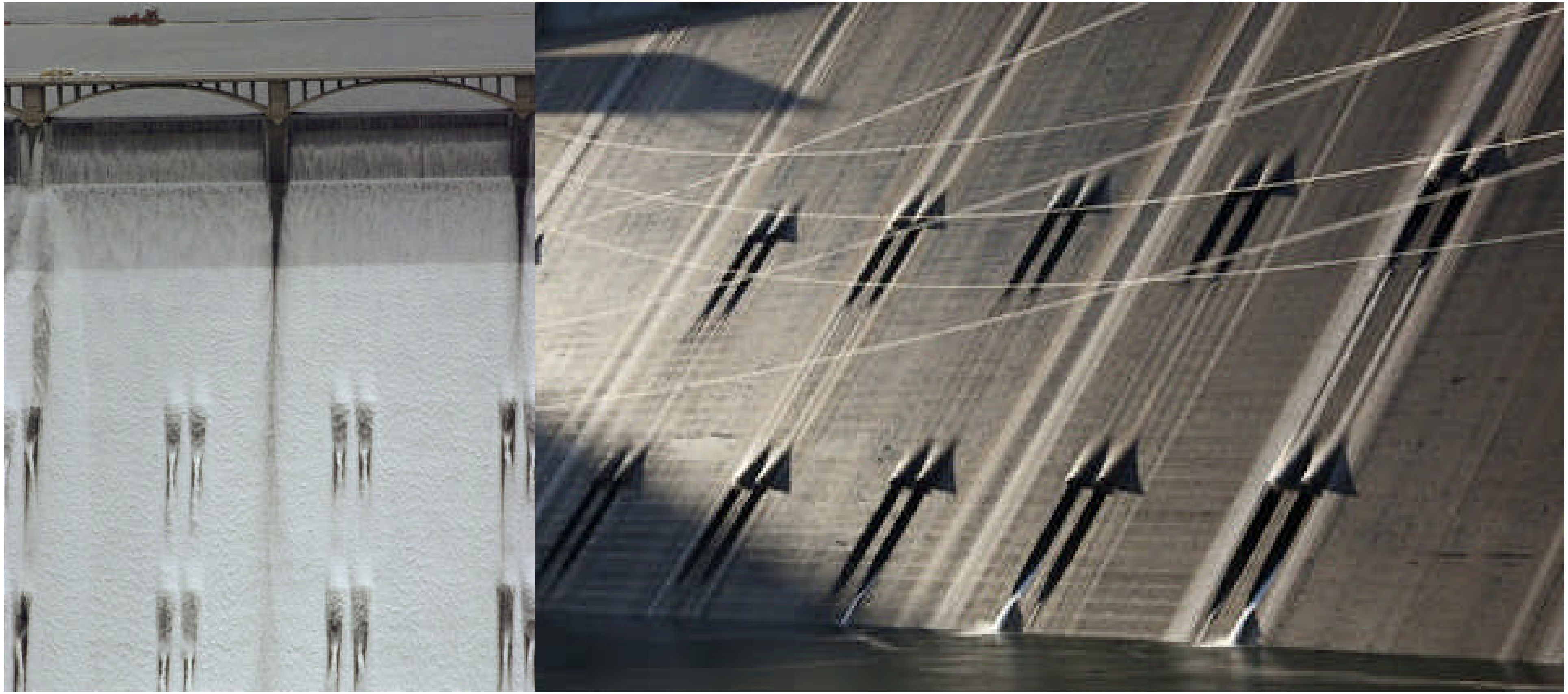


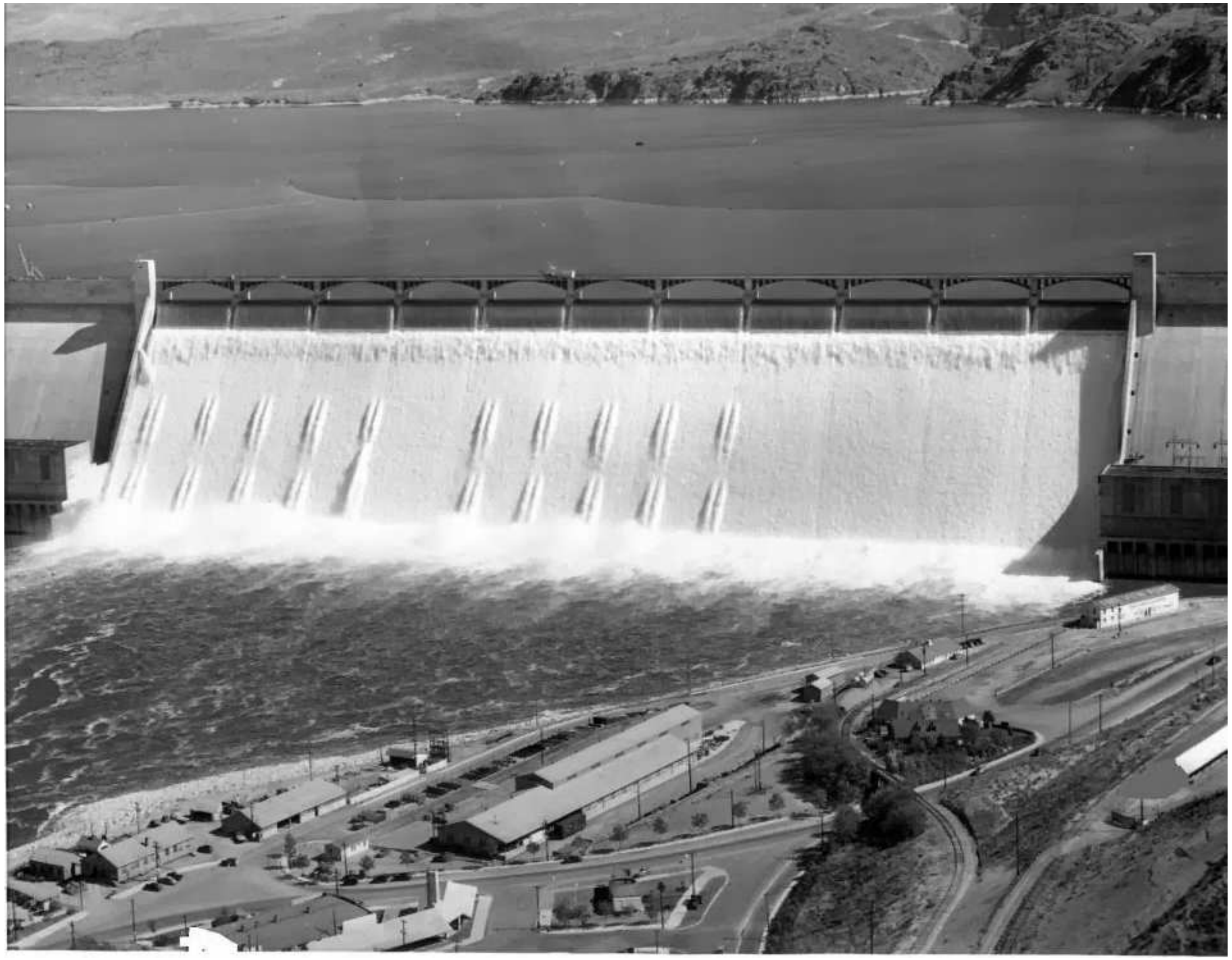

***"…The whole population of the United States could be contained within the dimensions of the dam, so vast is the structure. It weighs twice as much as the nation's people. Its spillway forms a spectacular waterfall twice as high as Niagara. Across the top is a 135-foot highway. Even when the spillways aren't in use the smaller volume of water cascading from permanent outlet holes lower in the dam sets up air waves powerful enough to vibrate wooden buildings in the vicinity. Erosion below the dam is prevented by a concrete 'bucket' or artificial plunge pool at the foot of the spillway that is ninety-feet wide and thirty-feet deep. The interior of the dam is pierced by 8½ miles of inspection galleries, one of which contains a narrow-gauge railway track. The dam supports a reservoir 151 miles long containing enough water to supply all of the needs of New York City for a ten-year period…"***

***Popular Mechanics,* May 1942**

**<u>Left</u>: caption: "White water surges through permanent outlets low on the face of Grand Coulee Dam, setting up air waves that shake nearby buildings. The main spillway is twice Niagara's height."**





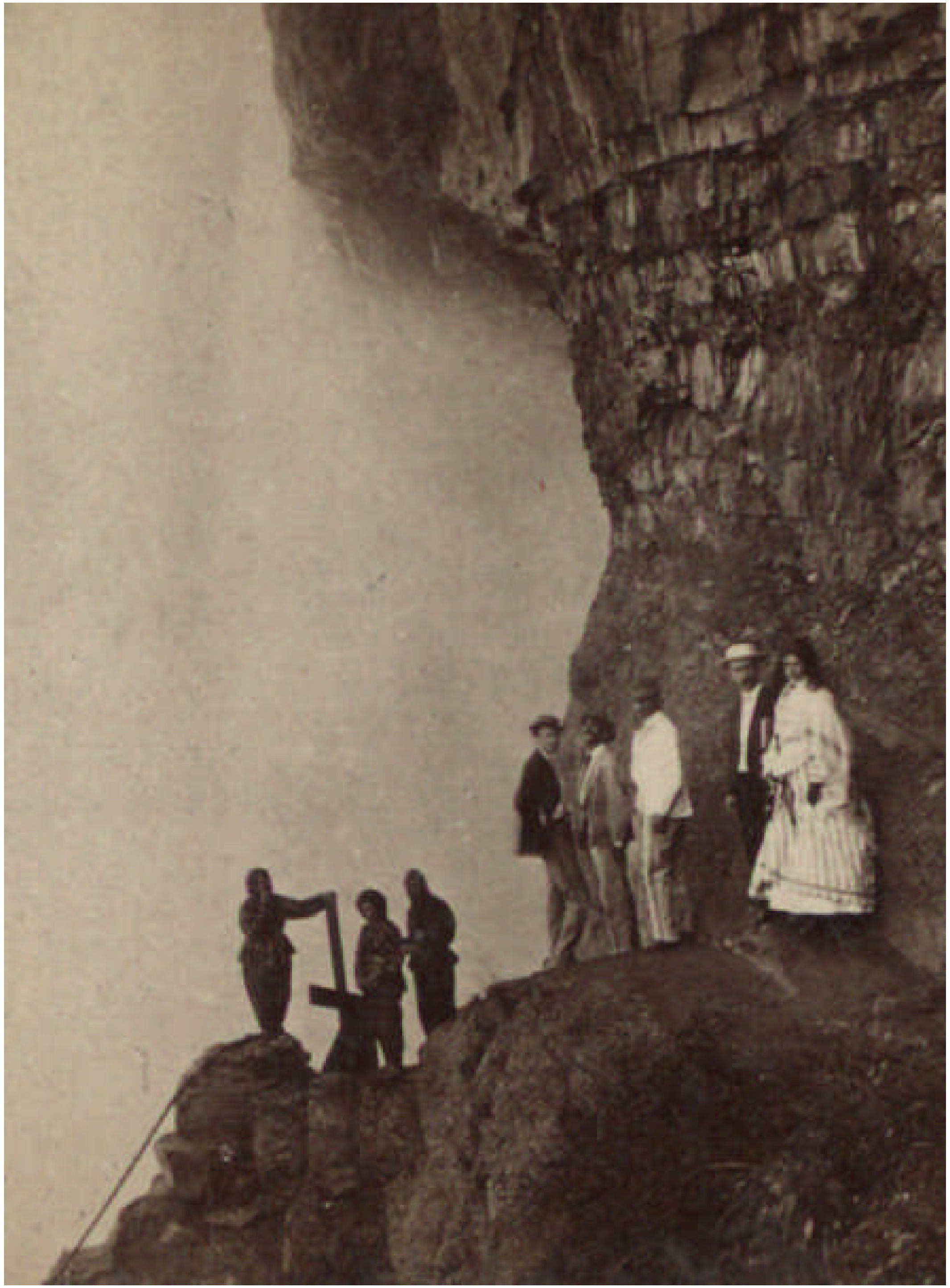


# And Points in Between

***"Inside the mass of concrete, to be known as Grand Coulee dam, there will operate a small train with tiny flat cars on a rail line about three-quarters of a mile long. It will haul machinery and equipment from powerhouse to powerhouse and points in between and will find especial heavy use during construction of the two stations. Rails for the line were laid in the concrete floor of one of the big galleries during the pouring period. The track runs at right angles to the east powerhouse, then turns to run parallel to the dam and again turns at right angles to the west power station…"***

***Spokane Chronicle,*** **December 31st 1937**

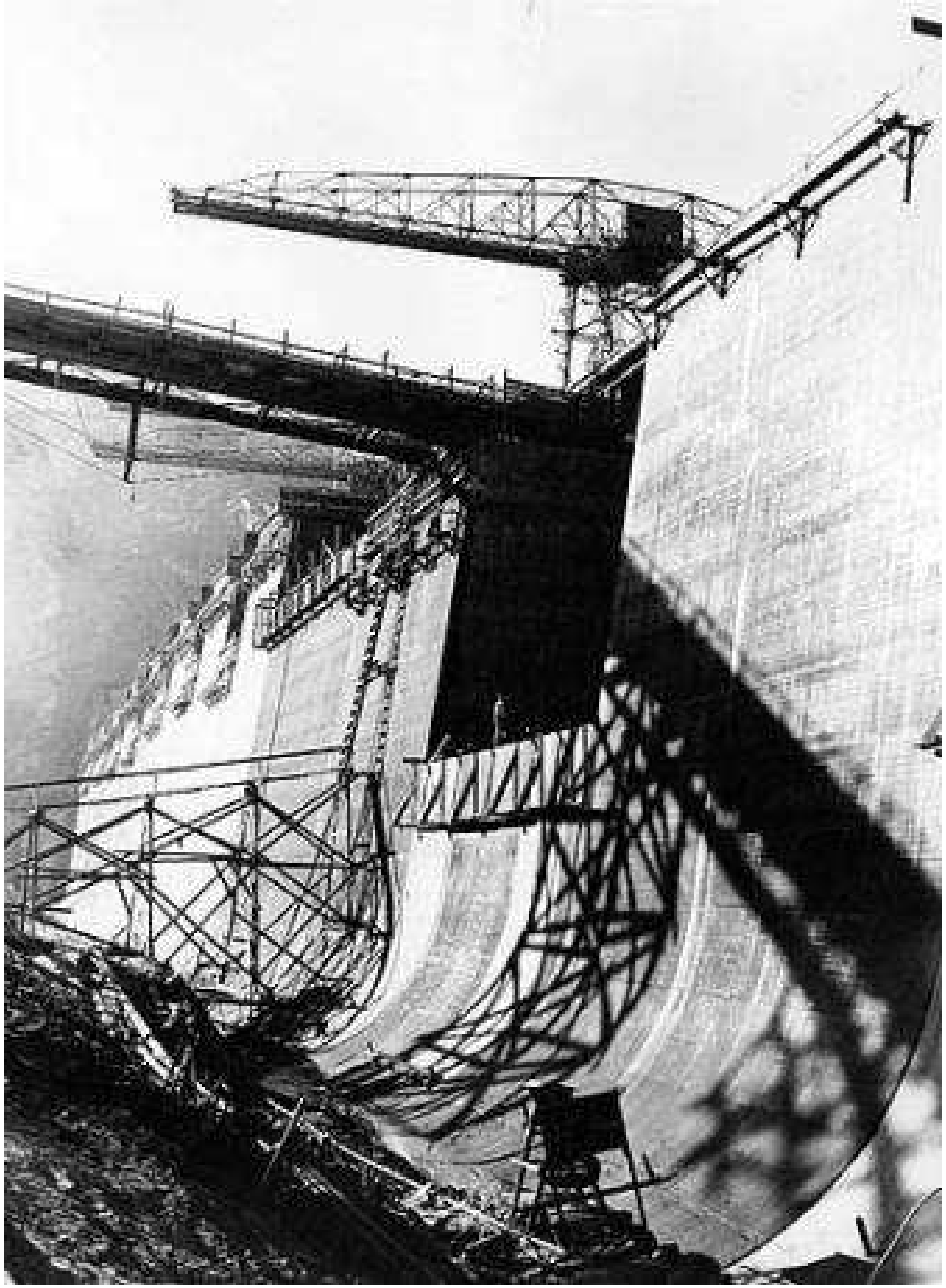
# To Slow the Flow



***"…Then there was the long span apron of the Grand Coulee. In designing a huge dam which discharges thousands of tons of water each second, the water must be delivered to the channel below as smoothly as possible, or it may eat back under the toe of the structure - as witness the caverns under the lip of Niagara. Original plans called for a long apron. Laboratory studies showed it was possible to substitute what the engineers call a 'bucket' instead, at a saving of $4,750,000…"***

***Popular Mechanics,*** **October 1945**

**Left: caption: "Cave of the Winds – Niagara"**

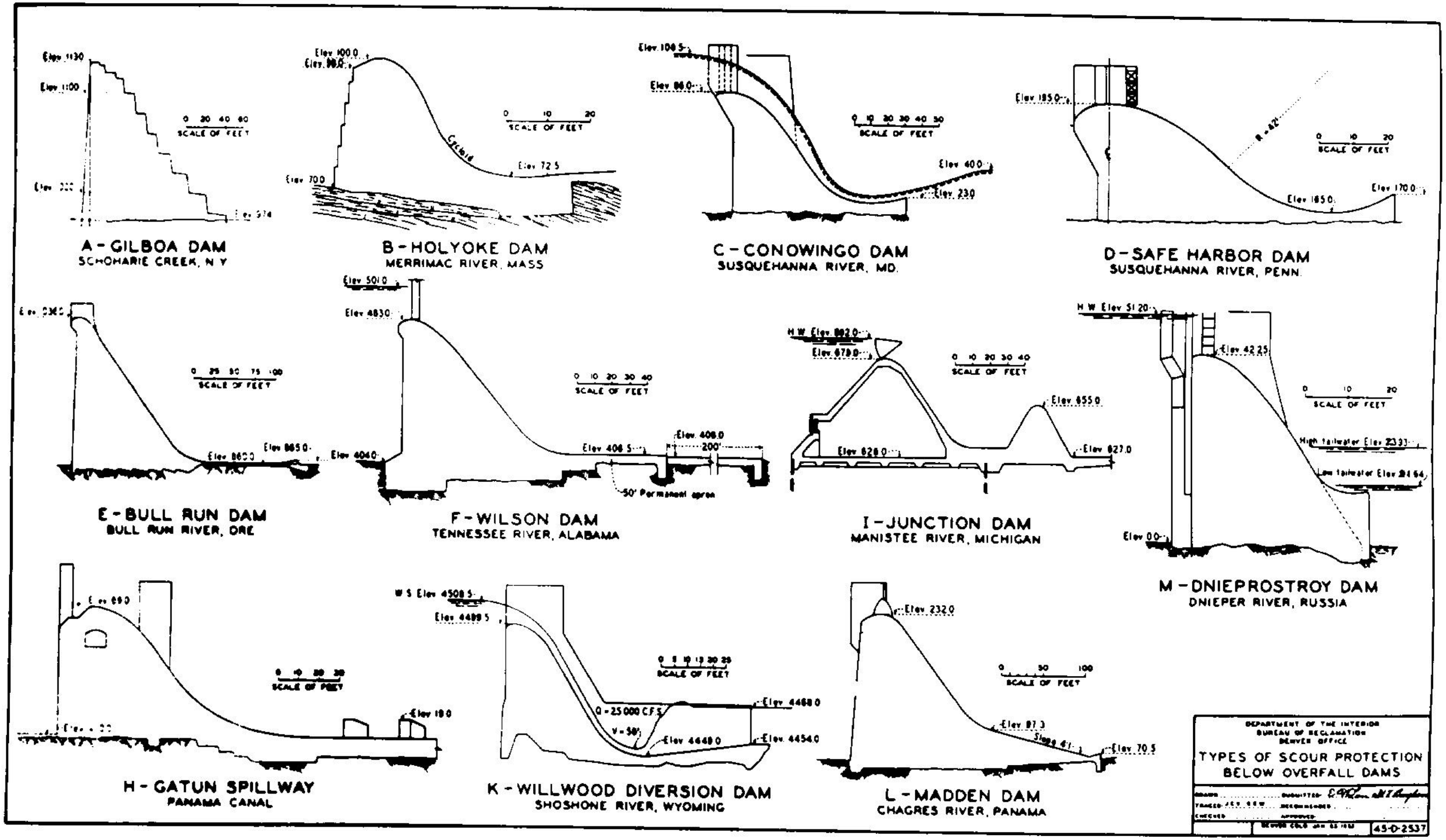


***"…To protect the bed rock at the top of the dam against the impact of 25,000,000 horsepower of energy dropping over the spillway, is something to think about, too. This the engineers plan to do by providing a deep pool below the dam, and a 'bucket' to divert the flow from the bed rock…"***

***Popular Science,* February 1936**

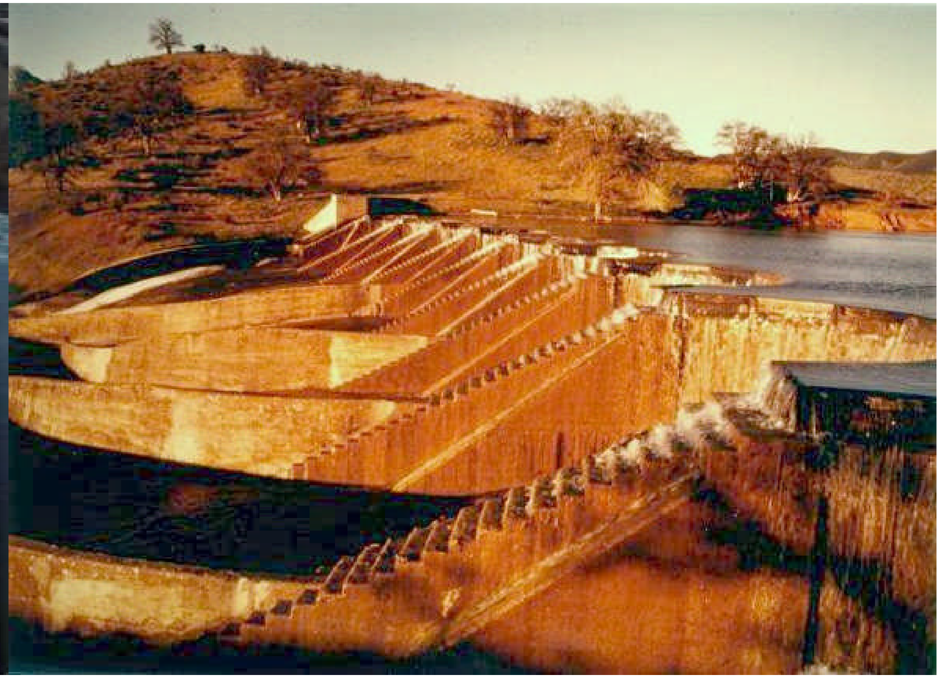
**<u>Left</u>: caption: "Curved basin of the 'roller bucket' on the front face of the Grand Coulee Dam during construction, October 1937"**

**The U.S.B.R.'s *Hydraulic Laboratory* was created to fill a need during the design of *Hoover Dam*, which was to be the highest dam in the world thus new technology had to be developed for the structural, mechanical and hydraulic design/s of the gravity-arch dam. U.S.B.R.'s first hydraulic laboratory was at *Colorado A&M College* (now *Colorado State University*) at Fort Collins, CO. Typically, their staff was recruited from the parent agency; the *U.S. Geological Survey*. Additional personnel sources were other Government agencies, construction engineers, private practice engineers and graduates from prestigious universities. Each design leader assembled a design manual based on their training and experience. In turn, these were passed on to subordinates who added to the standards and pool of knowledge. Distinguished Hydraulicists such as *Horace W. King, William P. Creager, Julian Hinds, Theodore Rehbock* and many others participated in the U.S.B.R. hydraulic lab.**




**<u>Above</u>: a typical page from a 1933 design manual entitled "Types of Scour Protection Below Dams." It provides an overview of various types of spillway structures. Eleven structures are shown, including a stepped spillway, several ski jump spillways, a few with forced "hydraulic jump" energy dissipators and some with very long paved aprons (for a natural hydraulic "jump").**

**<u>Above</u>: caption: "Stepped spillway at Lahontan Dam, Nevada"**
**<u>Left</u>: caption: "Stepped sp-illway at Upper Stillwater Dam, Utah"**



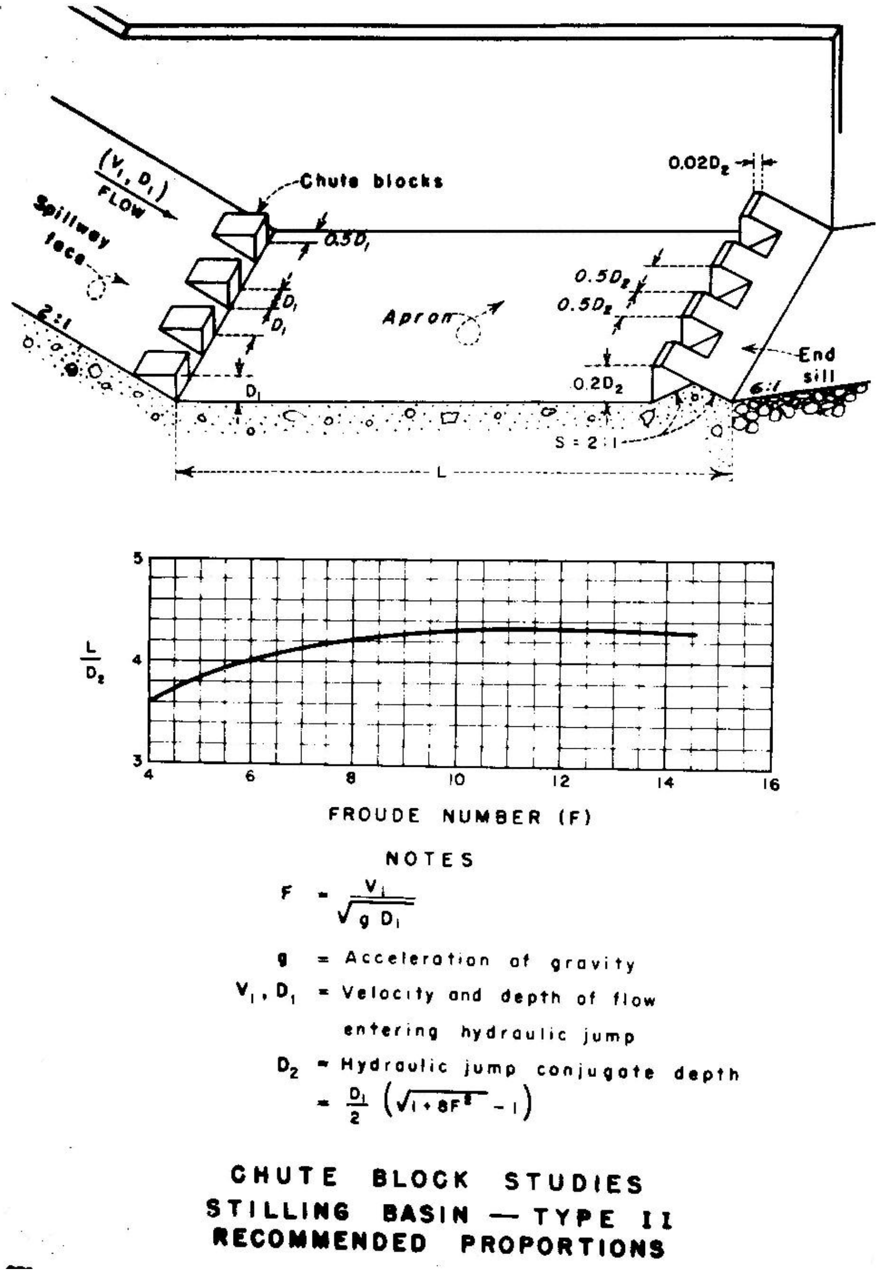
**Early U.S.B.R. dams typically did not include energy dissipators in their design. Most had controlled or uncontrolled spillways, outlet works or diversion structures whose principle goal was to control the flow for storage and future use. Control systems were present; radial gates, drum gates, slide gates, cylinder gates, ensign valves and needle valves, but if more water was coming in than could be stored, it was turned loose and the problem headed downstream.**

**<u>Top Left</u>: caption: "Labyrinth spillway at Ute Dam, New Mexico"**

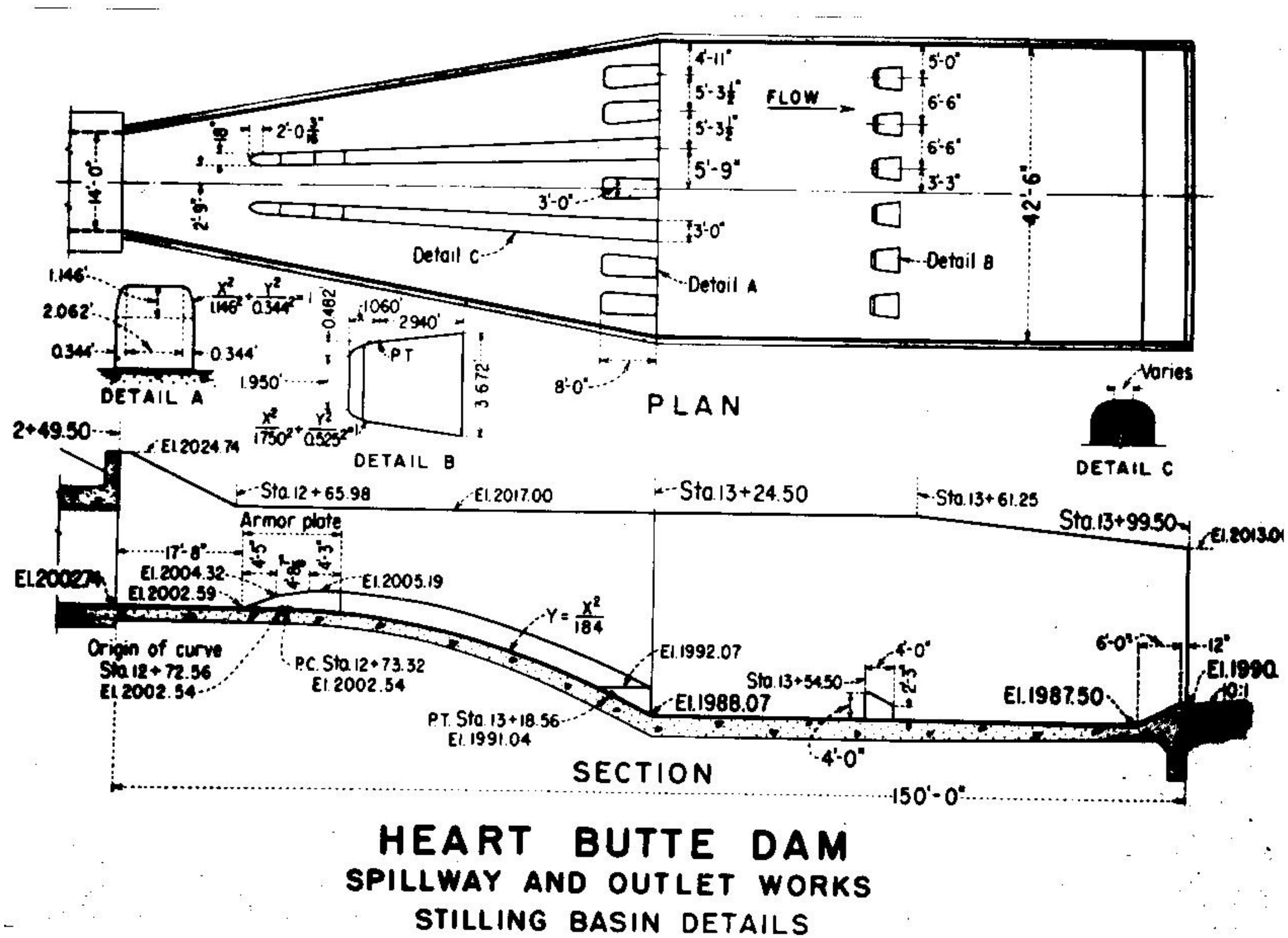
**<u>Top Right</u>: caption: "Labyrinth spillway at East Park Dam, California"**

# The Hydraulic Jump

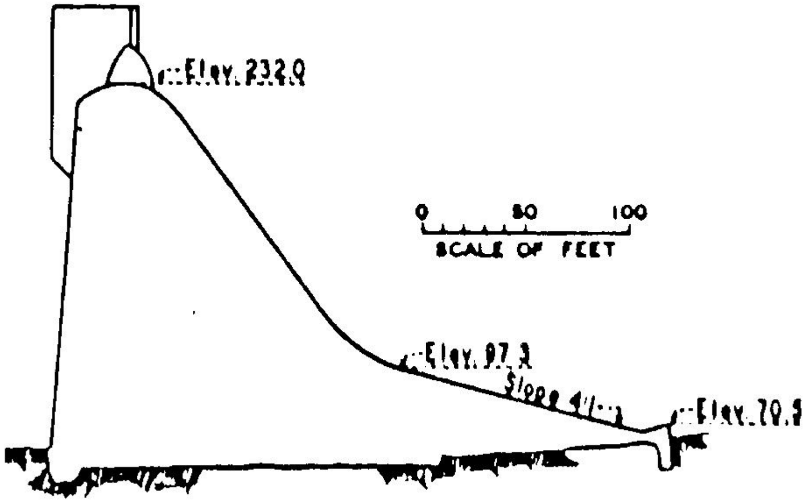
**The most common energy dissipater is some form of a "stilling basin" using the "hydraulic jump." *Leonardo da Vinci* sketched it in one of his notebooks in the 15th Century; *Venturi* wrote about it in the 18th century and *Georgio Bidone* of the *University of Turin* (Italy) "discovered" it. However, none of them were interested in it as an energy dissipater. In the 19th/early 20th century/s, advanced research studies concerning the hydraulic jump were made at *Lehigh University, Worcester Polytechnic University, Cornell University*, *University of California* and many distinguished European universities. U.S.B.R. designers recognized the danger of not including energy dissipators in their designs and began to draw on the experience of European designers, the *Tennessee Valley Authority* (TVA), *Panama Canal* designers and many others. The natural evolution was that some of the more exotic structures featured parabolic humps in the floor, gigantic impact blocks, trapezoidal shapes and practically anything else that would "slow-the-flow." U.S.B.R. *stilling basins* featured a rectangular shape that used as design parameters the inflow-outflow depths derived from the momentum equation; that is, the lengths were a function of the downstream depth and the heights a function of the incoming flow depth. The width and spacing of the appurtenances were left to the discretion of the individual designer, but usually occupied about half of the basin width.**




<u>Left</u>: caption: “The U.S.B.R.’s first modified Hydraulic Jump Stilling Basin Energy Dissipator (Type II). The basin contains chute blocks at the upstream end and a dentated end sill, but no intermediate or floor blocks. The end sill seems to have been patterned after the “Rehbock Sill,” an appurtenance that was developed by Theodore Rehbock years earlier.”

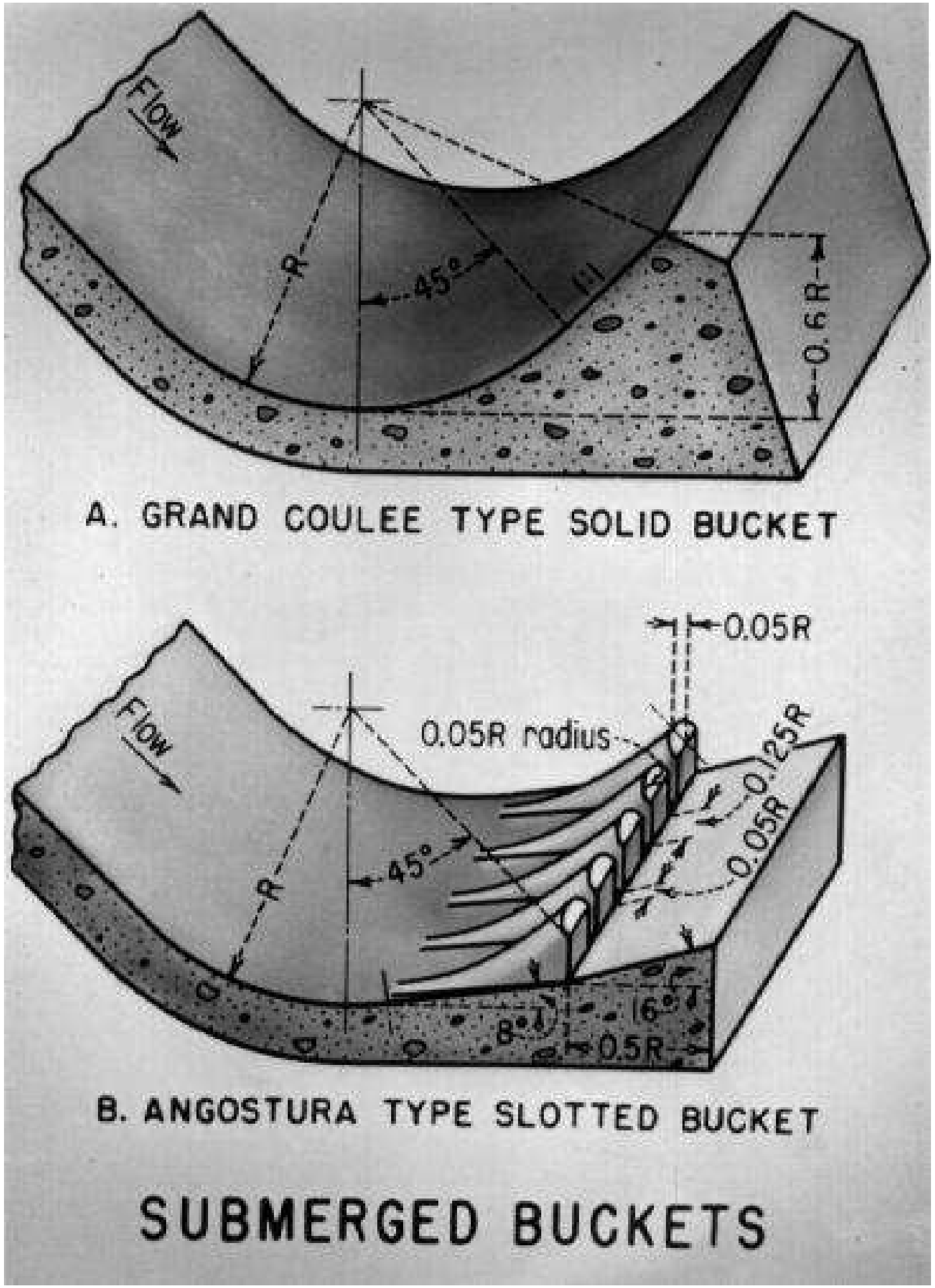



**<u>Above</u>: caption: "The next most popular U.S.B.R. basin design was Basin III (above). Essentially, it's the same as Basin II except for a solid triangular end sill and a set of floor blocks placed at about the one-third point of the basin. Typically, an hydraulic jump of this type is accompanied by surface waves, making it unstable."**

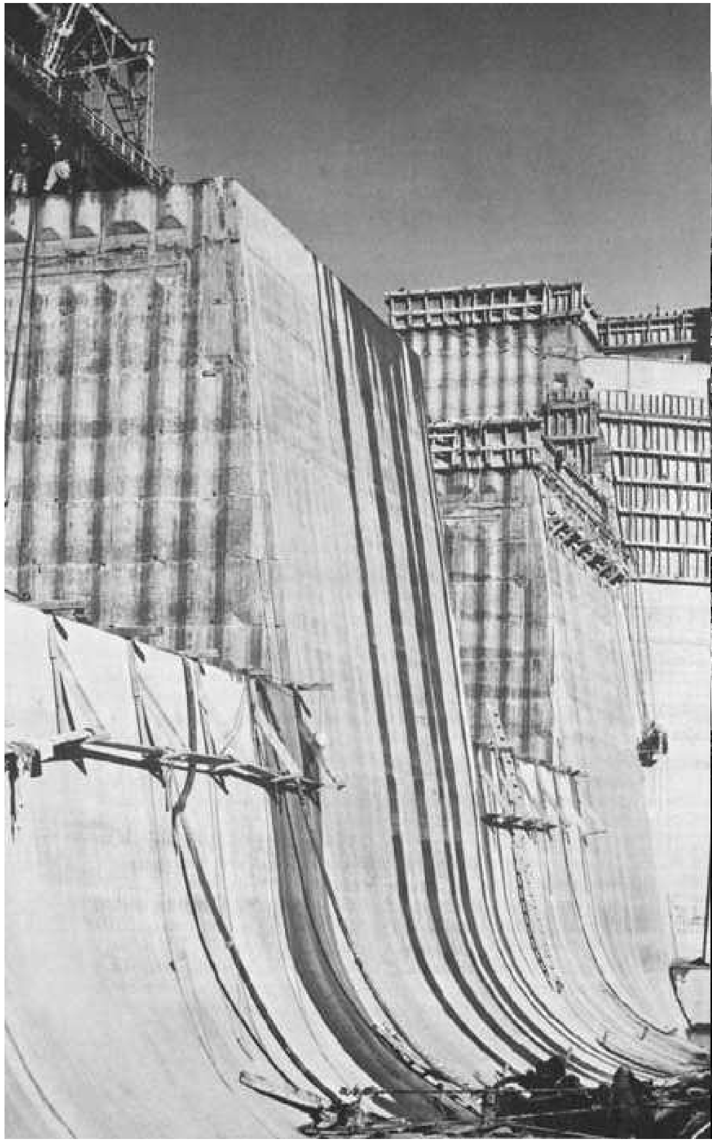


L - MADDEN DAM
CHAGRES RIVER, PANAMA

**<u>Left</u>: caption: "Basin V, the 'sloping apron basin,' was developed for Madden Dam in the Panama Canal Zone. It was also used at Canyon Ferry Dam (in Montana) and Folsom Dam (in California), among many others."**

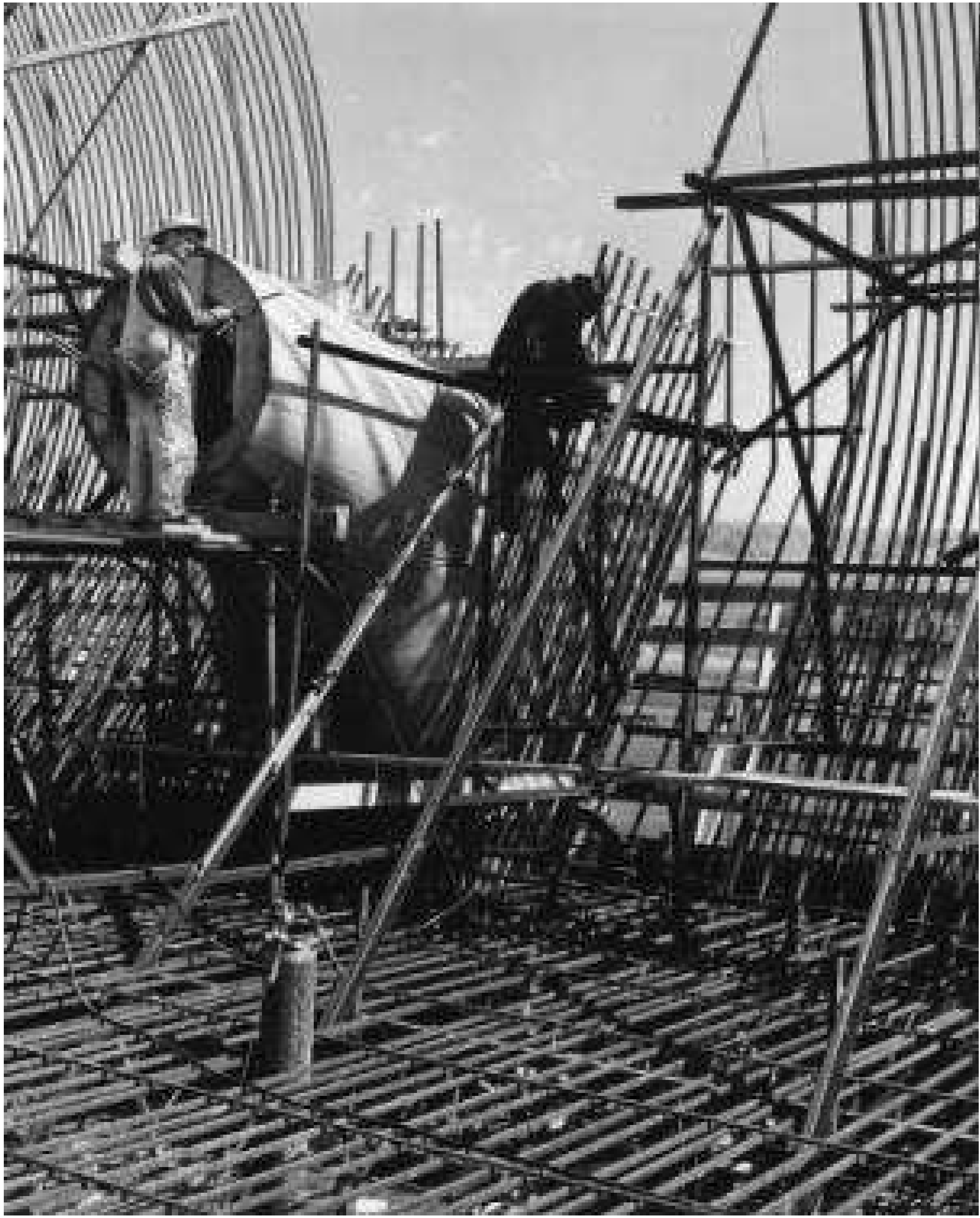


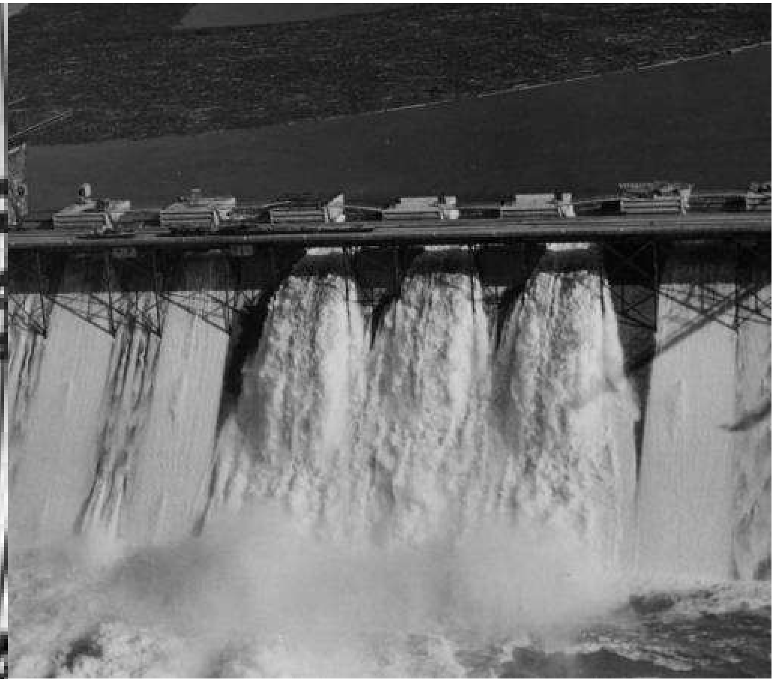

**<u>Left</u>: caption: "Basin VII, the 'Solid Bucket' (top) was developed for Grand Coulee Dam in 1933. A modified version known as the 'Slotted Bucket' was developed for Angostura Dam (South Dakota) in 1945 (bottom)."**




<u>**Above**</u>**: caption: “November 2013. Grand Coulee Dam in the morning light. The cold November air causes water to freeze on the face of the dam and steam to rise from the water in the stilling basin.”**

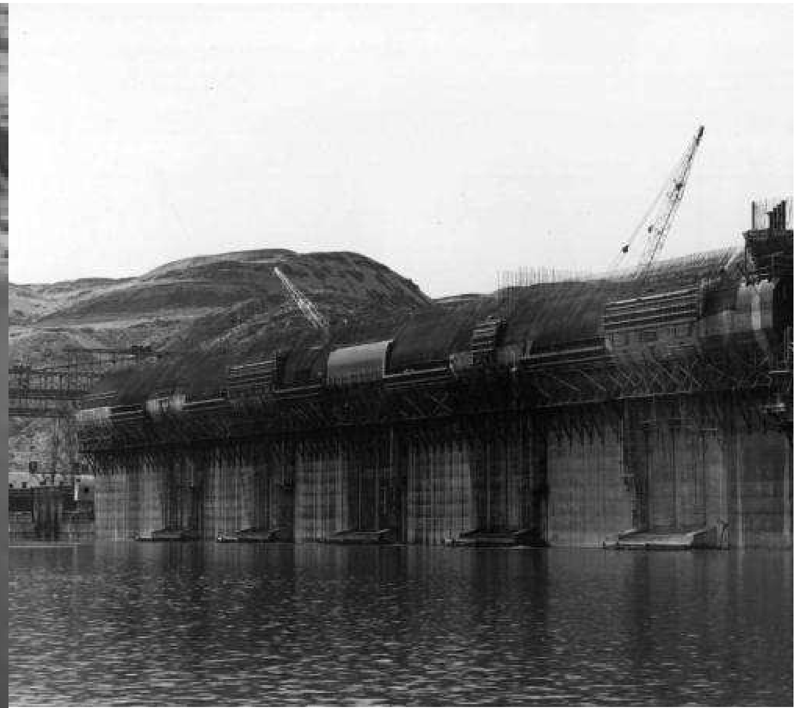
# Over the Top



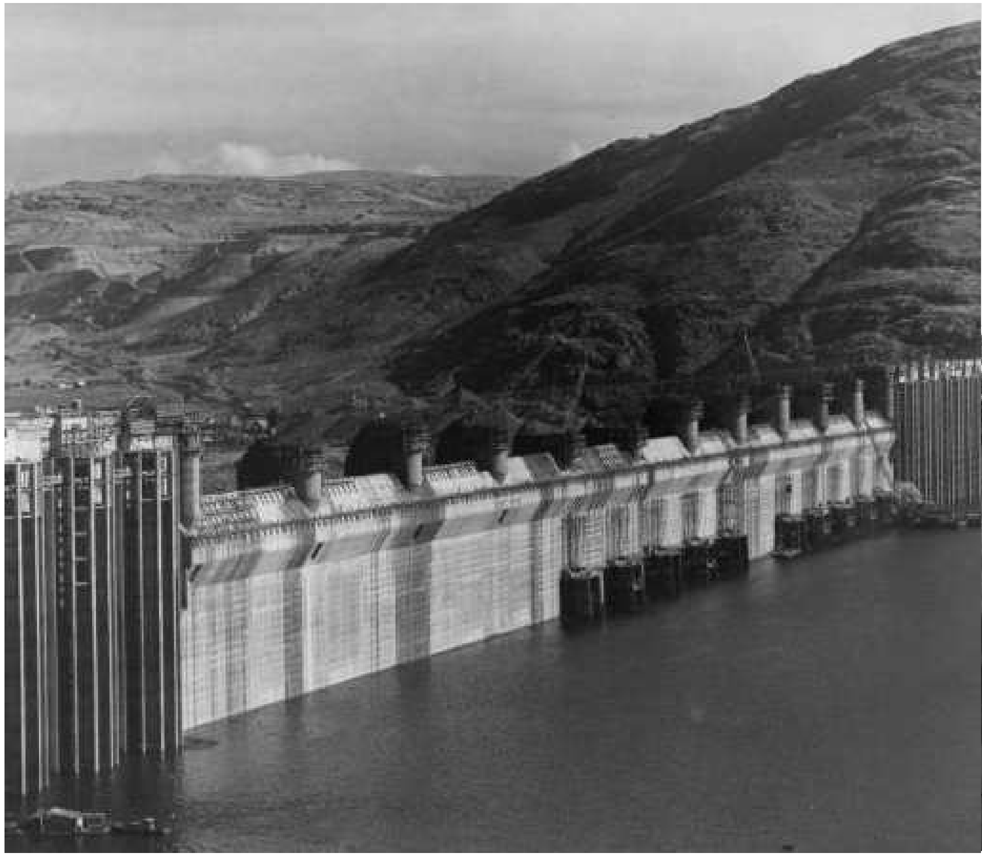


**<u>Above</u>: caption: “Spillway and drum gate construction, June 1940”**

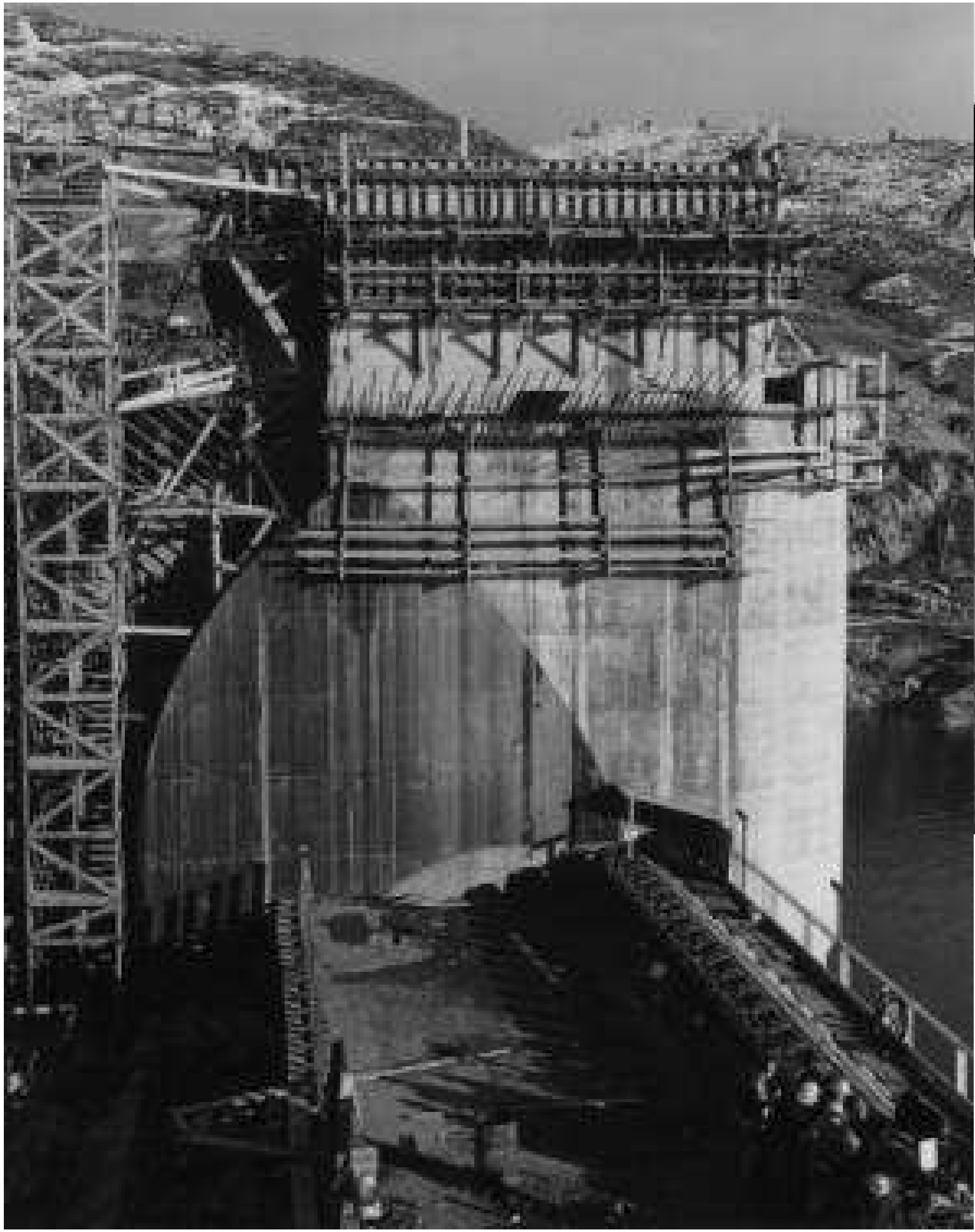
**<u>Left</u>: caption: “Transition form for inlet to 57-inch supply pipe for drum gate control. One of these water supply inlets is in each pier for a total of eleven. A 57-inch butterfly valve will be connected to this inlet for control of water supply, June 1940.”**

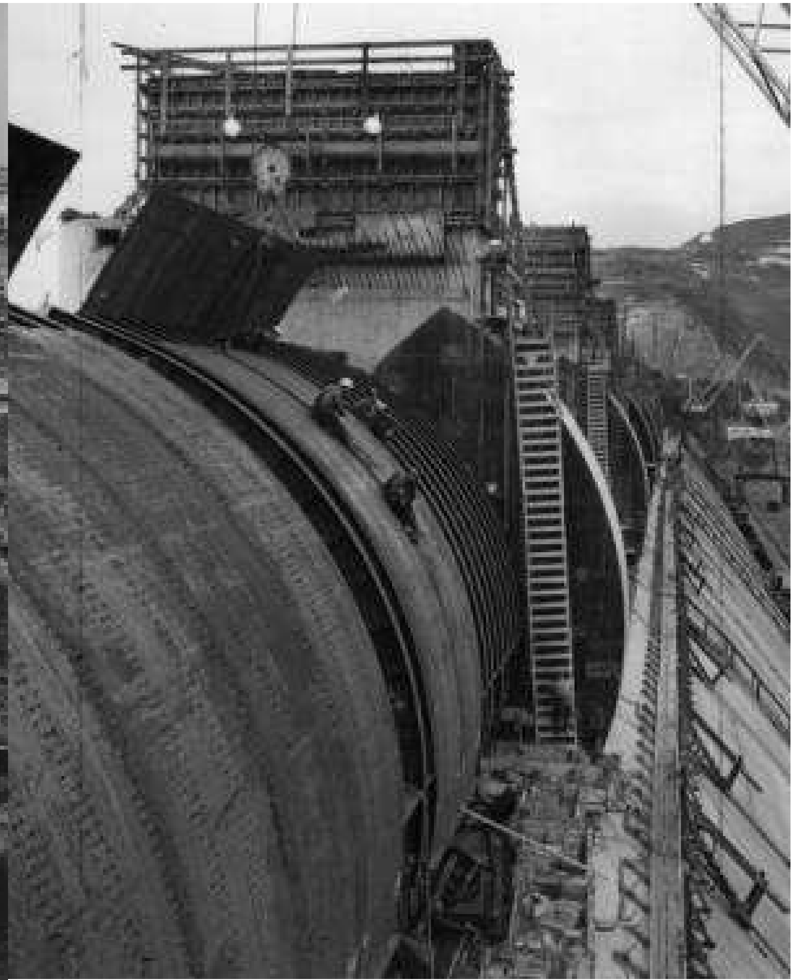


**<u>Above & Left</u>: caption: "Steel and Form work for drum gate install-ation. Steel is for spill-way crest, bridge piers, and drum gate chamber, June 1940"**



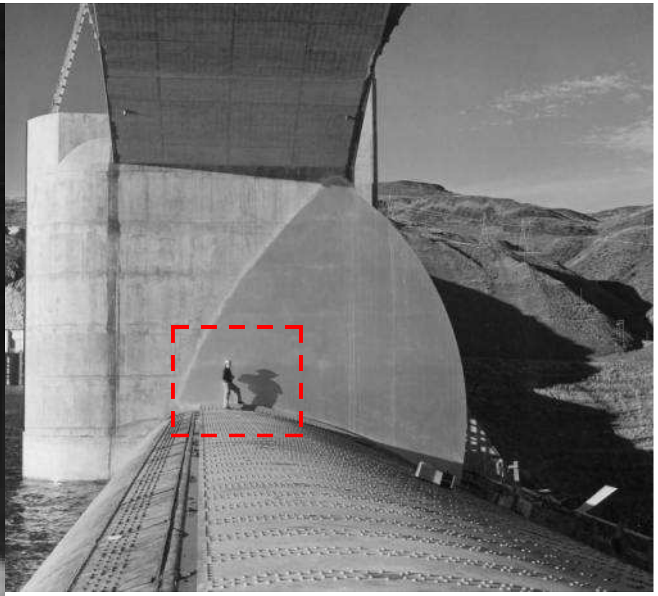
<u>Left</u>: caption: "Spillway and drum gate construction, October 1940"
<u>Right</u>: caption: "Spillway and drum gate construction - Spillway Section – downstream face, October 1940"





**<u>Above</u>: caption: "Men work on drum gate number one, November 1940"**
**<u>Left</u>: caption: "East end of spillway, Nov. 1940"**

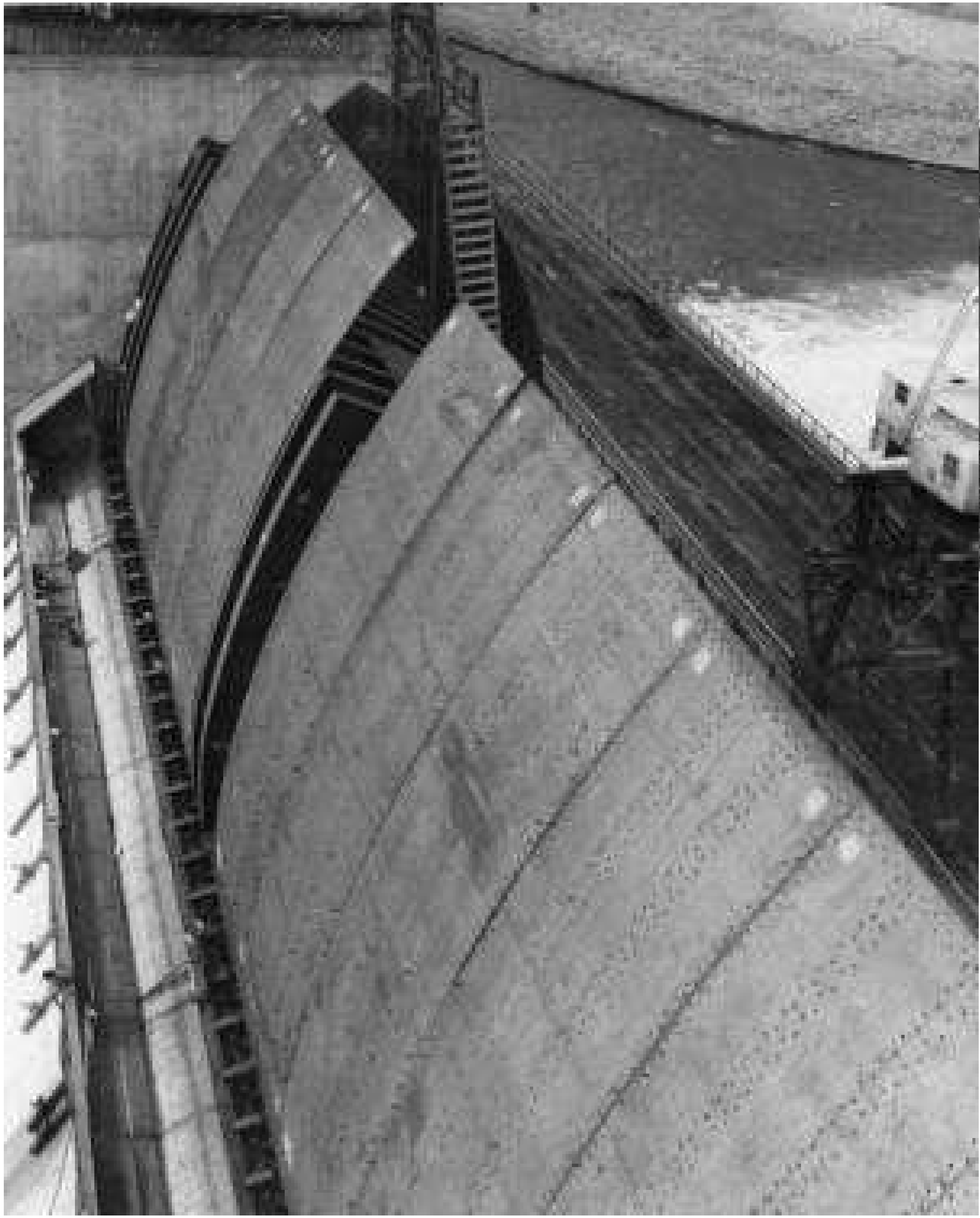
**<u>Above & Left</u>: caption: "Men align drum gate hinges, Nov. 1940"**

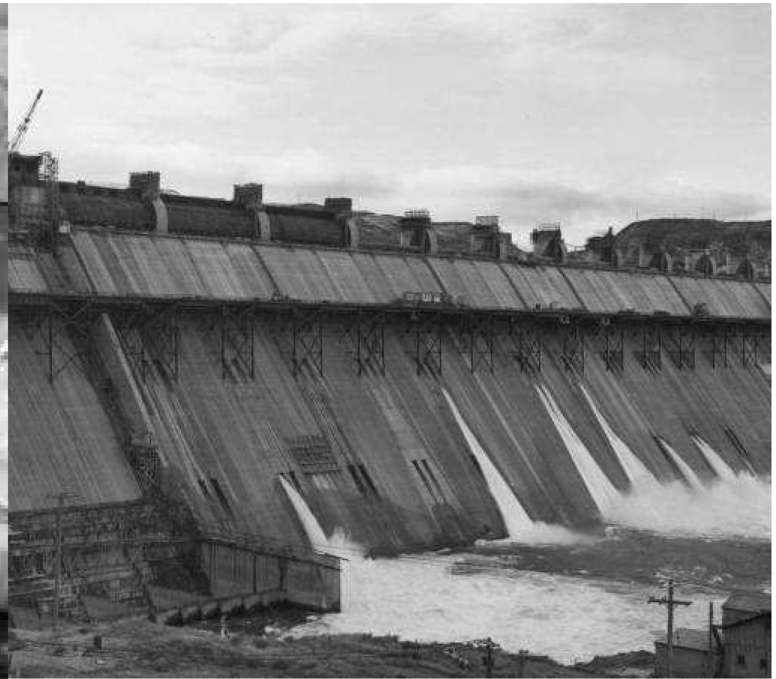


**<u>Above</u>: caption: "A Workman stands on the drum gate arch to give scale, December 1941"**
**<u>Left</u>: caption: "Aim cross-hairs for alig-ning drum gates"**

**<u>Above</u>: caption: "Installation of main girders for drum gate Number One, December 1940"**

**<u>Left</u>: caption: "Drum gate Number One, Dec. 1940"**

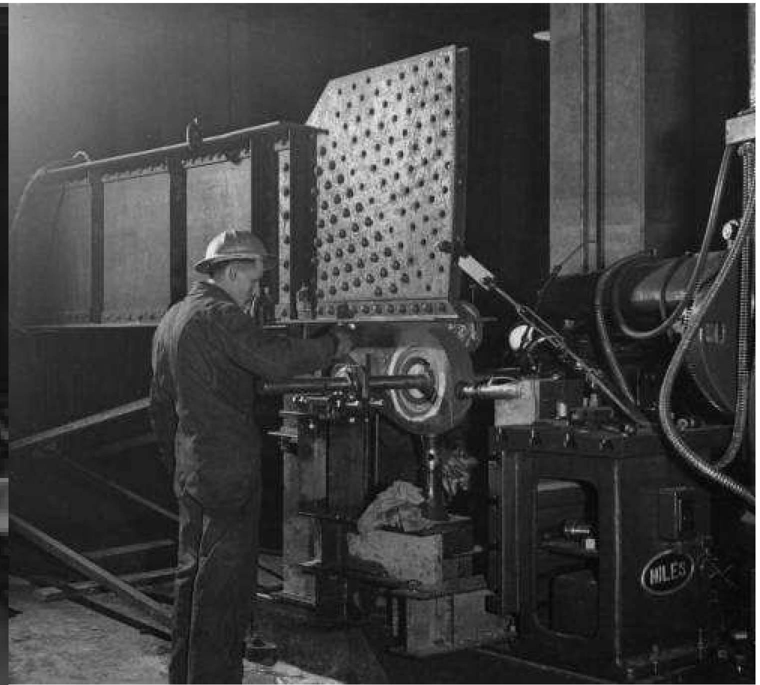




**Above: caption: “Down-stream photo of the spillway section, December 1940”**
**Left: caption: “Drum gate Number One, December 1940”**

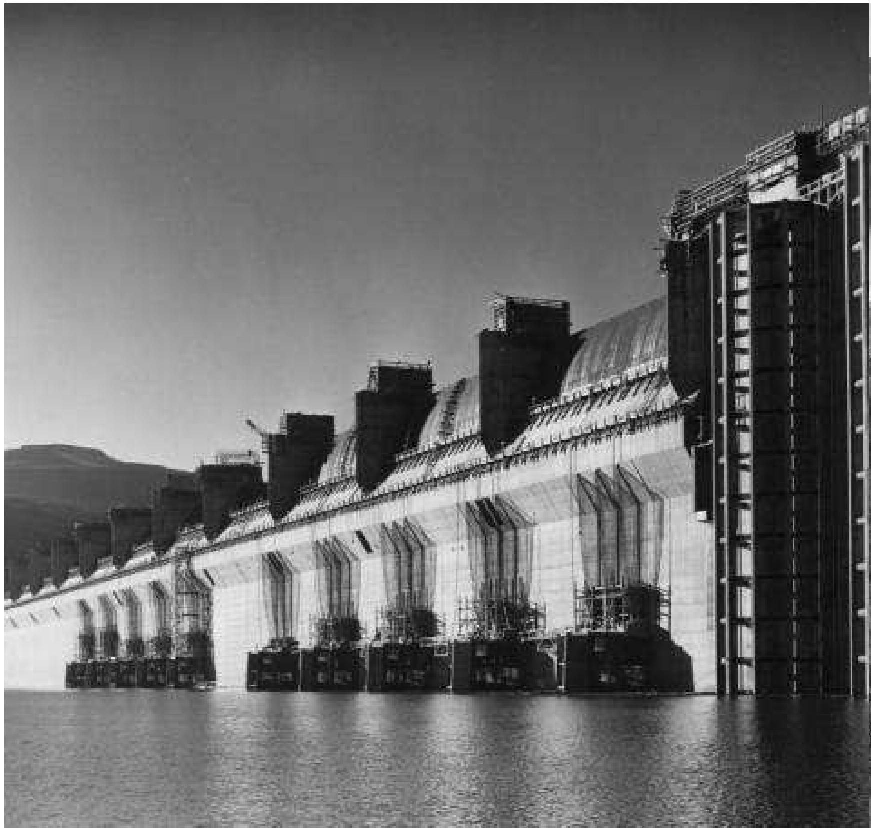
**Above: caption: “Men stand on girder during drum gate construct-ion, January 1941”**

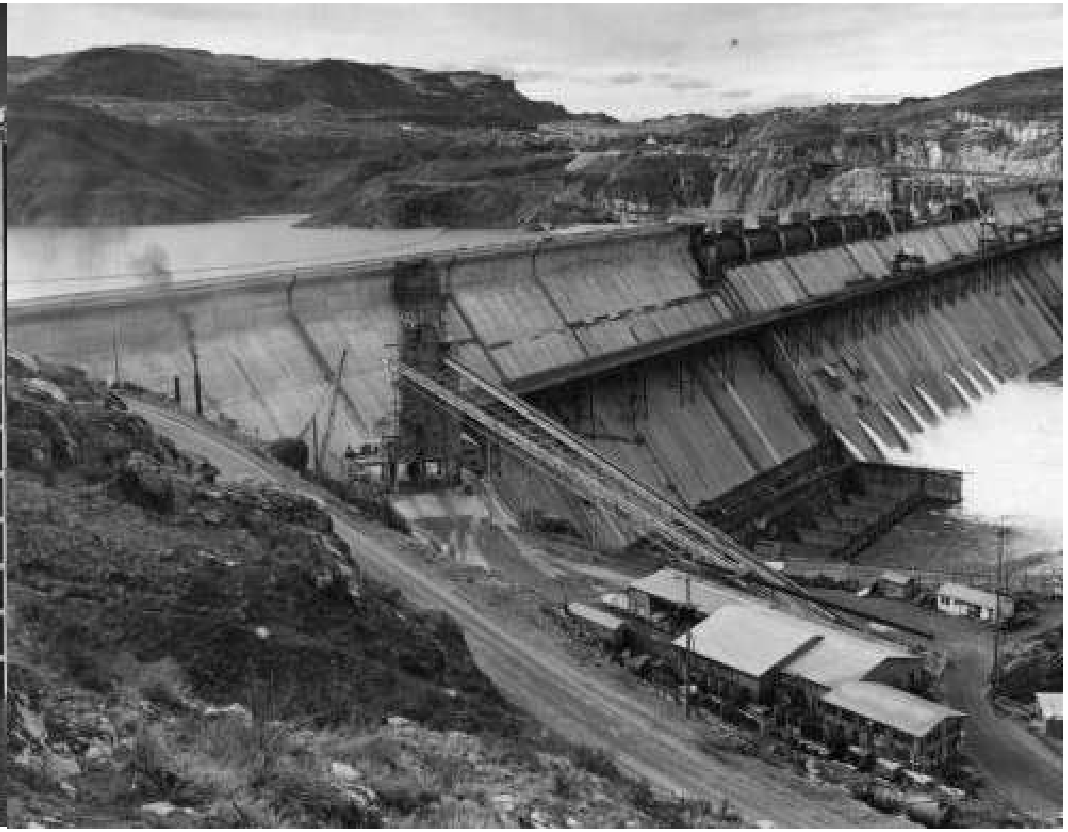
**Left: caption: “Riveting and welding face plates on drum gate Number One, January 1941”**



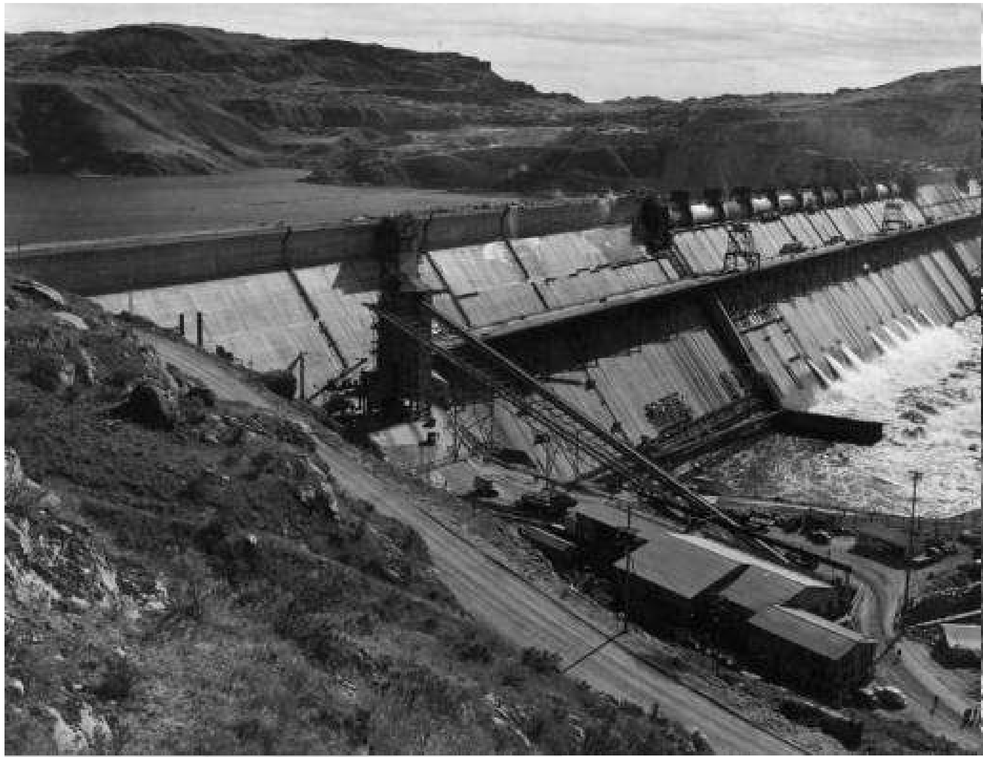
**<u>Above</u>: caption: “Re-boring drum gate girder. Machine shop – powerhouse, January 1941”**

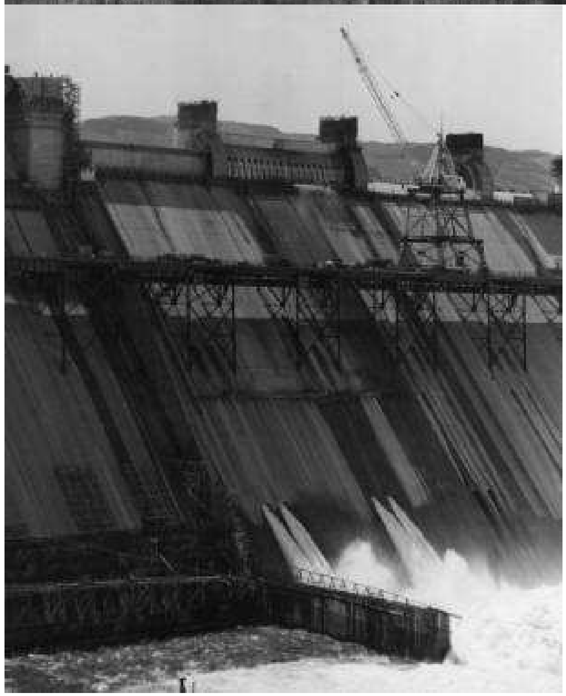
**<u>Left</u>: caption: “School for Riveters, January 1941”**



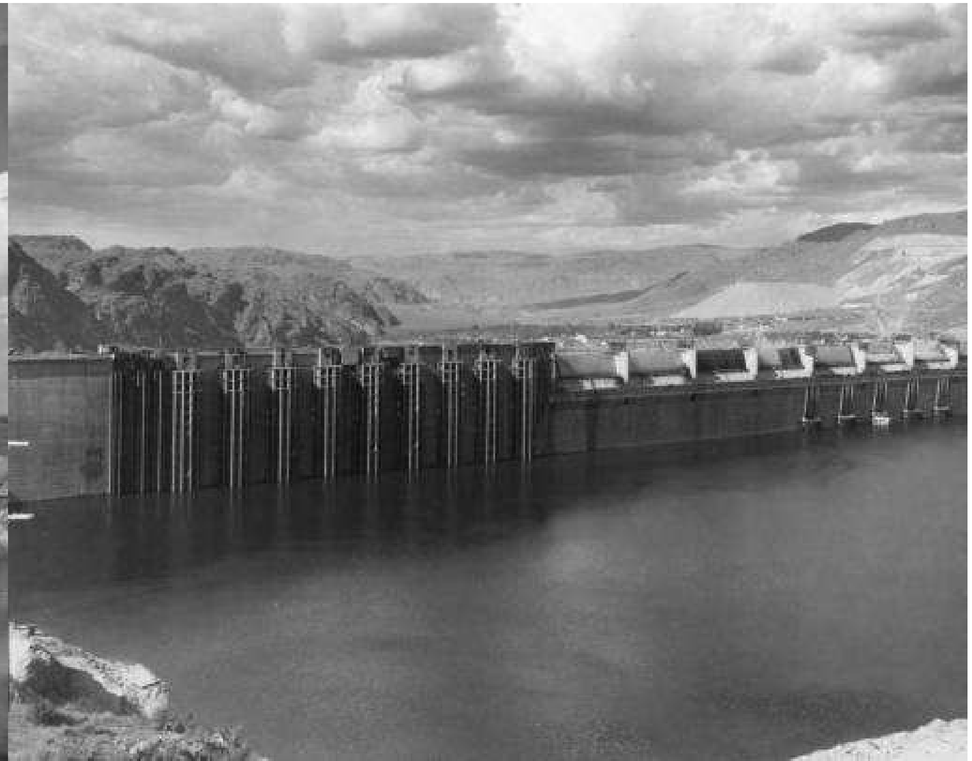


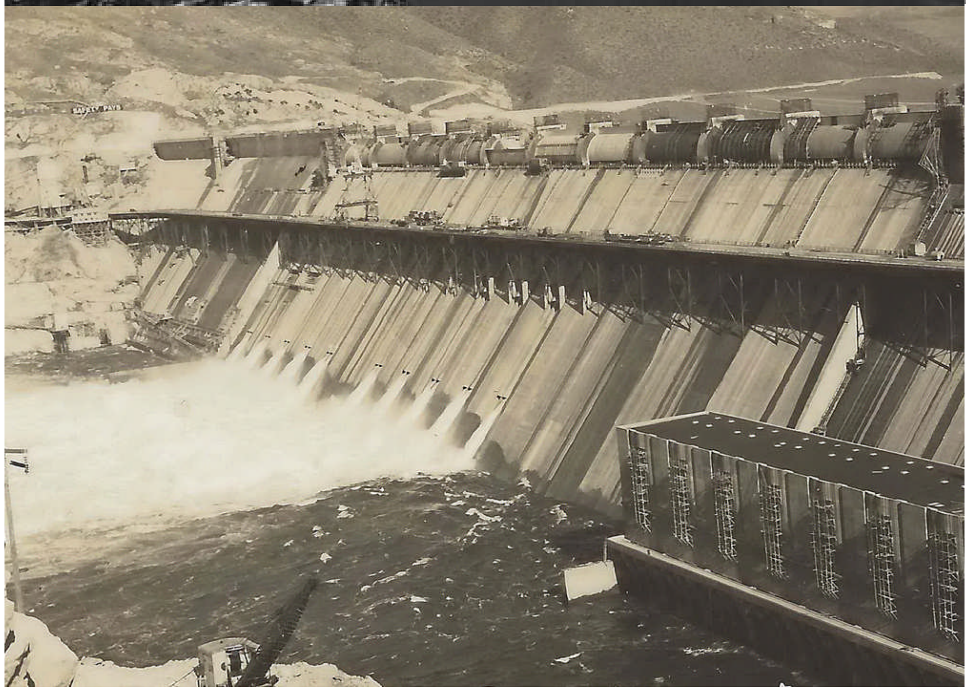
**Top Left: caption: “View of the spillway section from the left bank, February 1941”**
**Top Right: caption: “View of the spillway section from the left bank, March 1941”**
**Left: caption: “Close up view of men working on eastern spillway arch, July 1941”**



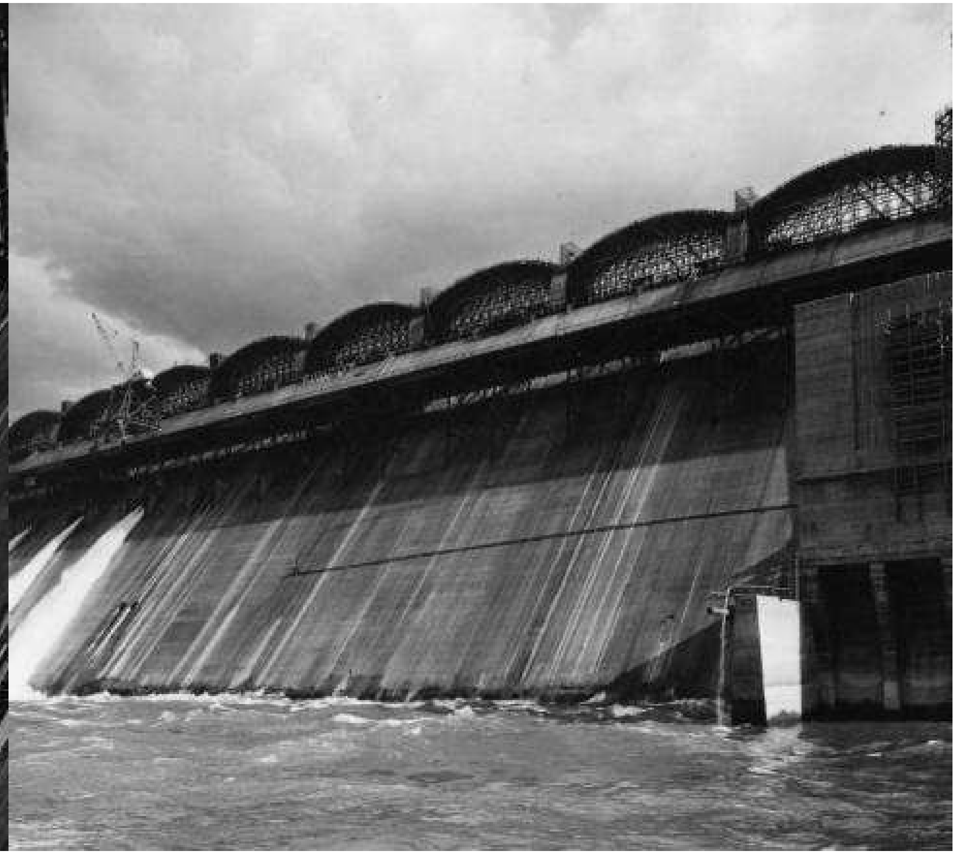


**<u>Top Left</u>: caption: "View of the spillway section of Grand Coulee taken from the right bank, May 1941"**
**<u>Top Right</u>: caption: "View of Grand Coulee from west bank. Cranes visible on bank, May 1941"**
**<u>Left</u>: "View of drum gates near base of the dam, May 1941"**

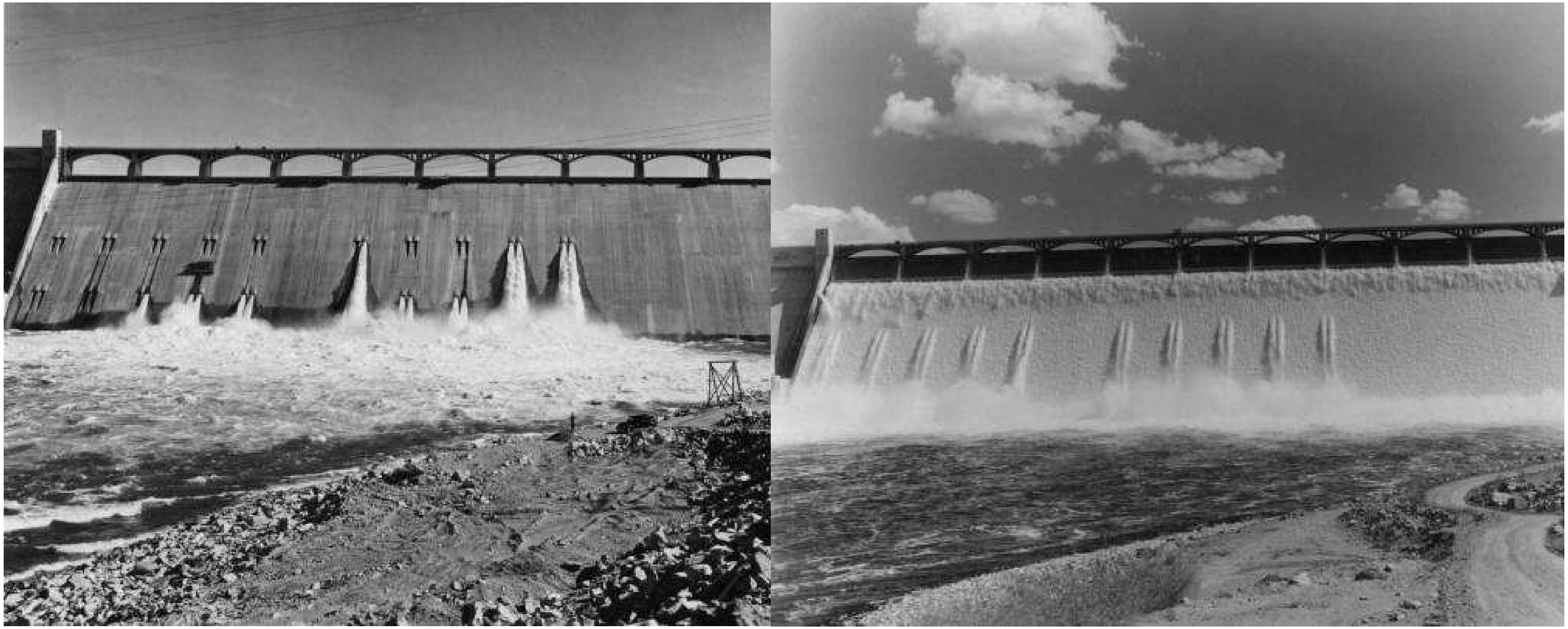




**<u>Top Left</u>: caption: “Upstream view of the dam taken from Rattlesnake Peak, April 1941”**
**<u>Top Right</u>: caption: “Upstr-eam view of the dam, May 1941”**
**<u>Left</u>: caption: “Downstream Face, ca. 1941”**



**Top Left: caption: “View of all of the spillway arches, July 1941”**
**Top Right: caption: “View of a portion of the spillway section showing formwork and falsework for construction of spillway bridge spans. The construction trestle appears below the formwork. Eight of the 102-inch outlet tubes are shown in use for diversion of the river flow (right), August 1941”**
**Left: caption: “View overlooking Coulee Dam - a new transmission tower rises, August 1941”**



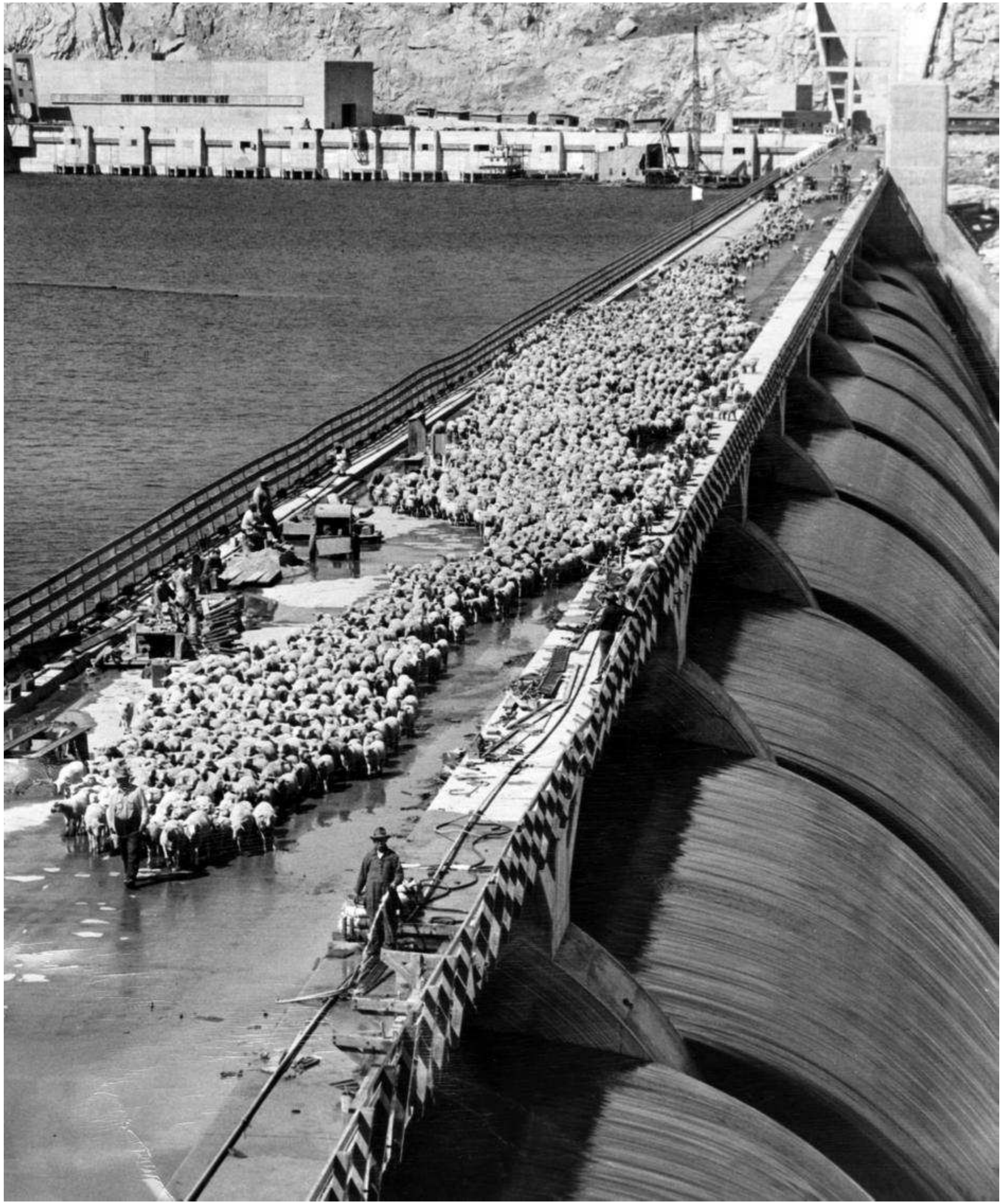
**Left: caption: “Spillway section of the dam as seen from the left bank near the shop building. Note the man and car at the waterline (normal), April 1942”**

**Right: caption: “General view of the spillway section of Grand Coulee Dam, taken from the west bank for the Columbia River. On this date, approximately 80,000 cubic-feet of water per second was plunged nearly 350 feet vertically down the face of the dam, creating a waterfall more than twice the height of Niagara. An additional 25,000 cubic-feet of water per second is passing through the hydro-turbine installed in the west powerhouse, August 1944”**

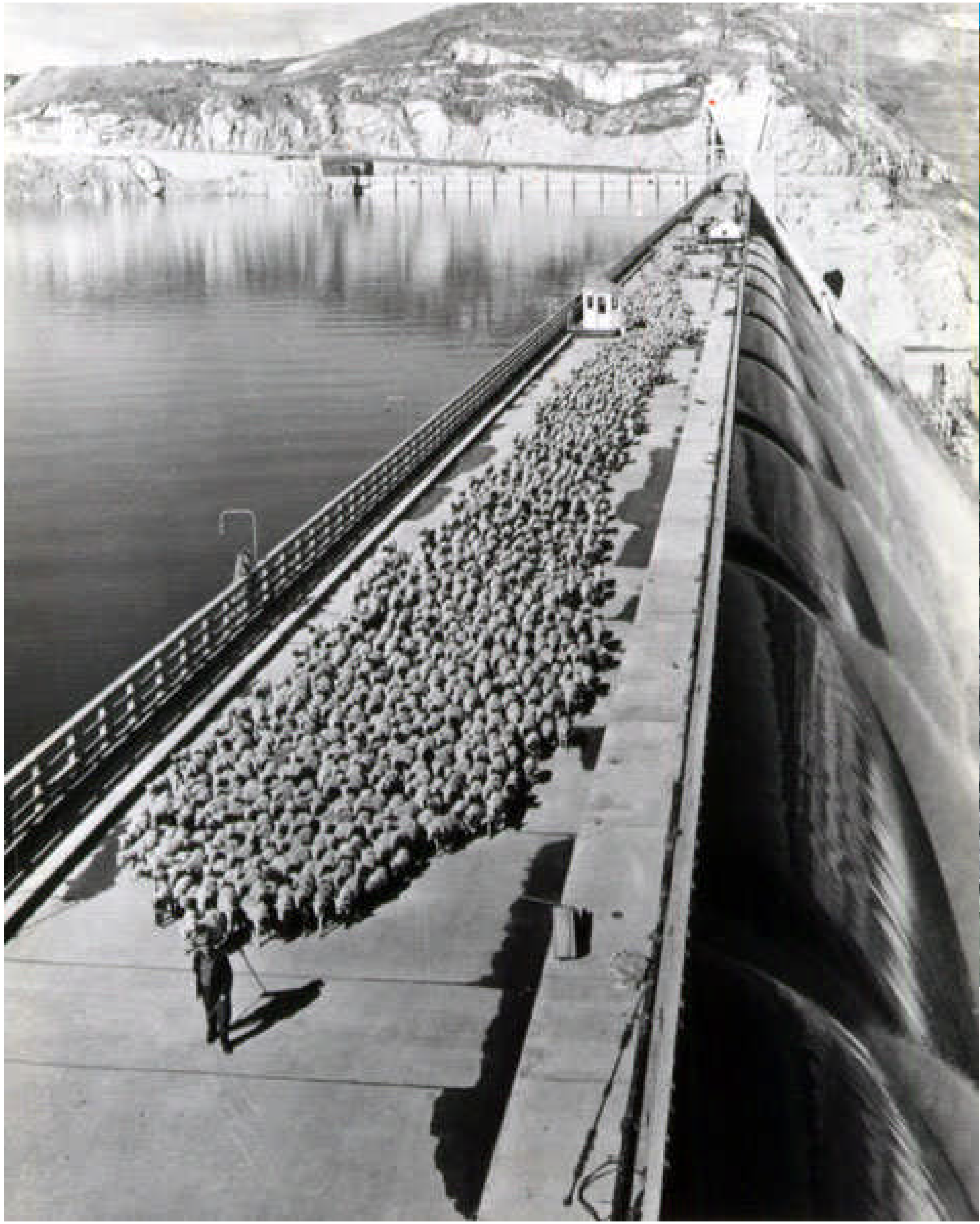
**<u>Above</u>: caption: "View of arch bridge piers and spillway atop Grand Coulee Dam"**

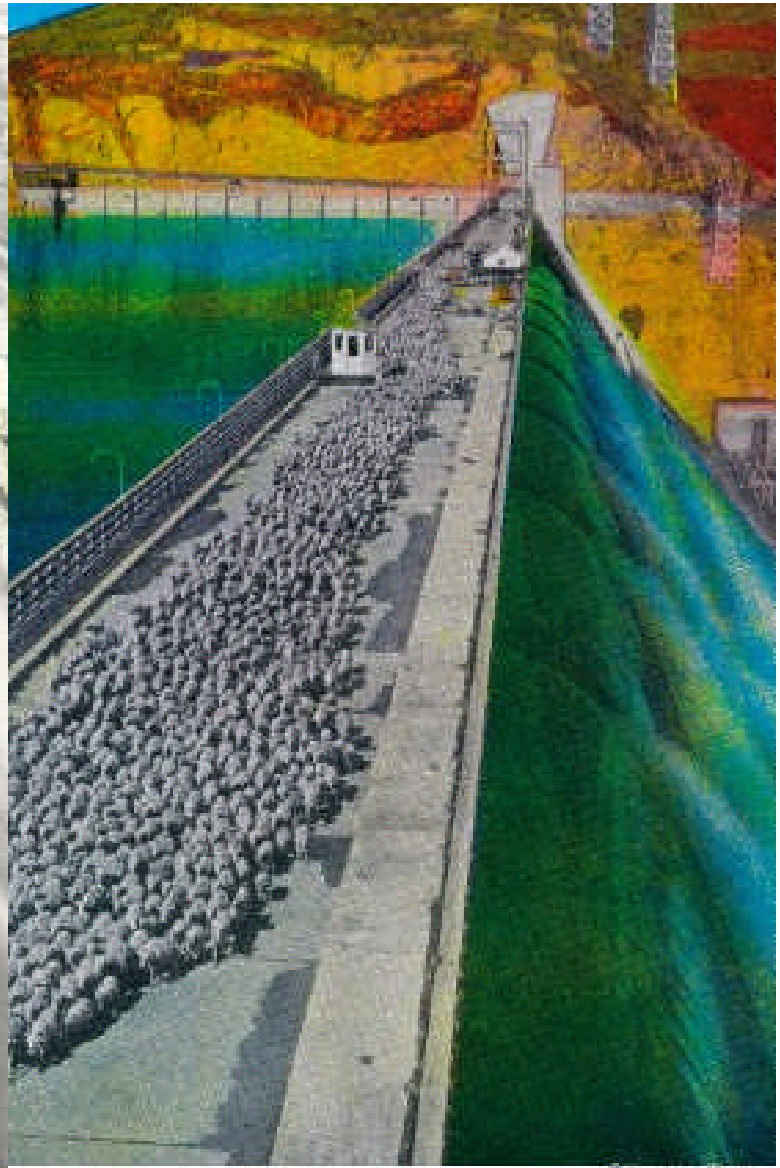
**<u>Left</u>: caption: "View of trash racks and bridge piers during their construction"**

# Hereafter



<u>**Left**</u>**: caption: "A flock of 2600 sheep belonging to Joe Hodgen of Adrian makes its last annual trek across Grand Coulee Dam, heading for summer pasture. The grasslands which provided feed for the flock which each year has moved north through the Grand Coulee will be flooded next year. The Coulee becomes the equalizing reservoir for the Columbia Basin irrigation project. Hodgen has been taking his sheep through the area for thirty-two years. They'll go by truck hereafter."**



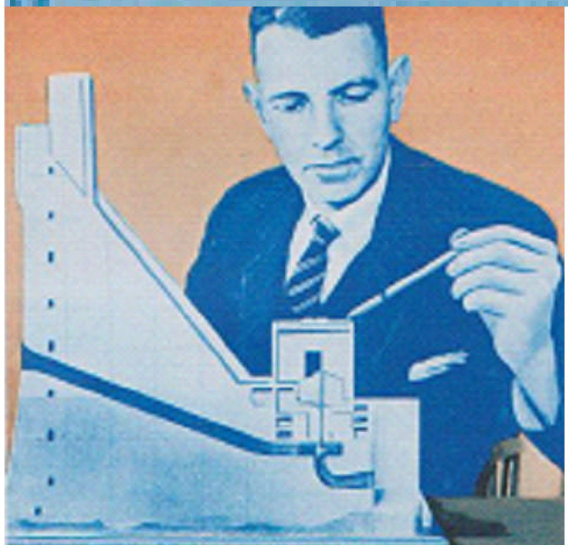


**<u>Above & Left</u>: when a local shepherd took his flock across the dam, the image got a great deal of attention locally and nationally. In fact, it became a popular postcard (above).**

# A View to a Spill

***"…Sightseers appear at the Grand Coulee Dam in such great numbers that, as a matter of safety as well as of convenience to them, special facilities for handling visitors have been provided. Only employees on shift are admitted to construction areas, but the topography at the dam serves the tourist's purposes admirably. On each side of the river, extensive free parking areas accommodate large numbers of cars, and from positions high above and overlooking operations the visitor looks down upon the river and construction activities. Ample provisions are made for the safety and comfort of visitors. Each week during the tourist season, thousands of visitors view with interest an accurate model of the dam located in the west vista house. There is shown, first, one six-hundredth actual size, the vicinity as it appeared before construction work was started, then the excavated area and several stages in the progress of the work, and, finally, the model of the dam, powerhouses, and pumping plant as they will finally appear. Signs along the highway entering Government property direct the visitor to the free Government parking spaces and vista houses…"***

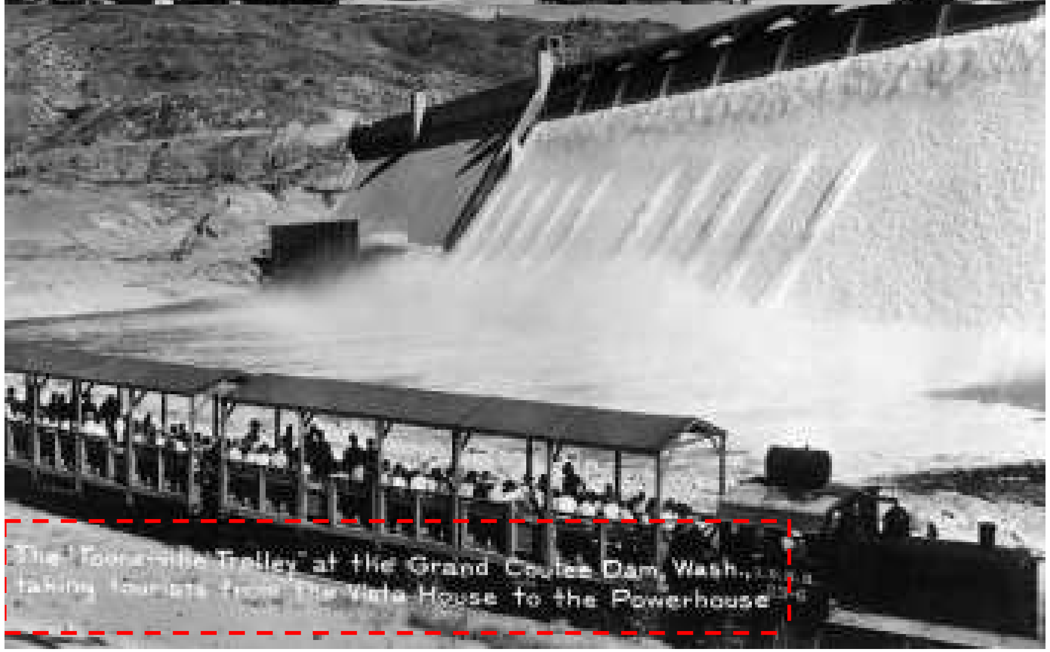
***U.S. Bureau of Reclamation* (ca. 1937)**



**Above: caption: "Upper part of model shows portion of Grand Coulee which was excavated. Lower part shows dam set in excavation."**

**Left: caption: "Cutaway model showing cross-section of dam as it will appear when completed"**

<u>Left</u>: caption: "'Look at that beautiful water, Maw,' exclaimed Mr. George C. Green to his wife as the viewed the Grand Coulee Dam spillway from the parking lot overlooking the west power-house. His statement was not unusual in the way of tourists but the mode of transportation was certainly extreme, a 1904 Oldsmobile. Mr. and Mrs. Green traveled from Lambertsville, New Jersey to Grand Coulee Dam, covering nearly 6,000 miles en-route and planed on going through California in return, July 1946"

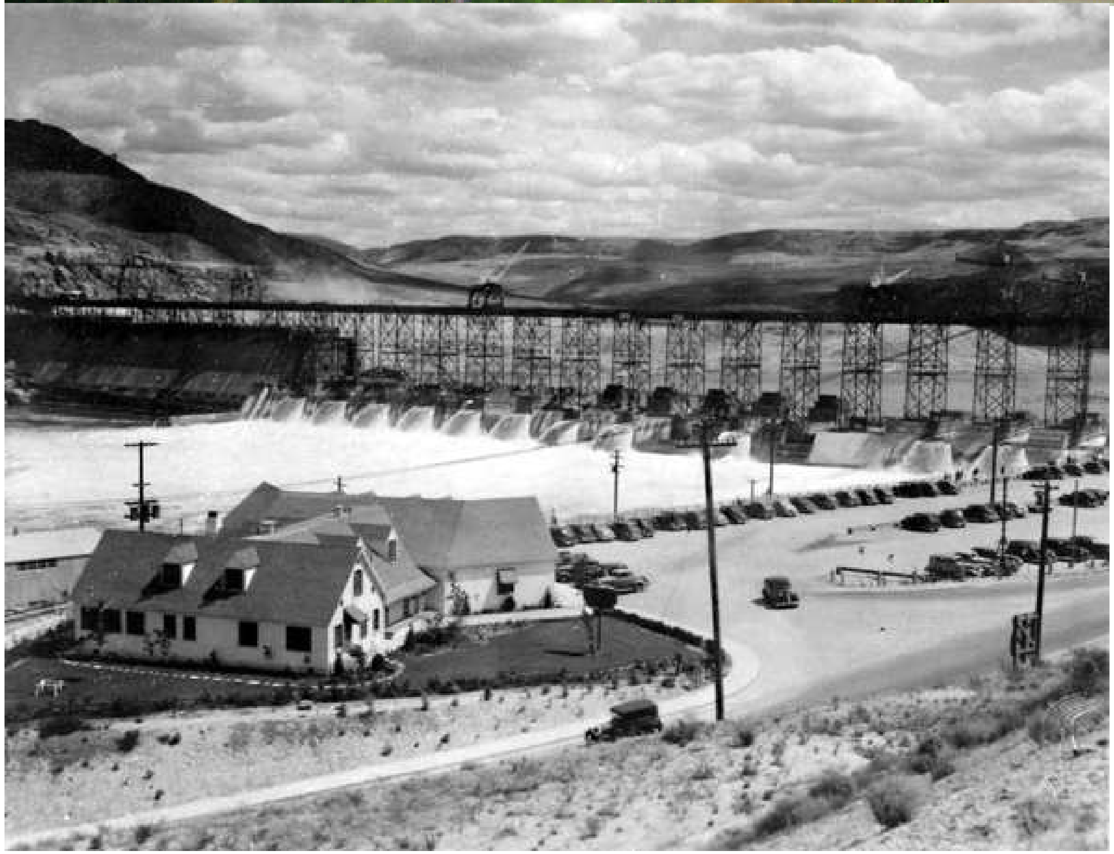

***"Preparations for a tourist horde are being made as swiftly as possible, officials of the Bureau of Reclamation said here today, when they announced that they had started work on a vista point on the east side of the river, the first work of that sort on that bank. On the west side, CCC crews are fast whipping a vista point into shape…"***

***Spokesman-Review,*** **March 12th 1936**

**<u>Top</u>: caption: "Vista House Grand Coulee Dam. On every day of the year except Christmas and New Years day, guides are on duty at the West Vista House at the Grand Coulee Dam, Washington to tell visitors about the Columbia Basin Reclamation Project, which includes the world's largest masonry dam and the world's greatest power producer, and which will later include America's largest single irrigation project."**

**<u>Bottom</u>: caption: "The 'Toonerville Trolley at the Grand Coulee Dam, Wash., taking tourists from the Vista House to the Powerhouse"**





**<u>Above L&R</u>: caption: "'Green Hut Cafe' – overlooking Grand Coulee Dam, Wash."**

**<u>Left</u>: caption: "The Green Hut restaurant in the foreground was built by C.D. Newland on leased land here at Grand Coulee Dam (July 1939)"**

# Roll On, Columbia

*Green Douglas firs where the water cuts through*
*Down the wild mountains and canyons she flew*
*Canadian north-west to the ocean so blue*
*It's roll on Columbia roll on…*

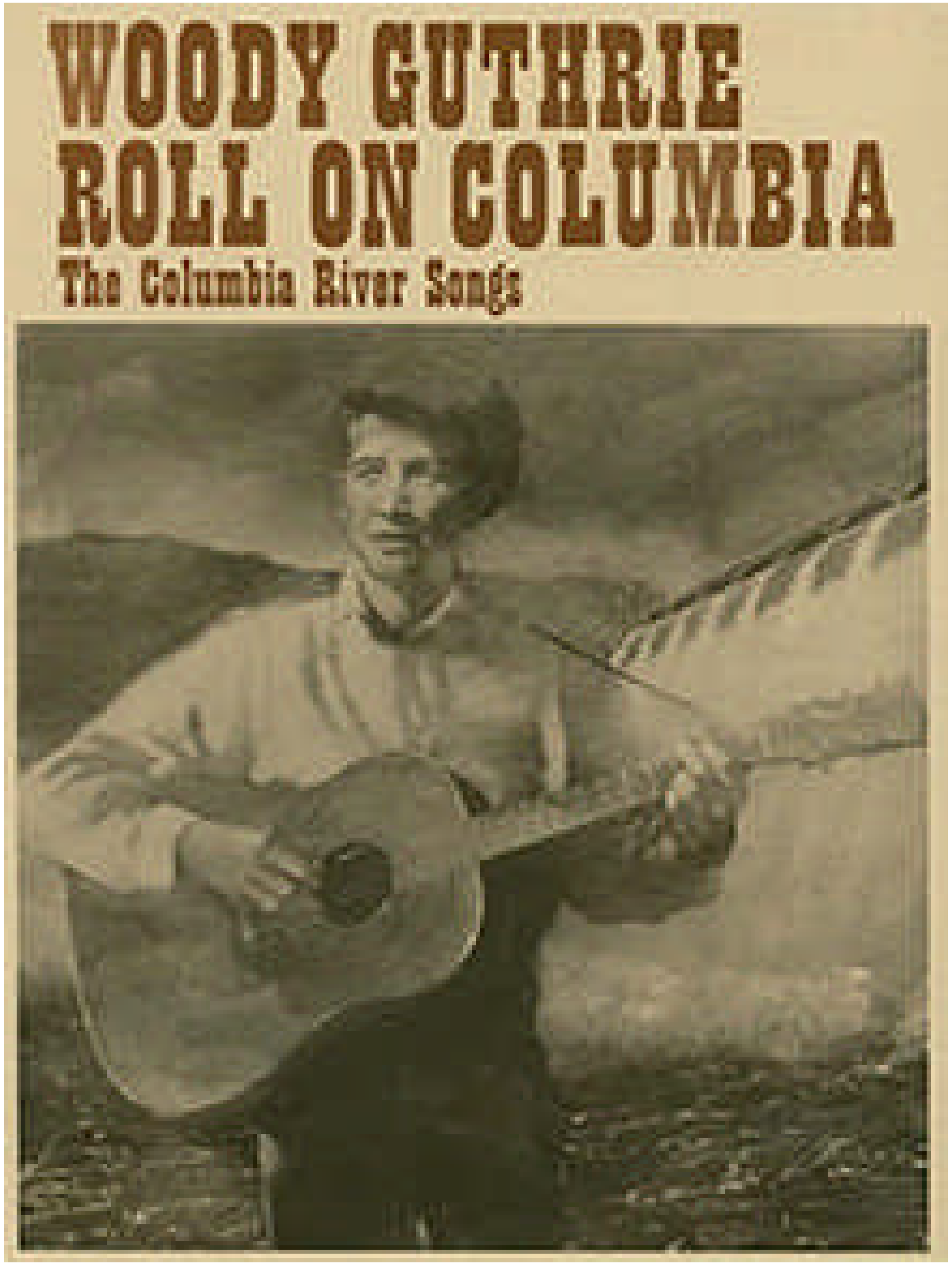
*…Tom Jefferson's visions would not let him rest*
*An empire he saw in the Pacific north-west*
*St. Louis, St. Clarke, and they did the rest*
*It's roll on Columbia roll on…*

*…At Bonneville now there are ships in the locks*
*Waters have risen and hid all the rocks*
*Shiploads of plenty will steam past the docks*
*It's roll on Columbia roll on…*

*…And up on the river is the Grand Coulee Dam*
*Mightiest thing ever built by a man*
*To run the great factories and water the land*
*It's roll on Columbia roll on*

*Roll on Columbia roll on*
*Roll on Columbia roll on*
*Your power is turning our darkness to dawn*
*So roll on Columbia roll on*

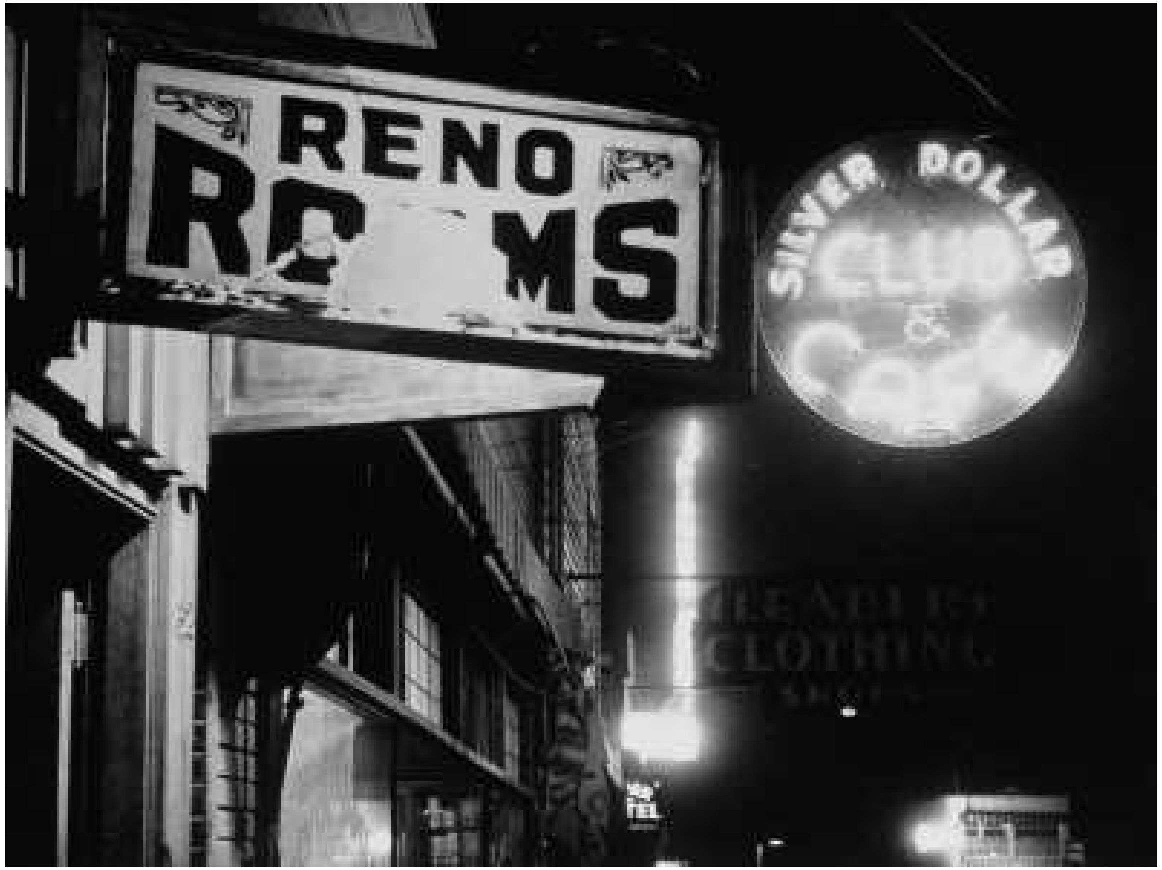
**RE: song entitled: "Roll On, Columbia, Roll On," by folk singer *Woody Guthrie***




**"Roll On, Columbia, Roll On," was part of the *Columbia River Ballads* - a set of twenty-six songs written by folk singer/songwriter *Woody Guthrie* as part of a commission by the *Bonneville Power Administration* (BPA), the federal agency created to sell and distribute power from the Columbia River's federal hydroelectric facilities (primarily *Bonneville* and *Grand Coulee Dam/s*). At the time (1941), the agency was facing a controversy because several counties in Washington and Oregon had begun construction of their own dams on the Columbia, outside of federal jurisdiction. The BPA hired Guthrie to write a set of songs about the federal projects to gain support for federal regulation of hydroelectricity. Of all the Columbia River Ballads, *Roll on, Columbia* was by far the most popular, forever associated with the *Columbia Basin Project.* It became the "official folk song" of the State of Washington in 1987.**

**On the downstream, eastern bank of *Grand Coulee Dam* there’s a statue of a man, sitting on a bench, playing his guitar for two young children (above L&R). It’s named: “After Work,” and represents a popular, wholesome leisure activity of the dam workmen (of course, there were also the B Street bars and brothels to keep them entertained in their off-hours). The image of the man singing and playing the acoustic guitar plays on the idealized image of the folk singer, used to great effect by the *Bonneville Power Administration* in 1941 for publicity purposes. The image of *Woody Guthrie* writing songs about the *Columbia River* immediately comes to mind. Truth be told, he was hired for only thirty days and spent most of his time in Portland, Oregon. The children on the bench are also somewhat out-of-place. Most of the people who migrated to the *Grand Coulee* area during the dam’s construction were single, unemployed men seeking work.**


RENO
SILVER DOLLAR
CLUB
&
CLOTHING

# Part 9

# A Planned Promised Land

***"...in this region major projects were started which all believed could achieve the planned promised land...The dams along the Columbia were designed to achieve the promised land for the people of the Pacific Northwest."***

***Richard Lowitt,*** **Author**

# Coming Into Being

*"…How was this 'Eighth Wonder of the World,' as it has been called, brought into being? It happens to have been the writer's good fortune to know several of the citizens of Washington State who have pressed for a favorable decision by Uncle Sam on this project in years when it looked as though the sprawling waste that was the Central Columbian Basin might remain forever a sage-dotted desert. Among these was James O'Sullivan, now secretary of the Columbia Basin Commission, formerly a mathematics teacher and civil engineer. He, as much as any one man, followed the project through until Uncle Sam turned it over to Dr. Elwood G. Mead, of the U.S. Reclamation Service, with the order to 'carry on' with the gigantic undertaking…"*

***Popular Science,*** **February 1936**

***"…Merely to hint at the romance, the grim battle that led to final endorsement and financing of the project, there was one winter when O'Sullivan, down to his last dollar, borrowed enough money to mount an oil stove in the back of a rickety old limousine. In this car he plowed through snow and sleet and boggy roads, pleading with the citizens of one little town after another to help get the state behind this dream of half a century. A milliner donated five dollars a month from her scanty earnings, for a year. A depression-haunted banker in a tank village took his last Liberty Bond from his private safe, to help convince the legislators at Olympia that Grand Coulee, proven sound engineering after years of bickering and contrary reports, must be made a reality…"***

***Popular Science,*** **February 1936**

***"…For fifteen years, state, Federal, and private engineers had wrestled with the problem. Finally, the U.S. Army engineers recommended a comprehensive plan for developing the Columbia to provide storage, navigation, flood control, power, and irrigation. It calls for ten dams, including one at Rock Island, Wash., already built by private capital; Bonneville, close to Portland, Ore., and Grand Coulee…"***

***Popular Science,* February 1936**

***"…'Two hundred and fifty feet to bed rock!' howled the engineers, when the building of Grand Coulee was proposed. As a matter of fact, the builders have struck bed rock well within 100-feet at nearly every point…"***

***Popular Science,* February 1936**

# An Empire of Their Own

***"Such a power if developed would operate railroads, factories, mines, irrigation pumps, furnish heat and light in such measure that all in all it would be the most unique, the most interesting, and the most remarkable development of both irrigation and power in this age of industrial and scientific miracles."***

***Rufus Woods***

**Left: caption: "Rufus Woods at Grand Coulee Dam, ca. 1941." On May 14th 1919, *Rufus Woods* – editor and publisher of *The Wenatchee Daily World,* wrote a headline stating that a dam on the Columbia River *"Would furnish the Power to Run all Industries in a Washington Empire."***

**The power and the irrigation provided by the *Columbia Basin Project* (CBP) made it an essential element in the economy of the western U.S. The businessmen of Washington State towns like Wenatchee, Ephrata, Spokane and Pasco understood the link intuitively. They foresaw that damming the river would provide cheap electricity and abundant water, thus transforming the region into an agricultural and industrial power house. By selling the electricity generated by the dam, the costs would be amortized making the project self-financing. The dream of practically free irrigation (supported by the sale of electric power) seemed unarguable. After all, why should Washington State farmers not have the same advantages as wetter regions of the country? Artificial irrigation would provide what nature had not.**

# Nature’s Failure

***"…Farmers, businessmen, professionals, and promoters looked to irrigation to make the dry parts of the West bloom. This lure would bring industry, development, and self-sufficiency. Increasingly they expected the federal government to pay the costs. Seldom did they see the paradox as they demanded financial support from the East and at the same time resented their colonial status. They wanted independence, growth, development, and a successful agricultural base to make their regions autonomous, independent, and prosperous. They wanted to remake the East and they accommodated themselves to local conditions and federal largess only enough to accomplish that end. It led them to decry both the stingy support they felt they received from the government and the strings attached to the money they fought so hard to garner…"***

***Paul C. Pitzer*, Author/Historian**

**RE: the goal of the CBP was reclamation to compensate for "nature's failure." Once irrigated, the project's promoters felt certain that the land would support thousands of farmers who, in turn, would provide the human base for an industrial empire. After all, settlers who came to the arid *Columbia Basin* in the 1870s and '80s dreamed of irrigation. Thus, the CBP was the result of many interrelated visions of the future. The dam's enormous power potential would turn machines, illuminate cities and bring prosperity to an area heretofore avoided as a no-man's-land. All of this drove the construction of *Grand Coulee Dam* and the CBP.**

***"The farms on the 516,320 acres of land that have been irrigated on the project have made generally excellent progress. As a result of pre-planning, the project has made greater strides than has any other irrigated area in a similar period in the history of the West. The new farms are wired for electricity and telephone. Schools are conveniently available to all farm families. By and large, settlers in the Columbia Basin Project lands have escaped the austerity and drudgery of pioneers on many other reclamation projects*. *World War II delayed settlement for a decade and changed the entire technological structure of United States agri-culture. Large scale, low labor requirement, highly specialized, mechanized, effic-ient farm operating units made the family farm of tradition an outmoded, un-realistic concept. The policies governing the project (and other Bureau of Rec-lamation projects), however, were unresponsive to the changed post-war conditions. The inflexibility has led to several deplorable aspects as the project's development responded more to outside forces and less and less to control by planners."***

***William Warne,* U.S.B.R. - Assistant Commissioner (1973)**

**RE: when the CBP began in earnest (in 1933), FDR's *New Deal* included the concept of a pre-planed economy. What they hoped to create was a "Planned Promised Land" of small farms (about eighty-acres each) where displaced "Dust Bowl" refugees could settle into a new, productive life. Through a controlled economy, the federal government would guar-antee the success of these settlers. In the late 1930s, New Deal planners and others in the region debated how best to achieve their goals. However, before any of the newly fertile land had received water, America entered WWII and the rapid changes that it brought altered the vision from irrigation to power production for the duration of the war.**


**Grant County, WA (left) was created by the Washington State Legislature in 1909, with civic leaders immediately undertaking a promotional campaign to attract settlers to the area. In a pamphlet prepared for the *Alaska-Yukon-Pacific Exposition* (held in Seattle later that year), Grant County was already being trumpeted as a place with few pests, great weather and excellent schools and churches. It was also being promoted in exposition pamphlets as a prime area for agriculture: *"Farmers in Grant County make more money and make it easier than the farmers of any other section."* However, truth be told, by 1909 the Grant County area had been through several years of unusually wet weather, so the pamphlet only represented the area's most recent history. Generally, Grant County has a semi-arid climate, with warm and sunny weather but not enough rainfall to support large-scale farming without help from other water sources. To cultivate lands that did not border on a natural waterway, man-made irrigation systems were required.**

# A Founder’s Tale

**In early 1952 (the 50th anniversary of the founding of the U.S.B.R.), *W. Gale Matthews* (left, ca. 1945), a long-time resident of Grant County (since 1890) and, at the time of his reminiscence, president of the *Grant County Title Abstract Company*, recalled the beginnings of the *Columbia Basin Reclamation Project* (CBRP) which would, ultimately, give birth to *Grand Coulee Dam*. Matthews' account was transcribed from a speech he gave to the *Grant County Historical Society* in early 1952. He tells of the early ridicule facing this proposal and the war of ideas waged between dam proponents and others advocating a rival irrigation scheme.**

*“One of the earliest attempts to irrigate any sizable part of this area occurred following 1897 when the last James J. Hill (1838-1916), President of the Great Northern Railway Company, was contacted by one J.B. McIntyre, who lived in the Puget Sound Country. In 1898 Mr. Hill and the Great Northern Railway Company entered into a contract with the Co-operative Irrigation Company to furnish funds to build an irrigation ditch which would, when completed, take water from Brook Lake and irrigate the area. The ditch was started but the Company got into financial difficulties and after one or two reorganizations a ditch was constructed and a large aqueduct was built across the swamp west of the town of Adrian and water was actually delivered to some of the land. However, the program was not a success and was ultimately abandoned...”*

***W. Gale Matthews*, 1952**

***"…By 1910, the Columbia Basin area had been quite completely settled, as relates to the even numbered sections, by homesteaders and of course the odd numbered sections were Northern Pacific Railway land under an Act of Congress. These homesteaders were encouraged by the lush growth of bunch grass and sagebrush and endeavored to farm it by dry land methods but their crops had from year to year grown less and less, due to lack of rainfall. It was around 1907 when a group of homesteaders in the south Quincy area got together and formed an association known as the Quincy Valley Water Users Association. The purpose of this organization was to levy voluntary assessments on themselves and to secure what other financial assistance they could and have studies made looking to the reclamation of the great Quincy Valley. One Joseph Jacobs, a consulting engineer of Seattle, did some studies looking to the watering of the Quincy Valley from Lake Wenatchee. The result of his studies was so encouraging to the homesteaders in the Quincy Valley that around 1910 the Quincy Valley Irrigation District was organized under State law and detailed plans and studies were made and paid for by assessments levied on the land by that irrigation district…"***

***W. Gale Matthews*, 1952**

***"…In 1914 there was submitted to the State of Washington a proposition to bond the State for several million dollars to irrigate the Quincy flats. The bond issue did not carry and the plan failed and little that was tangible was done for several years following. In all probability the actual beginning of the Columbia Basin Reclamation Project, based upon the building of Grand Coulee Dam, can be traced to an incident which happened in Ephrata in the last spring or possibly early summer of 1917…"***

***W. Gale Matthews*, 1952**

***"…At that time the nations of the world, including our own country, were engaged in World War I and it was the patriotic duty of everyone to give their best efforts to the production of more foodstuffs in order that our own armies and the armies of our allies might be fed. This idea was frequently the subject of conversation. On that particular spring day in 1917 there were gathered in the office of Mr. William M. Clapp, an attorney in Ephrata, Washington, several people living in Ephrata and the subjects of the day were being discussed and among them the matter of raising more grain and bringing more land into production. Someone remarked that it would have been a good idea had the State of Washington in 1914 approved the bond issue and the Quincy flats could be producing large tonnages of grain and other foodstuffs. Someone said that the water could be pumped from the Columbia River at Rock Island by building a dam at Rock Island to produce the power…"***

***W. Gale Matthews*, 1952**

***"…Among those present in the office that afternoon were A.A. Goldsmith of Soap Lake, Mr. Clapp, of course, Mr. Paul D. Donaldson, and possibly there was present the Honorable Sam B. Hill, who was then Judge of our Superior Court and myself. Sam B. Hill later was elected to Congress from the Fifth Washington District and contributed materially to the ultimate consummation of this Project. When the subject of the dam at Rock Island was mentioned, Mr. Donaldson spoke up. He had recently been on a geological trip with the late Dr. Landis of the University of Washington, and their trip had taken them along the Columbia River and around Grand Coulee. Dr. Landis apparently had been discussing with Mr. Donaldson on that trip the theory of the glaciers which came down across the Okanogan highlands and dammed the Columbia River at a point below the present site of the Grand Coulee Dam, and which resulted in a division of the flow of the Columbia River and as the ages passed the excavating of Grand Coulee…"***

***W. Gale Matthews*, 1952**

# Speaking of Dams…

***"…Mr. Donaldson said, 'Speaking of Dams,' and then went on to relate to those present the theory and the story which Dr. Landis had related to him on the trip. When Mr. Donaldson had completed that recitation, Mr. Clapp spoke up and suggested that if nature had at one time dammed the Columbia River near the head or rather below the head of Grand Coulee with ice why could it not again be dammed with concrete and the flow of the river diverted again down through Grand Coulee and the water used to irrigate the great Columbia River Basin extending down through Grant County, Adams County, Franklin County clear down to the Snake River…"***

***W. Gale Matthews*, 1952**

***"…Of course, general discussion was had on the subject and in their entire ignorance of the engineering features involved, those present conceded that it might be a good idea. No one, however, had the courage to go out and say very much about the idea, fearing the 'kidding' which would result. However, that group and others from time to time frequently met in Mr. Clapp's office and other offices around Ephrata and the subject of the dam in the Columbia River would always come up until the few in Ephrata had succeeded in selling themselves on the feasibility of the idea…"***

***W. Gale Matthews*, 1952**

**Left: *William M.* ("Billy") *Clapp*, in December 1945**

***"…As the summer of 1917 passed and the fall came on, the little group in Ephrata took into their confidence Mr. Norval Enger who at that time was the Deputy County Engineer of Grant County. He was a very able engineer and at the present time is engaged in work for the Bureau of Reclamation on one of the projects in the Dakotas. Mr. Enger listened very attentively to the ideas of the group and when asked if he would run a preliminary set of levels to determine the difference in elevation between the river and the floor of the Coulee and make some investigation as to the side walls and so forth, he agree to do so if the County Commissioners would consent to it…"***

***W. Gale Matthews*, 1952**

***"…With some hesitation Mr. Clapp, Mr. Donaldson, Mr. Goldsmith and Mr. Matthews appeared before the Board of County Commissioners and 'propositioned them on the matter.' The County Commissioners consisting of Mr. D.C. Thiemens, of Ephrata and Mr. J.C. White of Moses Lake were not very enthusiastic about the deal. The third member of the board, Mr. Thomas H. Twining of Coulee City, was not present, he at that time being in the armed forces. However, the County Commissioners agreed that Mr. Enger could make something of a reconnaissance survey of the area provided the petitioners did not say anything about the matter publicly and the facts of the case are that nothing appears on the Commissioners' records about it…"***

***W. Gale Matthews*, 1952**

***"…Mr. Enger did during the winter of 1917-1918 run a set of levels from the river up to Grand Coulee and did take a look at the general situation. He reported to the Commissioners and to the group in Ephrata that the proposition might have merit but it would require a great deal of engineering study and the costs would be beyond the financial ability of the County. Little else of importance happened in connection with the project except the conversations of the Ephrata group continued and grew more frequent and the convictions of those in on the proposed project became more fixed each day that the project not only could, but definitely should, be built. However, they met with a considerable discouragement for whenever the subject was mentioned to others around town, the net result was generally ridicule…"***

***W. Gale Matthews*, 1952**

***"…It was shortly before the eighteenth of July 1918, when Rufus Woods (1878-1950), publisher of the Wenatchee Daily World, dropped by the office of Mr. Matthews one afternoon and inquired as to the possibility of a story about the Ephrata area to be published in the Wenatchee Daily World. It was quite the custom of Mr. Woods to cover the Central Washington area and pick up stories for his paper. Mr. Matthews informed Mr. Woods that at the moment he was a little bit busy but that there was a story which merited some study and suggested that Mr. Woods go to see Mr. Clapp and ask him to relate the story about a proposed dam in the Columbia Basin area. Mr. Woods saw Mr. Clapp, heard the story and received it with that enthusiasm which characterized Mr. Woods whenever he ran onto a good local story that would attract attention…"***

***W. Gale Matthews*, 1952**

***“….Mr. Woods wrote the story and published it in the Wenatchee Daily World on July 18, 1918. The story was spread out all over the front page with giant headlines and it certainly did attract attention. Woods’ story actually appeared on page 7, crowded off the front page by news of the war in Europe. The late Judge R.S. Steiner wrote Mr. Woods a letter ridiculing the story and the idea and he concluded his letter with these words ‘Baron Munchausen, thou art a piker.’ The story was copied in whole or in part by newspapers all over the state and the general comment of the papers was quite in line with the comment of Judge Steiner…”***

***W. Gale Matthews,*** **1952**

***“The last, the newest, the most ambitious idea in the way of reclamation and the development of water power ever formulated is now in the process of development. The idea contemplates turning the Columbia River back into its old bed in Grand Coulee, by the construction of a giant dam, the reclamation of between one and two million acres of land in Grant, Adams, and Franklin counties and the development of a water power approximating Niagara Falls…Should it develop that the dam could be built at a reasonable cost, there will unfold one of the most interesting development projects ever conceived by man…”***

***The Wenatchee Daily World*, July 18th 1918**

*"…Shortly after the publication of the 'Munchausen' article by Rufus Woods in the Daily World on July 18, 1918, an engineer by the name of Ralston who had been employed by Washington Water Power Company, advocated a scheme of reclamation of the Columbia Basin Lands by bringing water from the Idaho lakes which thereafter was referred to as the Pend Oreille or Gravity Project. Little was said about Mr. Ralston's idea until after a speech by Governor Ernest Lister (1870-1919) when a great deal of publicity was given both to the Governor's speech and to the Ralston plan, they having been along the same line. Shortly, after this, along in the fall of 1918, a meeting was held in Pasco which resulted in the organization of the Columbia Basin Irrigation League…"*

***W. Gale Matthews*, 1952**

***"…The net result of the 'Munchausen' article in the Wenatchee Daily World and the organization of the Columbia Basin Irrigation League was that from that time there were two camps each advocating the reclamation of the Columbia Basin Project, the Ephrata group with the Grand Coulee Dam as its proposed source and the Irrigation League with the Idaho lakes as its proposed source…"***

***W. Gale Matthews*, 1952**

***"…As time passed such men as the late Arthur P. Davis who was then Commissioner of Reclamation and the late Colonel Hugh Cooper, a very eminent engineer and dam builder took occasion to view the proposed Grand Coulee Dam site and the comments which they made at the time gave encouragement to the Ephrata group…It was in 1919 that James O'Sullivan of Port Huron, Michigan, and who formerly lived in Ephrata made a trip west and became interested in the Grand Coulee Dam. He again returned to Ephrata in 1920 and from that time on did little else but devote his entire time and all of his energy to the Columbia Basin Project. Unfortunately he did not live to see water run through the canals which he had so vividly described from the platform and in newspaper articles…As time went on all the people of Ephrata, Grant County, and ultimately the State of Washington and the Northwest became cognizant of, and many of them became active supporters of, the Grand Coulee Dam…"***

***W. Gale Matthews*, 1952**

***"…The Senior Senator from the State of Washington was the Honorable Wesley L. Jones (1863-1932). He was one of the most prominent men in the Senate and was Chairman of the Senate Appropriation Committee, a most important and strategic position. Senator Jones had, of course, heard of the Grand Coulee Dam proposal for irrigation of the Columbia Basin Project, but by reason of the many duties confronting him as one of the leaders in the Senate, he had not become as familiar with the idea as had Senator Dill. Senator Dill undertook the project of convincing Senator Jones that the Grand Coulee Dam idea merited a full and complete investigation. Senator Jones became convinced that the project did merit complete investigation and in the appropriation passed in the year 1927, first session of the 69th Congress, dated January 21, 1927, succeeded in having included an item of $600,000 in the Rivers and Harbors part of the appropriation earmarked for an investigation of the Columbia River from the British boundary to the mouth of the river for power, navigation, flood control and reclamation. This appropriation was passed…"***

***W. Gale Matthews*, 1952**

***"…The Corps of Engineers of the United States Army undertook that study. That part of the work involving the river from the British boundary, that is the Canadian boundary, to the Snake River was handled under the direction of the late Major John S. Butler. The results of his investigations were embodied in what is known as the '308 Report,' which settled the controversy over the source of water for the Project. This report was the basis upon which further and more complete investigations of the Grand Coulee Dam and Columbia Basin Project were made, and the result of that appropriation, that investigation, that report, is well known. The Dam was built and the Reclamation Project has now reached the stage where water will in 1952 be delivered to the arid lands of the great Columbia Basin Project…"***

***W. Gale Matthews*, 1952**

***"…The number of those engaged in the work is in the thousands. It became a great community, county, state and Northwest Project and through the significant work of the people in the entire Northwest, the Project is no longer the dream of a few timid souls in Ephrata but it is a reality. For generations to come, it will be a monument to united community effort. It will be a memorial to those hardy individuals who braved the uncertainties and hardships of a pioneer existence to homestead this area at the turn of the century and pave the way for a new empire."***

***W. Gale Matthews*, 1952**


★ FIRST DAY OF ISSUE ★
THE LARGEST POWER PLANT ON EARTH
Commemorating
THE DEDICATION OF
GRAND COULEE DAM
FLUEGEL COVERS
GRAND COULEE
MAY 15
1952
WASH.
FIRST DAY OF ISSUE
Mr. Henry F. Houghton
569 South Main Street
Athol, Massachusetts


GRAND COULEE DAM
FRANK ARTHUR BANKS
HAROLD LOY ICKES
PRODUCER OF GREATEST ENGINEERING FEAT OF ALL TIME.
U.S. SECRETARY OF INTERIOR GAVE BANKS THIS MAMMOTH ASSIGNMENT.
FIRST DAY COVER
GRAND COULEE
MAY 15
9-AM
1952
WASH.
FIRST DAY OF ISSUE
Leal Norton
920 44th Street
Sacramento 16, California


U.S. POSTAGE
3¢
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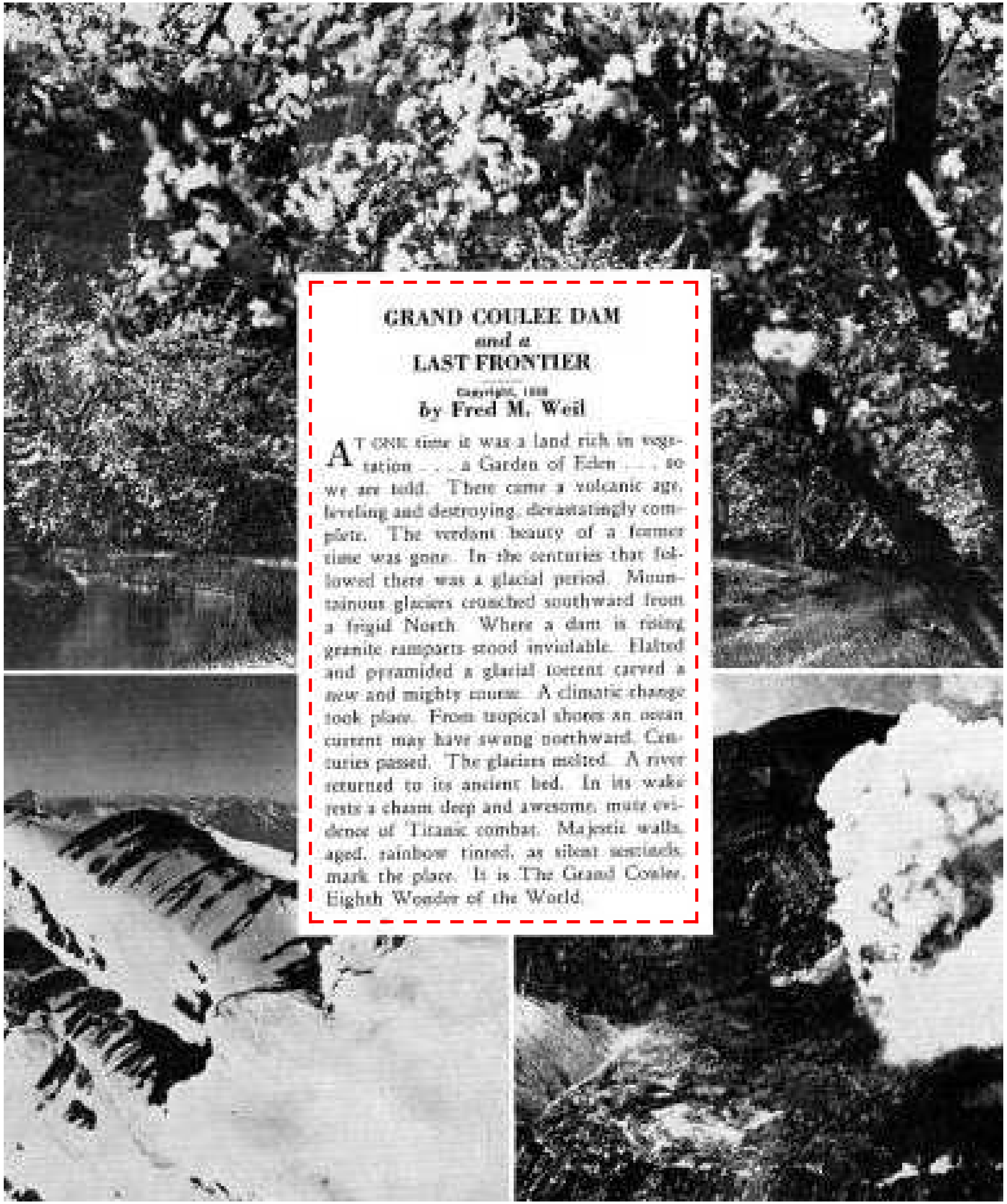
1902
1952
RECLAMATION
IRRIGATION
POWER

# Part 10

# The Battle of Grand Coulee

# *A Last Frontier*



GRAND COULEE DAM
and a
LAST FRONTIER

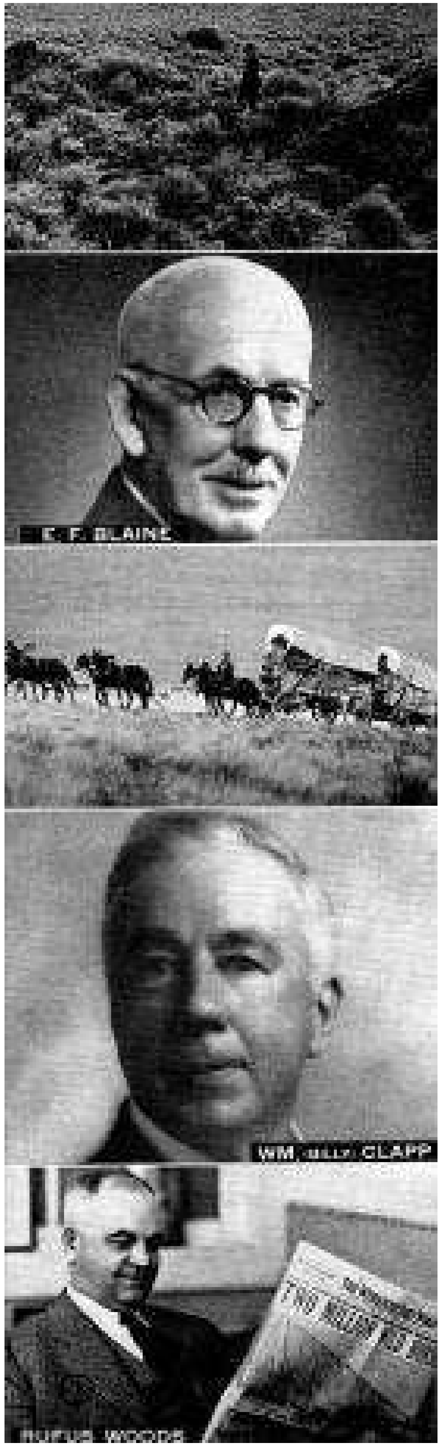
Copyright, [illegible]

by Fred M. Weil

AT ONE time it was a land rich in vegetation . . . a Garden of Eden . . . so we are told. There came a volcanic age, leveling and destroying, devastatingly complete. The verdant beauty of a former time was gone. In the centuries that followed there was a glacial period. Mountainous glaciers crunched southward from a frigid North. Where a dam is rising granite ramparts stood inviolable. Halted and pyramided a glacial torrent carved a new and mighty course. A climatic change took place. From tropical shores an ocean current may have swung northward. Centuries passed. The glaciers melted. A river returned to its ancient bed. In its wake rests a chasm deep and awesome, mute evidence of Titanic combat. Majestic walls, aged, rainbow tinted, as silent sentinels mark the place. It is The Grand Coulee, Eighth Wonder of the World.

***"At one time it was a land rich in vegetation…A Garden of Eden…so we are told. There came a volcanic age, leveling and destroying, devastatingly complete. The verdant beauty of a former time was gone. In the centuries that followed there was a glacial period. Mountainous glaciers crunched southward from a frigid North. Where a dam is rising granite ramparts stood inviolable. Halted and pyramided a glacial torrent carved a new and mighty course. A climate change took place. From tropical shores an ocean current may have swung northward. Centuries passed. The glaciers melted. A river returned to its ancient bed. In its wake rests a chasm deep and awesome, mute evidence of Titanic combat. Majestic walls, aged, rainbow tinted, as silent sentinels, mark the place. It is the Grand Coulee, Eighth Wonder of the World."***

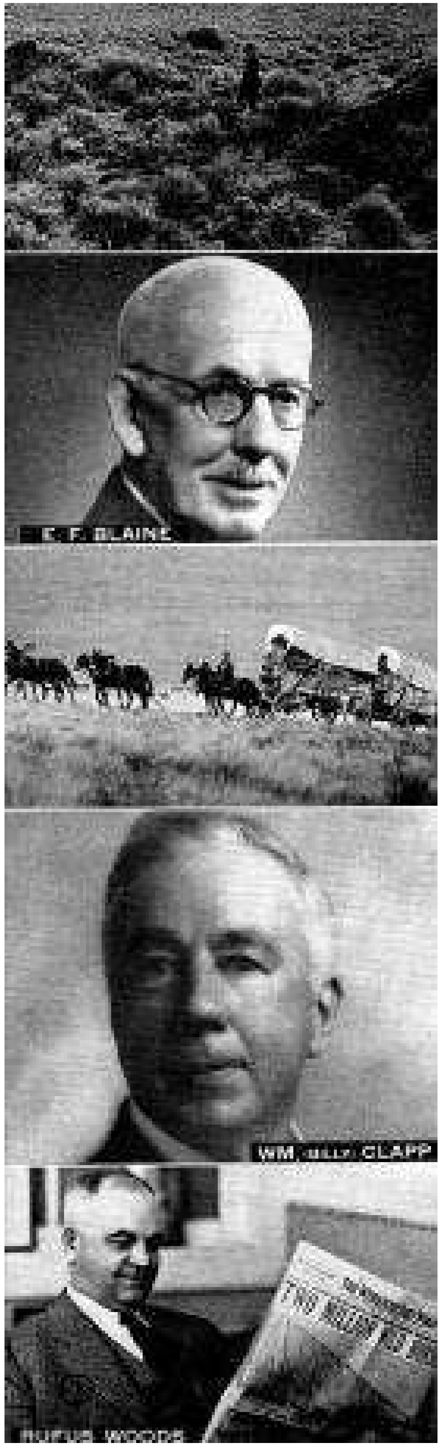
# ***There Came a Time***




***"…There came a time when the volcanic waste became a silted sage-brush desert. There was unused moisture stored through the ages; there was rainfall. The West beckoned. After the Civil War the covered wagon rolled west again. The Northern Pacific, with large land grants as bonus, worked through to the coast in the early eighties. 'Jim' Hill came through with his 'iron horse,' the Great Northern, a half decade later. The Indian and buff-alo were shoved aside. Homesteading was on. In 1900 could be witnessed hundreds of families settling upon the sage-brush lands west of the Big Bend, now known as the Columbia Basin. Hardy men and women cleared the land, plowed and planted it to grain and other crops. They built houses, barns: they dug wells, erected wind-mills, schools and churches. Here and there small towns sprung up. Anticipating ample crops, the Milwaukee ex-tended itself through the Basin. For a time all seemed well and the future of the settler secure…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

## *What Happened*

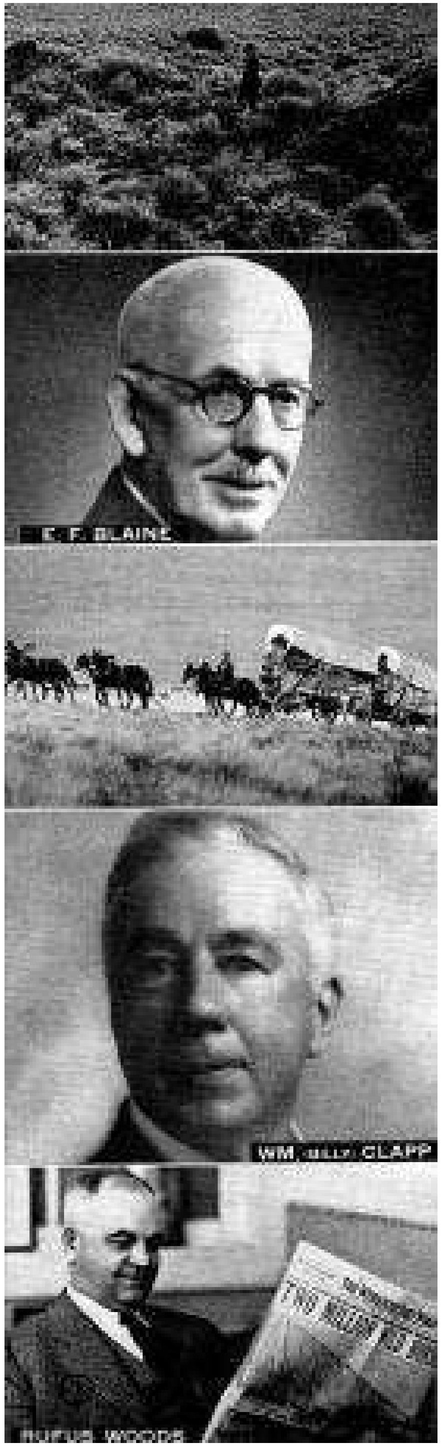



***"…The stored moisture exhausted, a dry cycle, one of those inexplicable freaks of nature., set in. An annual rainfall, never too plentiful, receded. Crops fell away. One by one the homesteads were abandoned and the discouraged settlers trekked on to lands of more certain promise. The coyote, alone once more, howled woefully into a hazy solitude…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

**<u>Above L&R</u>: caption: “Dry-Farming tragedies like those pictured dot the 1,200,000 acres of rich but dry lands of the Columbia Basin Project”**

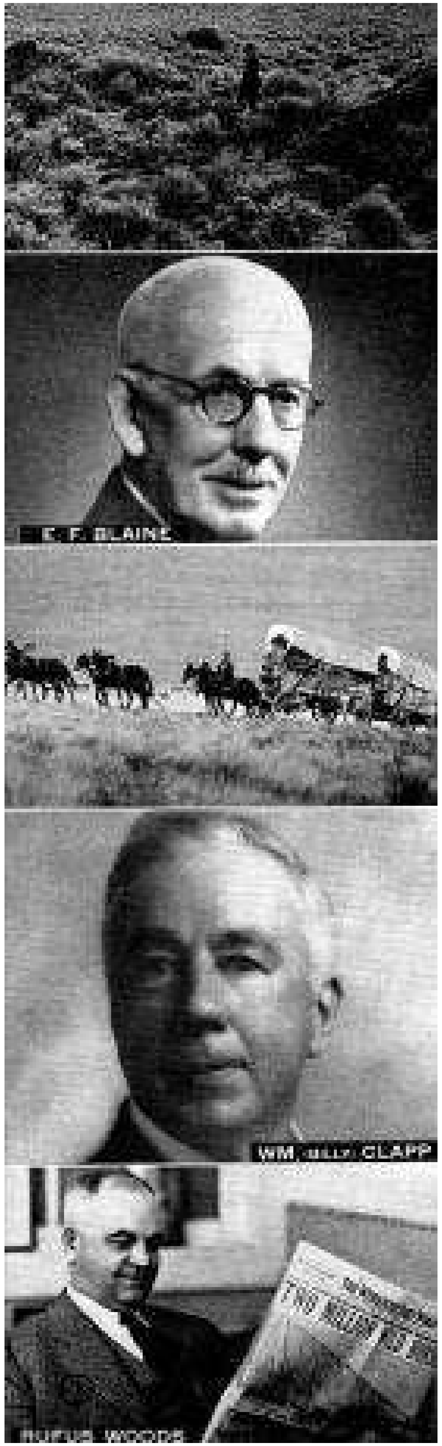
# *What to Do*




***"…Moved by the tragedy of a land deserted, civic leaders of Eastern Washington led the way in an effort to supplant the depleted rainfall with man-made rain, irrigation. E.F. Blaine of Sunnyside, affectionately known as the father of the Columbia Basin Project, conceived a plan to bring water from Flathead Lake in Western Montana and Pend Orielle Lake in Idaho, through natural river courses, tunnels, canals, and ditches, to the Basin lands. The state legislature in 1919 appropriated $100,000 for a survey and investigation of the plan. A state wide Columbia Basin Irrigation League was formed, and Chambers of Commerce and Commercial Clubs assisted. The method was devoid of any appreciable power possibilities and was essentially a reclamation undertaking…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

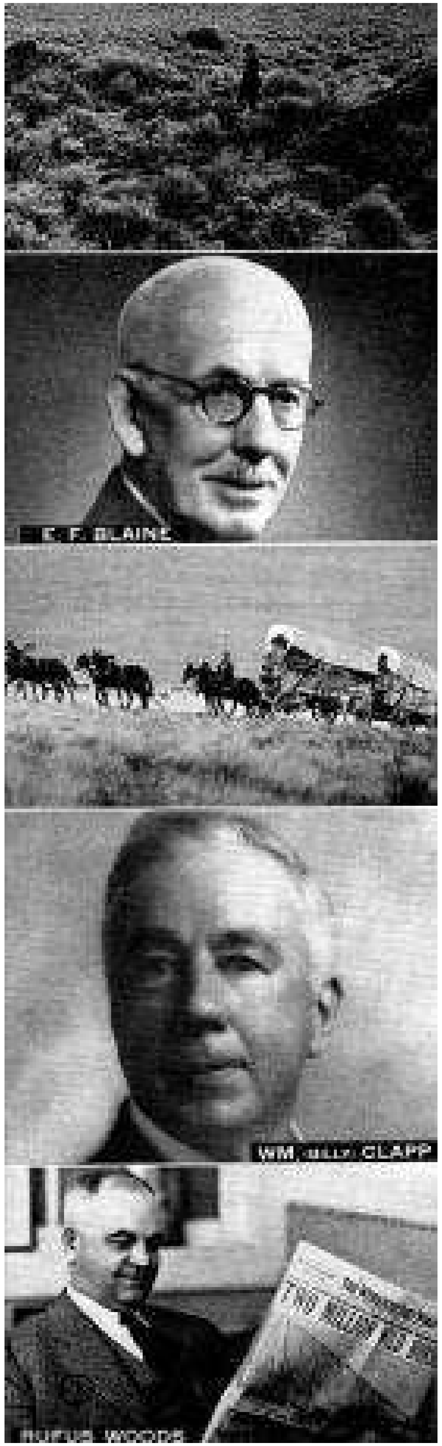
# *Came a Vision*




*"…Also living to witness the development of his timely vision, is William Clapp, pioneer lawyer of Ephrata, who in 1918 conceived a plan. In his dust-strewn office, one afternoon to 'Billy' Clapp there came a dream, a vision, and then a steadfast belief that man could do with concrete what nature had done with glaciers. A great dam could be built at the head of the Grand Coulee and the waters of the river once more returned in part to the Coulee walls, there to be diked, impounded and loosed in canals and ditches to redeem the abandoned acres and make green again the fields of yesterday. From the sale of surplus power of a dam so built, would be paid the construction cost of reclaiming the basin lands…"*

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# *Unbelief and Ridicule*

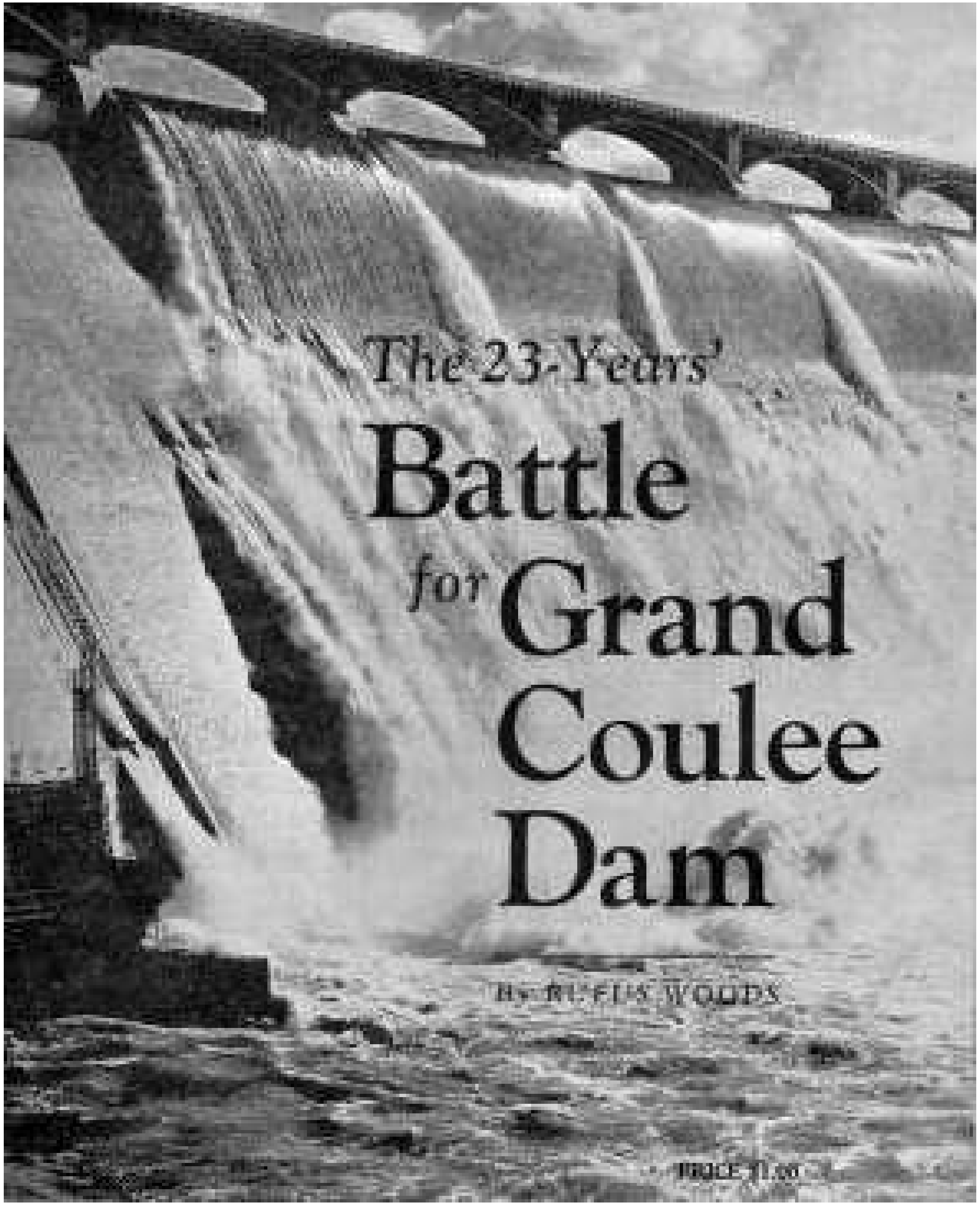



***"…Like Fulton, men who dared to dream of the 'biggest thing on earth' and to cost as many millions as the Panama Canal, were chided and ridiculed. Rufus Woods, pioneer newspaper man of Wenatchee, printed the story. A learned judge forthwith declared, 'Baron Munchhausen, compared to Rufus Woods, Thou Art a Piker.' The support of Jim O'Sullivan, construction engineer and contractor, was sought. 'Jim' declared the plan feasible and all were ridiculed…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…In 1906 David R. McGinnis had come to me as the secretary of the Wenatchee Commercial Club with a plan for irrigating the lands of central Washington from Lake Wenatchee. But no dam was then under consideration. The first proposal on Grand Coulee as a dam site was in Ephrata in July, 1918…"***

***Rufus Woods*** **(1942)**




***"As publisher of The Wenatchee Daily World, I had the honor of writing the first article on Grand Coulee Dam. That was July 18, 1918. That was the 'Signal Gun' for a battle royal which lasted twenty-three years…The Wenatchee World naturally became the mouthpiece of the organization pumping for the dam."***

***Rufus Woods*** **(1944)**

## FORMULATE BRAND NEW PLAN FOR IRRIGATION OF GRANT, ADAMS, FRANKLIN COUNTIES

**Last and newest and most ambitious idea contemplates turning the Columbia back into its old bed in Grand Coulee - the development of a waterpower equal to Niagara and the irrigation of a million acres or more. Idea first conceived by William Clapp of Ephrata**

**RE: heading/sub-heading of the article published in *The Wenatchee Daily World*, July 18th 1918 by editor/publisher *Rufus Woods***

***"…The battle began from the very day the Wenatchee World published that first article and continued until the dam was completed in 1941. We had gone out on a thesis that the Columbia River was too big for private development - that it must be developed by government money, either state or national, for it was too big and too important an asset to be nibbled at by low-head dams…"***

***Rufus Woods*** **(1944)**

***“People here will be interested in the visit of Colonel Hugh Cooper, builder of Keokuk Dam and the greatest authority on dam construction in the world…Col. Cooper landed in Wenatchee Thursday night in company with Wilbur S. Yearsley of Spokane and Paul D. Donaldson of Ephrata. He had just been up the Grand Coulee to look over the big dam site on the Columbia. ‘It’s alluring!...most alluring!’ was the significant answer of the great engineer in regard to his opinion regarding that wonderful power site. ‘It is time the people of this state should begin to realize what they have. To one who has visited the countries of Europe and seen how they carefully worked out results from their meager natural resources, it is of more than usual interest to look over the state of Washington where nature has been so profligate.”***

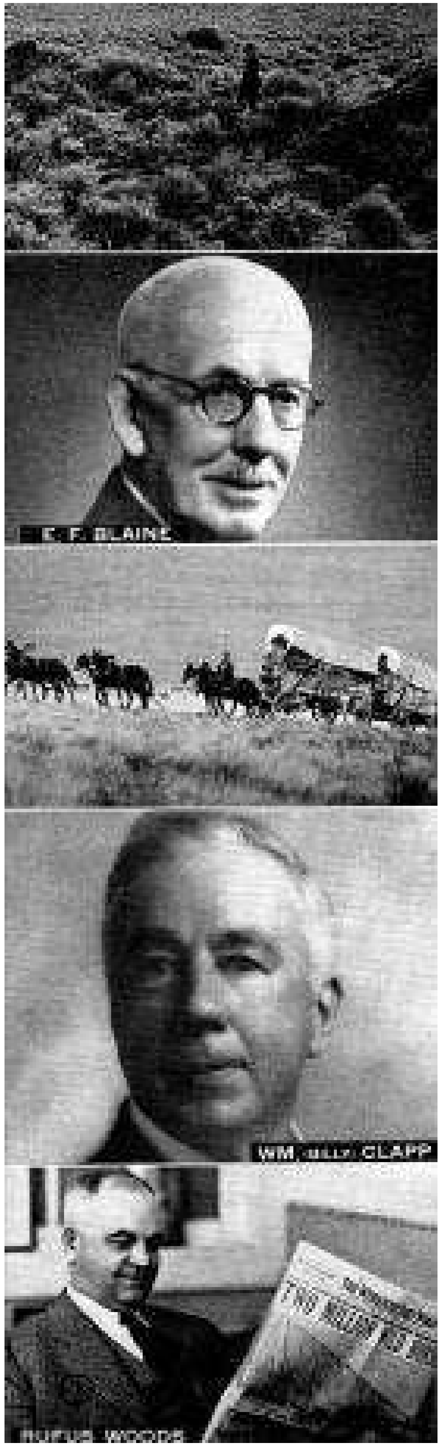
***The Wenatchee Daily World,*** **November 1920**

***"It's a great idea, boys, but you will find that you are up against all the money in the world"***
***F.A. Keasal,* Contractor (1920)**

***"We are against the pumping plan…to operate the dam and pumping plant in Grand Coulee, a large amount of power must be sold - power that can not be sold except in competition with existing power companies which have ample facilities to take care of all the needs of the Northwest for many years to com if not for centuries"***

***Mark Woodruff,*** **Secretary of the Spokane, Washington-based *Columbia Basin Irrigation League* (1920)**

# *Rival Groups*




***"…The plan to irrigate the Basin divided itself into two groups. The pioneers of the Basin itself, Julius Johnson, Frank McCann, Ed Southard, and a host of others, supported the Clapp plan, and gave unstintingly of their time and money. The Columbia Basin Irrigation League clung to the gravity plan and for the next ten years engineering experts, state experts, and national experts found for and against both plans, and rivalry between the groups was high. No definite light or conclusion was reached until 1929, when, through the efforts of the late Senator Wesley L. Jones, army engineers, then making power surveys of the Columbia River, were directed to investigate the merits of the respective plans to reclaim the Basin…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# THE WENATCHEE DAILY WORLD

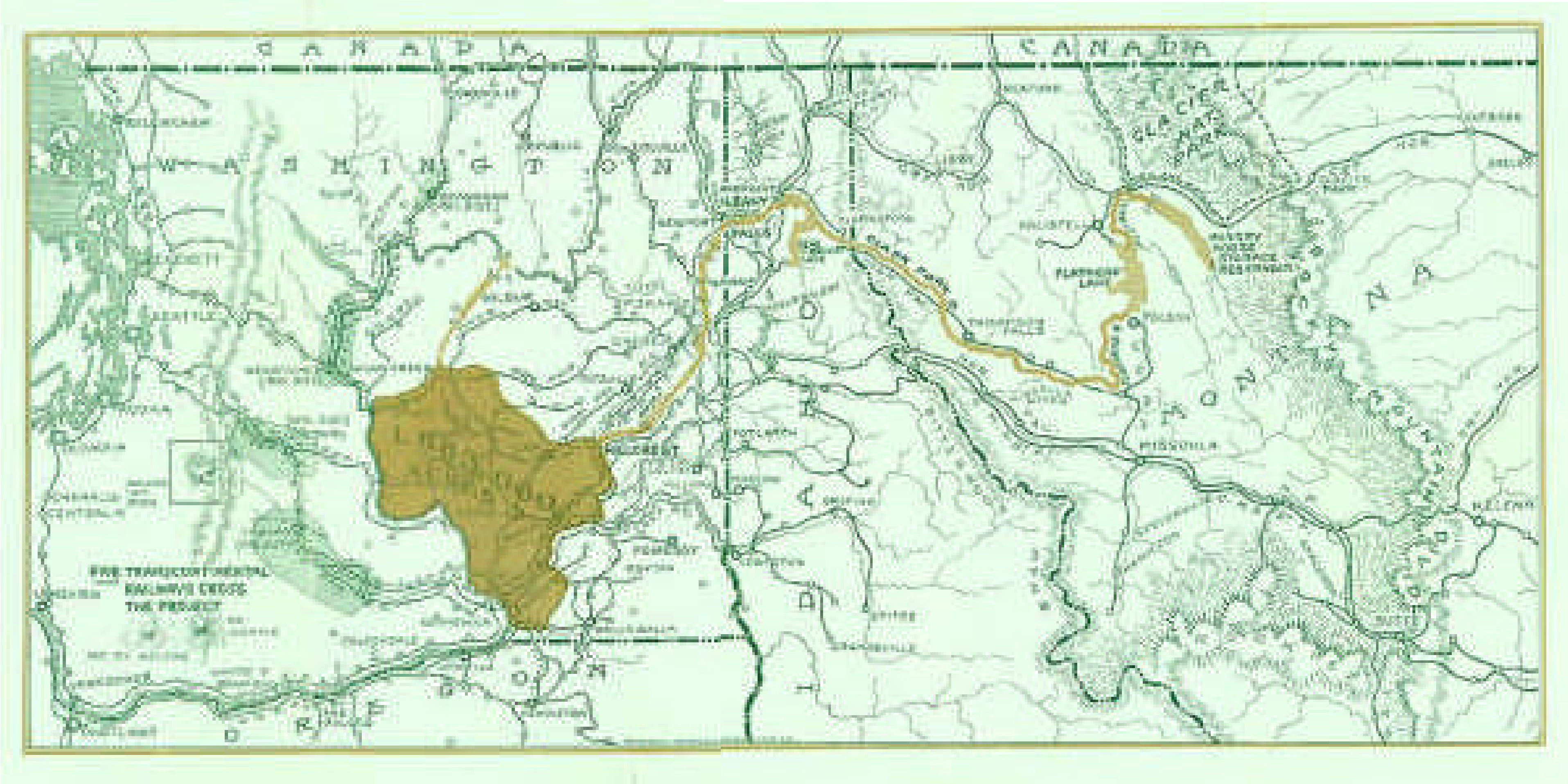
## Two Plans Which Are Proposed for the Irrigation of Columbia Basin Lands

EDITORIAL

***"…There was another opposition plan to irrigate the lands of the Columbia Basin - but it produced no power, as opposed to this plan with its 2,000,000 horsepower. That scheme contemplated a 132 mile main canal as compared with a main canal of this project of only ten miles. It provided for 62 miles of tunnels through this basalt, as compared with a tunnel of only a mile and a quarter. Yet that scheme was used to hoax the people of the state for thirteen years! Until in 1931, the U.S. Army Engineers OK'd the present plans which have been carried through with such credit to the U.S.B.R. engineers who have had it in charge…"***

***Rufus Woods*** **(ca. 1944)**

**RE: the first newspaper article concerning the "opposition plan" came out in late 1918. On November 27th 1918, Grant County engineer *C.W. Duncan* issued the first engineering report concerning a dam at *Grand Coulee.***



<u>**Above**</u>**: caption: "Grand Coulee was left off the map put out by the Spokane Organization! Here was the plan – 134 mile main canal, 62 miles of tunnels, virtually one unit, and NO POWER to speak of. Grand Coulee required but ten miles of main canal, one-and-a-quarter miles of tunnel, and would produce over 2,000,000 horsepower."**

***“…The amount of land that could be irrigated by this project, if carried out, is estimated to be in excess of two million acres. The irrigation season in this area coincides approximately with the period of high water in the Columbia River, so that there would be no interference with the development of one of the world’s greatest Hydro-Electric power plants at this point. Time for more than a hasty reconnaissance of one of the critical features has been lacking, so that no statement as to its financial practicability can be made with assurance at this time. The great benefits to the State and the Nation that would follow the consummation of the project, justify the recommendation that its merits be thoroughly investigated. Respectfully submitted, C.W. Duncan, County Engineer, Grant County”***

**RE: “Conclusions” of the first engineering report (11/27/1918)**

(From THE WENATCHEE DAILY WORLD, April 19, 1919)

# "NEXT BIG THING AFTER PANAMA CANAL."

## Remark Made by Leading Reclamation Engineer Regarding Columbia Basin Project 15 Years Ago--Indications Are That the Plan of Damming the Columbia Is Not at All Impossible

## COST OF BIG DAM ABOUT $30,000,000

Views Showing Beautiful [illegible] Country Under Columbia Basin

***"You have a wonderful project. I cannot conceive of bedrock being over fifty feet. It is probably only about twenty feet. Even if it is one-hundred feet it can be built for less than half of the Pend Orielle plan. Then it will cost less than one-half to maintain. The borings should cost you $20,000 to $50,000. That $50,000 is the only gamble you will have. If the borings are OK as per surface indications the expenditure of $150,000 would be the next move. If I can talk thirty minutes to the legislature I can convince them they ought to appropriate $200,000. The project has certain features no other project has. If all data is properly presented Congress cannot refuse the appropriations, as it has so many favorable aspects. You are on the right track - and don't let them talk you out of it!"***

***Hugh L. Cooper*** **(left), Hydraulic Engineer (1920)**
**RE: excerpt from a conversation with *Rufus Woods***

***"Hugh Cooper, the promoting engineer…is trying to defeat the state's plans for reclamation of the Columbia river basin lands with a gravity flow from the Pend Orielle river, admitted to groups of Spokane citizens last November that if bedrock could not be found within 100-feet it would not be practical to dam the Columbia river. In the core drilling in search of bedrock a depth of 154-feet had been attained last Tuesday…This verifies the predictions of the engineers of the Columbia Basin Survey Commission…This emphasizes the Spokesman-Review's conviction that these core drilling operations are a waste of the state's money…There never was justification for the demand for the borings for a possible dam site. Now that these borings have proved the utter futility of the search for bedrock the state and federal authorities ought to give no further consideration to the dam - or of Hugh Cooper and the little group of land speculators in Grant county who noisily demanded the wasting of the state's appropriation."***

***Spokesman-Review*** **(1920)**

***"…In the sections of the Columbia from the mouth of the Wenatchee to the International boundary there are only one or two instances of bedrock occurring at the bed of the stream. Throughout this long section of the river the stream is running for the most part over great deposits of boulders, gravel, sand and other washed materials. It is very clear that in the stretch of the river at the head of the Grand Coulee, the Columbia has the old glacial deposit and not the granite rock for its bed. Judging from the outcrops of granite on the sides of the valley at the opposite ends of the dam, the maximum depth of bedrock in the center of the channel is estimated to be between 150 and 250-feet. The possibilities are that the depth would be in excess of 200-feet, rather than less. Every probability points to site's being unsuitable for a dam of sufficient height to develop the power required. Other sites were examined above and below the head of the Grand Coulee, but none presented more favorable conditions…"***

**RE: excerpt from the *Columbia Basin Survey Commission* report (1920)**

***“…On the basis of the present plans the Federal government will be expected to supply 30% of the money, or $18,000,000. This state is to underwrite bonds for the balance, or $42,000,000…The project is intended to reclaim a vast area of arid land, and to supply a huge volume of hydro-electric energy. Here we have the general setup. It is the state’s greatest undertaking. It is great, too, in volume. But it is vastly more impressive in the magnitude of the folly! There is no call for more agricultural land. The government is now paying farmers a bonus to cut down the yield of excessively produced crops. There is no demand for hydro-electric power. The publicly owned plants of Seattle and Tacoma, and the privately owned plants of the Washington Water Power and Stone & Webster enterprises are already equipped to supply all of the energy this state will be able to consume in a generation. The Coulee Dam project would have no market, or, if it were to gain a market it would be taking customers upon which the present plants depend. Washington has started into an enterprise that is almost certain to be disastrous. It should stop it NOW!”***

***Bellingham Herald*** **(ca. late 1920s)**

# The Prime Essentials

***"The committee is satisfied that the prime essentials of a successful irrigation project are found in the Columbia Basin Project…It is convinced that the Project is feasible from engineering and economic viewpoints, and that it should be adopted as a federal reclamation project. Extensive engineering, hydrographic, soil and economic surveys have been conducted thereon over a period of many years. From these studies every determinative factor of feasibility is shown to exist there."***

**RE: excerpt from the February 27th 1928 report of the *House Committee on Irrigation and Reclamation***

**By 1930, the lines between the opposing forces were being drawn. After ten-plus years of bitter debate, many in central Washington State believed it was time the issue came to a head, one way or the other. In late September 1930, *Rufus Woods* ran an editorial in *The Wenatchee Daily World* making arguments in favor of the dam and against the gravity canal. The article was headlined: "Coulee Dam versus Pend Orielle - A Comparison." The article went into great detail about the merits of the dam plan as far as maintenance, construction cost, water use and power generation/demand were concerned.**

***"…We are just wondering how much longer we are to be kidded along with the Columbia Basin project. For ten years now we have been told that there is a chance for the irrigation of the lands of the Columbia Basin. Some $600,000 has been appropriated and otherwise raised and all of it has been expended and what is there to show for it? That money has been under the supervision of the officers of the Columbia Basin League. James O'Sullivan in one year, with only $2,600 to work with, has done more to bring the whole thing to a successful issue and has done more to awaken interest in the project and its possibilities by pointing what may be done with a dam at the head of Grand Coulee than the proponents of the 134-mile main canal plan have done in ten years with $600,000…"***

***The Wenatchee Daily World,* September 26th 1930**

***"…Without quibbling further on this project, isn't it about time to recognize that the plan to bring water with the main canal 134 miles long is preposterous? Furthermore, it involves the three states of Oregon, Washington, and Idaho, as well as British Columbia. Isn't it also about time to recognize the fact that prospective water users are virtually 100% opposed to settling an expense account of $200.00 an acre on their land? In other words they are virtually 100% against the Pend Orielle-Spokane plan. These same water users are virtually 100% for the plan of bringing water down through Grand Coulee…"***

***The Wenatchee Daily World*, September 26th 1930**

*"…The Columbia Basin Irrigation League has estimated the duration of time required for construction as follows:*

- *Two years for organizing the forces of engineers and for them to make up the plans and specifications on which bids can be taken for different pieces of construction;*
- *Eight years for the construction of the main gravity canal or Grand Coulee Dam and Pumping Plant, as the case may be;*
- *Ten years for settling of farmers on first unit of about 470,000 acres;*
- *Ten years for settling of farmers on second unit of approximately 470,000 acres;*
- *Five years for settling of farmers on third unit of approximately 470,000 acres;*
- *Eight years for settling of farmers on fourth unit of approximately 470,000 acres.*

*Project completed in Forty years…"*

**RE: excerpt from *Columbia Basin Irrigation Project: All the Facts to August, 1930***

***"…To bring water through Grand Coulee, a dam across the Columbia would be necessary, but that dam will create from 1,000,000 to 2,000,000 primary horsepower besides virtually unlimited secondary power (summer power) with which to do all the pumping that is necessary for covering the lands throughout all eastern Washington. The Grand Coulee Dam plan also dovetails into the greater government plan providing for the complete development of the Columbia river resources…"***

***The Wenatchee Daily World,* September 26th 1930**

***"…We believe that anyone who has made any study of the situation at all can realize the utter futility, the impracticability of the plan to bring water through 134 miles of main canal when it could be delivered on the ground with a main canal of only eight miles…"***

***The Wenatchee Daily World,* September 26th 1930**

***"…First the story was that there was no bedrock for a dam along the Columbia. This was proven false very easily. Opposition developed to core drilling along the Columbia but core drilling developed the very finest foundation site at the head of the Grand Coulee. The cry was that there was no chance to sell power. There has been a growing demand for power throughout the Northwest. Even Seattle and Tacoma within fifteen years will be short of power according to their present rate of increase…"***

***The Wenatchee Daily World,* September 26th 1930**

***"…The time for pussyfooting on this proposal is past. We charge that those who are trying to settle a $200.00 an acre debt, and over, are disloyal to settlers and water users on the land. The Grand Coulee plan will put water on the land and if it does as well as the Salt River project it will pay a dividend to every water user besides. The water users on the Salt River basin project have 250,000 acres under water. They have 87,000 horsepower which has been sold to outside interests. The Grand Coulee project would develop one full horsepower per acre for sale for every acre developed or three times what has been accomplished on the Salt River Valley. The Pend Orielle-Spokane system will require twenty to forty years to construct, according to publication of its proponents, and such a big charge will have to be put on the land which may prevent it from being colonized."***

***The Wenatchee Daily World,* September 26th 1930**

***“Of all the outrages on agriculture, not stumbled into by accident but deliberately to be riveted on our necks, we are beginning to think the Columbia River Basin Project takes the cake. We have watched this scheme for years, as it has slowly wormed its way into the reclamation picture, and has planned to jockey Congress into a position where it would be helpless to resist. At no distant date, the plans will be matured, and the screws will be applied. It is up to agriculture to see that Congress has sufficient backing to stiffen its backbone to say ‘no!’…”***

***The Farm Journal,*** **April 1932**

***"…The best way to reach those members of the House is through their own constituents, manufacturers of the very large variety of merchandise made in the Eastern and Middle Western regions and sold in the Northwest. Show the manufacturer and wholesaler and jobber that the only method by which sales of their goods can be expanded in this region is through putting Columbia Basin into settlement and production. Ask them to urge their congressmen to vote for the Columbia Basin Adoption Bill on those grounds, and because the opening of an enlarged market out here will supply labor with employment back there, thus creating a purchasing power that business is lacking at this time…"***

**RE: excerpt from *Campaign Information – Plan for Co-operation of Chambers of Commerce and Civic Clubs with Columbia Basin Irrigation League to Secure Adoption of Columbia Basin Irrigation Project by Congress* (ca. 1931)**

The Columbia River Development League

Its Purpose: Just Construction of Grand Coulee Dam across the Columbia River
and subsequent orderly development of lands of the Columbia Basin
in units only as needed.

November 16, 1932

To the _________ Chamber of Commerce.

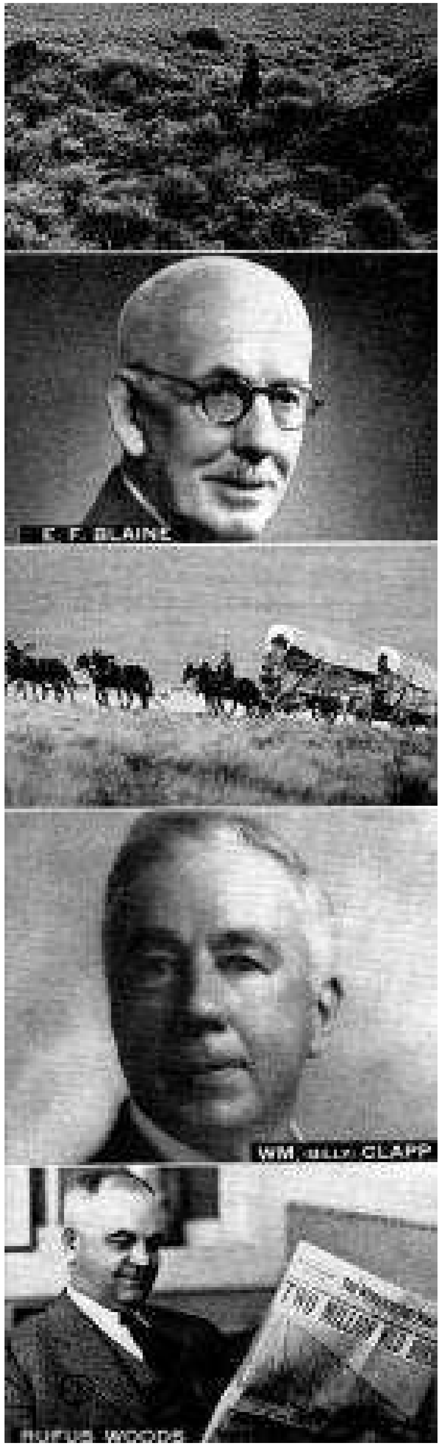
Will you unite with us in endeavoring to put over the Grand Coulee Dam, if possible, at the next session of Congress? The prospects of authorization never were so great as they are today. This project has been OK'd as the most remarkable in America today – one that is 'self-liquidating' and which conforms to the program of President Hoover and President-elect Roosevelt. The greatest engineering authorities in the world have passed on it. The United States Army Engineers have just made an exhaustive report in its favor, the Engineers of the Bureau of Reclamation have confirmed that report, and Col. Hugh Cooper, the foremost hydraulic engineer in the world declares it is the greatest thing in America today. And all we need is assistance from all over the state in bringing this matter to a definite head in Washington, D.C., as well as throughout this state.

The Grand Coulee Dam will build itself by the sale of its own power, and this sale can be accomplished before a yard of concrete has been poured.

The Grand Coulee project is really the foundation for the future prosperity of the state of Washington. It is the beginning of a program of development which will last throughout several decades. WILL YOU JOIN US IN THIS MOVEMENT FOR A STEADY AND ORDERLY DEVELOPMENT OF THE STATE OF WASHINGTON? Remember, under the Grand Coulee Dam Plan, OK'd by the engineers, the land will be developed unit by unit, only as needed.

Very truly yours,
COLUMBIA RIVER DEVELOPMENT LEAGUE
Rufus Woods, President
James O'Sullivan, Executive Secretary
Ray Clark, Treasurer

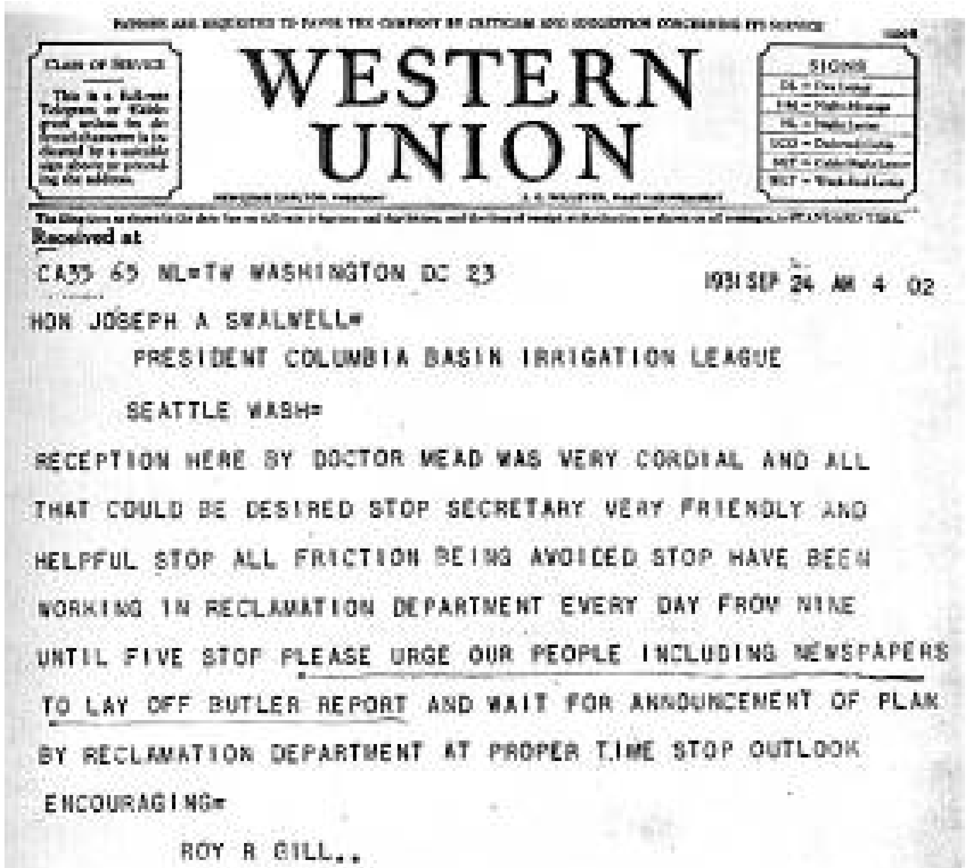
## ***Investigation…Report***




***"…To the late major John S. Butler, U.S. Engrs., was assigned this task. After investigation and study, Major Butler reported the gravity plan to bring water from Montana and Idaho not feasible because of a too high per acre construction cost. Billy Clapp's plan to dam the Columbia at the head of the Grand Coulee, 'where granite ramparts stood inviolable,' Major Butler reported feasible. An un-awakened public was indifferent to both reports and because of the millions involved in the construction of so great a project, believed it was one belonging to another generation. This lack of faith was not shared by the pioneer settlers. Their project had been pronounced feasible by army engineers and with renewed hope and Spartan courage, led by Jim O'Sullivan, they carried on…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

**A final report favoring the construction of the dam was produced by the *U.S. Army Corp of Engineers* in late 1931 and presented to the 73rd Congress as *House Document 103*. This was supplemented in January of 1932 by a report from the U.S.B.R. outlining the details of a dam-based irrigation project. Initial excavation of the dam site began in December 1933 with work toward improving the local infrastructure proceeding in parallel. On August 30th 1935, Congress authorized the construction of a high dam in lieu of a low dam.**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HON JOSEPH A SWALWELL=

PRESIDENT COLUMBIA BASIN IRRIGATION LEAGUE

SEATTLE WASH=

RECEPTION HERE BY DOCTOR MEAD WAS VERY CORDIAL AND ALL THAT COULD BE DESIRED STOP SECRETARY VERY FRIENDLY AND HELPFUL STOP ALL FRICTION BEING AVOIDED STOP HAVE BEEN WORKING IN RECLAMATION DEPARTMENT EVERY DAY FROM NINE UNTIL FIVE STOP PLEASE URGE OUR PEOPLE INCLUDING NEWSPAPERS TO LAY OFF BUTLER REPORT AND WAIT FOR ANNOUNCEMENT OF PLAN BY RECLAMATION DEPARTMENT AT PROPER TIME STOP OUTLOOK ENCOURAGING=

ROY R GILL..

**Left: telegram sent on September 24th 1931 by *Roy R. Gill* to dam opposition president *Joseph A. Swalwell* of the *Columbia Basin Irrigation League.* Gill was sent to Washington D.C. to lobby for the *Pend Orielle* plan and against the dam. With the pending release of Major Butler’s report, Gill urged his boss to “Lay-Off” the report and wait until the U.S.B.R. made an official announcement concerning the two plans studied by the Corps of Engineers report.**

**Rufus Woods,**
**Publisher, Daily World,**
**Wenatchee, Wash.**
**Senator Jones after seeing Hoover revealed in strict confidence we will get great deal, if not all expected for dam – (Quote me if desired, “Dam Stock Took Big Jump Today”) – STOP – Portland, Vancouver, Clarkston, other chambers flooding congress and army with resolutions favoring development lower Columbia per Army report – STOP – Essential Hedges promptly forward Northwest Delegation and General Brown resolutions every chamber Northwest favoring Grand Coulee dam – STOP – Am busy at Army headquarters.**
**James O’Sullivan**

**RE: telegram sent on November 30th 1931 by *James O’Sullivan* to *Rufus Woods* concerning the favorable “Butler Report”**

***'That, gentlemen, is my report"***

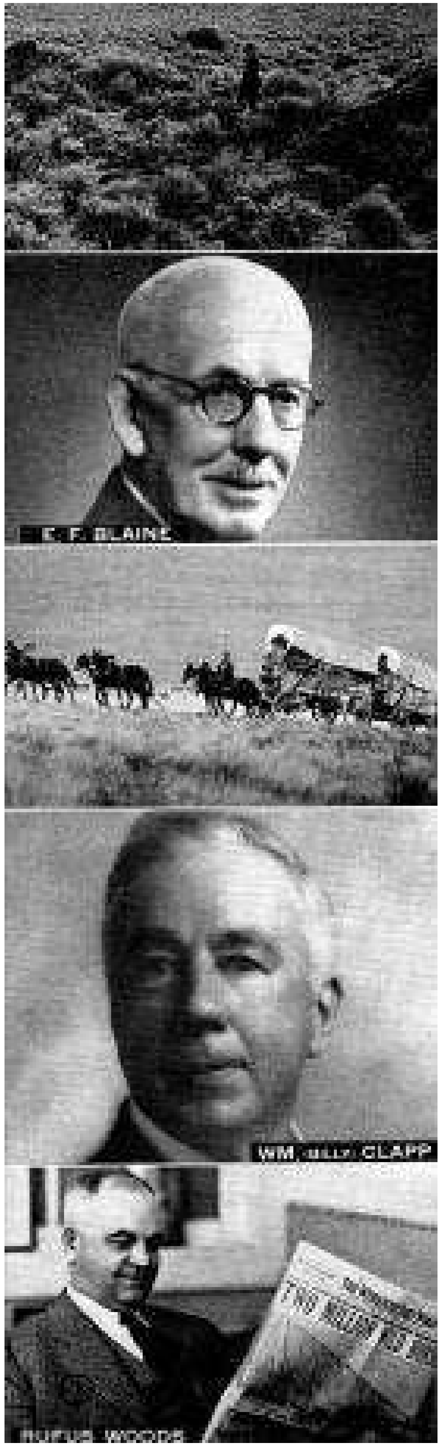
**Major *John S. Butler,* U.S. Army Corps of Engineers, November 1931**

**RE: Butler (left) authored the U.S. Army Corps of Engineers' "Comprehensive Report of the Survey of the Columbia River from the Snake River North." Butler's objective report was the straw that broke the opposition to the dam's back. Butler, headquartered in Seattle, found that some of his superior officers did not agree with his conclusions. He and his staff went to Portland, OR, where he spent a week defending the report's integrity and refused to bow to political pressure, much to his credit. Later, he would be promoted to Colonel. Unfortunately, Butler did not live long enough to see the dam his report made possible completed.**

***"…That date, July 18, 1918, signaled the beginning of a thirteen year campaign by the Wenatchee World when the people of the state were misled, and even the other dailies of the state, because of all the heavily financed propaganda against it, of course hesitated to take any stand in its behalf. But with the report from the U.S. Army Engineers in its favor, the other papers joined the campaign in the ranks of those who had greater opportunity to study the project…"***

***Rufus Woods*** **(ca. 1944)**

# *Then One Day*



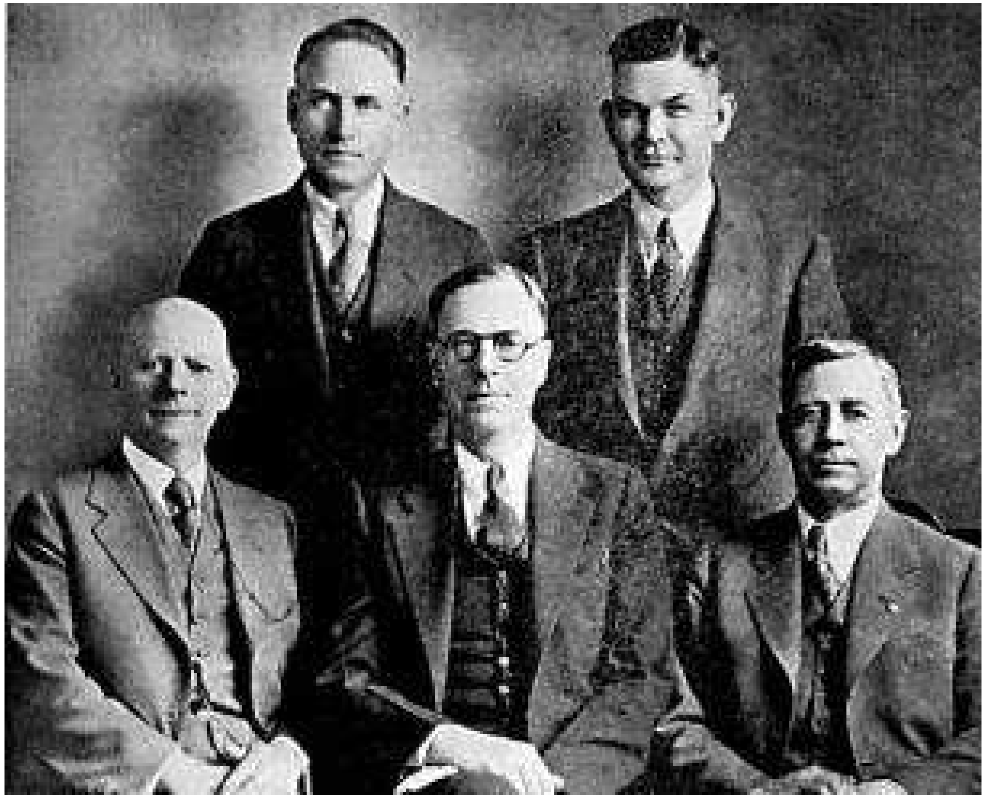

***"…Franklin D. Roosevelt was made President of the United States. A nation was stymied by a hopeless, jobless depression. Bold and courageous action was imperative. Men must be put to work. Worthy projects were sought. The Northwest was soon to be electrified by word of the President's favor and a sanction of a dam at Grand Coulee to cost $63,000,000. The State of Washington at once advanced money for preliminary core drillings, test pit and engineering work…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…The Washington legislature of 1933 authorized the Columbia basin Commission. That commission was given $35,000 and authority to do what it could toward bringing about the immediate construction of the Grand Coulee Dam…Roosevelt seemed favorable to the idea, but it was necessary that the State of Washington should show its interest in the project. To do this it was necessary that this state should finish the drawing of plans and the preliminary work, this amounting to $377,000…Following this Roosevelt authorized the setting aside of $63,000,000 for the construction of the first unit…"***

***Rufus Woods*** **(1944)**

**RE: a total of $377K was committed to the project by the State of Washington in 1933. This was followed soon after by a promise from FDR to provide initial funds in the amount of $63 million to begin work on the dam as a project under the auspices of the *Public Works Administration* (PWA).**



**<u>Above</u>: caption: "One of the first jobs of the Columbia Basin Commission was to name an Engineering Advisory Board. It selected for this board some able and outstanding men. Senator Horace E. Smith, Omak (top left), has been one of the leaders in the state senate and had fathered through some important legislation for the Dam. A.F. Darland, Tacoma (top right), who later became assistant to Frank A. Banks, USBR engineer in charge of construction, and W.C. Morse of Seattle (lower right) who had much to do with some of the big projects on Puget Sound. D.C. Henry, consultant (lower left), had been the man who threatened 'to blow things all to pieces' if the opposition didn't quit putting out false reports about Grand Coulee dam site 'being rotten.' James O'Sullivan, secretary of the Commission, is in the center of the photograph."**

***"…Money had been secured for core-drilling at the dam site. There was opposition but there was enough strength in the legislature to put through an appropriation of $50,000 for this purpose. Opposition did not dare to be too vocal then. After all, there were three-thousand land owners in the area of Central Washington. These alone had quite a voice in the legislature. Then there were the members of the legislature from all over the Central Washington country who were united on this plan for core drilling…"***

***Rufus Woods*** **(1944)**

***"…After the appropriations there came time for the core-drilling. Then there went out all over the state rumors that the bedrock of Grand Coulee was rotten rock. 'It's a crazy idea to put a dam on uncertain formation. It's a reckless waste of money,' boomed forth the opposition. That opposition was from every corner of the state…"***

***Rufus Woods*** **(1944)**

***“No dam site? You have the greatest dam site in the world. Look at that granite. You may go clear to the top if you wish to.”***

***Arthur P. Davis,*** **U.S.R.S. Commissioner**

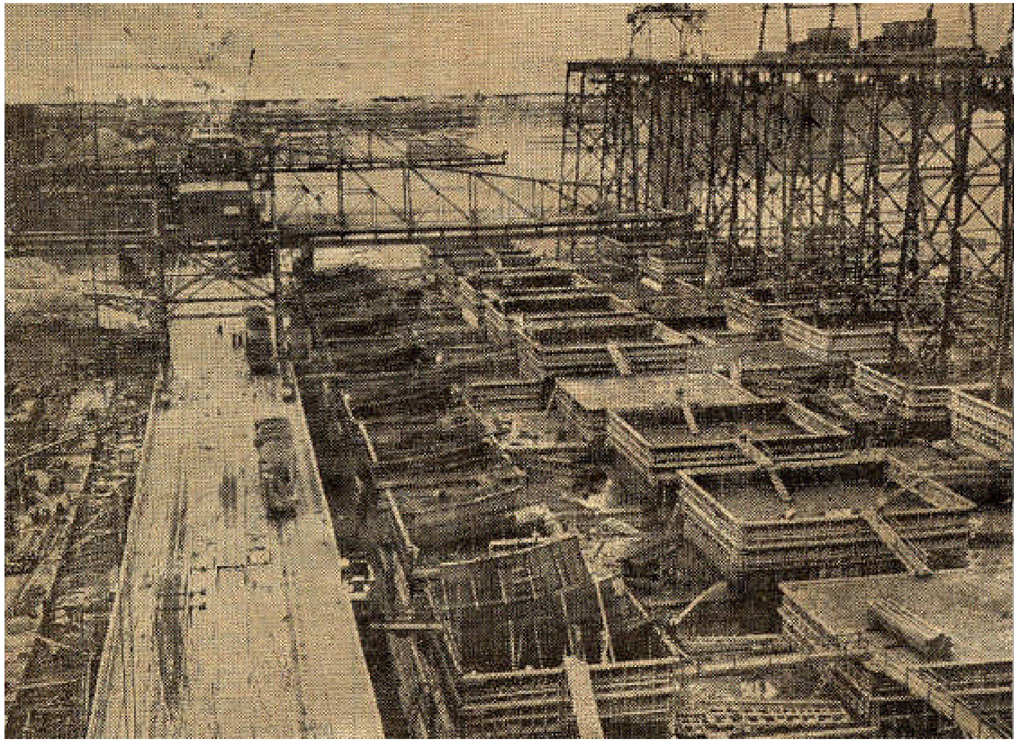
**RE: at first, Davis had bought into the opposition’s arguments against the dam based on its geology. However, he later visited the dam site, going so far as to hire a boat and spent two days carefully studying the location after which, he declared it eminently suitable for a dam. Now, with the *U.S*. *Reclamation Service* (U.S.R.S.) commissioner on the side of the dam, the opposition determined to get rid of *A.P. Davis* and to replace him with someone with views more in-line with their own. They tried to stir-up opposition to Davis by getting local Chambers of Commerce to issue resolutions against his administration. It back-fired. Instead, a swarm of resolutions came forth in praise of his leadership of the Reclamation Service. That failed, the opposition developed a new strategy to bypass Davis’ Reclamation Service. The opposition backed a bill that would transfer the work of irrigation from the U.S.R.S. to the newly established *U.S. Bureau of Reclamation* (U.S.B.R.). The trick worked. The bill slipped through Congress and a new commissioner (also named “Davis” - from Idaho) was appointed to head the U.S.B.R. A.P. Davis was left high and dry and unemployed. Many engineers on staff at the U.S.B.R. resented this political maneuvering and resigned in protest and/or refused to rewrite reports to satisfy their new boss from Idaho. Also, besides their well-funded war chest, the opposition sought to control the dam’s purse strings at both the federal and state levels.**

***"A.P. Davis of the United States Reclamation Service, who was known to be favorable to the dam, had his job cut from under him by the organization of a new Bureau of Reclamation with another man in charge…"***

**RE: a U.S. Congressman recalling to *Rufus Woods* how the "Power Trust" lobbied to remove *A.P. Davis* due to his backing of both the *Boulder* and *Grand Coulee Dam* project/s**

***“The first plans provided for a low dam. Further studies developed the importance of building the foundation for a high dam. Only $35,000,000 had been expended of the $63,000,000 tentatively set aside for the work, and it was necessary to go to Congress for further appropriations. Congress in the session of 1933 authorized an appropriation of $20,000,000, thanks to Sam R. Hill who engineered the work in Congress. This, when expended, made a total of $55,000,000 expended on the dam. About $65,000,000 more was required to complete the high dam”***

***Rufus Woods*** **(1944)**

**<u>Left</u>: caption: “President Roosevelt’s signature to the interior department supply bill has assured continuation of work at Grand Coulee dam for another year. The bill, which contained a $20,000,000 item for Coulee construction and $750,000 for administration, was signed Tuesday. Rapid progress is being made at the dam, as is indicated by this picture taken Sunday. The framework for the giant penstocks which will feed water to the generators, may be seen just at the right of the left-hand trestle. The penstocks, steel-lined, will be 18-feet in diameter. Nearly 500,000 yards of concrete have been poured in the dam foundation” (Spokane Chronicle, June 25th 1936)**

**<u>Right</u>: caption: “Two men of note look over construction work on Grand Coulee Dam - Frank A. Banks, Construction Chief Engineer, shows President Roosevelt where the top of the dam will be”**

**<u>Above</u>: caption: "Officials viewing Grand Coulee Dam construction site, Oct. 1937"**
**<u>Left</u>: caption: "Steel trestles for placing concrete in the foundation, Grand Coulee Dam site, Summer 1936"**

***“Appropriation of $20,000,000 by Congress yesterday for work on the Grand Coulee dam is seen by Spokane businessmen as another long step toward completion of the ultimate high dam and development of the Columbia Basin Irrigation Project. They are enthused by the prospect of the spending of $20,000,000 more in this area in the next 12 to 15 months; but even more enthused over the prospect of permanent benefits when the dam is completed…This is the first appropriation by Congress for the project, previous all-ocation of funds having come from the president’s PWA and other funds…”***

***Spokesman-Review,* June 16th 1936**

***“The new appropriation means the project will go ahead without interruption for at least another year. In 1938 we must again go to Congress for an appropriation to continue the dam structure higher than the present proposed 177-feet above low water…”***

***J.E. McGovern, Columbia Basin Commission* (June 1936)**

***"…When the time came for the legislature to meet in 1933 there was developed the idea of a Columbia Basin Commission to foster the program in behalf of a dam across the Columbia at the head of the Grand Coulee. Over twenty years before there had been a Survey Commission for the purpose of studying the Columbia project. But for some reason this group of men paid little attention to the proposal of a dam at the head of Grand Coulee. The most astounding statement was made in their report that it was 150 to 250-feet to bedrock 'more likely over 200-feet than less than that' said the report. It turned out to be about 50-feet as Col. Cooper had estimated. So the Columbia Commission of 1933 is to be distinguished from the Survey Commission of over two decades before…"***

***Rufus Woods*** **(1944)**

# The Grand Coulee Delusion

***"If the people of Washington permit themselves to fall into this new tax-trap cunningly contrived by politicians who never created a payroll, who themselves pay little or no taxes, and who recklessly play with other peoples' money and property for their own enrichment - it will be over the protests and warnings of the press as to the Grand Coulee del-usion…"***

***Business Chronicle,*** **November 1st 1933**

***"…When the time came for the Columbia Basin Commission to clear the decks so far as legal matters were concerned, it was necessary to show that there were no filings on the Columbia river to interfere with the building of the Coulee Dam. The filings of the Washington Water Power company on Kettle Falls had expired. Then the company made an application for renewal and the renewal was granted by the Governor Hartley administration. The filings had expired again years before. Hence, there was no legal objection to the construction of the Grand Coulee Dam. But in 1933 over from the State Department of Conservation and Resources there came 'extension of permit' granting to the Washington Water Power company rights which it did not have…"***

***Rufus Woods*** **(1944)**

<u>Above</u>: caption: “Kettle Falls as Drawn in 1846.” When the core-drilling at Grand Coulee demonstrated its feasibility as a dam site, the *Washington Water Power Company* filed for a permit on Kettle Falls to act as a stumbling block to the *Grand Coulee Dam*. In an editorial, *The Wenatchee Daily World* objected to the filing unless/until the future of the Grand Coulee was decided. However, a temporary permit was granted. Later, during the dam’s construction, WWPCo claimed the federal government owed them $600K in damages. After a long court fight, a federal judge declined the claim.

# East vs. West

***"…Gradually the Great West is coming into her own. For a hundred years there has been continual fight against the abysmal ignorance of the east regarding things western…As the middle west for years was known as 'the Great American Desert,' so was the Pacific Northwest known from 1800 to 1850 as an uninhabitable wilderness…When we look up the sayings of some of the supposedly wise men of a hundred years ago, we understand how well those saying fit into some of the editorial comment we read of now in certain eastern publications regarding things western…"***

***The Wenatchee Daily World*, July 12th 1932**

***"…God forbid that the time should ever come when a state on the shores of the Pacific, with its interests and tendencies of trade all looking toward the Asiatic nations of the east shall add its jarring claims to our already distracted and over-burdened confederacy - Senator Dayton of New Jersey…"***
***The Wenatchee Daily World*, July 12th 1932**

***"…The ridge of the Rocky mountains may be named as a convenient, natural and everlasting boundary. Along this ridge the western limit of the Republic should be drawn, and the statute of the fabled go Terminus should be erected on the highest peak, never to be thrown down - Senator Benton, 1825…"***

***The Wenatchee Daily World*, July 12th 1932**

***"…What is the character of this country? Why, as I understand it, that seven hundred miles this side of the Rocky mountains is uninhabitable, where rain scarcely ever falls - a barren sandy soil - mountains totally impassable except in certain parts, where there were gaps or depressions, to be reached only by going some hundreds of miles out of the direct course. Well, what are we going to do in a case like this? How are we going to apply steam? Have you made anything like an estimate of the cost of building a railroad from here to the mouth of the Columbia? Why, the wealth of the Indies would be insufficient. You would have to tunnel through mountains five or six hundred miles in extent. Of what use would this be for agricultural purposes? I would not, for that purpose give a pinch of snuff for the whole territory. I wish it was an impassable barrier to secure us from the intrusion of others. If there was an embankment of only five feet to be removed, I would not consent to expend five dollars to remove that embankment to enable our population to go there. I thank god for His mercy in placing the Rocky mountains there - Senator McDuffie…"***

***The Wenatchee Daily World*, July 12th 1932**

***"…What can we ever hope to do with the western coast, a coast of three thousand miles, rock bound, cheerless and uninviting, and not a harbor in it? What use have we for such a country? Mr. President, I will never vote one cent from the public treasury to place the Pacific Coast one inch nearer Boston than it is now! - Daniel Webster…"***

***The Wenatchee Daily World*, July 12th 1932**

# What Does He Know?

***"Why do magazines like yours place yourselves in a queer condition with articles like appeared in your Washington Bulletin on October 15, where Dr. Henry Riggs is featured as saying that 'Grand Coulee Dam is typical of those things that won't have any more usefulness than the pyramids of Egypt.' I am going to keep that copy to show you fellows in later years. No project in the United States was ever more thoroughly engineered than the Grand Coulee Columbia Basin Project. Does Henry Riggs think that water won't create power when it falls downhill? Does he know that we have only a limited amount of land that can be irrigated and we must provide for maximum use of our streams instead of minimum use?...Does Henry Riggs think he knows more about this country than the United States Army engineers. Does he know anything more about this than these Boards of Engineers and those of the state of Washington, who made studies costing over a million dollars before tackling it? Your quotation from Riggs is an example of the same line we have heard from the East from the days of Daniel Webster. When that gentleman said he 'wouldn't spend another dollar to bring the West one mile nearer the East than it is today.'…"***

***Rufus Woods***

**RE: excerpts from a December 12th 1938 letter to the editor of *Business Week* which featured an article authored by *Grand Coulee Dam* opponent *Henry Riggs***

# Seek and Ye Shall Find

***“The form or configuration of the country is the most perfect and admirable which the imagination can conceive. All its outlines are distinctly marked; all its interior is connected together. Frozen regions on the north, the ocean and its mou-ntainous coast to the west, the Rocky mountains to the east, sandy and desert plains to the south - such are its bou-ndaries. Within the whole country is watered by streams of a single river, issuing from the north, east and south, uniting in a region of tide water, and communicating with the area by a single outlet. Such a country is formed for defense and what-ever power gets possession of it will probably be able to keep it.”***

**Major *Joshua Pitcher*, U.S. Army (early 1800s)**
**RE: the Northwest Country**

***“One summer day, back in 1918 – so it is told – a country lawyer and a country editor met in a Columbia Basin town. ‘Bill,’ spoke the editor, ‘give me a good story for my paper.’ His friend glanced over the rough, dry countryside, and after a moment of contemplation, said: ‘Why not build a dam at Grand Coulee and turn the waters of the Columbia onto Columbia Basin lands?’ By the end of the week the idea had popped into circulation. Soon it was taken up by leading Northwest booster organizations…Later the Columbia Basin League was organized and an able propagandist imported from the Middle West. Reclamation, a traditional craving of the West, then denoted its prime objective. The irrigation possibilities of Columbia Basin had been investigated by the Federal Government as far back as 1903, when there was only half the amount of western land under irrigation that there is today, leaving less pretentious undertakings elsewhere. And it is well to point out here that the simplest thing, by far, for an engineer sent west by the Government to do is to find what he has been sent to seek…”***

***Outlook*** **magazine, July 1934**

# A Libel on the State of Washington

***"…A survey of uncle Sam's 'Reclamation Bureau,' which is preparing to spend $277,000,000 on dams, dykes, ditches and drainage canals has just been completed by Owen P. White, for Collier's Weekly. He finds that the projects underway in the Reclamation Bureau are likely to prove a heavy burden upon the federal pocketbook, with small likelihood of any adequate return to anybody…Mr. White sums up his conclusions as follows: 'Thus, with reclamation in this kind of muddle, and with the Department of Agriculture trying to take one-eighth of all farms out of production, it would seem that now would be a pretty good time to give the Reclamation Bureau a nice long rest. Not retire it permanently, perhaps, but at least tell it emphatically that it must live within its income, must quit being a fairy godmother to land speculators, and must prove its worth by showing, through farmer's records, that it has actually benefited farmers…"***

**RE: excerpt from an article appearing in the June 16th 1934 issue of *Colliers Weekly* magazine entitled: "Save the Desert"**

**Editor of Collier's** **June 21,1934**
**New York, N.Y.**
**Gentlemen:**

**Herewith is a reply to that unwarranted article of Owen P. White entitled "Save the Desert," of June 16. That man ought to be sent to jail save only that he can prove himself ignorant instead of malicious.**

**Anyway we will give Mr. White $100 in prize money if he can show more misleading inferences, statements, half truths and more misinformation than this one in any magazine article appearing in any respectable publication in America in the last ten years.**

**With possession of the facts, we think Collier's should repudiate and correct the White article.**

**Very truly,**
**Rufus Woods,**
**Publisher, Wenatchee World**

***"The White article is one of the most discreditable things Collier's has ever printed since I have been acquainted with it. It is a tissue of misrepresent-ations which, if not mal-icious, is senseless."***

**RE: response by *W.W. Rob-ertson* (left) - publisher of Yak-ima, WA newspapers: *The Daily Republic* and *The Mor-ning Herald.* The former had responded to the *Collier's Weekly* article and White's acc-usations, going so far as to send a copy of the paper to Collier's New York City editor.**

***"In a recent issue of Collier's magazine is a bitter tirade against irrigation in the West, that reminds one of a similar tirade published in the Country Gentleman a few years ago. Country Gentleman took an isolated project in Colorado as its basic theme…The author of the article is Owen P. White…Even a casual reading of the article in question would indicate that White was writing about conditions that might have existed 20 or 25 years ago. He quotes some modern statistics but uses only portions that would back up some of his irrational theories…The article is without doubt written for a very definite purpose, to antagonize Collier's readers against the West and particularly against western agriculture…The best boosters of reclamation in the West agree that some projects have been built through political pressure, that were not chosen wisely. At the same time there have been some marvelous government projects…Reclamation has been the big factor in developing the Pacific Coast and Rocky Mountain states. The money used in developing these western reclamation projects has come from the sale of government lands, oil and mineral leases in those states. The eastern and central states were given the money form the sale of the government lands outright. The government has pursued a different policy for the far west and is using that money for development within those states. In fairness to the West, that money belongs here…"***

***Ellensberg Record,*** **1934**

***"Apparently power interests in the East, opposed to the development of the resources of the Pacific Northwest, are getting into print from time to time articles which give an unfair impression of this entire region. The latest objectionable article appeared recently in an issue of Collier's Weekly, dealing with the Grand Coulee project and informing the nation that the intention was to provide water for several hundred thousand acres of alkali soil and capped the climax by referring to Washington as a 'doubtful agricultural state'…The Collier's article has been termed 'a libel on the State of Washington' and certainly it was most unfair and based on misinformation. Industry is moving away from the New England states and thousands of farmers in the drought area of the Plains states have been obliged to give up their homes. The Pacific Northwest is the greatest potential area for development that remains within the continental United States and in time is destined to become one of the best customers of that portion of the East which has manufacture to sell to the hinterland."***

***Walla Walla Bulletin,* 1934**

***"…The West has had to fight for irrigation to take the place of the mineral wealth, most of which has gone to the East. In other words, the West has been a 'colony' for the past 100 years. But today the West is demanding an autonomy of her own - the right to develop her resources in the interest of western economy…The answer to the Collier Weekly's article…represents, too, the idea that the West was becoming defiant of the efforts made to continue her in the category of a subservient to the East. The great manufacturing concerns, the railroads, the insurance companies had waxed fat at the expense of the West. So part of this battle for Grand Coulee was also a battle for western autonomy…"***

***Rufus Woods*** **(1944)**

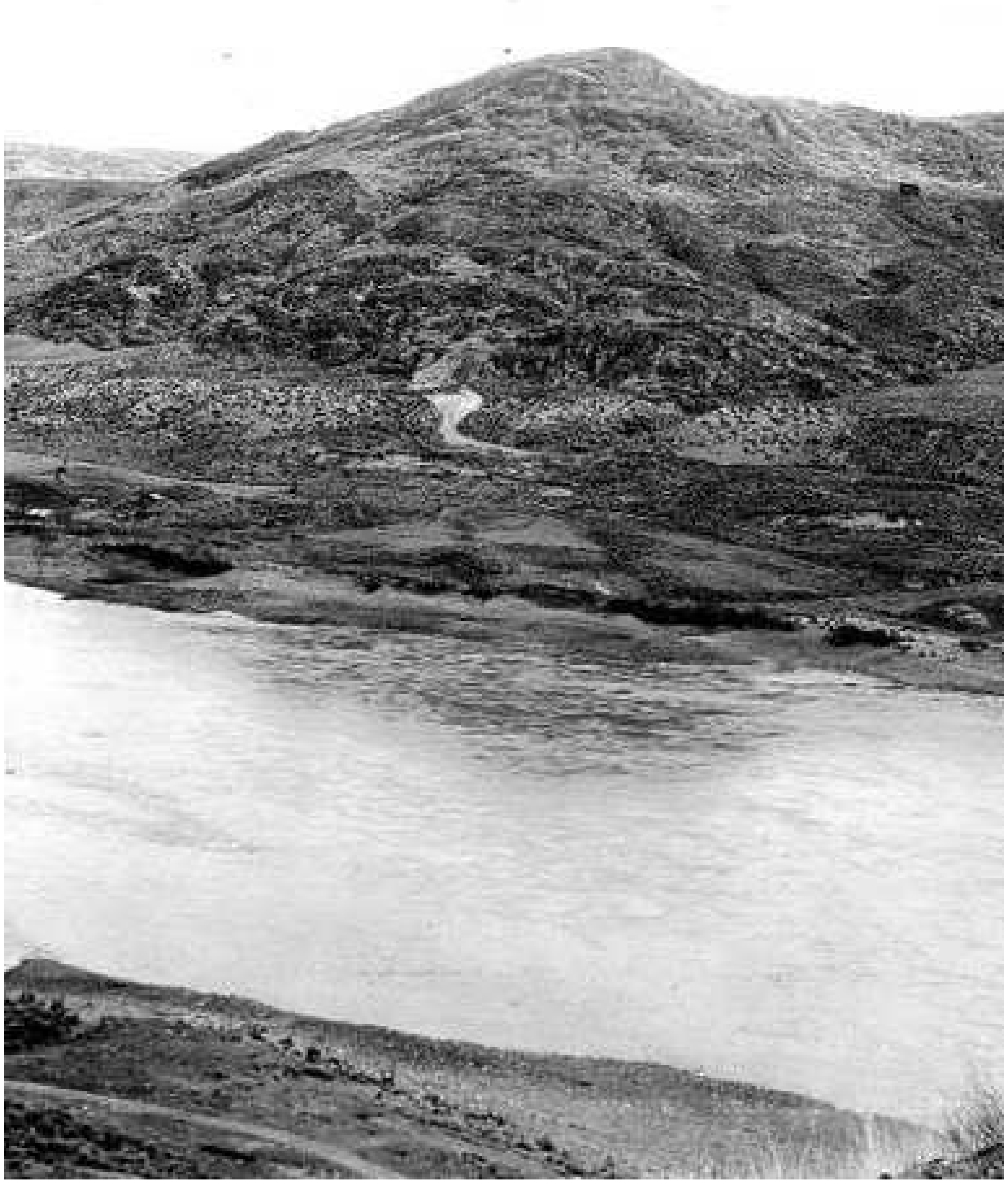
# Part 11

# At Long Last

## *A Dam is Begun*


***"…Sam Seaton ran an old cable ferry at the site of the dam. 'Sam,' with a dozen others, comprised the entire population for miles around when Governor Clarence D. Martin, in the fall of 1933, in the presence of pioneer settlers, Indian chieftains, and state and national dignitaries, turned the first shovel full of earth that was to start the biggest dam in history on its way. There were no railroads and no highways except the kind found in a sparsely settle frontier country. The scene soon changed. In December the government let a preliminary contract to David H. Ryan to move 2,000,000 yards of excavation. The weakened roadways meagerly surfaced, quickly crumpled beneath the clanging equipment of the first contractor and the hurried ingress of workers and tradesmen. At the site of the dam steam shovels crunched and groaned. 'Cats' raced hither and dither, and bulldozers gouged and leveled. Sam's ferry was soon overtaxed and augmented with another. Tradesmen lined the roadways. Almost overnight, 'up on the hill,' the town Grand Coulee, was born…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**



***"Now that work on the first unit of the Grand Coulee dam is about to begin, I wish to call your attention to the time when you came to me while I was secretary of the Wenatchee Commercial Club in 1906 when we got together on the plans for irrigating the lands of the Columbia Basin. Then years later, as the idea began to take root throughout the state, the Columbia River Development League was organized and you, David R. McGinnis, were the first president. I now wish to congratulate you on your part in this remarkable development…The first unit will be $63,000,000. It will produce 350,000 primary horse-power and 350,000 secondary horsepower…"***

***Rufus Woods***

**RE: excerpts from a July 21st 1933 letter to *David R. McGinnis***

**<u>Left</u>: caption: "Grand Coulee Dam construction site looking east, December 1933"**

***"…When finished the dam will be nearly a mile long and three times as high as Niagara Falls. It will back up a lake 151 miles long clear to the Canadian border and its generators will develop the equivalent of 2,700,000 horsepower, more than the hydroelectric power of all seven dams of the Tennessee Valley Authority combined…"***

***Popular Mechanics, April 1938***

**Left: caption: "Opening of Bids on Grand Coulee Dam and Power Plant, Civic Building, Spokane, June 18, 1934"**

***Anticipation…Doubt***


***"…The first winter found the public unconvinced that actual construction of a dam would ever take place or that the government would really call for bids. The unbeliever and the skeptic were loosed again. It was mild and muddy. The weakened roads were all but obliterated. Of physical comfort there was little. Government engineers commuted from Almira and nearby towns, but the workmen, the tradesmen, and the venturesome lived hopefully and uncomplainingly at Grand Coulee through lively hours of boots, blazers, and frontier bedlam. In the spring more towns were launched: Grand Coulee Center, Grand Coulee Heights, Delano, Electric City and Osborne. When the government called for bids for a low dam, doubt gave way to joy, and optimism reached a high peak when the bids were opened June 18, and a contract actually let to Mason-Walsh-Atkinson-Kier Company soon after…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

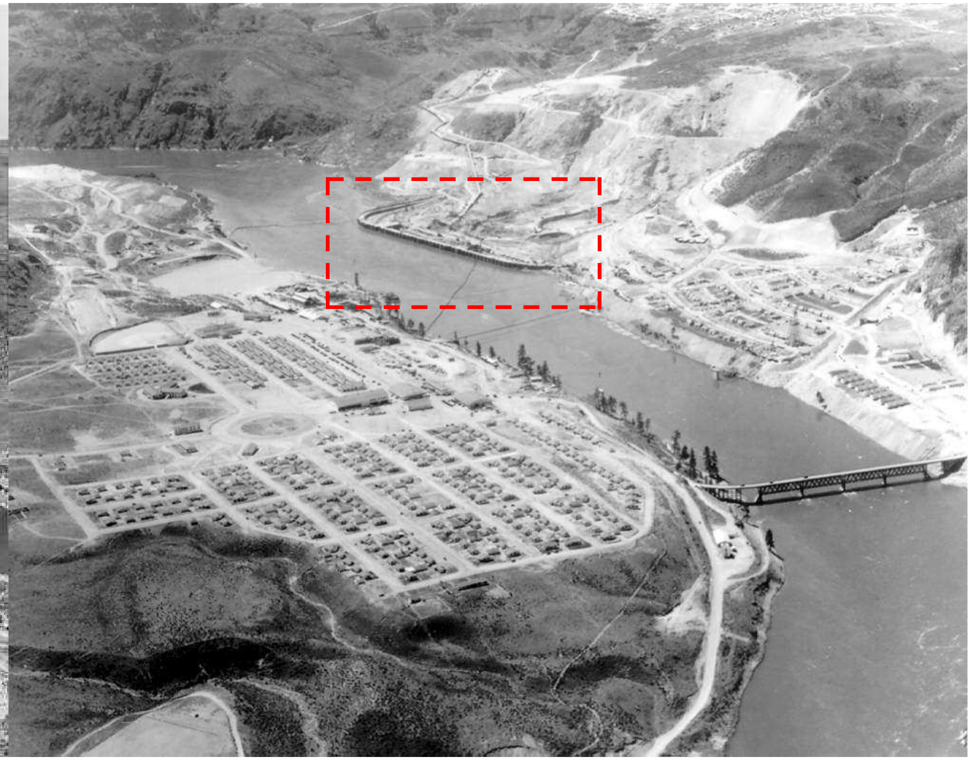
# *MWAK Contract*


***"…During the winter and spring of 1934 the Bureau of Reclamation had progressed rapidly in the building of its permanent town of Coulee Dam on the west bank of the river and its corps of engineers moved from Almira to the Dam in the early summer. Soon on the east bank of the river was created the town of Mason City, named in honor of the late Silas Mason, head of MWAK. Seldom, if ever, outside of army activities, did a town rise with such rapidity and precision. Meanwhile the government, exercising its right of eminent domain, acquired the land of Sam Seaton and his neighbors, located and established a gravel pit, let a contract for a construction railroad up the Grand Coulee, and established cement silos midway between the city of Grand Coulee and the river. President Roosevelt visited the dam on August 4 and speaking to 20,000 people in Grand Coulee near the Tepee site promised to come again one day to view the progress of the Dam to reclaim the barren acres of the Basin…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

**<u>Above</u>: caption: "DAM SITE: In January of 1934, only a fringe of tents bordered the Columbia river where it bends its ancient course northward. They housed the engineers who were beginning execution of precise blueprints. Centuries ago a glacier had blocked the Columbia at about this point, causing the river to shift its course eastward. Later, when the sun had taken care of the glacier, the river returned to its former course, leaving the 'Grand Coulee.' Now it was to be blocked again, and with what a difference! The deserted Grand Coulee is the site of the balancing reservoir two miles distant from the dam – its altitude 280-feet above the dam reservoir – where water will be stored to irrigate the 1,200,000 acres which the project will serve. Water from the dam reservoir will be pumped to the balancing reservoir, to flow by gravity through canals to farms in the vast Columbia Basin."**

**<u>Above</u>: caption: "Digging a 35-Acre Hole to Bedrock. To remove the 44 million tons of earth and rock from Grand Coulee Dam site, a conveyor belt was laid which, fed by a fleet of tractors and buggies, carried all but the large rock a mile and a half over the hill to Rattlesnake canyon on the west side of the river. Material excavated on the east side journeyed across a conveyor bridge and made connections with the Rattle-snake Express. For four years this conveyor operated."**

**<u>Left</u>: caption: "Grand Coulee Dam looking south toward Steamboat Rock, Washington, ca. 1935"**

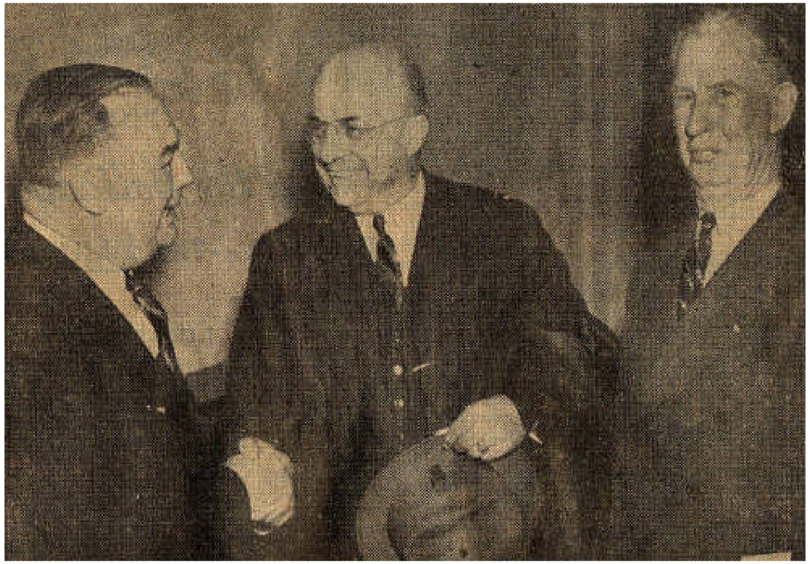
**<u>Right</u>: caption: "Aerial view of the dam site taken on May 5, 1935. A major amount of earth removal had already occurred on the west (right) bank at the time of this photo. An extensive cofferdam is visible on the west bank near the center of the picture."**


***"…The pioneers knew that reclamation of their land could not be had with a low Dam, and in June, 1935, renewed a plea for a high Dam. Together with their supporters they convinced the President a high Dam was necessary. An order was secured diverting the use of the $63,000,000 to build a low Dam to build the foundation for a high Dam. During the years that followed, MWAK moved millions of yards of excavation over the largest conveyor belt ever used; it built the great coffer dams, and accomplished the tremendous task of diverting the Columbia River. It poured the greatest quantity of concrete ever poured on one job, and in the late fall of 1937, under the leadership of Harvey Slocum, Tom Walsh, Guy Atkinson, Colonel Whitson and others of an able force, brought to a successful close the building of the foundation for the biggest dam on earth…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

*“With the opening of bids for the completion of Grand Coulee dam only two days away, it appeared virtually certain last night there would be three bids submitted…When the first contract was let there were but two bidders, the Six Companies, builders of Boulder dam, and the MWAK company, winners of the contract…MWAK made little if any profit on the contract which will be completed this month, due largely to the adverse court decision which subjects them to a state tax of approximately $1,000,000. It is said the company is anxious to get the next contract in order to balance the first. Another bidder will be the Interior Construction Company, composed of seven firms, six of which were in the famous Six Companies…The third contender for the Grand Coulee contract last night appeared to be a group of firms represented by Harvey Slocum, consulting engineer of San Francisco, who was former job foreman for the MWAK company…”*

***Spokesman-Review*, December 8th 1937**



***“The Interior Construction Company, composed of the Mason-Walsh-Atkinson-Kier Company, present contractor, and seven other firms, today submitted a low bid of $34,442,240 for completion of the $120,000,000 Grand Coulee high dam. Only one other bid was submitted. The Pacific Construction Co., asked $42,185,507.50 to complete the dam. With MWAK in the ‘new’ company are Morrison-Knudsen; J.P. Shea Co., McDonald & Keller; Pacific Bridge Company; Henry J. Kaiser; Utah Construction Company, and General Construction Company…”***

***Spokane Press,* December 10th 1937**

**Above: caption: “The big three in the new Interior Construction Company, low bidders for the completion of Grand Coulee dam, were in jovial mood following the opening of bids in Spokane yesterday. Tom Walsh, left, president of MWAK Company, Chairman of the Board of the new company, is shaking hands with Henry J. Kaiser, president of the amalgamated firms. Mr. Kaiser, a former Spokane man, entered the contracting business in this city a number of years ago. At the right is Guy F. Atkinson, vice president of MWAK, and also vice president of the new concern.”**

***"New engineering and administrative personnel to direct the completion of the Grand Coulee dam was named today and will take over from the MWAK company for the Interior Construction Company just as soon as the Bureau of Reclamation has approved the low $34,000,000 bid of the Interior Company. Edgar F. Kaiser, son of Henry J. Kaiser, president of the Interior, will be in complete charge as project manager, a position generally similar to that the younger Mr. Kaiser held on the Bonneville project..."***

***Spokane Chronicle,* December 17th 1937**

***"Private contractors' bids for completion of Grand Coulee dam may be rejected by Secretary of Interior Ickes and the Unites States government may itself finish the dam, the Spokane Press learned today on good authority. Delay in awarding the contract for which bids were let last December, has been occasioned by this possibility, The Press learned. Reports from the capital indicate the contract will finally be awarded to the MWAK-Interior Company, low bidders. However, at last reports definite decision had not been reached and government authorities are still debating the question. The decision is expected to be reached within a few days. The low bid on the completed project was $34,442,240."***

***Spokane Press,* January 12th 1938**

***"…Secretary Ickes announced today award of a $34,442,240 contract to the Interior Construction Company, Oakland, Cal., for completion of Grand Coulee dam on the Columbia river. The contract, one of the largest awarded for a federal reclamation project, involves placement of approximately 5,250,000 cubic yards of concrete on a foundation dam recently completed at a total cost of $63,000,000. Construction will start as soon as the contracts are signed and necessary formalities are completed…Secretary Ickes has requested the name of the successful bidder be changed so it will not infer the concern is directly connected with the Department of the Interior…"***

***Spokane Chronicle,*** **January 28th 1938**

***"Thomas J. Walsh, Chairman of the Board of the syndicate which won the contract for completing the Grand Coulee dam, said the contractors would adopt the name Consolidated Builders, Inc…The $34,442,240 bid of the nine company syndicate was submitted under the name of Interior Construction Company. The change will be made at the request of Secretary Ickes to avoid similarity to the Department of the Interior…The syndicate was incorporated in Nevada."***

***Seattle Post-Intelligencer,* February 9th 1938**

***“The Consolidated Builders, Inc., the new contractors for Grand Coulee dam, will take over the work on the project about March 1, it was stated today by the Bureau of Reclamation. It is expected by that time MWAK will complete certain of the clean-up work and will be formally released from their contract. W.E. Kier, vice president of MWAK, arrived here today from the meeting of the officers of the new company, of which MWAK is a part, and stated that Edgar Kaiser, general manager for C.B.I., will announce plans of the new contractors upon his arrival here…”***

***Spokesman-Review,*** **February 18th 1938**

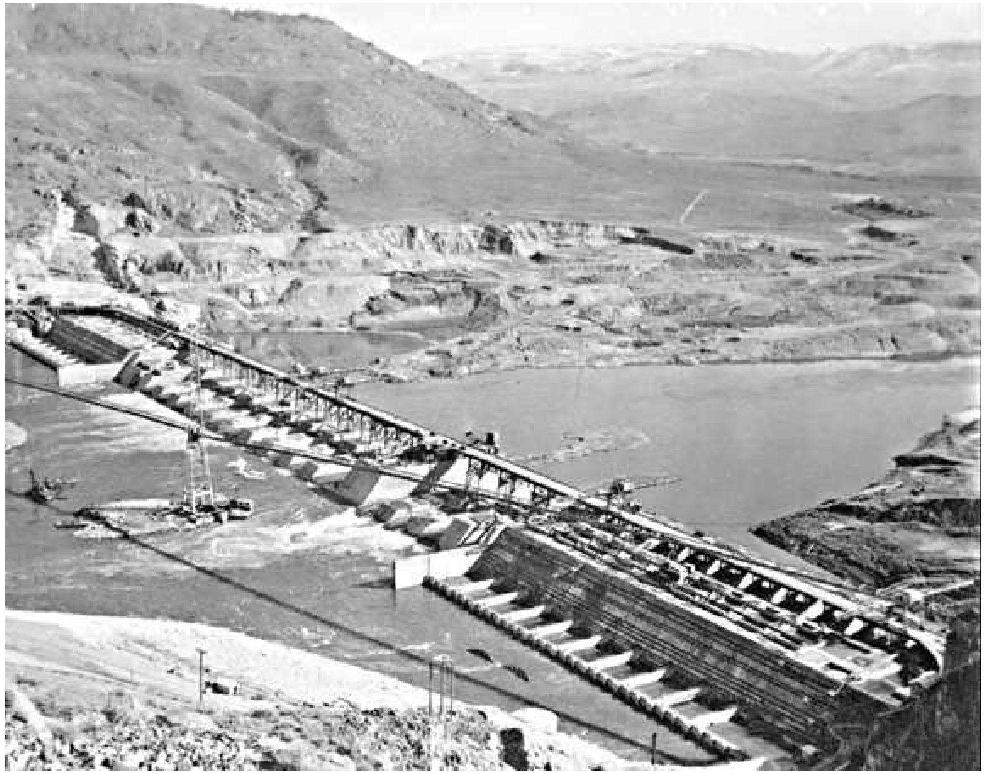
**<u>Top Left</u>: caption: "Officials view model of Grand Coulee dam site, October 1937**
**<u>Top Right</u>: caption: "MWAK Co. officials at dinner, Grand Coulee, October 1937"**
**<u>Left</u>: caption: "Silas Mason is Chairman of the Board of the Silas Mason Company, a unit of Mason-Walsh-Atkinson-Kier Company, General Contractors for construction of the Grand Coulee Dam."**

# The Rivers and Harbors Act

***"…That for the purpose of controlling floods, improving navigation, regulating the flow of the streams of the United States, providing for storage and for the delivery of the stored waters thereof, for the reclamation of public lands and Indian reservations, and other beneficial uses, and for the generation of electric energy as a means of financially aiding and assisting such undertakings the projects known as 'Parker Dam' on the Colorado River and 'Grand Coulee Dam' on the Columbia River are hereby authorized and adopted."***

***1935 Rivers and Harbors Act, SEC. 2, August 30, 1935, H.R. 6250***

**RE: FDR envisioned the *Grand Coulee Dam* fitting into his *New Deal* policies under the auspices of the *Public Works Administration* (PWA). It would create jobs, farming opportunities and would, in the end, pay for itself. In addition, as part of a larger public effort, FDR wanted to keep electricity prices low by limiting private ownership of utility companies. Many opposed a federal takeover of the project (including its most prominent supporters), but Washington State lacked the resources to fully realize the project. In August 1935, with the help of FDR and a U.S. Supreme Court decision allowing the acquisition of public land and Indian Reservations, Congress authorized funding for the upgraded high dam under the *1935 River and Harbors Act*.**

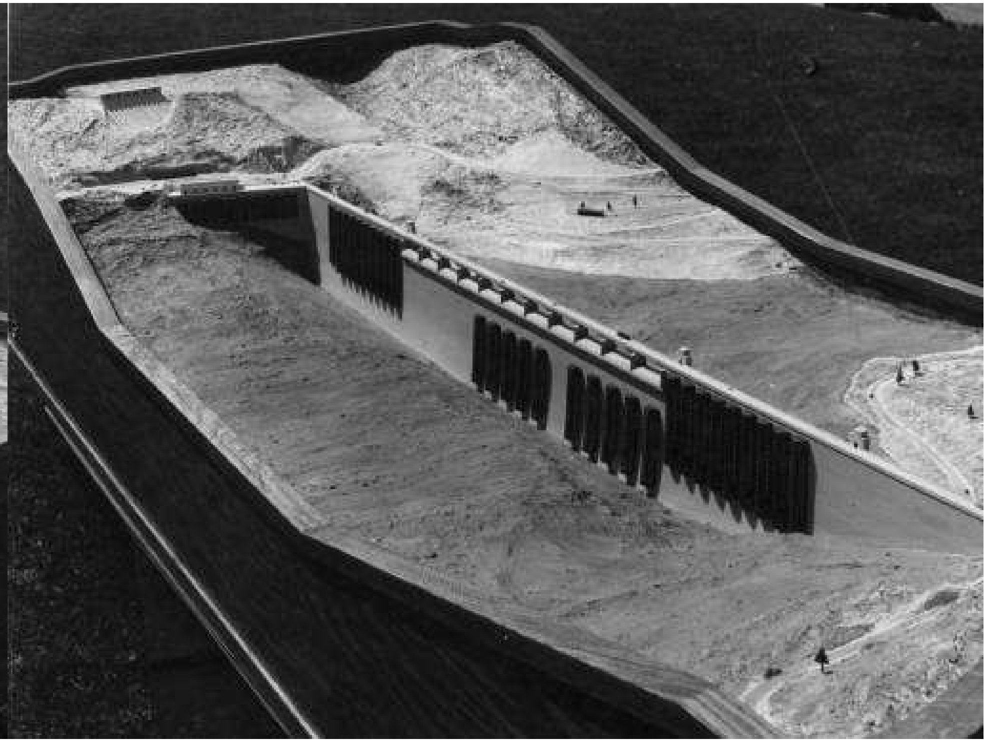


***"…Construction of the Grand Coulee dam started in 1934 under a $29,300,000 contract awarded to the Mason-Walsh-Atkinson-Kier company by the Bureau of Reclamation. This initial contract, calling for the construction of the dam up to a height of 177-feet, is now being completed. Additional contracts are to be awarded for finishing the dam…"***

***Popular Mechanics,* April 1938**

**<u>Top</u>: caption: "Looking east from Fiddle Creek area at Grand Coulee Dam at the close of M.W.A.K. contract (March 1938)"**

**<u>Bottom</u>: caption: "East side view of Dam (March 1938)"**

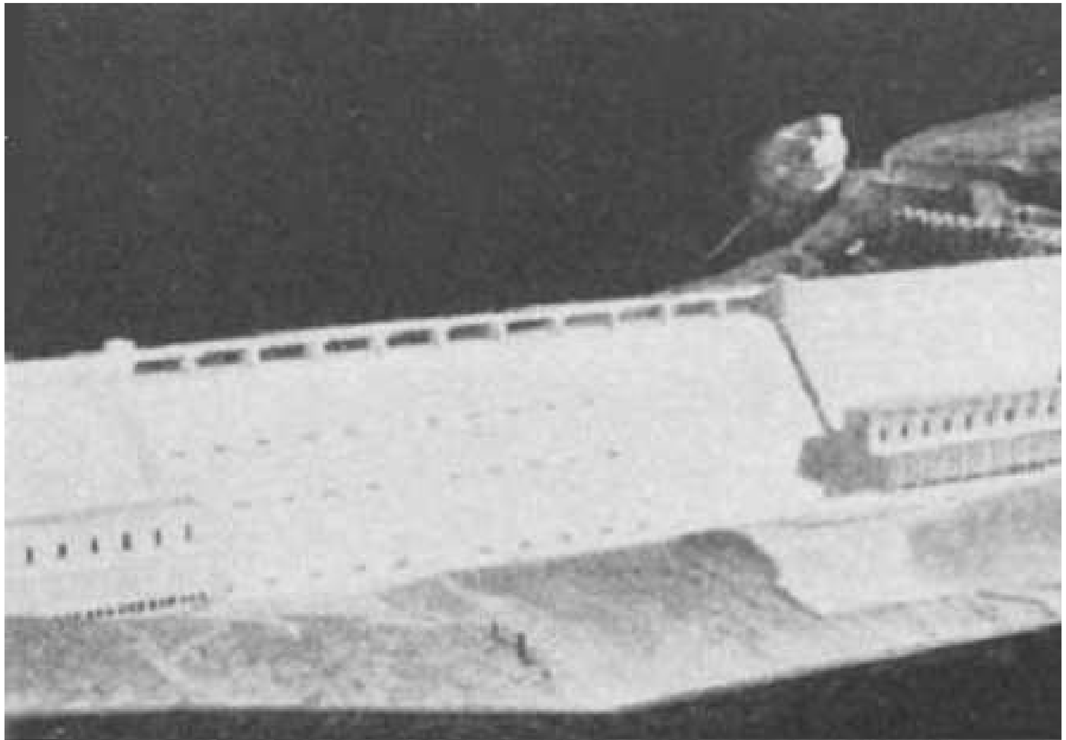


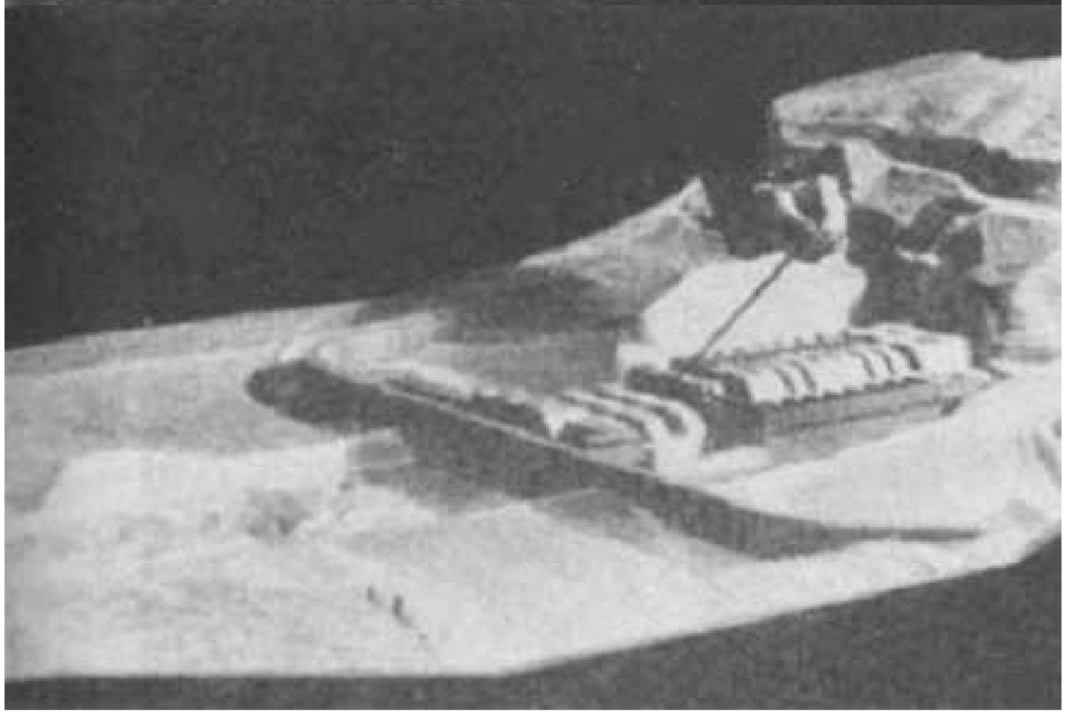
***"…Meanwhile, laboratory research on the design of the dam has been finished. Scale models of the structure, some of rubber and some of plaster, have been tested under varying conditions of load and temperature. Models of such features as spillways and control valves have undergone experiments in a hydraulics laboratory, and samples of the sand, rock, and other ingredients that would go into the dam have been given exhaustive tests. Such experimental work will continue long after the new dam has gone into service…"***

***Popular Mechanics,* August 1942**

**Left: caption: "Model of Grand Coulee Dam – downstream face"**

**Right: caption: "Model of Grand Coulee Dam – upstream face"**





***"…So that the MWAK company may get an accurate picture of how the completed structure on which they are now working will look, two carpenters have just finished making a Plaster of Paris model of the dam, at the order of the general contractor. The model is built to scale, about 75-feet to one inch and has been carefully molded to bring out every detail. A loose piece of plaster has been made to represent the shape of the high dam to show how it is to be superimposed on the low dam structure, if it is…"***

***Spokane Chronicle,*** **January 31st 1935**

**Top: caption: "Its tremendous size is illustrated by showing scale models of motor stages and freight trucks on the dam"**

**Bottom: caption: "The purpose of the west cofferdam and the design of the diversion gaps on the west side are explained"**

***"The building of the scale model of the dam site is coming along nicely…The model is being built of layers of cardboard, less than one-eighth of an inch thick and sawed on a jigsaw to conform to the topographical contours of the land…So constructed that it will show first, the district adjacent to the dam as it was originally…"***

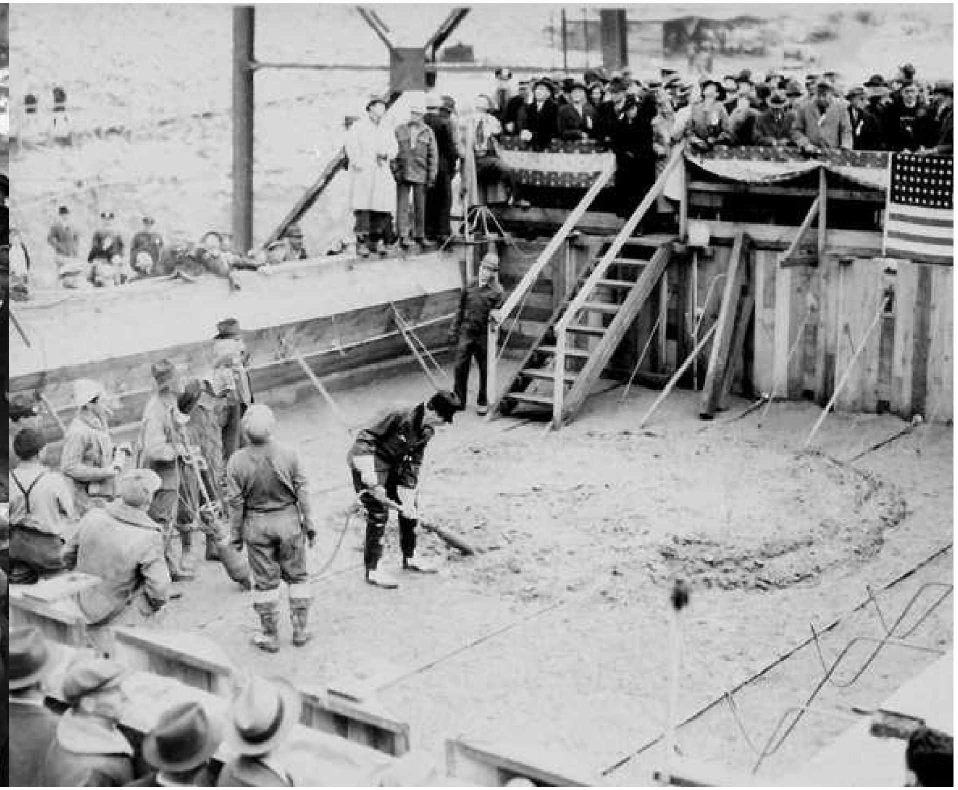
***Spokesman-Review,***

**April 24th 1936**

***"…the model will be fitted so that the excavation areas can be lifted out, displaying the present finished slopes. The cofferdam can then be put in, as well as the cross-stream coffer, to show the methods of diversion. A wooden model of the dam will be built, which can be slipped in place, to show how the completed project will look. The finished model will weigh about 400 pounds…"***

***Spokesman-Review,*** **April 24th 1936**

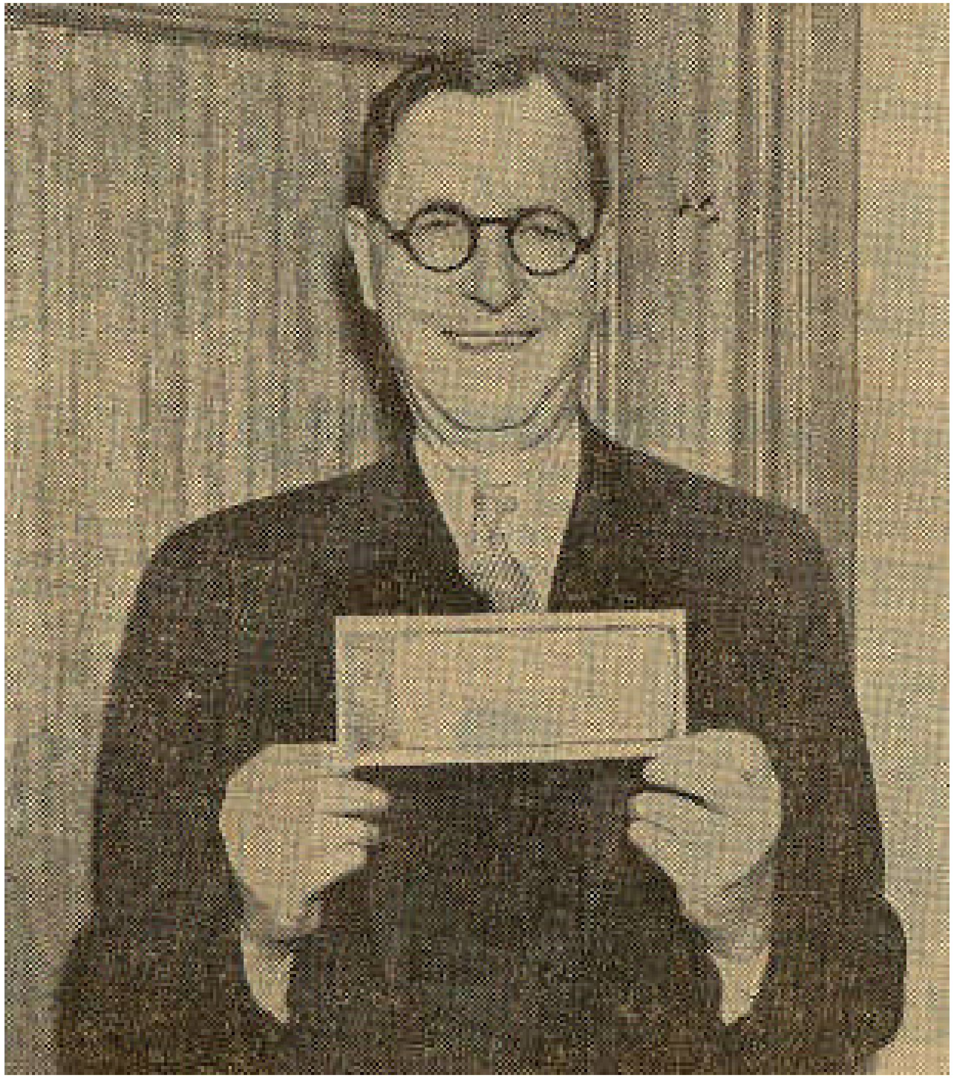
The U.S.B.R. did not want to back up water into Canada thus, it was decided that the International border would be the limiting factor as to how high the dam should be built. Also, due to concerns over the marketability of the power the dam would produce, the original proposal called for a low dam. This dam would have been 200-feet lower than the maximum height allowed by the Canadian border restriction. However, after much lobbying by *Rufus Woods* and *Billy Clapp* (left), the U.S.B.R. decided to design the dam to its maximum height while providing incremental increases in generation capacity if/when required.

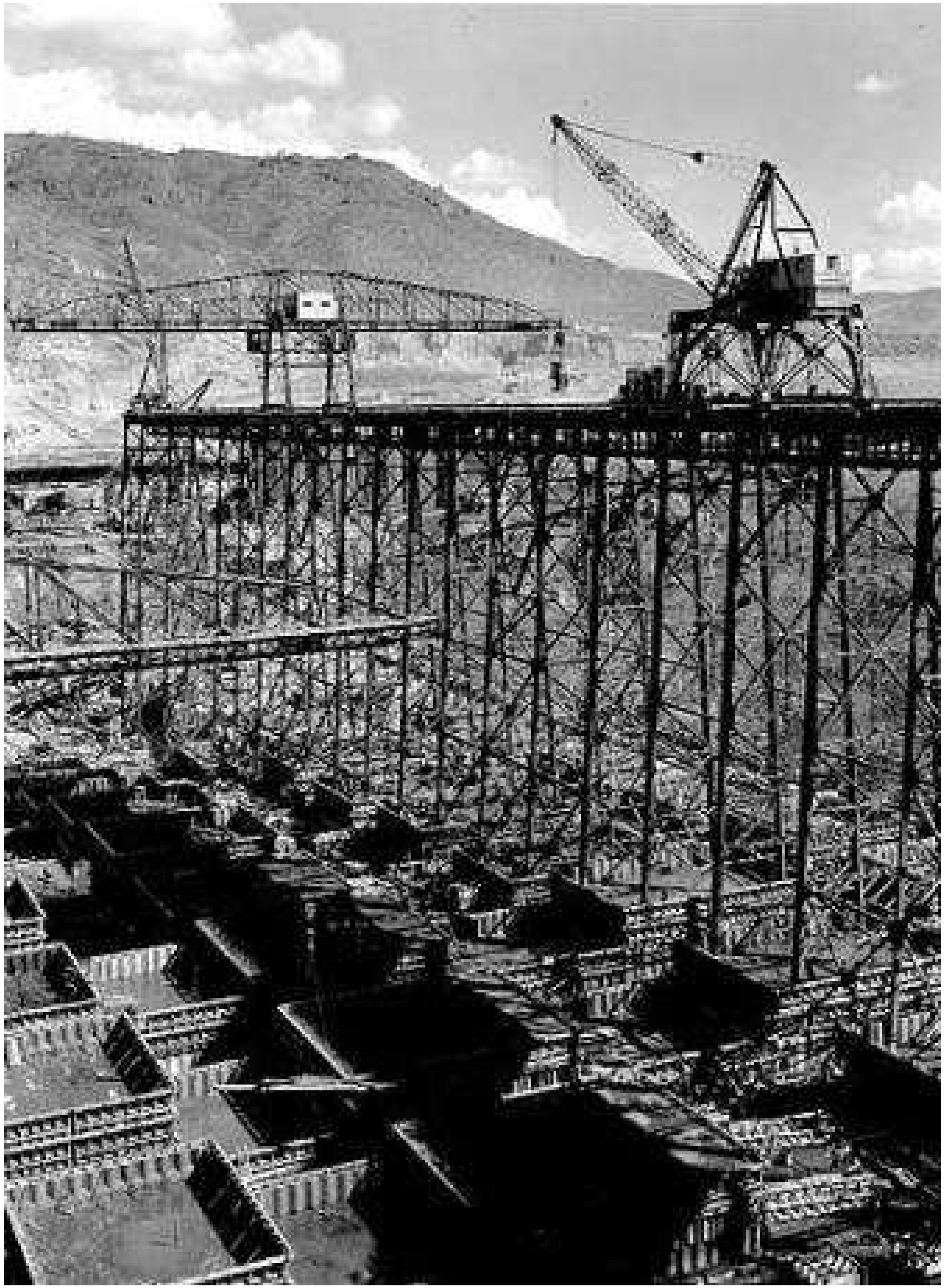
**The first bucket of concrete was poured into *Grand Coulee Dam* by Washington State Governor *Clarence D. Martin* on December 6th 1935 while a large crowd gathered for the event looked on. After this initial pour, only 2,624,000 bucketsful of concrete remained to be poured. Each bucketful added four cubic-yards (eight tons) to the concrete mass of the dam.**

**<u>Left</u>: caption: "Governor Clarence C. Martin placing official first concrete pour at Grand Coulee Dam, December 6, 1935"**

**<u>Right</u>: caption: "Governor Clarence C. Martin vibrating first official concrete pour at Grand Coulee Dam, December 6, 1935"**



**<u>Left</u>: caption: "The check shown in this picture brought a smile to the face of James O'Sullivan, secretary of the Columbia Basin Commission, and it will probably bring a grin to the face of Governor Clarence D. Martin when he sees it. It is a payroll check drawn on the MWAK Company by Roy Dycus, paymaster, for 75 cents, payable to Governor Martin. The governor earned it last Friday, when he joined the MWAK crew and helped spread the first concrete that went into the foundations of the Grand Coulee dam." (*Spokesman-Review*, December 10th 1935)**



***"…The dam looked more like a bridge than a dam during the first year or so of construction and that is just about what it really was. Before the first slab of concrete was poured an 11,000 ton steel trestle was built across the river so huge hammerhead cranes could move back and froth to place the concrete. As the concrete now rises up around it this enormous steel skeleton is being buried in the dam…"***

***Popular Mechanics,*** **April 1938**

**Left: trestle and cranes (ca. 1936)**

***Towns on the Hill***


***"…During the three year construction period of MWAK, the payroll reached a peak of 6,000 men, exclusive of the payroll of the Bureau of Reclamation, as well as numerous public utilities such as telephone, light, water and transportation companies. At Coulee Dam (Engineers' Town) homes were provided only for engineers and employees of the government; at Mason City homes were provided for officials, key men, and some of the permanent force. The overflow, for lack of any provision for them, sought and built places to live in the towns 'on the hill' where schools and churches were provided with state and government assistance, and where private capital provided theatres, hotels, fraternal halls, stores, shops, and so forth. For their spiritual and material welfare. These towns prospered. In the fall of 1935 a city government was believed necessary. The towns of Grand Coulee, Grand Coulee Center and Grand Coulee Heights incorporated as a third-class city to be known as Grand Coulee, with an official population of 6,000 within its corporate limits and 2,500 more on government land and outside additions. Down the Coulee Highway, the smaller towns of Delano, Electric City and Osborne had also prospered…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**


**<u>Above</u>: caption: "Men Needed Jobs, and found them at Grand Coulee Dam. Almost every construction craft was represented, from deep-sea divers to steeplejacks. Started when jobs were at a premium, this great self-liquidating project helped relieve the unemployment problem. The above scene of changing shifts was enacted three times a day during the entire construction period. Peak employment was reached in June 1937, when 7,455 men were employed. This is one public works which is paying handsome dividends."**

**<u>Left</u>: caption: "Here workmen are seen operating a hand driven air pump which provides breathing air to divers as they inspect submerged areas of the dam"**

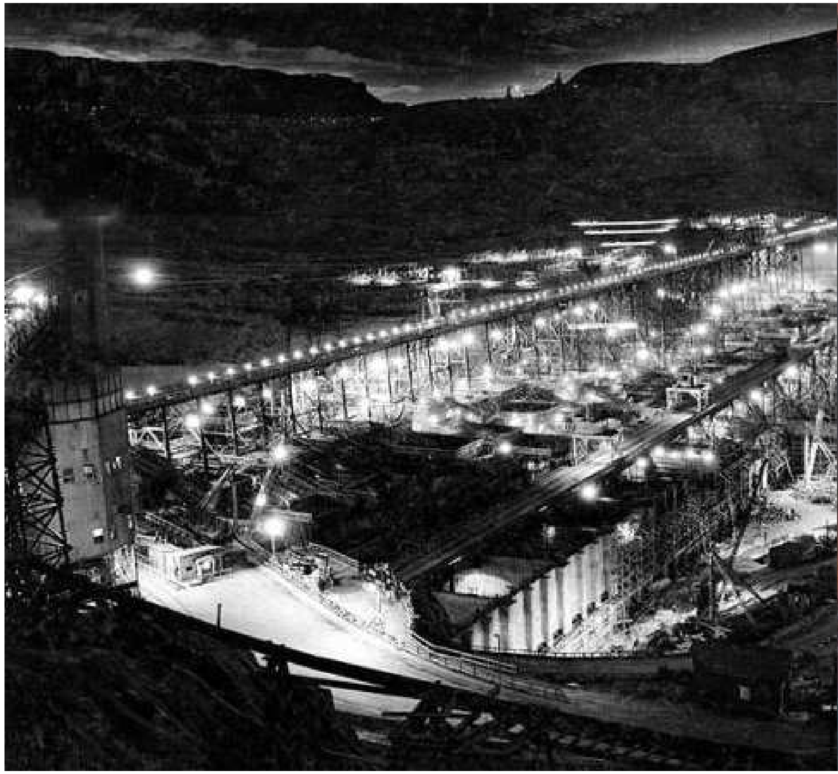
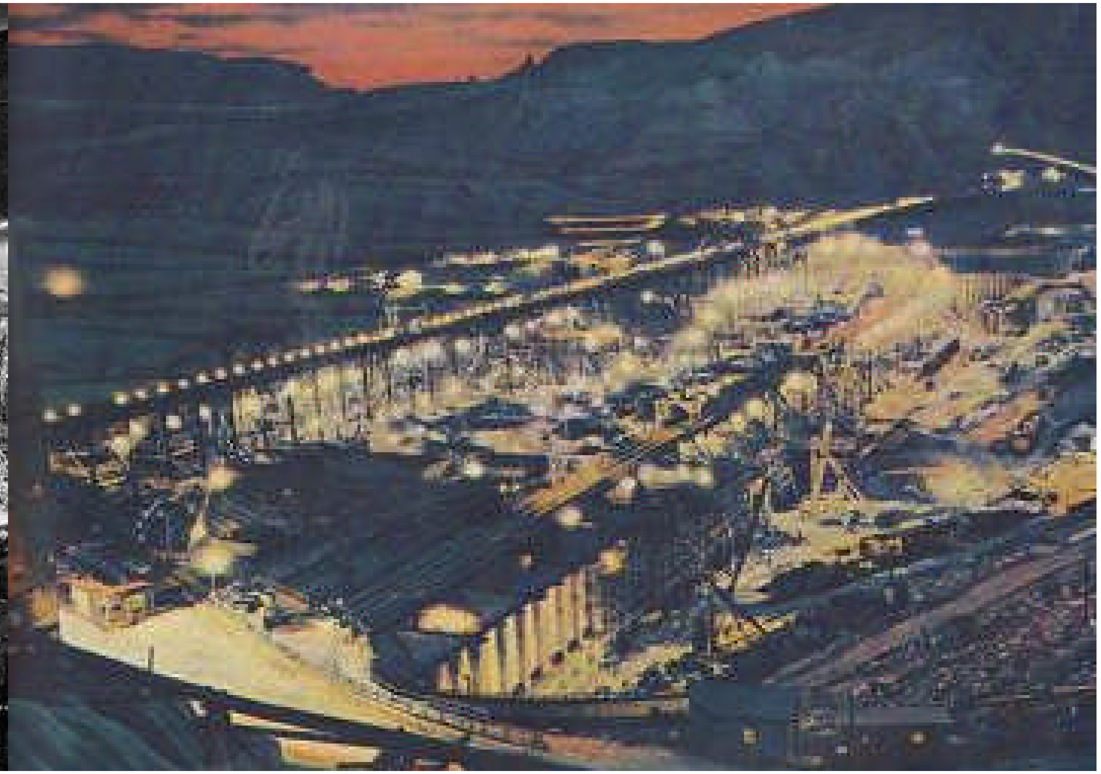
# A Twentieth Century Gulliver

***"…If you should visit the dam today, you literally become a twentieth century Gulliver. From a vista house perched part way up the canyon wall you peer down at a man-made mountain of concrete along the flanks and shoulders of which crawl toy engines and trains, tiny cranes and pygmy trucks. The men who are building the monster are simply black moving dots. But when you get down closer the toy engines loom up as ten-ton Diesel-electric locomotives running on standard-gauge track and the tiny trains become long flatcars loaded with huge buckets of concrete. This dam is so huge that an entire railroad system, complete to dispatcher, switchyards and signal systems, runs all over it…"***

***Popular Mechanics,* April 1938**

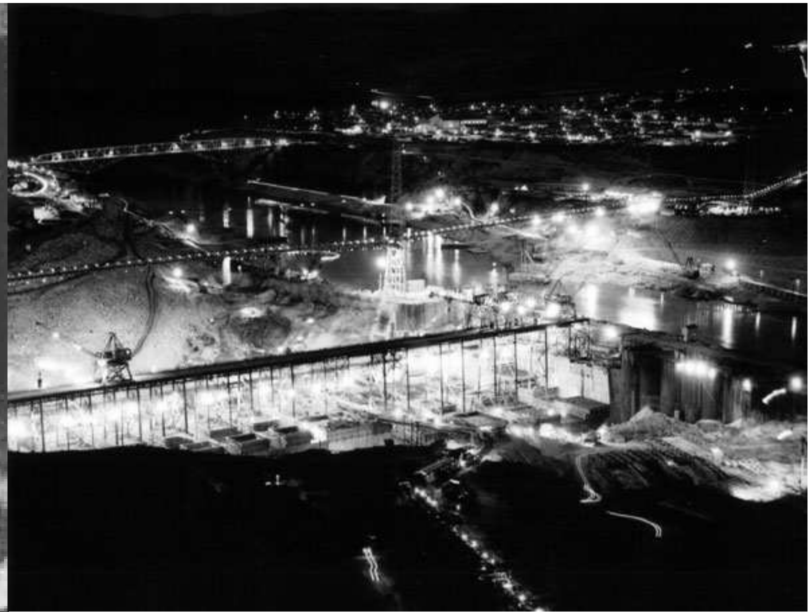
***"Thousands of persons who already have marveled at the magnitude of the Grand Coulee dam in the daylight have yet a bigger thrill awaiting them should they view the project from the air at night…No matter how dark the night the Grand Coulee can be located without difficulty, because in the floor of the Coulee, which until work on the dam was almost void of settlement, is now a line of lights, telling of scores of new residents…"***

***Spokane Chronicle,* May 13th 1935**

***"…Few cities in the northwest are more brilliantly illuminated than Mason City and the neighboring private towns. To persons unaccustomed to night flying the Grand Coulee dam project might be easily mistaken for Spokane itself as the plane slips over the rolling hills and is surprisingly confronted with a great blaze of electrical display. Grand Coulee gives every appearance of a modern city with its scores of red neon signs, and automobile headlights darting in all directions…Strings of lights spanning the Columbia river indicate the railroad and 'cat-walk' bridges...There was a beehive of activity inside the huge cofferdam…"***

***Spokane Chronicle*, May 13th 1935**

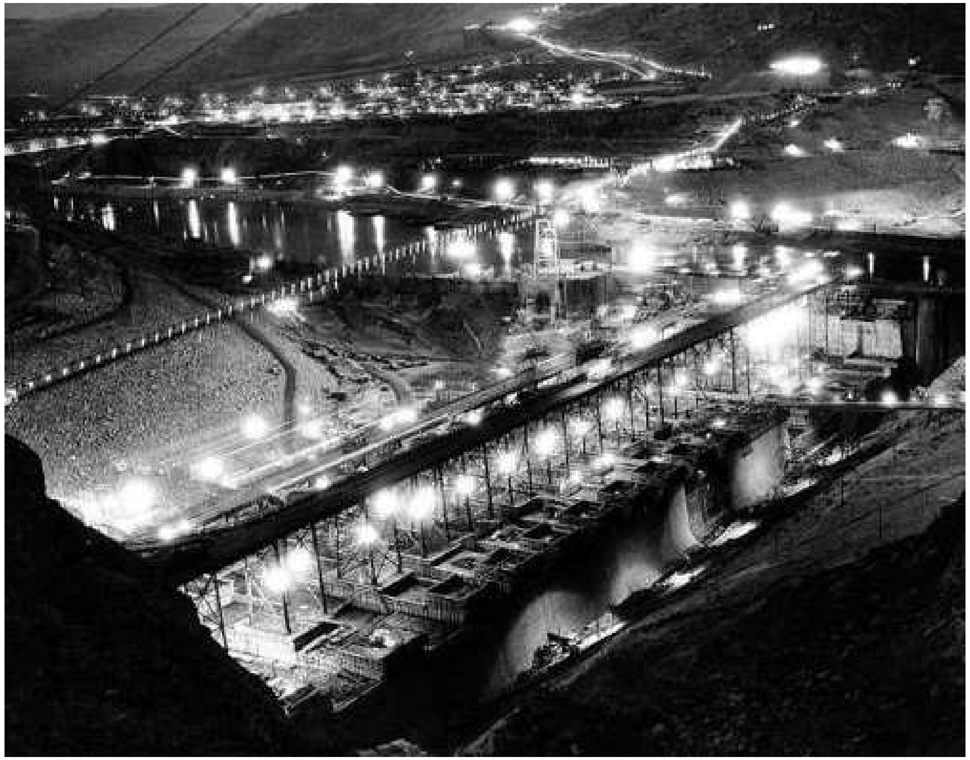


***"…Every detail was visible from 2,000-feet above the work…A string of lights leading from the cofferdam to Rattlesnake canyon designated the huge conveyor…"***

***Spokane Chronicle,* May 13th 1935**

**<u>Above</u>: caption: "Work to complete the foundation takes place around the clock (ca. 1936)"**

**<u>Left</u>: caption: "Under powerful lights covering an area three miles long, work on the base of the dam went on day and night without interruption"**



***"…Both Mason City and the government engineers' towns offer an orderly appearance with street lights marking intersections. Although it was 11 p.m. there was much activity outside of the project itself. Scores of people were seen on the streets of the private towns, and automobile headlights could be seen flashing their hurried trips toward the project."***

***Spokane Chronicle,* May 13th 1935**

**<u>Top</u>: caption: “An early air view of dam site and Mason City (left foreground) and Coulee Dam, the camps”**

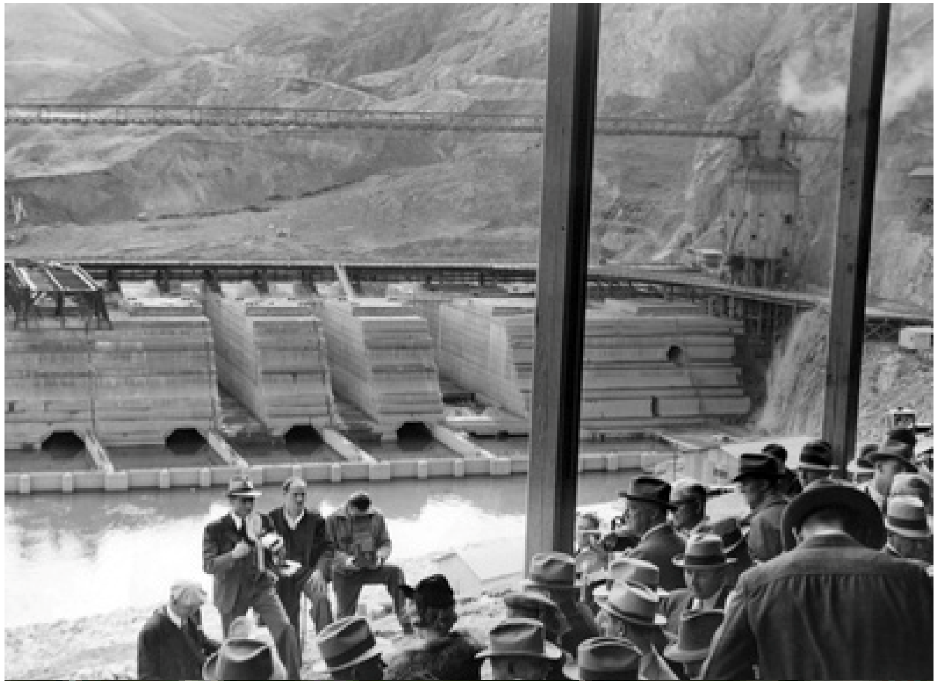
**<u>Bottom</u>: caption: “Night and Day work proceeds on the gigantic Grand Coulee Dam. As light as day are the workings shown here with a myriad of flood lights replacing the sun. In the distance is Mason City, the contractors’ electrified camp, on the east side of the river. The permanent government city, Coulee Dam, is the cluster of lights in the extreme left distance.”**

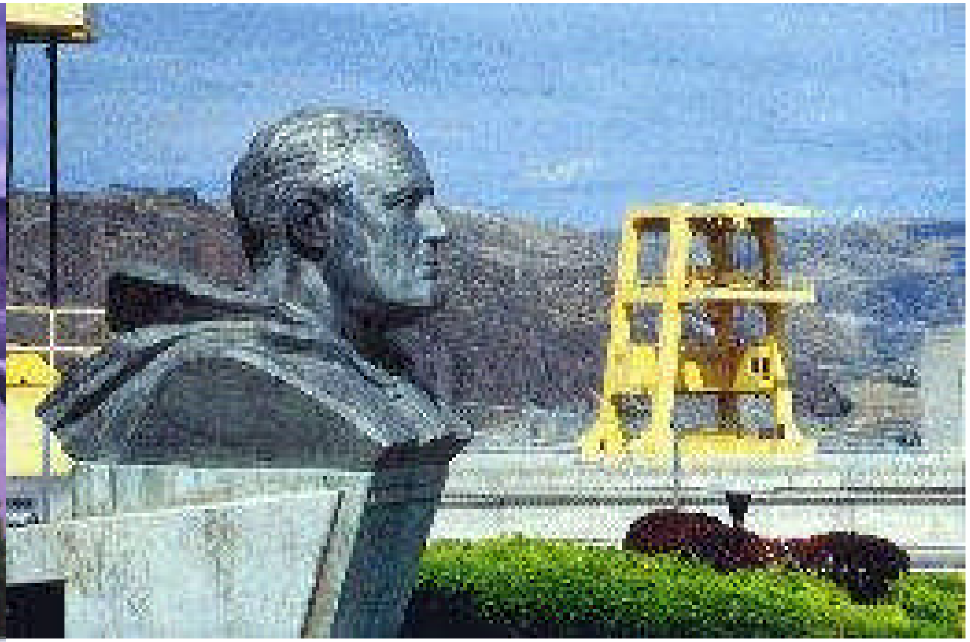

**Above L&R: caption: “The President made a second visit to Grand Coulee Dam, October 2, 1937. His first was in 1934. Here he takes time out for a luncheon from the contractor’s mess hall. Frank A, Banks, supervising engineer for the Bureau of Reclamation, is on the right. Speaking to the 5,000 persons who that day gathered in his honor, the President first complimented the builders on the remarkable progress he had observed, and then said: ‘We must remember that probably half the total cost of this dam is paid to the factories east of the Mississippi river, so in a very correct sense it is a national undertaking that is doing a national good.’”**

***“Coming back to Grand Coulee after three years I am made very happy by the wonderful progress I have seen. We look forward not only to the great good this will do in the development of power, but also in the development of thousands of homes. There are thousands of families in this country who are not making good because they are trying to farm on poor land, and I look forward to the day when the valley is dammed up to give the first opportunity to these American families who need some good farm land in place of their present farms. They are a splendid class of people, and it is up to us as a Nation to help them to live better than they are living now, So, in a very correct sense, it is a national undertaking and doing a national good.”***

***Franklin Delano Roosevelt,* POTUS**

**RE: excerpt from his October 2nd 1937 speech at the Grand Coulee dam site (above L&R)**



***"To Franklin Delano Roosevelt, thirty-first President of the United States, whose vision and unswerving devotion to the cause of conservation and development of natural resources of the west for national security and the permanent enrichment of the American people, brought about the construction of the Grand Coulee Dam, this reservoir is dedicated."***

**RE: inscription on the memorial overlooking the man-made lake named in FDR's honor: *Franklin D. Roosevelt Lake* (a/k/a "Lake Roosevelt")**

# *Winter of 1937-38*

***"…With a peak employment of 6,000 in October, 1937, MWAK gave warning that this number would be decreased to probably 500 men by January 1, due to the completion of its contract. The job was to be shut down and this army of men would be out of work, unless the government called for bids and let a contract for the completion of the dam in time to avoid a serious lapse in employment. It soon became apparent this lapse would occur. A few departed. Fewer still wanted to depart. Many had built homes, families had intermarried, children were in school, and there was no place to go where other employment could be had, and no place to go of equal promise for the future. The result was that the workers stood fast, school attendance increased, and relief offices were set up to take care of those unable to take care of themselves. Grand Coulee experienced its first major unemployment situation, relieved somewhat in the early spring by a WPA allotment for city improvements…"***

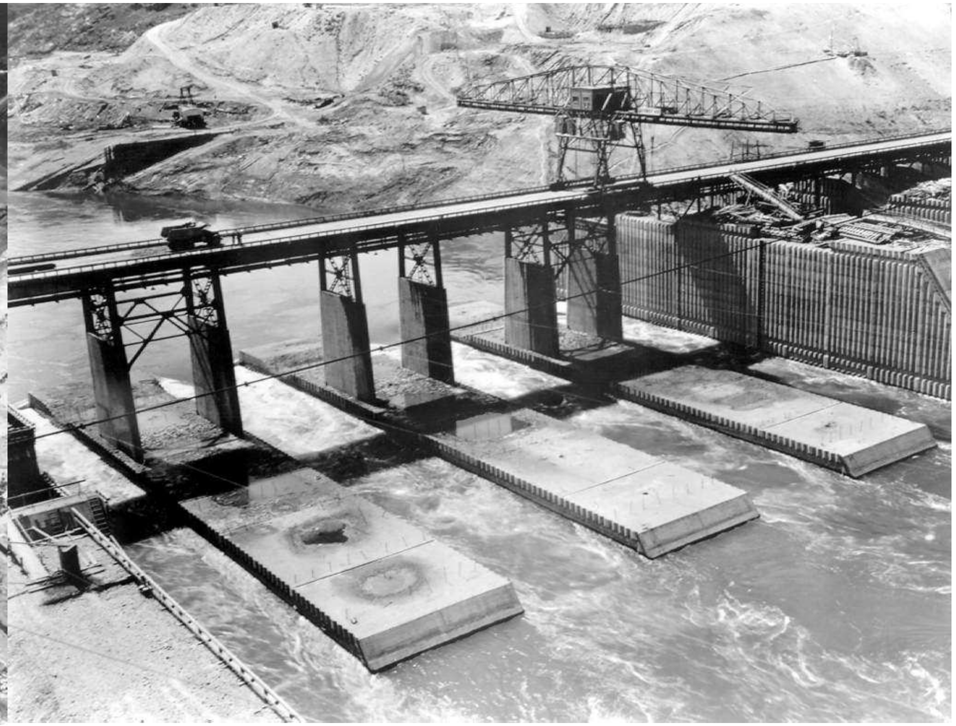
**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"All major concrete work on Grand Coulee dam under the present contract will be completed between December 5 and 10, and almost all the 5,000 employees will be laid-off then, the MWAK Company, contractors for the giant project, reported to United Press today. A small crew will be maintained to pour the remaining blocks of concrete. When this is completed about Christmas less than 100 men are to be employed in cleanup work to finish the contract, sometime in January, it was announced. Bids for completion of the high dam will be opened here December 10."***

***Spokane Press,* December 21st, 1937**

**Left: caption: "Within the Steel Cofferdam which roped off the diverted Columbia river, great power shovels excavated the river bed in the spring and summer of 1937, in preparation for placing concrete for the center section of Grand Coulee Dam. It called for lots of digging. This scene was typical throughout the early construction period."**

**<u>Above</u>: caption: "Step This Way Please, the engineers told the Columbia river that spring of 1937 when they were ready to excavate its ancient bed on which was to lie the center portion of Grand Coulee Dam. And it did. A wall of steel, shaped to a blunt arrow, pointed the way. The care of a great river during construction of a dam is among the most difficult parts of the job."**



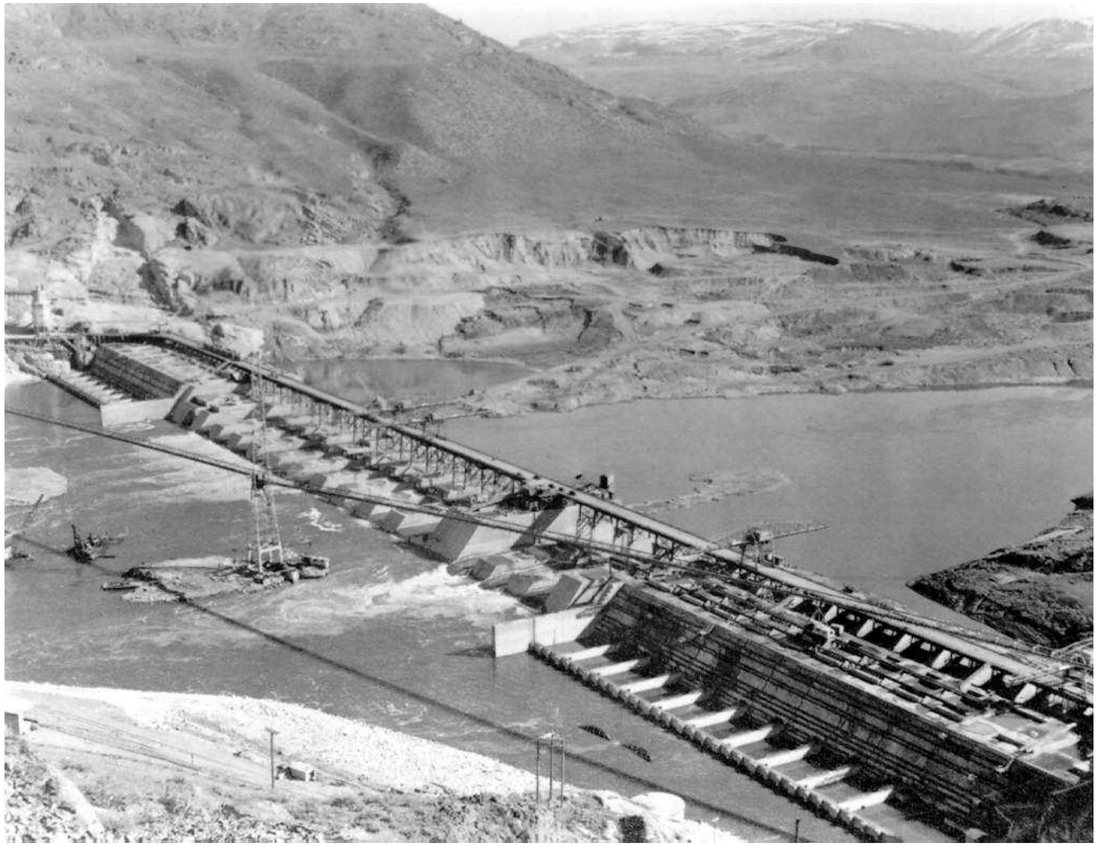
**<u>Left</u>: caption: “Photo taken from the upstream side of the dam on March 16, 1937. The west (left) cofferdam has been removed and water is being diverted through channels in the west dam base by an extensive coffer-dam on the east side of the river. This technique of protecting only half of the construction site at a time allowed the base of the dam to be built without interrupting the flow of the river.”**
**<u>Right</u>: caption: “Close-up view of the west side diversion channels used to accommodate the flow of the river while work proceeded on the east side of the dam. Photo taken on April 29, 1937.”**

# *A High Dam*

***"…On January 28, 1938, a contract for the completion of Grand Coulee Dam was let by Secretary Ickes of the Department of the Interior to a combination of contractors included in the 'MWAK' Co., builders of the base of the dam, and in the Six Companies, builders of the Boulder Dam, second largest dam in the country. Joined with them, in a corporation known as Consolidated Builders, Inc., or 'CBI,' is the General Construction Co., builders of Owyhee Dam, third largest dam in the United States. The government also let a separate contract to Western Pipe and Steel Company to build the penstocks for the dam. Mason City took on new life. Equipment was overhauled, buildings renovated and improved, and preliminary work gotten under way with plans for 'full steam ahead' after high water and by the fall of 1938…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

**<u>Above</u>: caption: "By March of 1938 concreting had spread across the three-quarter-mile length of Grand Coulee Dam. That spring the Columbia, swollen with melted snows, observed somewhat different traffic signals from those of the year before when it had been shoved to the left to make way for mid-river excavation. The 1938 spring floods, for the first time, slipped past the alternate slots left in the center spillway section of the dam and, directed but not interrupted, wasted on to the sea. By spring of 1939, storage had begun."**



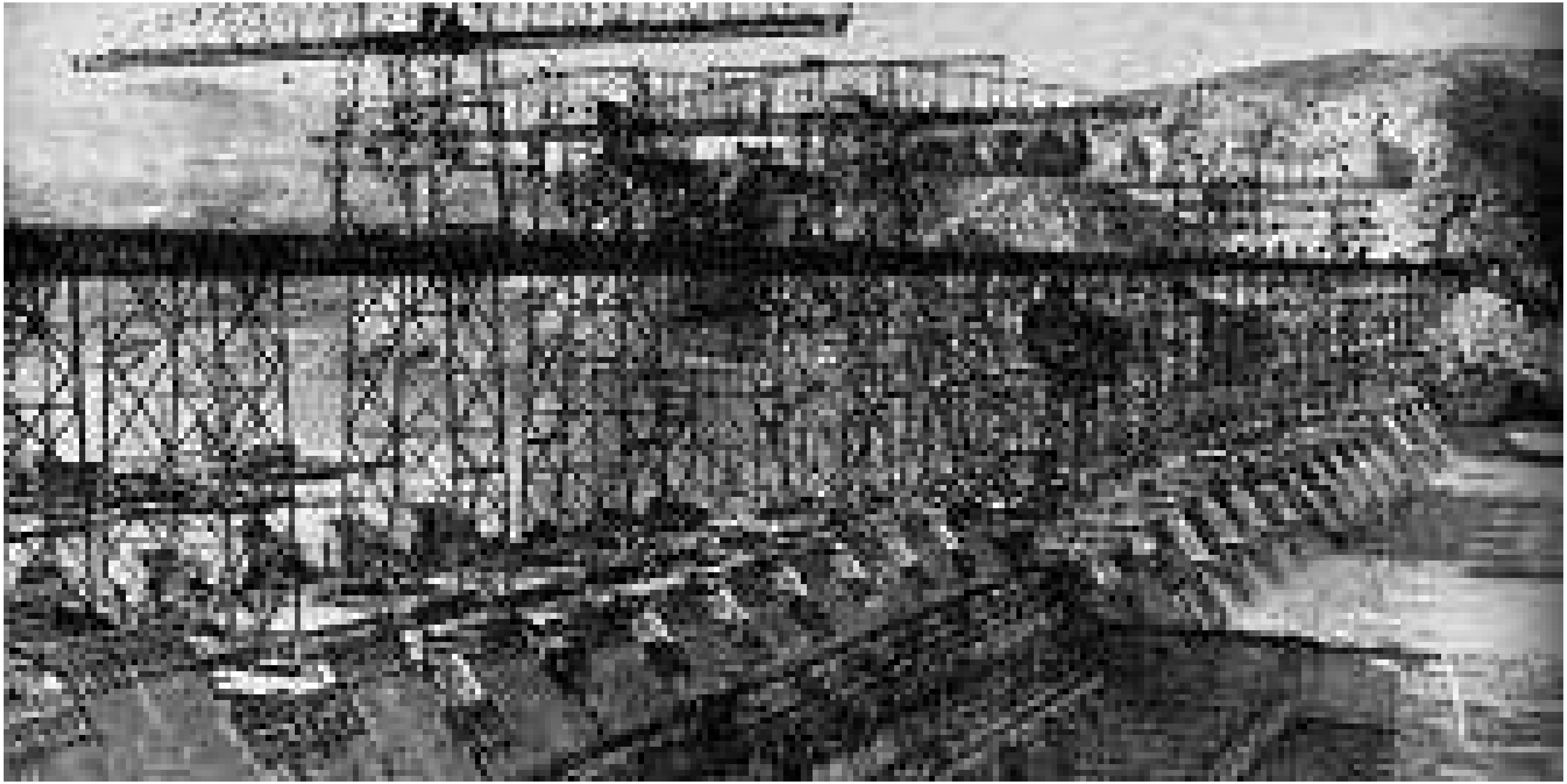
**In this photograph (taken on March 8th 1938), both the east and west cofferdams have been removed and the two sides of the dam are joined together. This shot was taken shortly after the completion of the dam base construction phase which marked the end of the MWAK contract. MWAK was responsible for constructing the dam's base while *Consolidated Builders Inc.* completed the project. The construction trestles are at elevation 1024. Top concrete had been poured to a maximum elevation of 1010 in the abutment sections and to 945 in the spillway section (with the exception of blocks 39 and 40 which were carried to elevation 1000). The powerhouse foundations were completed to elevation 948.8 and the training walls to elevation 980.**

***"…The gravel pit was reopened at a lower level, a huge jaw crusher was added to break up boulders and provide more gravel, the washing and screening plant was overhauled and enlarged, and a new mile-long conveyor replaced a series of conveyors between the processing plant and the stock piles at the dam. The two concrete mixing plants on each side of the river were overhauled and reassembled in a single plant. 'House of Magic,' on the east side of the river at a higher elevation. A contract was let to Bethlehem Steel Company to build a 4-track steel trestle, 180-feet high and 3,600-feet long on the base of the dam, built by MWAK company. The four gantry cranes used in building the base of the dam were enlarged, their span being increased from 230 to 300-feet, and three new and larger cranes were added to the concrete-placing equipment…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…At this time (July 1, 1939) about a million and a half yards of concrete have been added to the dam, substantial progress has been made on the west power house, twelve 17-foot tunnels have been driven diagonally upward through the west canyon wall for future pump-outlet pipes (reclamation purposes) and by the close of 1939 the ends of the dam are expected to be higher than the trestle. Work on the central section of the dam is confined to low-water seasons. Approximately 5,000 men are employed…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**



**<u>Above</u>: caption: "Wasting Energy Harnessed – Here man and his great machines are painstakingly applying a harness to the greatest power stream in the civilized world. Hour after hour, day after day, year after year man poured concrete, gradually - finally - getting the wild and rugged Columbia harnessed - tamed. It was slow. It was tedious. But as patiently as ants, men labored under the direction of great engineers. This 1939 picture shows the dam over half completed, with great cranes carrying and depositing large buckets of concrete. As the dam was raised the trestlework was buried in the concrete. This picture was taken with the Bureau of Reclamation photographer standing below the dam on the Okanogan side, looking south toward Grand Coulee and the Basin."**

# Part 12

# Object Lesson

# *Date Dam Completed and Cost*

***"…the Dam with three of its main generators installed is scheduled to be completed by 1942. Beginning in 1933 and up to June, 1938, $68,000,000 has been secured from WPA, ERA, and Congress for construction of the Dam. In June, 1938, when Congress appropriated an additional $13,000,000 for the fiscal year ending July 1, 1939, approximately all of the $68,-000,000 had been expended. The $13,000,000 appropriated by Congress being deemed insufficient to carry on the work without interruption to July 1, 1939, Secretary Ickes alotted another $13,000,000 from PWA. One may estimate that another $50,000,000 to $60,000,000 will be needed…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…Previous engineering reports indicate a total cost of $186,000,000 including maximum power development. The addition of a $2,000,000 fish hatchery, the foundation and outer wall of the pumping station, $1,000,000 for economic studies and surveys of the Reclamation Project, and increased costs of acquisition of lands to be flooded, may advance the cost of the dam to $195,000,000…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

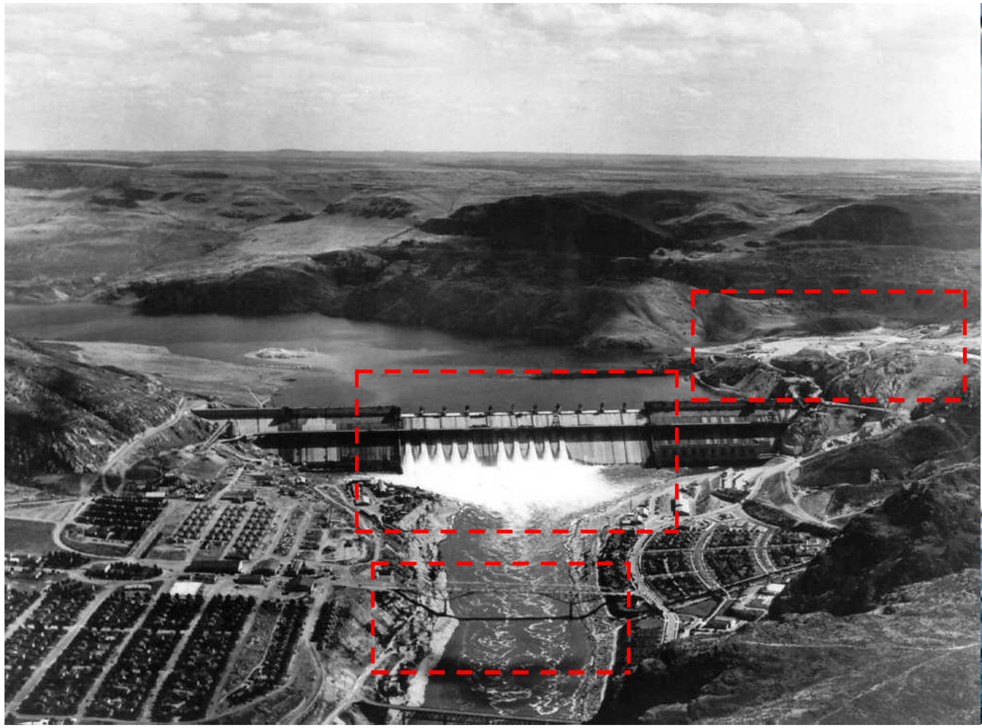
***"…This figure contemplates a fifteen year program for power development, estimated to cost $67,000,000, which is included in the above figures. Three main generators, with a capacity of 450,000 horsepower are planned to be installed by 1942, the date scheduled for the completion of the dam. Some $40,000,000 to $45,000,000 of the total of $195,000,000, will not be required by that date, but only as needed over a period of fifteen years after the completion of the Dam…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…It is estimated that the dam and powerhouses will cost a total of $178,790,000 and that the combined dam and irrigation project will present a total investment of $376,631,000…"***

***Popular Mechanics,* April 1938**

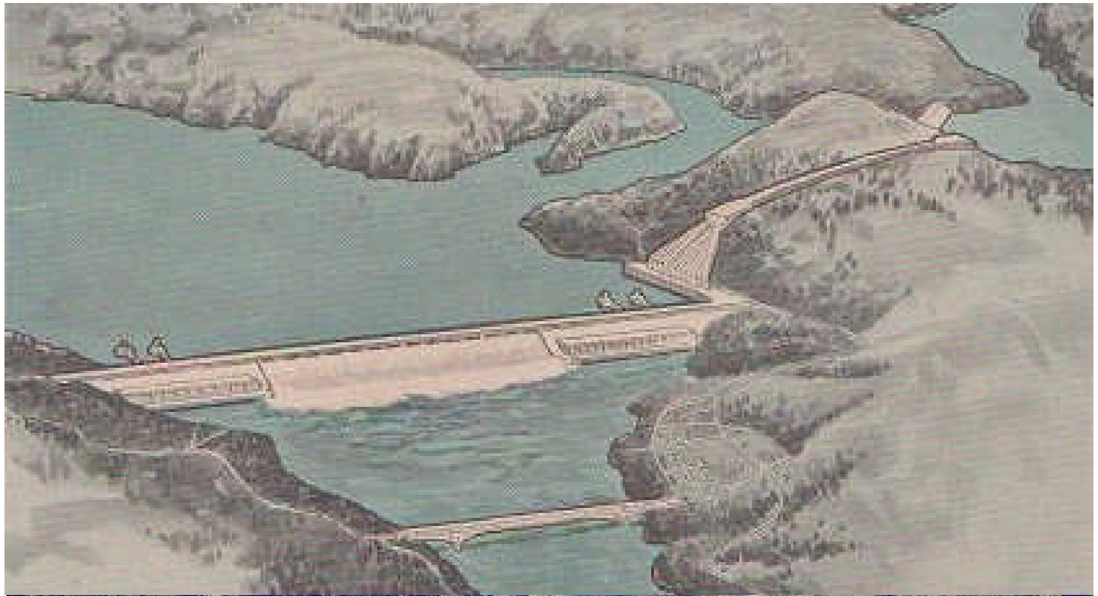
**RE: by 1941, the main dam was essentially finished with construction of the powerhouses and pumping plant was well underway. Ironically, because of America's entry into WWII in the aftermath of the attack on *Pearl Harbor*, the production of electricity became the overriding priority for the dam given the tremendous amounts of electricity required to produce aluminum. This aluminum would be turned into fuselages, wings etc. for the multitude of airplanes needed for the war effort. Irrigation would have to take a back seat until the war was concluded. During the war, six *Grand Coulee Dam* generators were brought on line as well as two smaller generators (taken from the yet to be completed *Shasta Dam*). After the war, an emphasis was put back on irrigation and construction was resumed on the pumping plant in 1946.**



**<u>Left</u>: aerial photograph of the partially completed dam taken on June 15th 1941. The normal *Columbia River* flow is allowed to pass through a series of 102-inch diameter outlet tubes which pass through the dam's spillway. There are sixty tubes in all. They are laid-out in three rows with each row containing two sets of five pairs each. The outlets of the lowest row of tubes are below the water level on the downstream side. The tubes are not symmetrically placed on the spillway (as seen on the east (left) side in the photograph). Other significant features include the large depression above and to the right of the dam. This became *Crescent Bay* as the lake behind the dam filled. The steel highway bridge in the foreground serves as the primary means of travel between the east and west sides of the city of *Coulee Dam*.**



**<u>Right</u>: close up of the spillway taken from the east side of the river**



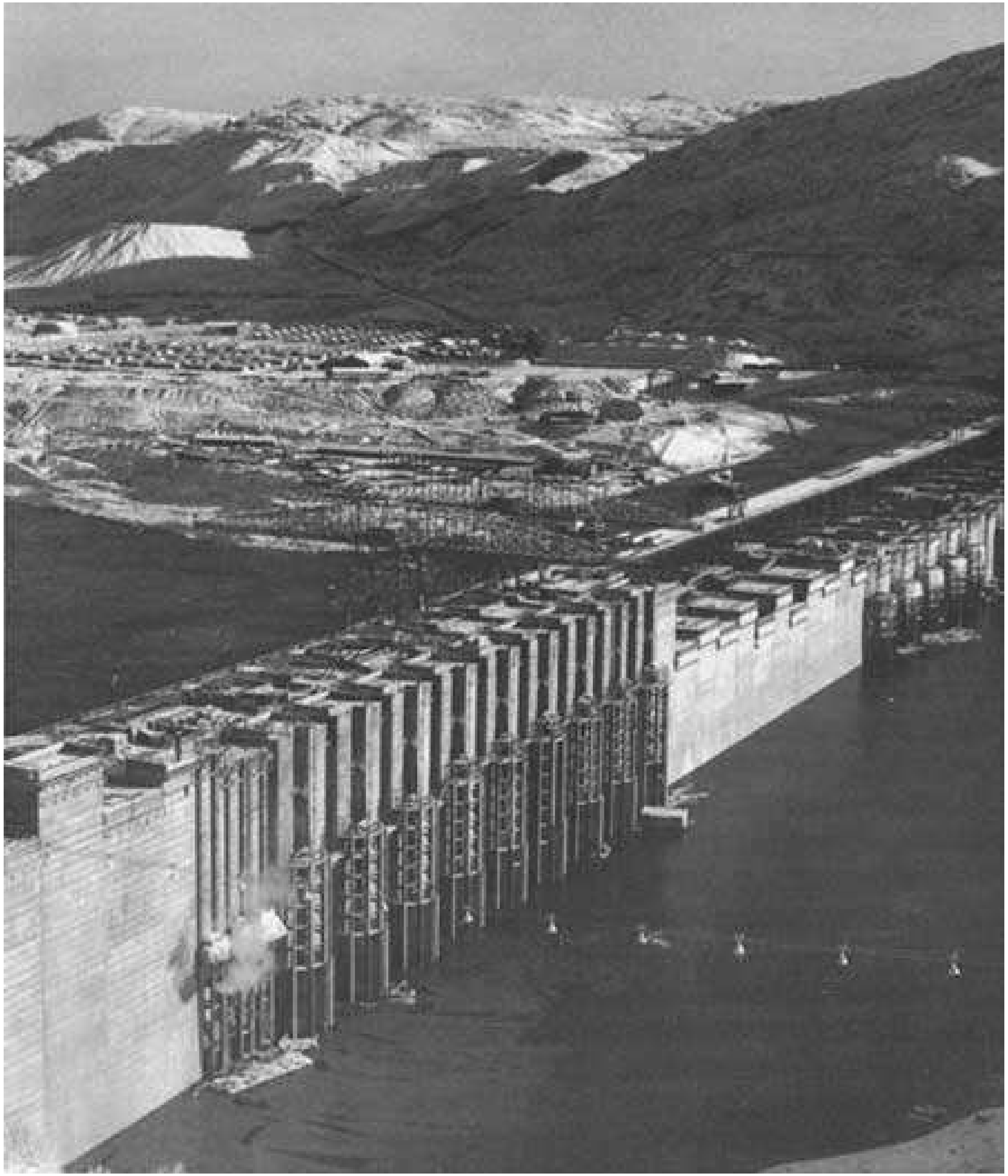
**<u>Above</u>: caption: "Hold That River! – Here It Stands, An Enduring Monument To "The Magic Spirit of Willing Men." Grand Coulee Dam as it looks from down-river, showing the turbulent Columbia, after it has been directed through the mighty generating turbines. Behind this huge slab of concrete is Columbia Lake, which extends for 150 miles back to the Canadian border, with a tremendous reserve of water to be released in an orderly manner so that its power can be utilized to the fullest extent both at Grand Coulee, and power plants at other dams below. The reservoir for Grand Coulee-Columbia Basin Irrigation project has been provided by nature in the coulee to the right of this scene (south). It will require but a 200-foot lift to raise the river water into its former channel in Grand Coulee, and from here the water will be distributed by gravity to 1,200,000 acres of land in the project."**

# The American Standard


***"We are going to see with our own eyes electricity made so cheap that it will become a standard article of use not only for manufacturing but for every home…I know that this country is going to be filled with the homes not only of a great many people from this state, but by a great many families from other states of the Union - men, women, and children who will be making an honest livelihood and doing their best to live up to the American standard of living and the American standard of citizenship."***



**POTUS *Franklin D. Roosevelt,* August 3rd 1934**



**<u>Left</u>: caption: "A little over a year after this picture was taken in 1940 the first small station-service generators began producing power at Grand Coulee."**

***Cost of Reclamation Project***

***"…After all, man will not do with concrete what nature did with glaciers. The height of Grand Coulee Dam, 550-feet, is the maximum height that could be had without backing the Columbia River over the Canadian line. To return the waters of the river to the Grand Coulee (canyon) it must be pumped 280-feet higher. The cost of installing the twelve giant pumps; the twelve 12-ft. diameter discharge pipes to carry the water through rock tunnels 280-feet to the outlet structure at the top of the hill north of Grand Coulee; the cost of the big canal 1.8 miles long from the outlet structure down to the Grand Coulee reservoir near the Steel Mill east of Electric City, (a canal big enough to carry the annual discharge of the Colorado River); the cost of the 90-ft. high, 1,000-ft. long rock and earth-dike at the curve of the road one-half mile west of the Tepee; the cost of a second dike near Coulee City and the cost of the tunnels, canals, and ditches necessary to convey water to all of the 1,200,000 acres of the Basin is estimated to total a sum of $200,000,000. The cost of the dam with maximum power development and the cost of the full development of the reclamation project, will approximate $400,000,000 – as much as Panama…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

## *When Will Reclamation Begin and When Will it be Completed?*

***"…The answer to this question depends upon securing funds for construction. Arm and reclamation engineer who have reported on the project, favor the irrigation of the first unit of 40,000 acres in the first year following the completion of the dam, and irrigation of the balance of the 1,200,000 acres in similar units each year, until the 1,200,000 acres are reclaimed. This 'settle as you go' program is logical and one which could be speeded as settling of the Basin lands will create a large and ever increasing market for Grand Coulee power. The plan of gradual reclamation over the next forty years will not add to existing farm surpluses such as wheat, tobacco and cotton. The Basin lands are not suited to the production of tobacco and cotton, and not economically suited to the production of wheat. The land for the most part will be devoted to the production of diversified and deficit crops and the raising of livestock, largely for home consumption and needed by the far western states themselves…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# ***Staggering Figures***

***"…Where is all this money to come from? Is so stupendous an expenditure justified? Yes, because the entire project will be self-liquidating in fifty years. At no time will more than $260,000,000 of the $400,000,000 be required to actually be expended. The Grand Coulee Dam will develop 2,520,000 horsepower - one-third greater than the combined development at Niagara Falls. Only 625,000 secondary, or flood-water horsepower will be needed to pump water into the Grand Coulee (canyon) reservoir to irrigate the Columbia Basin. There will be left for sale, for residential, commercial and industrial purposes, 1,200,000 prime or continuous horse-power; and for irrigation and seasonal commercial and industrial purposes about 700,000 secondary or flood-water horsepower…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…It is estimated that the sale at the dam of the prime horsepower at approximately 2 mills per kilowatt-hour, and a portion of the secondary power at one-half mill per kilowatt-hour, will pay for the dam and the power plant, with interest at 3½%, and one-half the cost of the reclamation project, in fifty years after the dam is built. The other half of the reclamation cost will be paid by those who colonize the Basin lands. When the lands in the Basin are opened to the settler, the cost of the land itself, will not exceed $10 or $15 per acre. An Anti-Speculation law, recently passed by Congress, guards against land manipulation. The cost for a water-right for this land is estimated at $85 to $90 per acre, this water-right cost to the farmer to be amortized over a period of forty years without interest. The annual maintenance charge for water per acre may be less than $3.00…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

## *Colossal But Self-Liquidating and Worthy*

***"…The Grand Coulee Dam and Columbia Basin Projects are colossal in size and cost, but it must be remembered that the resources unlocked by their construction are of proportions and value too vast to be realized. The dam controls and regulates the river for navigation, flood control, and greatly increased power downstream. It develops the largest bloc of low-cost power on the North American Continent. It makes possible the reclamation of the largest body of arid land in the United States. Unlike our great rivers and harbors projects, the Grand Coulee Dam and Columbia River Basin projects will be self-liquidating. Careful studies by engineers and economists show that the natural growth of the power market in the Pacific Northwest alone will absorb all of Grand Coulee power within fifteen years after it is available. The Grand Coulee Dam and Columbia Basin projects will in time increase the population of the Pacific Northwest by two million people. This added population in itself would consume Grand Coulee power…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***Everybody Benefited***

***"…Visitors to the Grand Coulee often wonder what good the construction of the Grand Coulee Dam will do for other sections of the United States. This is a sincere question and is entitled to an honest answer. The Grand Coulee Dam is merely being assembled at Grand Coulee. In the foundation contract $16,000,000 worth of material, equipment, and supplies were pur-chased for the dam in various states, outside of Washington. A large part of $16,000,000 more spent for labor found its way to eastern markets. The completion of the dam will involve the expenditure of many like millions in the Middle West and East…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

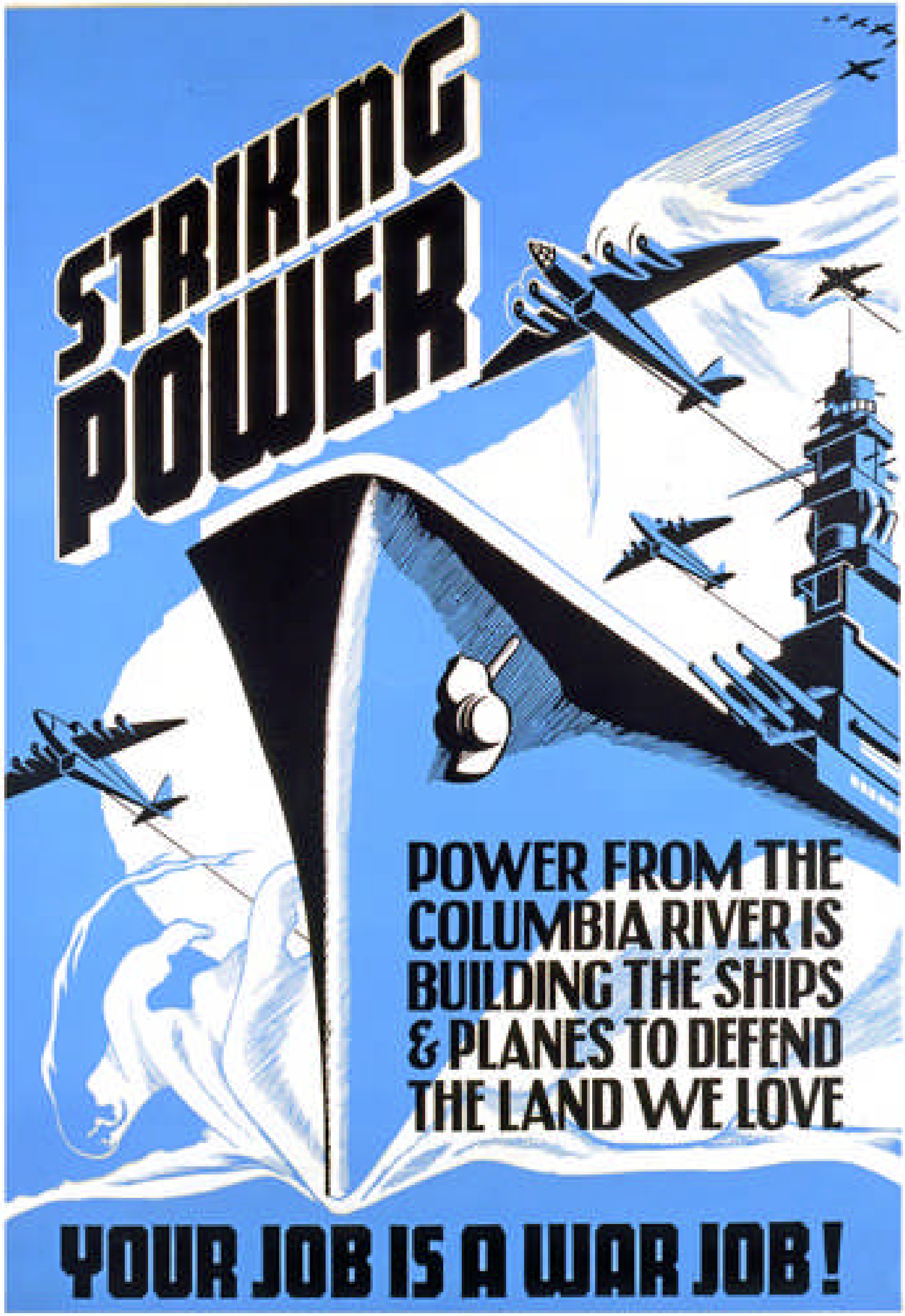
***"…When the Grand Coulee Dam and Columbia Basin projects are finished and the basin lands are peopled, statistics reveal that the new population resulting therefrom will require annually 260,000 carloads of agricultural and manufactured products from States other than the State of Washington, most of them east of the Mississippi River. this means increased employment and prosperity throughout the Nation. Further, the 1,200,000 acre Columbia Basin Project and the 8,500 square miles of land about and to the north of the Dam, are the last great undeveloped frontiers of the United States. With the reclaiming and development of these lands there will be built and developed many towns and cities, affording opportunities on a large scale for people of the East and Middle West. These projects will give your sons and daughters a new chance in life such as they may not have in their own state…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# ***National Defense***

***"…Grand Coulee Dam strategically located 200 miles inland – protected by mountain barriers – with mild climate, water and rail transportation, good highways, available foodstuffs, and all important, an ample low cost power at the site of the dam, is undoubtedly in the minds of military experts as a valued and highly suitable place for the manufacture of munitions, the establishment of munitions depots, the manufacture of land and naval airplanes, and other wartime equipment, and as an assembly point and training ground for troops in the event of a national emergency. Tranquilly located in a chasm of the Columbia 2,000-feet below friendly, flanking hilltops an ideal setting is afforded for anti-aircraft defense…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**


STRIKING POWER
POWER FROM THE COLUMBIA RIVER IS BUILDING THE SHIPS & PLANES TO DEFEND THE LAND WE LOVE
YOUR JOB IS A WAR JOB!

# *Slumbering Riches*

***"…The idea of the Grand Coulee Dam was born primarily of a purpose to reclaim the drought stricken Columbia Basin. The extended and colossal development of the undertaking is evolving uses transcending the dream of 'Billy' Clapp…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…A use little thought of and a highly potential market for industrial power, lies at the Dam's own doorstep. About and to the north of Grand Coulee to the British Columbia line, are 8,500 square miles of comparatively and un-reclaimed natural resources. Unlike the Basin lands, they have a diversification of value, possessing a triple wealth of mineral, timber, and agriculture. This part of North America – equal in size to the combined area of Connecticut, Rhode Island, and Delaware – lost in isolation between two transcontinental railroads, was little heard of until the dam was begun; it is little heard of now, but as the dam goes upward and the Columbia has begun backing itself to the Canadian line, it is startlingly apparent that when the dam is finished, a new empire will lie revealed. The new waterway, 150 miles to the border and 100 miles up tributary streams, will unlock this treasure chest and with slack water transportation and low cost power for development, its dormant wealth will find its way to the Dam, to be smelted, manufactured, milled, and marketed…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# *Agriculture and Stock Raising*

***"…In the years of struggle to secure the Dam and irrigate the lands of the Basin, the fact that 200,000 more acres could be irrigated in parts of Douglas and Okanogan Counties, nearer the Dam, was overlooked. In the opinion of local engineers, 50,000 acres can be irrigated by gravity flow when the dam is done – some within the Dam's own shadow. Scattered about in plains and valleys over a wide area, this land is of a quality equal to that of the Basin and its total acreage represents a project one-sixth as large…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…Then, there will be many fertile acres within the grand Coulee (canyon) above the water line of the reservoir, that will be choice lakeshore frontage, as well as tracts around the Dam and abutting the 500 new shore miles of the Columbia and its tributaries. The number of stock ranches and grain farms should rapidly increase with a new-found and low cost water transportation and market outlet, these livestock and grain products seek their way to the Dam to packing houses, mills, and elevators. In this hinterland there are now 50,000 people and 4,000 farms and stock ranches with an annual crop and stock production of $25,000,000. The population of Connecticut, Rhode Island, and Delaware, less in area, is $3,000,000, and their annual production would by comparison make $25,000,000 negligible…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# *Tall, Tall Timber*

***"…In Okanogan and Ferry Counties alone there are 8,745,000,000 feet of virgin timber, including good stands of pine on the upper San Poil. With low cost slack water transportation, much of this timber will be logged, boomed, and piloted to the Dam. It will be milled and manufactured into lumber and sash and doors for houses and barns and fences and boxes for fruits and vegetables that will be required by those on suburban tracts about the Dam, and in untold quantities by the settlers down in the Basin; also for the use and construction of industrial buildings and a city's growth and expansion. There should be furniture factories, pulp mills and other of the cellulose industries, including cellophane, cellulo-solk, etc…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# *Minerals*

***"…Within the Pacific Northwest are vast undeveloped resources including deposits of magnesium, limestone, magnesite, and aluminum. A mineral wealth of undetermined value, as great in area as any on the North American Continent, lies dormant between Grand Coulee Dam and the Canadian line. Isolated and apart through lack of low-cost transportation and power at a reasonable price for development, its unexplored value beckons…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…According to local engineers, there is aluminum in the Carleton-Methow, and sodium and soda lakes at Malotte in the Coleville reservation. There is marble, tungsten and silver graphite in the Riverside district; terra cotta, clay, silver, gold, lead, zinc, and magnesite at Oroville, anti-mony, platinum, and other minerals in the Loomis district; gold, silver, and lead at Tonasket; nickle, gold, silver, and copper along the San Poil, fire clay, silver, and aluminum at Bridgeport, placer gold in Meyers and Mary Ann Creeks, and in the Similkameen and Columbia Rivers. There are mountains of molybdenum at Disautel in quality and quantity to have attracted international attention. At Republic there are large deposits of low-grade gold, and a new mill has just been constructed at a cost of one-half million dollars. Up river from the Dam are huge deposits of lime rock for the manufacture of cement, and at grand Coulee and up river, heavy deposits of sand and gravel..."***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…This vast area, reserved in part for the first American, and little disturbed save for his moccasined tread, awaits a useful era of exploitation and development. The Grand Coulee Dam area is a logical place for the establishment of a smelter as well as electro-chemical, electro-metallurgical and fertilizer plants…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# *An Object Lesson*

***"…This northland is no dream child. One hundred and twenty-five miles north and east of Grand Coulee, entirely shorn and unpossessed of 'the biggest dam on earth' is the town of Trail, B.C., with a monthly industrial payroll of over $600,000, and increasing annually. The town of Trail with a population of 10,000, is the home of the world's largest non-ferrous metalurgical plant. It is also the home of a $12,000,000 chemical fertilizer plant, which in 1936, produced 95,000 tons of fertilizer. The value of metal production by the Consolidated Mining & Smelting Company of Canada, Ltd., in 1936 was $29,552,510. The town of Trail is a center of an area far less than the northland of Grand Coulee. It has no big dam. It has little irrigation and reclamation possibilities. It has minerals – so have we. It has timber – so have we. It has spirit and appreciation of its possibilities – so must we…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***What Happens When the Dam is Done?***

***"…Will we be as Rock Island, Fort Peck, Boulder? Let us see. Rock Island, built within twenty minutes ride of the beautiful Apple Cap-itol, Wenatchee, had no need for perpetuation as a town or city. Fort Peck, geographically iso-lated, and built for flood control largely for the benefit of people 1,500 miles downstream, would obviously be temporary as a town. Boulder thrivingly survives as a tourist att-raction. Grand Coulee, now a third class city of 6,000, one-hundred miles from Spokane and an equal distance from Wenatchee, is com-parable to none of them…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

*"…According to Bureau of Reclamation engineers, seventy men will operate the Dam when the job is done, and with their families live at Coulee Dam (Engineers' Town) on the west bank of the river below the Dam. The corps of engineers now engaged will move on to other assignments. The contractors' town of Mason City, largely of portable construction, is to be cleared away and its officials, key men and specialized force will move on to other projects. Up 'on the hill' part of the original town of Grand Coulee and to the north in the path of the big canal will be taken over by the government; temporary additions of government land will be vacated. In time the towns down the highway, except that part of Electric City that will be above the water line, will make way for the reservoir. The speedball highway, the railroad and the power line now in the bottom of the Coulee will probably move over to the east wall…"*

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…The greater part of the first town of Grand Coulee, The Center and The Heights now comprising the incorporated city of Grand Coulee, to be strategically located between the terminus of the 150 mile new waterway of the Columbia River, and the reservoir-lake of the Grand Coulee, will not be disturbed. The key men and constructionists living in the 'towns on the hill' will move to other projects and tradesmen and camp followers who came here for the construction period of the Dam will one by one vanish. Who will remain? The largest group will be in all likelihood will be the less skilled workmen and their families. A second group will be those citizens who have established themselves in permanent homes and business. Yet another group will be those who have saved, who like the country, and wish to remain at the site of the Dam. A final group will be men of vision who came to grand Coulee with some knowledge of the undeveloped resources of the country, and with sincere belief that at the Dam would one day be an industrial city…"***

**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

***"…Geographically located at the site of the world's greatest output of power, midway between the triple wealth of mineral, timber, and agriculture to the north, and the gigantic irrigation development to the south, the foundation for a manufacturing and industrial city and future distribution center has been laid at Grand Coulee. Grand Coulee, at the site of the world's greatest Dam, and to be midway between the newly formed lakes and water-ways, will be a tourist Mecca of a size and importance to challenge the imagination. Tourists will come for a day, a season, and a lifetime. Grand Coulee will be the rendezvous for the prospector, the rancher, and the timber cruiser. The wild game of the northland and the lure of the lakes affording hunting, fishing, yachting, boating, swimming, skating and skiing will make Grand Coulee an assembly point for the sportsman and the pleasure-seeker winter and summer. One quarter of a million came in 1938. More will have come in 1939."***

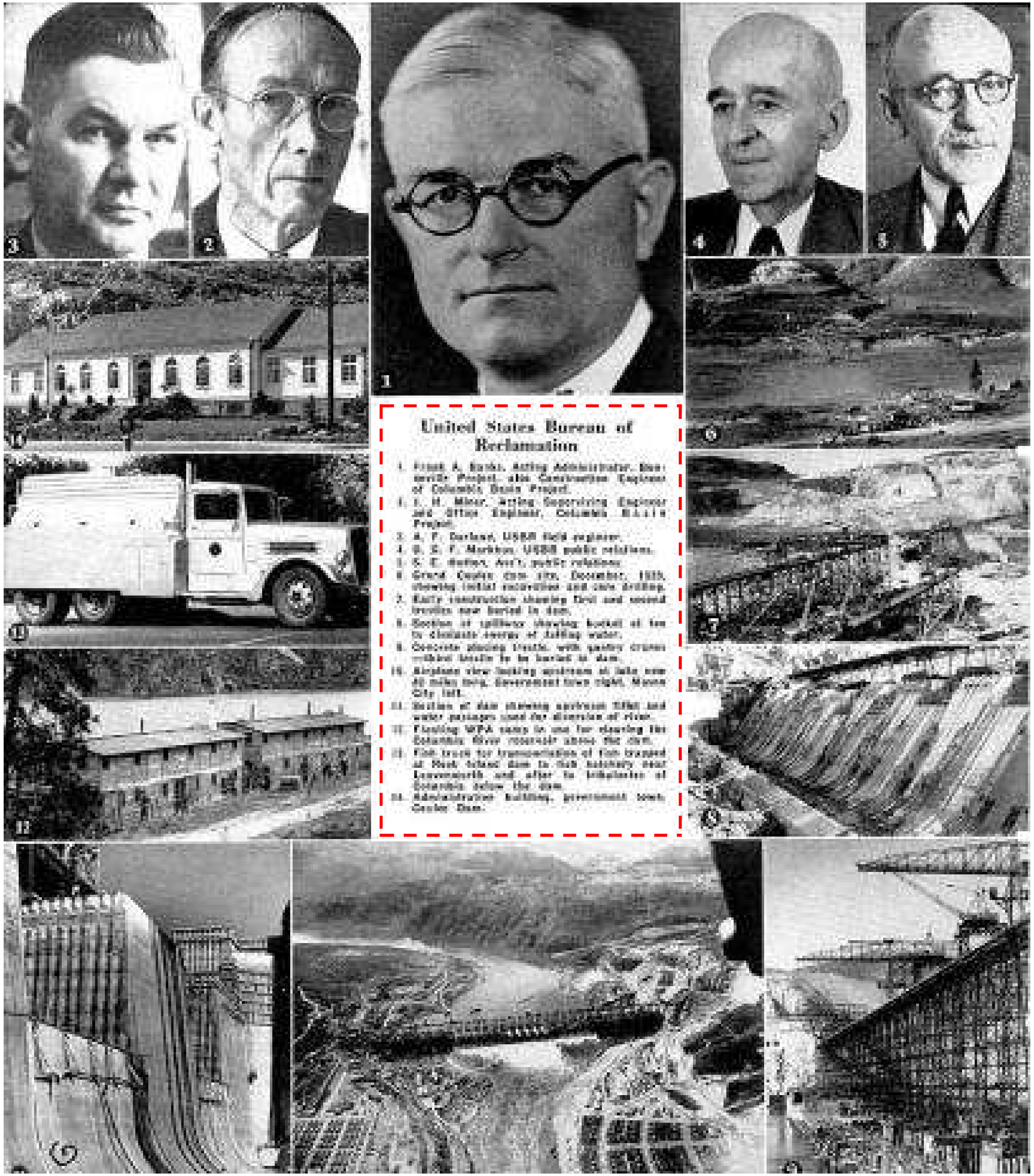
**RE: excerpt from *Grand Coulee Dam and a Last Frontier* (1939)**

# So Here it Stands

***"…So here it stands, a monument to the idea and the power of an idea; a monument to organization; a monument to cooperation; a monument to opposition; a monument to the United States Army Engineers; a monument to the United States Bureau of Reclamation; a monument to the magic spirit of willing men which accomplishes more than the might of money or the marvels of machinery; a monument to the brains, the intellect of great engineers - and you, class of 1942, could you come back here a thousand years hence, or could your spirit hover around this place ten thousand years hence, you would hear the sojourners talking as they behold this 'slab of concrete,' and you would hear them say, 'Here in 1942, indeed there once lived a great people.'"***

***Rufus Woods***

**RE: excerpt from a speech he made to the Grand Coulee High School's graduating class of 1942**




1. **Frank A. Banks, Acting Administrator, Bonneville project, also Construction Engineer of Columbia basin project.**
2. **J.H. Miner, Acting Supervising Engineer and Office Engineer, Columbia Basin Project.**
3. **A.F. Darland, USBR field engineer.**
4. **O.G.F. Markbus, USBR public relations.**
5. **S.E. Hutton, Ass't. public relations.**
6. **Grand Coulee dam site, December, 1933, showing initial excavation and core drilling.**
7. **Early construction showing first and second trestles now buried in dam.**
8. **Section of spillway showing bucket at toe to dissipate energy of falling water.**
9. **Concrete placing trestle, with gantry cranes – third trestle to be buried in dam.**
10. **Airplane view looking upstream at lake now 40 miles long. Government town right, Mason City left.**
11. **Section of dam showing upstream fillet and water passages used for diversion of river.**
12. **Floating WPA camp in use for clearing the Columbia River reservoir above the dam**
13. **Fish truck for transportation of fish trapped at Rock Island dam to fish hatchery.**
14. **Administration building.**

# Part 13

# CBRP: An Overview

# Purpose

***“A dream of 50 years, the irrigating of a vast tract of rich desert and dry-farming load in central Washington, is about to be realized through the construction of the Grand Coulee Dam, and a system at canals that, in time, will cover an area 60 miles wide, east and west, and 85 miles long, north and south, and bring to it the life-giving waters of the Columbia River. When fully developed, the Columbia Basin Reclamation Project will reclaim aver 1,200,000 acres of land, regulate the flow of the Columbia River far the benefit of downstream power plants and navigation, and develop electric energy to be used in pumping for irrigation and far other purposes, on the project and elsewhere…”***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Scope

***"…The enterprise involves building, in an isolated, sparsely populated district, a dam of unprecedented size, a power plant which will be, when completed, the biggest thing of its kind in the world, and a pumping plant big enough to pump dry, at least in their low-water seasons, any but a few of the largest rivers in the country. In the Grand Coulee, abandoned channel of the Columbia River, farmed during the last Ice Age, a balancing reservoir 27 miles long will be formed; and on the project lands, hundreds of miles of main and lateral canals and numerous auxiliary power and pumping plants must be built as the project develops…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Ownership of Land

***"…Much of the land on the project was homesteaded 30 to 40 years ago, and for a few years a number of small irrigation ventures and many dry farms were reasonably successful. Prolonged periods of drought and the overtaxing of stream flows and ground waters forced the abandonment of large areas of land and numerous small towns many years ago, but large areas are still devoted to the growing of grain on large tracts. In years of exceptionally heavy rainfall, they yield large crops. Practically all of the irrigable land is owned privately by individuals, counties, and railroads and other corporations, largely by farmer holders of mortgages on the land. Before water for irrigation of the land will be procurable from the Government, the land must be made available to settlers at reasonable prices…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Land on the Reservoir Site

***"…The high-water line in the reservoir will be 1,292-feet above sea level. All lands in the river basin upstream from the dam and below elevation 1,310 have been reserved for reservoir purposes. The greater part of such lands are privately owned. They have been surveyed and appraised and will be acquired by the Government. Chiefly cut-over timber lands, grazing lands, and pasture lands are affected. Two small towns and a little cultivated load are included within the reservoir area. Several miles of highway and railroad will be relocated, and several new bridges will be built to accommodate them. Kettle Falls and the nearby points at which fur-trading posts were established more than 100 years ago will be inundated…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Storage Reservoir

***"…A storage reservoir 151 miles long, averaging 4,000-feet in width and with a maximum depth of about 375-feet, will be formed behind the dam. It will extend up the Columbia River to the Canadian border, the elevation of which determined the height of the dam, and up the Spokane River 32 miles. The reservoir will have an area of 82,000 acres (128 square miles), and a total capacity of about 10 million acre-feet of water - equivalent to 25,000 gallons for every inhabitant of the United States, nearly a 10-year supply for all purposes for the city of New York. The estimated annual evaporation from the reservoir will be 200,000 acre-feet. The overage annual rate of flow of the Columbia River would fill the reservoir in about 2 months, and the average flow in June or July would fill it in less than 1 month. The upper 80-feet of the reservoir capacity, something over 5 million acre-feet, will be utilized when necessary for power production and for the regulation of the river flow for the benefit of future down-stream power plants, and for the improvement of navigation. Since the high-water and irrigating seasons coincide, stored water will not be required for irrigation, nor for power in pumping irrigation water…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Climate

***"…The mean annual temperature on the project lands is 50.4° F., and during the irrigation season from April to October, it is 62.2° F. The summers are characterized by hot days and cold nights. The average frost-free period is 169 days, considerably greater than that in many notably successful irrigated districts. The mean annual precipitation is 8.2 inches, but the mean for the growing season is only 3.6 inches…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Soil

***"…The soil, deposited chiefly from turbid glacial waters that covered the land during the last Ice Age, is generally deep, and it varies from fine, silty loam to sandy loam. There are small areas of sandy soil underlain with gravel. In 1911 the Bureau of Soils of the Department of Agriculture after a partial survey reported the soil to be extremely rich, stating that, if irrigated, it would be productive. Subsequent more extensive soil surveys confirm such findings…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Crops

***"…The crops may be any or all of those common to a temperate zone, such as hay, grain, beans, peas, other vegetables, and fruits. Since the land is to be held in relatively small tracts, intensive methods of farming will be followed, and no material additions will be made to 'surplus' crops. Much of the land will be devoted to the raising of livestock and forage crops…"***

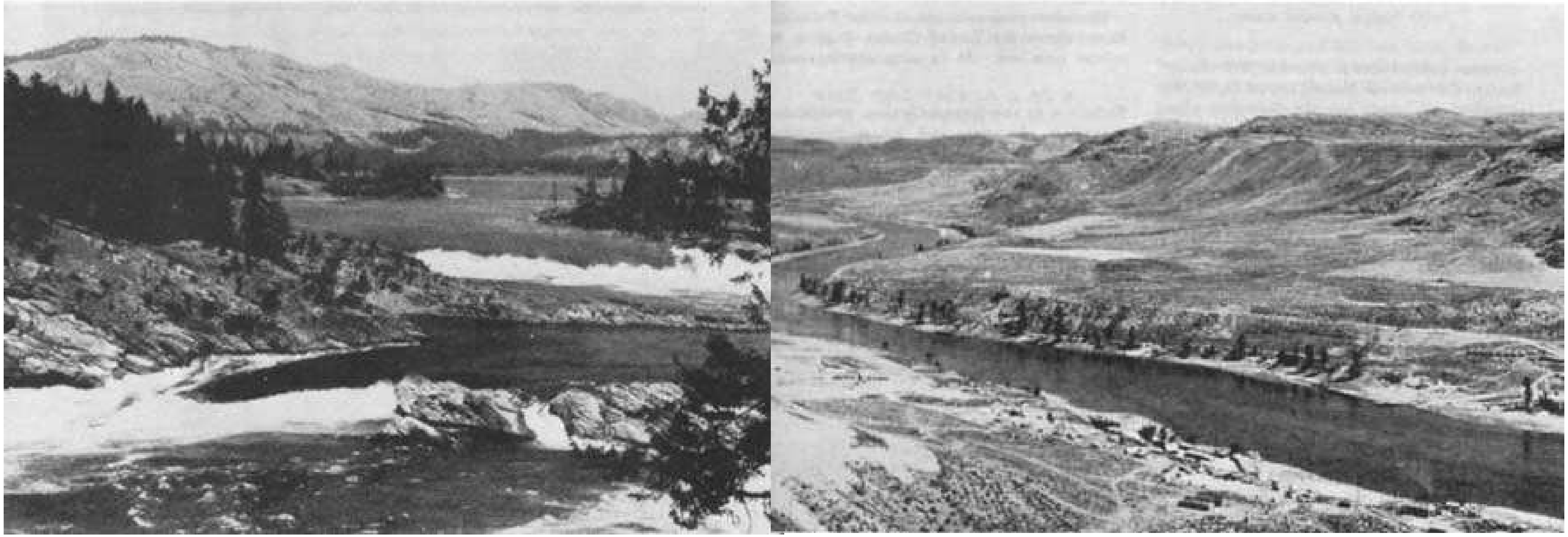
***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Columbia River Watershed

***"…The drainage basin of the Columbia River covers on area of 259,000 square miles. It includes almost all of Idaho, the greater parts of Washington and Oregon, and parts of British Columbia, Montana, Wyoming, Utah, and Nevada, an area equal to practically four times that of the New England States. The Columbia Basin Project is concerned with the 74,100-square mile area above the Grand Coulee, drained by the Columbia and its upper tributaries. Of this area, 39,000 square miles are in Canada…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# The Columbia River



***"…The Columbia River, second in flow only to the Mississippi and greatest in potential power among the rivers of North America, rises in Columbia Lake at an elevation of 2,650-feet in the southeastern part of British Columbia, flows northwesterly 195 miles, between the high timber-covered Rocky and Selkirk Mountains, thence southward 270 miles, entering the State of Washington 151 miles, by river, above the mouth of the Grand Coulee and the site of the dam. It contributes about 37 percent of the flow at the dam…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Kettle Falls, 112 miles above the dam, marks a spot of scenic and historic interest in the reservoir area which is generally surrounded by low timber-covered mountains. The 30-foot falls will be submerged."**

**Right: caption: "Below the dam site, the river is bounded by rugged, arid hills extending back on the right bank to the Okanogan and Cascade Mountains, and on the left to the Columbia Lava Plateau"**

# The Kootenai River

***"…Among its principal tributaries above the dam are the Kootenai, Clark Fork, and Spokane Rivers. The Kootenai has its source about 76 miles north of that of the Columbia, but flows in an opposite direction 180 miles into Montana, thence into Idaho; and, after making a 167-mile loop in the United States, returns into British Columbia through Kootenai Lake, and joins the Columbia 30 miles north of the international border. The Kootenai River drains an area of 19,450 square miles, 14,550 square miles of which are in Canada. Its average annual flow is about 34,000 second-feet, and its average run-off 25,300,000 acre-feet, about 31 percent of the run-off above the dam…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# The Clark Fork River

***"…Clark Fork of the Columbia River rises on the west side of the Rocky Mountains near Butte, Mont., and not far from the headwaters of the Missouri River, and the Snake River, largest tributary of the Columbia. Its course is generally to the northwest through Montana about 360 miles into Pend Oreille Lake in the panhandle section of Idaho. Thence its course is northerly nearly 100 miles, through Idaho and northeastern Washington into Canada, where it empties into the Columbia about one-half mile above the international boundary. The Clark Fork basin covers 25,820 square miles, only about 1,200 of which are in Canada. Its average annual flow is about 25,000 second-feet, and its average annual run-off 19,300,000 acre-feet. It brings into the Columbia about 23 percent of the water passing the dam…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# The Spokane River

***"…The Spokane River is, relatively, a minor tributary, its drainage area being only about 6,600 square miles, and its average annual flow only about 8,000 second-feet. Its source is Coeur d'Alene Lake in Idaho, which receives its water supply chiefly from the Coeur d'Alene and St. Joe Rivers, rising on the western slopes of the Bitter Root Mountains. The lake is a valuable regulator of the flow of the Spokane River. The average annual run-off of the Spokane River drainage basin is about 5,800,000 acre-feet…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# The Grand Coulee

***"...The Grand Coulee is a prehistoric river bed, 52 miles long, 1-1/2 to 5 miles wide, and at places nearly 1,000 feet deep. It is one of a number of southwest-trending channels which were cut in the lava plateau of central Washington by the displacement of the normal Columbia River drainage during the period of the last great Ice Age. Thousands of years ago, during the Ice Age, a thick sheet of ice moved southward into northern Washington. A portion of this ice sheet crossed and completely filled the gorge of the Columbia River at some point west of the site of Grand Coulee Dam. As a result of this ice obstruction, the upstream part of the gorge was converted into a great lake whose rising, turbid waters laid down hundreds of feet of sediment in the river canyon and ultimately spilled over through several low points in the south wall of the gorge, and flowed southwestward across the Columbia plateau. This temporary overflow swept away accumulations of surface soil, cut a complex series of channels into the lava sheets, and deposited millions of acre-feet of fine material in the lake created south and east of the Big Bend of the Columbia. In this manner were formed the scablands which are a prominent and interesting feature of geology of eastern Washington. The Grand Coulee, largest of these channels, is one of the scenic wonders of the Western United States…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**


**<u>Above</u>: caption: "Vista House at Dry Falls on Grand Coulee Dam Highway, Washington" (ca. 1934)**

***"…A short distance north of Coulee City the generally horizontal lava flows of the plateau dip sharply to the south-east, forming an immense wrinkle in the plateau surface before they again flatten out at a lower elevation. It is believed that the waters of the glacial Columbia River, flowing down this steep surface, initiated a waterfall which gradually cut its way northward and formed the rock trench known as the Upper Grand Coulee. Steamboat Bock is a remnant of the plateau surface, 2 miles long and 1/2 mile wide, left as an island as the falls retreated northward. Eventually these ancient falls died out as they ate away the last of the rock barrier which separated them from the valley of the Columbia River. As a result the upper coulee intersects the south wall of the valley of the Columbia River about 1 mile south (upstream) from the site of Grand Coulee Dam. At this point the floor of the coulee hangs about 500-feet above the level of the present river…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…The lower Grand Coulee was formed in a similar manner by retreating waterfalls which originated in the vicinity of Soap Lake. When the ice obstruction which had dammed and diverted the waters of the Columbia River finally melted away, the river resumed its old course and left at the head of the lower Grand Coulee a relic of its former might - the Dry Falls of the glacial Columbia River. They are located in the Dry Falls State Park a few miles south of Coulee City, on the road to Soap Lake. Here, from the roadside or from a vista house in the park, one can look at the site of the ancient waterfalls, more than 400-feet high and 3 miles wide, whose northward retreat cut the channel of the lower Grand Coulee. They are two and a half times as high and five times as wide as Niagara Falls, and according to some authorities the torrent of silt-laden water which poured over them is estimated to have had a volume as much as 100 times that at the present Niagara Falls…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…Two of the five largest recesses in the 3-mile northern brink of the extinct cataract are within view from the vista house. In the plunge-pools at the foot of the first are Fall Lake and Perch Lake. In the second alcove is an alkaline lake, or an alkaline flat in dry weather. Opposite the point separating the first and second horseshoe falls is Umatilla or Battleship Rock, and beyond that the left wall of on extensive section of the Coulee extending eastward, and providing a bed for Deep Lake, a mile and a half long. Near the east end of Deep Lake are two alcoves on the north and one on the east…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**The Upper and Lower Grand Coulee/s are separated by an ancient waterfall known as *Dry Falls* that had a drop of more than 400-feet over a crest three to four miles long. When the ice receded, the river returned to its original channel, leaving the Grand Coulee high and dry. Other landforms created by the Ice-Age Floods along their path from western Montana to the Pacific include glacial erratics, ripple marks, potholes and gravel bars.**

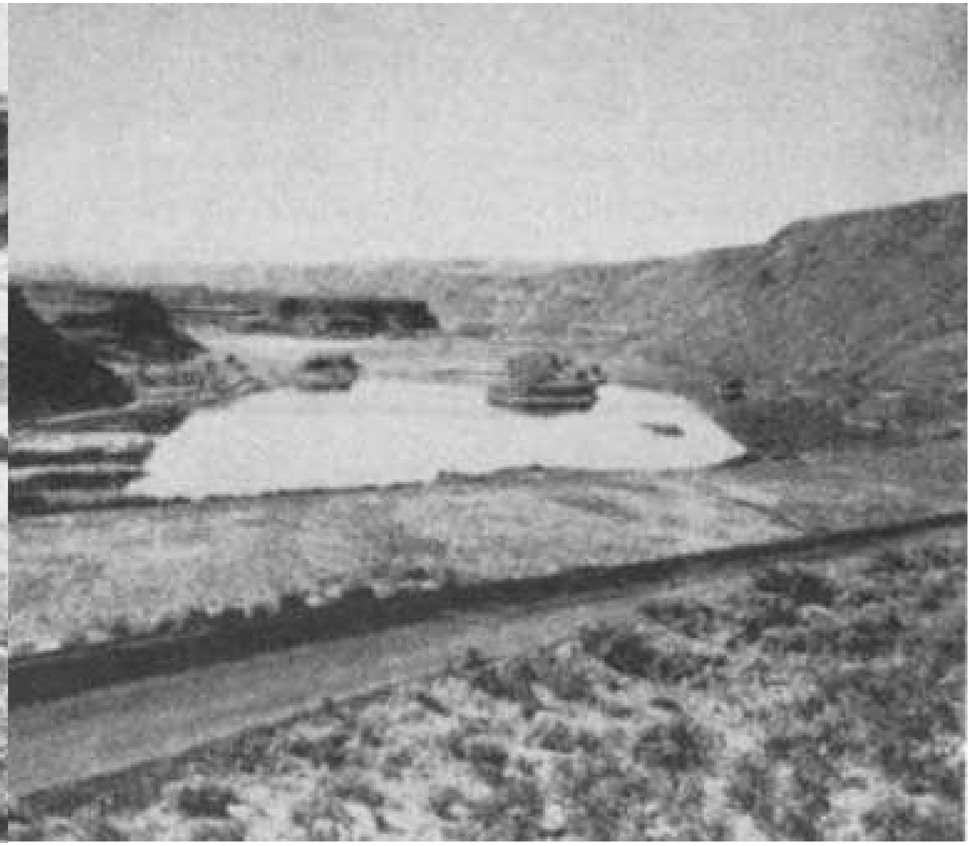


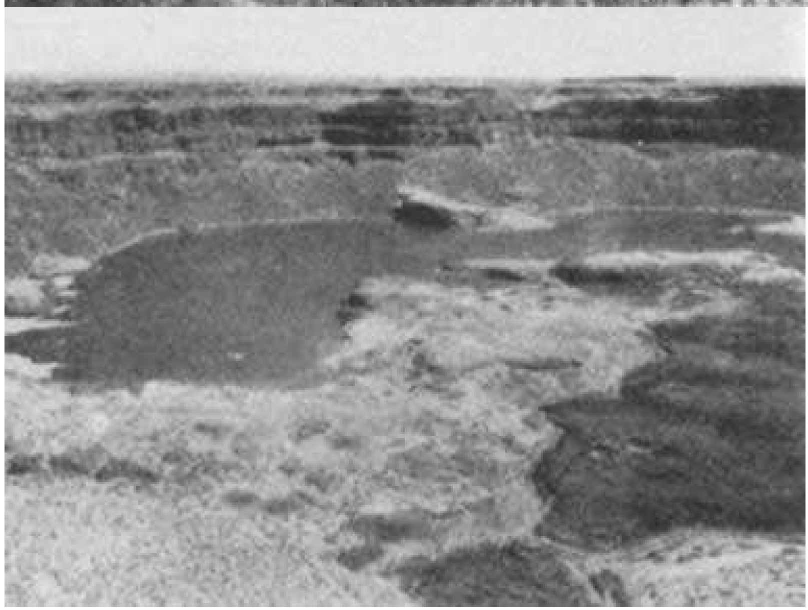
**<u>Above</u>: caption: "Vista House overlooking Dry Falls"**

# Lower Grand Coulee

*"…Along the State highway below the Dry Falls are Park Lake, Blue Lake, and Lake Lenore, each overflowing into the next in high-water periods, and all finally into Soap Lake which, having no outlet, is highly alkaline. In the Coulee walls there are visible at least seven lava flows. The time intervals between some of the flows were so long that surfaces disintegrated into soil, and vegetation flourished. On the shores of Blue Lake below the sixth flow, are casts of huge trees buried by the lava as it flowed over the land. In the soils between lava strata, explorers have found fossil remains of the ginkgo tree, which now grows only in the Orient, of the Sequoia, now growing only in California, of oak, elm, yew, cypress, gum, and of other varieties of trees now growing elsewhere, proving that long periods elapsed between successive flows, and that sometimes semitropical climates existed here millions of years ago…"*

***U.S. Bureau of Reclamation* (ca. 1937)**





**Top Left: caption: “Forty cubic miles of hard basalt cut out of the Columbia Lava Plateau left the Grand Coulee”**

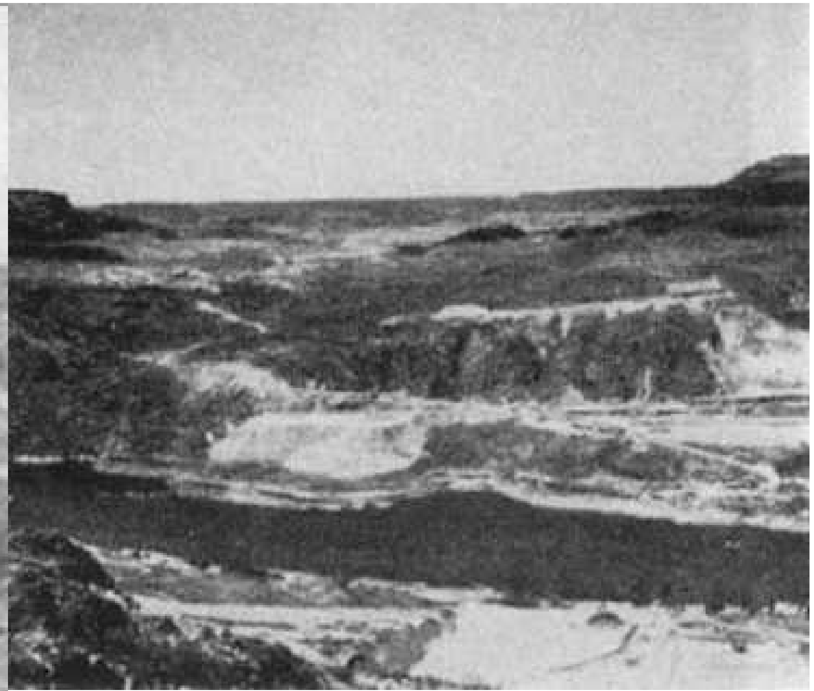
**Top Right: caption: “An excellent public highway skirts the chain of four beautiful lakes that occupy the greater part of the lower Grand Coulee”**

**Left: caption: “Dry Falls, head of the lower Grand Coulee, was the site of a cataract two and a half times as high and five times as wide as Niagara Falls”**

# Upper Grand Coulee

***"…At the dam site the Columbia flows in a channel 700 to 850-feet wide, in a canyon 2,000-feet wide at the bottom and a mile wide at the top. The average elevation of bedrock is about 875, of the river bed about 910, and of the low stage water level about 933. The average high-water mark over a period of years was 978, but in the flood of 1894 it is believed to have reached elevation 1,003. The drainage basin above this point covers 74,100 square miles, 39,000 of which lie in British Columbia. Particularly in Canada the headwaters of the Columbia rise in high mountain snows, glaciers, and lakes, which have the effect of regulating the river flow and bringing high-water periods in the months of June and July which will be highly advantageous to both irrigation and power development an the Columbia Basin Project…"***

***U.S. Bureau of Reclamation* (ca. 1937)**



**<u>Above</u>: caption: “Entrance to the Grand Coulee, prehistoric diversion channel, cut by a torrential glacial Columbia in the last Ice Age”**
**<u>Left</u>: caption: “Blockaded by ice, this canyon was for thousands of years filled to overflowing with turbid glacial water”**

***"…The mean flow of the river at the dam site during the past 23 years was 110,000 second-feet. A minimum of 17,000 second-feet and a maximum of 492,000 second-feet have been recorded, and it is estimated that in the flood of 1894 a flow of 725,000 second-feet was reached. By means of the Grand Coulee Dam it will be possible to regulate the flow to a minimum of 35,000 second-feet. The average annual run-off of the Columbia Basin above the Grand Coulee Dam is 80 million acre-feet. At an estimated maximum annual requirement of 5-feet of water for each acre of land to be irrigated, only 6 million acre-feet will be diverted from the river. The run-off at the Grand Coulee Dam is five times as great as that of the Colorado River at Boulder Dam…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Development of the Upper Columbia Basin

***"…A comprehensive plan for the development of the Columbia River, worked out by the Army engineers, contemplated the construction of 10 dams to utilize 92 percent of the available fall in the river between the international boundary and the Pacific Ocean. By far the largest and most important of these is the Grand Coulee Dam - largest because it uses 355-feet or 27 percent of the total available fall and includes an electric generating installation of 1,890,000-kilowatt capacity, which is larger than any existing development in the world today; and most important because it creates a storage reservoir of over 5 million acre-feet of usable capacity at the highest possible location on the river in this country, and affords the most feasible and practicable means of diverting the waters of the Columbia River out of its canyon and onto any considerable area of arid land…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…The Grand Coulee Dam is often referred to as the 'key' structure in the plan for the development of the Columbia River. The release of stored water from the reservoir behind the dam during periods of low flow not only will increase the minimum navigable channel depths by 2-feet below the Bonneville Dam and by 4-1/2-feet below the Grand Coulee Dam, with corresponding increases at intermediate points; but it will also double the amount of firm power that can be developed at the six power sites on the Columbia River between Grand Coulee Dam and the point where the Snake River joins the Columbia, and increase by 50 percent the firm power that can be generated at the various sites below this point, including Bonneville…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**<u>Left</u>: caption: "Two miles long and 900-feet high, Steamboat Rock is a spectacular landmark in the upper Grand Coulee"**

# Auxiliary Power

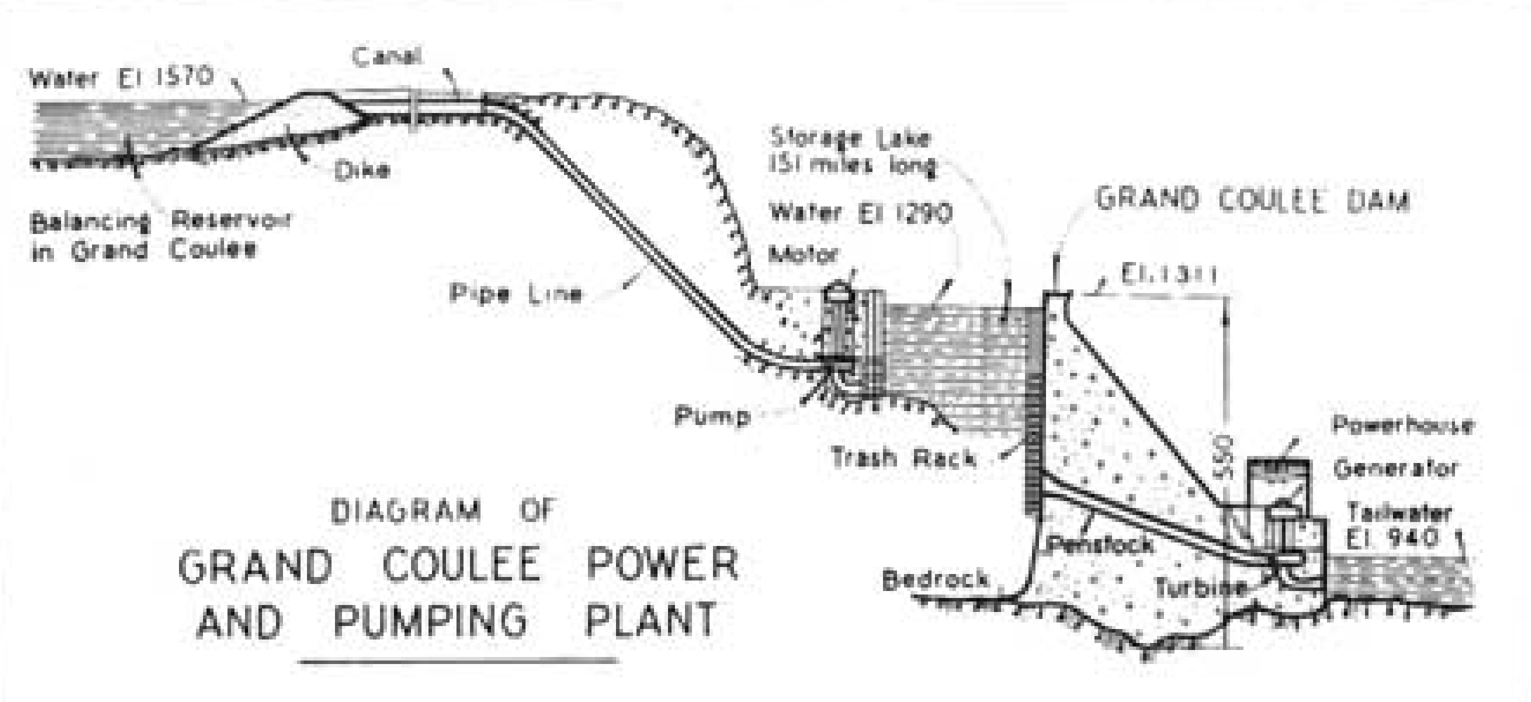
***"…As the system of main canals is extended, it will be necessary to provide at a number of points 'drops' in the canals because otherwise the gradient would produce undesirable and destructively swift currents in the canals. At a number of such points relatively small power plants will be built to utilize the energy of the falling water and generate electric power to be used in pumping water to lands above the main canals…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Pumping Plant

***"…The balancing reservoir in the Grand Coulee, to which all irrigation water for the Columbia Basin Project is to be pumped, will be nearly 660-feet above the low-water level of the river. The dam will raise the water to about 355-feet and pumps will lift that required for irrigation the rest of the way. The pumping plant will be located on the west side of the river, behind the dam, within the reservoir basin. There will be installed ultimately 12 pumps, each with a capacity of 1,600 cubic feet per second. Two of the pumps are regarded as 'spares,' the normal capacity of the pumping plant being 16,000 second-feet. Each pump would be able to take care of the domestic water requirements of nearly 7 million people. One pump will elevate sufficient water to irrigate 120,000 acres of land. Directly connected to each pump will be a 66,000-horsepower synchronous motor, two motors being supplied with power directly from one generator in the power plant. Generator and motor speeds will be adjustable to the most efficient pump speeds at various heads. Ordinarily, pumping will be against a 280-foot head; that is, from a full storage reservoir behind the dam to a full balancing reservoir in the Grand Coulee. Pumps will discharge through conduits 13-feet in diameter and about 800-feet long into a canal leading to the balancing reservoir in the Grand Coulee about 1.7 miles away…"***

***U.S. Bureau of Reclamation* (ca. 1937)**




***"…Pumping will be done on the Columbia Basin Project as a matter of efficiency and necessity, hence some power must be developed. High-water periods fortunately occur at such times that secondary or seasonal power will take care of pumping needs, and all primary and much secondary power will be available for use on and outside of the project lands as demands for power develop…"***

***U.S. Bureau of Reclamation* (ca. 1937)**



**Above: caption: "Diagram of Grand Coulee Power and Pumping Plant"**

# Auxiliary Pumping Plants

***"…Of the 1,200,000 acres of land in the project, 980,000 acres will be watered by gravity from the system of canals extending southward from the balancing reservoir. A total of about 220,000 acres of irrigable land is about 70-feet above the gravity canal system. Auxiliary pumping plants will be constructed to serve such plants as the project develops, power for them being derived from auxiliary power plants at canal 'drops' on the project lands…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Balancing Reservoir

***"…By means of two earth dams about 100-feet high, one 2 miles from the Grand Coulee Dam and the other near Coulee City, a balancing reservoir 27 miles long and covering an area of about 27,000 acres, or 43 square miles, will be formed in the upper Grand Coulee, its high-water level being 280-feet above that of the storage reservoir behind the Grand Coulee Dam. The maximum capacity of the balancing reservoir will be approximately 1,150,000 acre-feet, of which about one-half million acre-feet will be useful in regulating pumping and water consumption. Only a part of the irregular coulee floor will be flooded, but practically all of the railroad and much of the highway in the coulee will be inundated…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Canals and Distributing System

***"…Through a canal of 15,000 second-feet capacity, water will be carried about 10 miles southwesterly from the balancing reservoir to the heads of the 150-mile east-side canal and the 100-mile west-side canal, from which it will be distributed to farms through numerous laterals. Several large tunnels, siphons, wasteways, headgate structures, and bridges, and a drainage system for collecting and using seepage water will be required…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Cost of Water Rights

***"…The exact costs of water rights and of annual maintenance and operating charges cannot be determined until the project is much further advanced. They have been estimated as follows: The portion of the project costs chargeable to the reclamation of land is estimated at this time to be from $85 to $100 per acre, to be distributed over 40 years without interest. For operation and maintenance, including the cost of power for pumping, the annual charge is estimated at $2.60 per acre. On this basis the total indicated payments by the settler would be $2.60 per acre per year for operation and maintenance and nothing on account of construction for the first 4 years, and would be thereafter about $4.60 per acre per year for 4 years for operation and maintenance, and construction, and about $5.10 per acre per year for the next 32 years for operation and maintenance, and construction…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Years Required for Completion

***"…The irrigation of land in the Columbia Basin Project cannot begin until the Grand Coulee Dam, together with portions of the power plant and pumping station, is completed, and the Grand Coulee Reservoir and a system of canals to the northern boundary of the project lands are constructed. When that will be accomplished will depend upon the rate at which funds may be made available by the Congress. From 26 to 50 years may be required for the completion and settlement of the whole project. The period will be determined by the rate at which extensions of the canal system will make water available. If the land should be brought under cultivation at the rate of only 25,000 acres each year, 48 years will be required to reclaim the entire area to be irrigated…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Effects of Irrigation

***"…In the 11 arid and semiarid Western States are 39.5 percent of the area of the United States, a little more than 9 percent of the population, and less than 4.5 percent of the farmed and cropped area. So much of the land is in mountains, forests, and desert that these States can never be agriculturally self-sufficient. Great quantities of the staples of the Middle West and Southern States are shipped in, and chiefly protective foods, fruit, eggs, dairy products, and out-of-season vegetables are shipped out. The irrigated lands at the West supplement the ranges in producing feeder stock for Middle West farmers, and wool to compete with foreign producers in the American market, and they supplement rather than compete with Middle West and Eastern farms in producing a balanced national diet. Statistics show greater stability and greater purchasing power in irrigated districts than in farming and industrial districts throu-ghout the country. There is an insistent demand for irrigated land to replace the worn-out, eroded, and sub-marginal lands that are better suited to forestry and grazing than to cultivation…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…The Columbia Basin Project will bring about within a period of 25 to 50 years the establishment of 25,000 to 40,000 new farm homes, with a farm population of 100,000 to 200,000 people. In the gradual building, equipping, and improving of those homes there will be a steady demand for the products of eastern industry. Along with the farms, towns and cities will grow up on the project lands with a population as great as that of the farms, and material growth may be expected in the cities and towns in the surrounding area. It has been the experience of the past that for every family an on irrigated farm there is also one in the towns that are developed on the project to serve the farming districts, and still another in the more distant cities and towns engaged in the manufacturing and transportation of the things that the project people must buy…"***

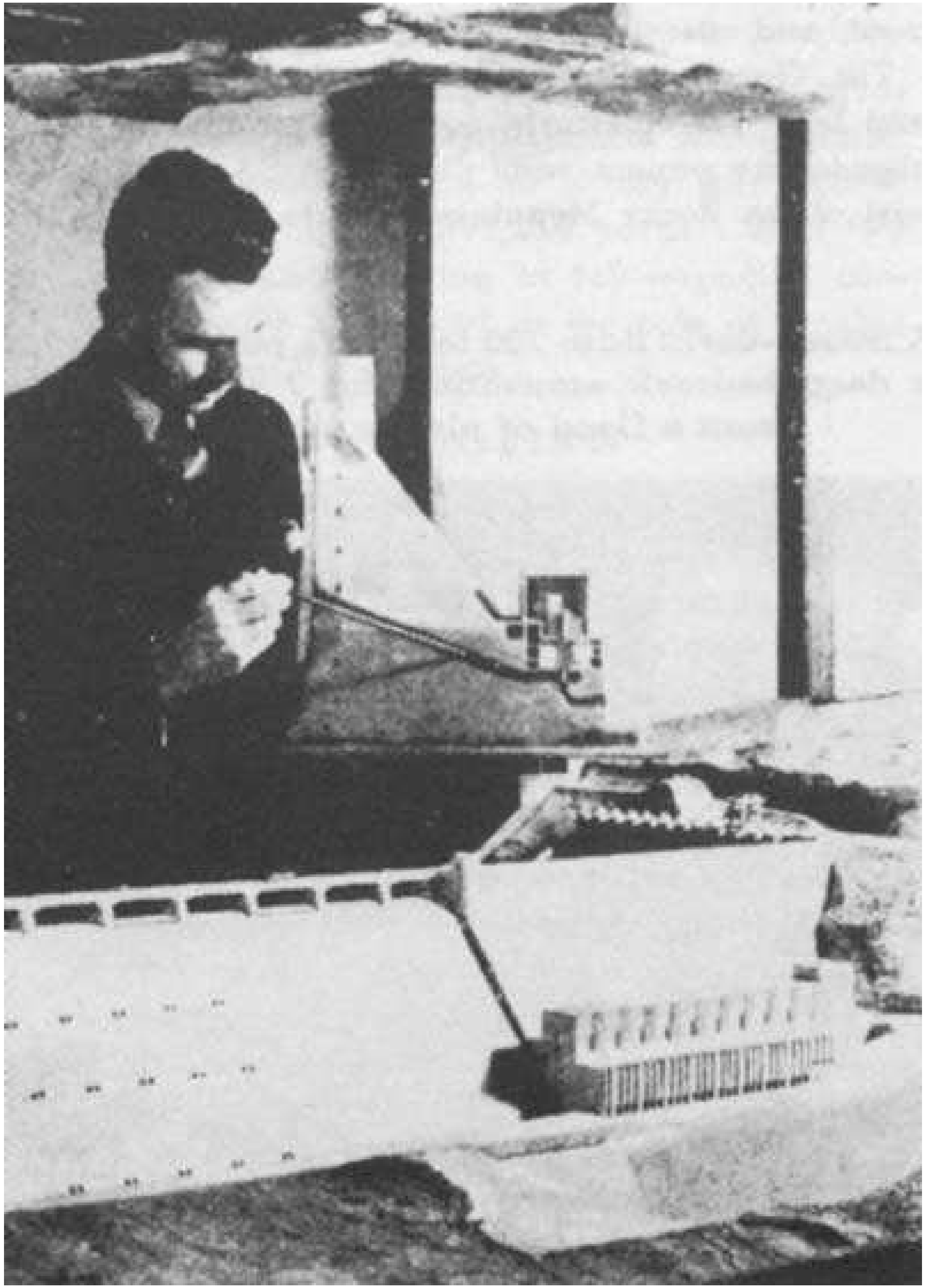
***U.S. Bureau of Reclamation* (ca. 1937)**

# Expenditures

***"…Over 6,000 men have been employed on the project at one time, at an average wage rate of 83 to 90 cents per hour. Employment is limited to a maximum of 8 hours per day and 40 hours per week. In the first 37 months of construction operations, the contractor paid out $18,615,617.48 in wages. In the first 15 months after beginning operations, the firm spent for equipment and supplies $11,413,628.63, of which 56½ percent went directly to points east of the Rocky Mountains. Of the remainder, large parts passed through the hands of western jobbers to eastern manufacturers, and thence to their employees, and through western corporations to eastern stockholders and manufacturers. Much of the wages of all western workers goes east for the purchase of staple foods, clothing, automobiles, household equipment, and miscellaneous requirements. The Government expenditures during 1935 and 1936, for materials, equipment, and supplies for the project, went directly to 23 States east of the Rocky Mountains and to 5 States west of the Continental Divide. In 1937 Government purchases for the dam were made in 34 States. Indirectly, the funds expended probably reached every State in the Union…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Generating Capacity

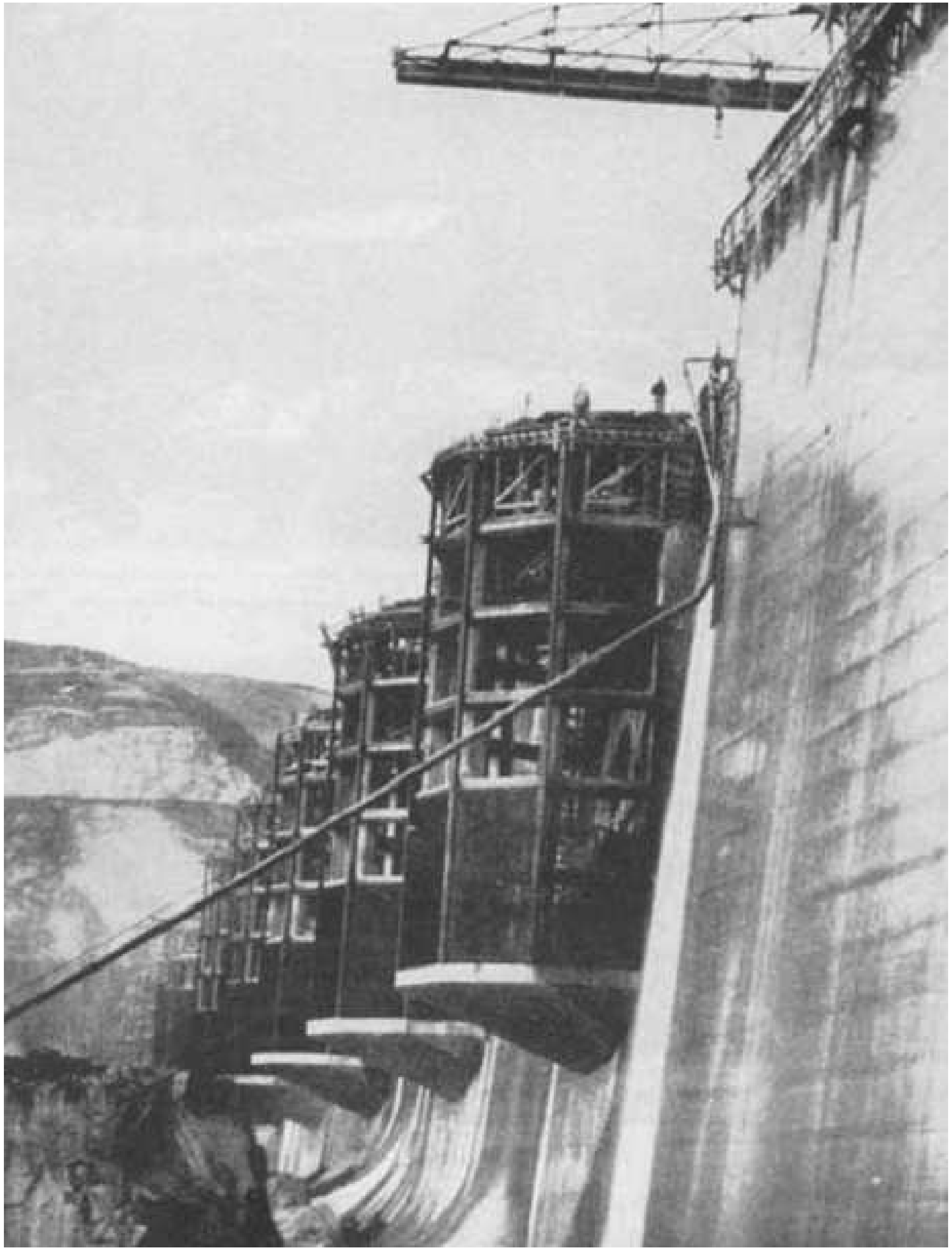


*"…When fully equipped the power plant at Grand Coulee will be by far the largest in existence. It will consist of two separate but similar powerhouses, one on each side of the river, each to contain, when completed, nine generators of 105,000 kilowatts capacity. The total ultimate installed generator capacity, including three 10,000-kilowatt station-service units, will be 1,920,000 kilowatts. The capacity of the 18 large generators to be used for commercial prime power and for seasonal power for pumping and other purposes will be 1,890,000 kilowatts, equivalent to 2,520,000 horsepower. The largest generators so far built are those at Boulder Dam, each rated 82,500 kilowatts…"*

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Through each 18-foot penstock water will pass at a rate of 141 tons per second to drive a loaded generator"**

# Turbines



***"…Each of the 18 large generators will be driven by a 150,000-horse-power vertical hydraulic turbine, to which water will be delivered through 1 of 18 steel penstocks 18-feet in diameter, each provided with shut-off gates and trash racks. The heads under which the turbines will operate will vary between 275 and 366-feet. At full load, water will pour through each turbine at the rate of 141 tons per second, enough passing in a day to provide 30 gallons each for nearly 100 million people. Through seven of the turbines, fully loaded, there will pass sufficient water to take care of the requirements of the entire population of the United States, at 150 gallons per person per day…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Heavy steel trash racks, supported on reinforced concrete frames on the upstream face of the dam, will protect outlet tunnels from debris. Similar and larger racks will cover the entrances to penstocks"**

# The Bureau of Reclamation

***“…The Bureau of Reclamation of the Department of the Interior is the Federal agency organized in 1902 to carry out the provisions of the Reclamation Act, ‘Appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands.’ In the 35 years of its existence the Bureau has built 138 storage and diversion dams, 24 powerhouses, 2,344 buildings, 19,116 miles of canals, ditches, and drains, 72-1/2 miles of tunnels, 4,367 miles of telephone lines, 267 miles of dikes and levees, 6,041 flumes, 18,694 culverts, 13,166 bridges, and 182,964 other irrigation structures…”***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…Living on the land made productive by these structures are 210,466 persons, and in the towns on the projects 653,441, served by 859 schools and 996 churches. The estimated gross value of the crops produced on Federal reclamation projects in the calendar year 1936 was $136,502,480. The average crop value for each of the 2,901,919 acres of land for which the Bureau of Reclamation furnished water in 1936 was $47.10. Since 1906, when the first Federal project went into operation, the grand total value of crops produced on these projects has been $2,311,983,242, or approximately 10 times the cost of the Federal irrigation works serving the lands. The return obtained by the farmer on Federal reclamation projects for each acre worked during 1936 was two and a half times that received by the average farmer the Nation over…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…Although the 1936 production from Federal reclamation projects was only 1.1 percent of the value of all the crops harvested from farms in the United States, approximately 864,000 people, on 48,773 farms and in 257 towns and cities which have sprung up in these areas, were supported by the projects. With the exception of some fruits and vegetables, the products at irrigated western farms do not reach eastern markets. More than half of the area is used in the production of hay and forage which is consumed on the farms, and is an important factor in the support of the livestock industry of the Western States…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

# Surveys

*"…Among the activities of the Bureau has been a surveying project of extraordinary magnitude. The reservoir flood-line and the taking-line at elevation 1,310, each nearly 400 miles long, were established, property lines were relocated, and new locations for highways and railroads within the reservoir were worked out. Surveys on project lands have included, so far, section-line retracement and the setting of monuments on more than a million acres of land, control-leveling on more than three quarters of a million acres, and topographic surveys of nearly as much…"*

***U.S. Bureau of Reclamation*** **(ca. 1937)**

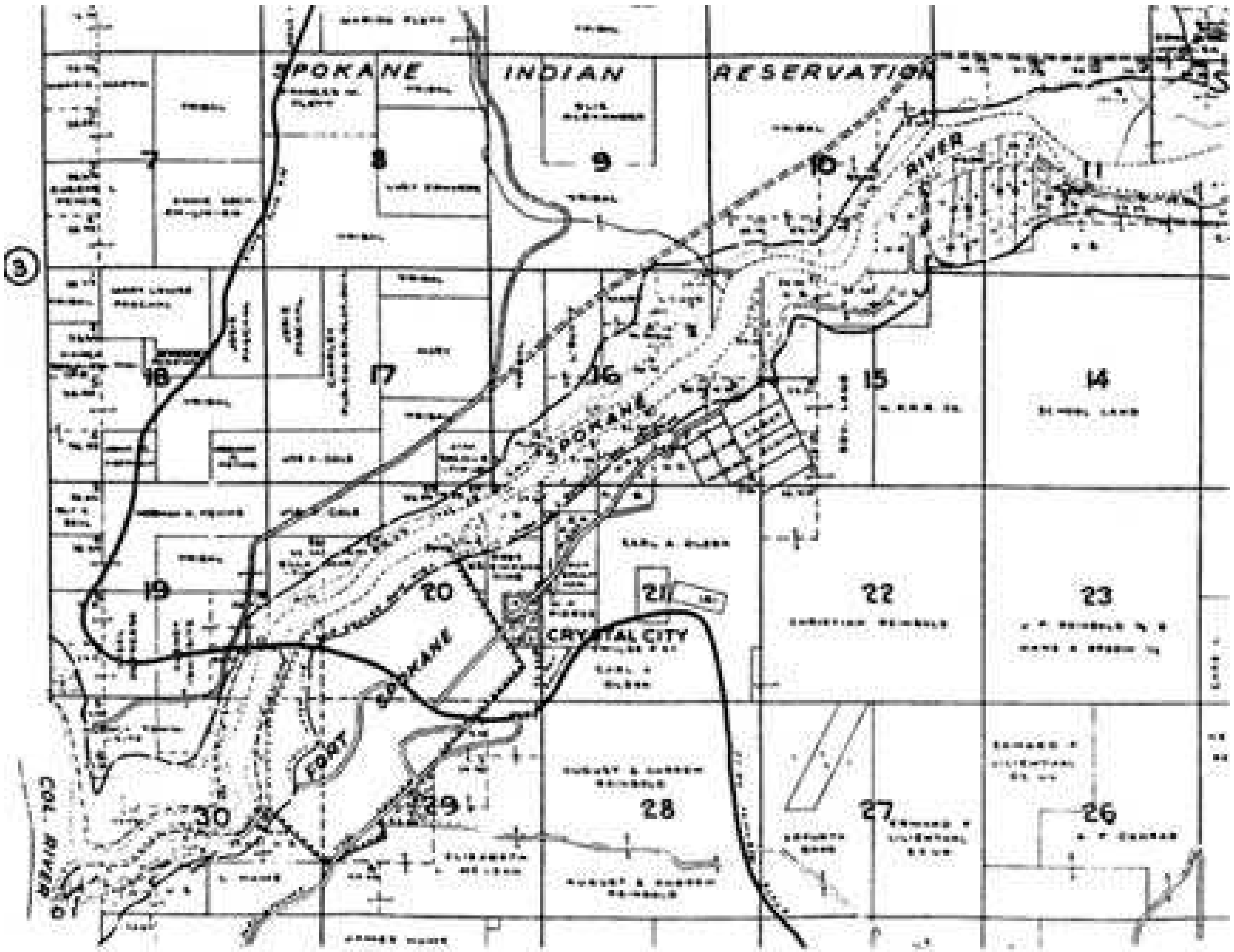

**<u>Above</u>: caption: "The topography of more than a million acres of land must be taken as a guide in designing irrigation works"**

**<u>Left</u>: caption: "Marks, buried under years of growth of witness trees, guided surveyors re-establishing property lines in the reservoir area"**

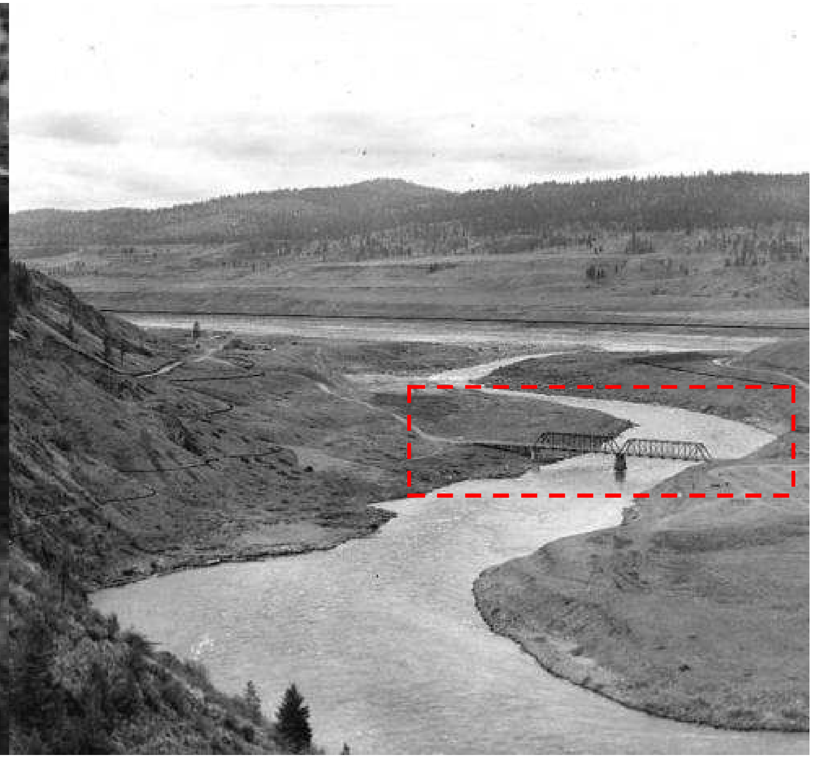
***"…There had to be an exacting survey made of the river valley above the dam. It was necessary to reckon to the exact inch the height water would reach when the dam was finished. This survey was made by triangulation methods over a period of many nights in order that uneven daytime temperature would not affect the delicate instruments. It was so accurate that a slight discrepancy of the United States Geological Survey levels, made years before, was discovered. Had this error not been rectified, and had the original elevations been used, a flood in the Columbia at some future time might have backed up beyond the 151-mile limit and into Canada, flooding Canadian towns and causing international complications…"***

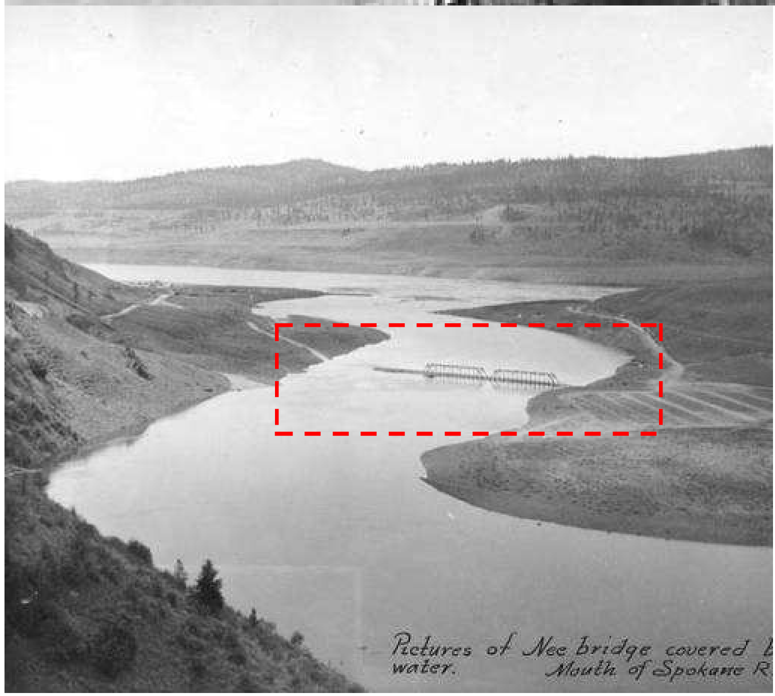
***Popular Mechanics,* February 1941**

**Beginning in 1933, U.S.B.R. engineers prepared to purchase land and rights-of-way for a reservoir that would stretch some 151 miles from the dam to close to the Canadian boundary. Surveyors worked for several years setting permanent monuments along the approximate 1,310-foot "taking line" to indicate the land the government needed to acquire. The "Columbia River Reservoir" eventually flooded approximately 70,500 acres, and the U.S.B.R. took an additional 11,500 acres of "freeboard" land (the strip of land between the 1,290 water line and the 1,310-foot taking line) for the reservoir. Within this area lay two railroads, three primary state highways, about one hundred and fifty miles of country roads, fourteen bridges, eleven towns, four sawmills, four telegraph and telephone systems, and many power lines and cemeteries. All of these had to be purchased and/or relocated before the waters came. Some towns were relocated to higher ground, but a number of small communities were not. In total, some three thousand people had to leave their homes because of the creation of the reservoir.**




**<u>Above</u>: caption: “Portion of a 1930s map showing the land ownership at the confluence of the Columbia and Spokane rivers. The dashed line represents the water line at 1,300-feet, but the actual water line was at 1,290-feet and the taking line for Bureau of Reclamation acquisition of land was at a minimum of 1,310-feet.”**

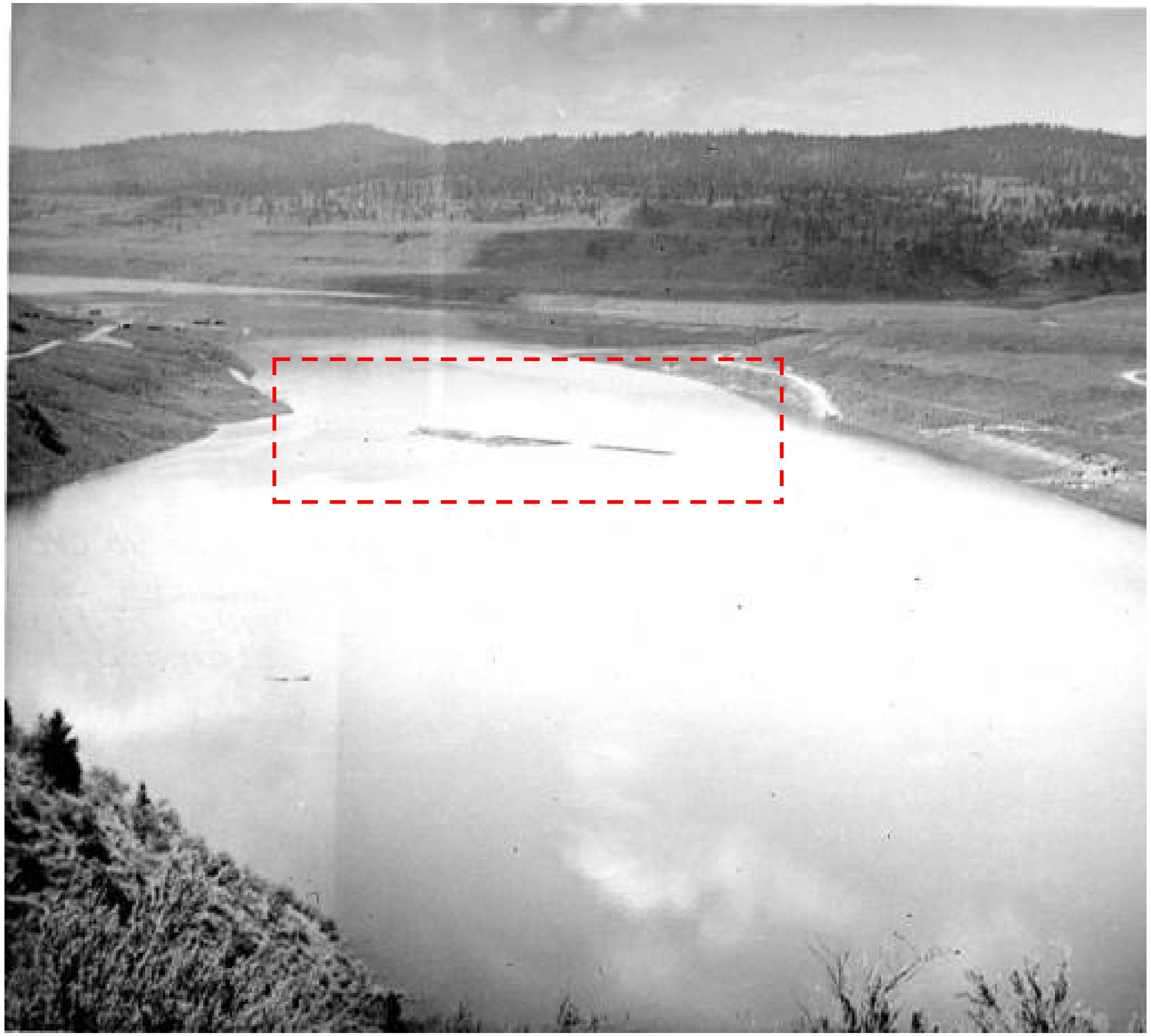


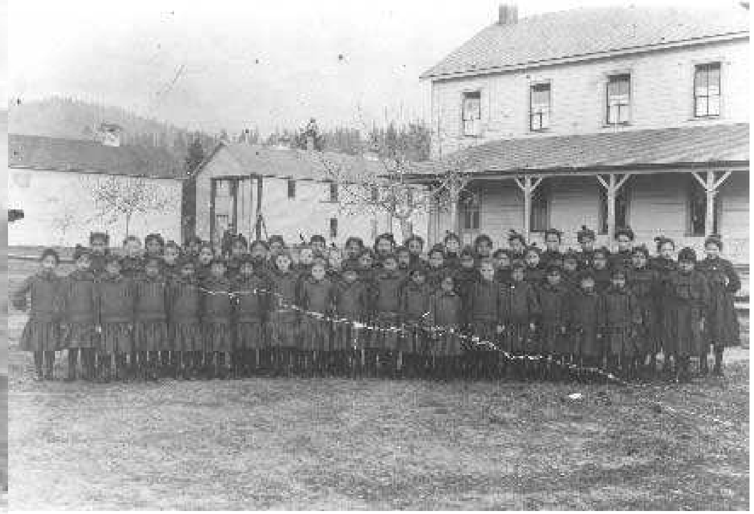



**<u>Top Left</u>: caption: "Aerial view of the confluence of the Columbia and Spokane rivers, 1932. The bridge across the Spokane River was one of several that had to be relocated. The new bridge is closer to the confluence and historic Fort Spokane."**

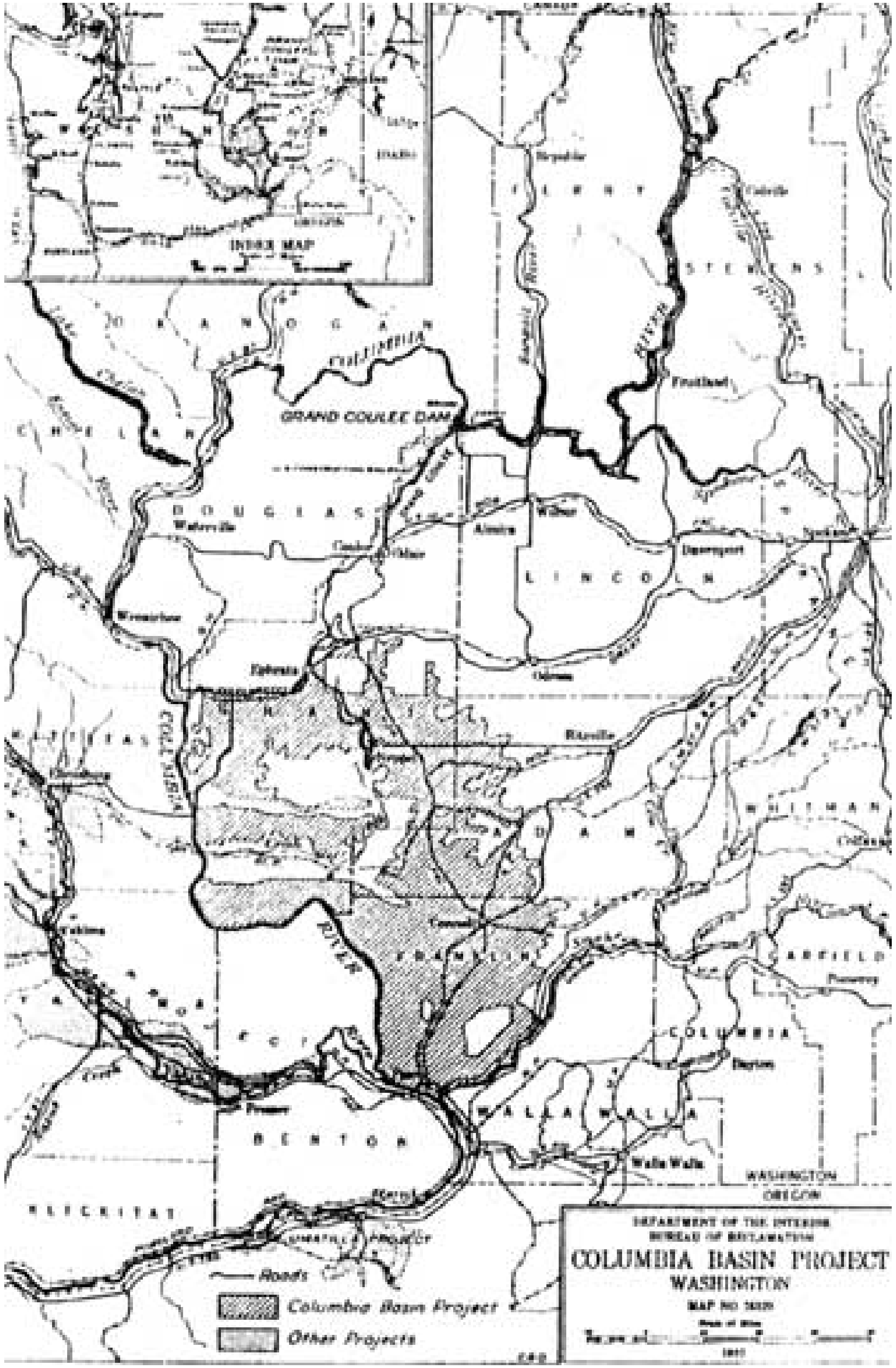
**<u>Top Right</u>: caption: "Nee Bridge, Spokane River, ca. 1939"**

**<u>Left</u>: caption: "Pictures of Nee Bridge covered by water. Mouth of Spokane River" (ca. 1940)**



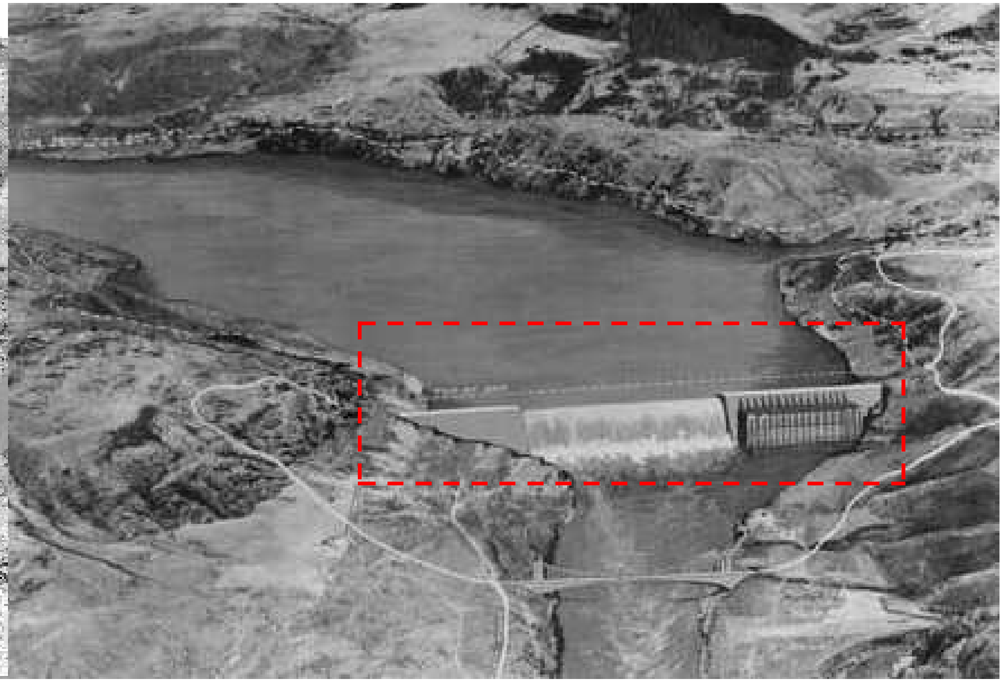


**<u>Above</u>: caption: "Group of girls who were students at the Indian School at Fort Spokane, ca. 1903"**
**<u>Left</u>: caption: "View of Fort Spokane from the south, ca. 1903"**




**As early as 1933, an appraisal board began valuing the twelve hundred parcels of land to be purchased. The appraisers considered the physical value of the land and also its productive and residential values. When landowners did not accept final government purchase offers, the U.S.B.R. filed condemnation suits (many property owners felt that they did not receive fair value for their land). By the close of 1942, all of the lands required for the reservoir had been acquired by purchase or condemnation or were under contract to purchase. In the end, over $10.5 million was paid for this land, including town lots and farms, plus the relocation of railroads, highways, sawmills, and other improvements.**

**Left: caption: “1937 map of the Columbia Basin Project showing lands to be irrigated by water pumped from the Upper Columbia River at Grand Coulee Dam into the equalizing reservoir (Banks Lake)”**

The decision to build *Grand Coulee Dam* higher than had originally been planned determined the size of the reservoir behind the dam. In 1933, the dam was designed to be a 200 to 300-foot low dam that would generate power and help in regulating navigation flows but would not aid in the proposed irrigation project. The reservoir created by the low dam would have reached 1,111-feet in elevation. In June 1935, the U.S.B.R. issued a change order for construction of the 500-foot high dam, which allowed for a reservoir reaching 1,290-feet in elevation and extending to the Canadian border. *The Rivers and Harbors Act* (August 1935) authorized the dam for the purposes of flood control, navigation, stream flow regulation, storage and delivery of stored waters, reclamation of public lands and Indian reservations, and the generation of hydroelectric power. Grand Coulee Dam had evolved into a major national project, not just a local New Deal relief measure.

**Left: caption: "Site of Grand Coulee Dam looking north across the Columbia River, January 1934. Note the ferry crossing."**

**Right: caption: "Showing the difference in reservoir size between the low and high dams proposed for the Grand Coulee project (ca. 1933)"**

**The Act of June 29th 1940 (*Acquisition of Indian Lands for Grand Coulee Dam, 54 Stat. 703*), gave the United States "all the right, title, and interest of the Indians in and to the tribal and allotted lands within the Spokane and Colville Reservations," up to 1,310-foot elevation (except at the Klaxta townsite where the federal government was allowed to take lands above that line). In addition, the act gave the government the right to take additional reservation lands "from time to time" as needed for utilities and roads in connection with the *Grand Coulee Dam* project. The Secretary of the Interior was allowed to determine "just and equitable compensation," with payments for tribal lands being transferred to the appropriate tribal account. Compensation due to individual owners was transferred to the superintendent of the *Colville Agency* to credit the individual's account. The Secretary of the Interior was then permitted to use these funds to purchase other lands and improvements or move existing improvements to a new site to benefit the allottee.**

**June 29, 1940**

**ACQUISITION OF INDIAN LANDS FOR GRAND COULEE DAM**

**An act for the acquisition of Indian lands for the Grand Coulee Dam and Reservoir, and for other purposes. (Act of June 29, 1940, ch. 460, 54 Stat. 703)**

**SEC. 1. [Indians' rights to lands granted for Grand Coulee Dam—No lands taken above elevation 1310 - Interests granted for pipe lines, highways, railroads, telegraph and telephone, electric transmission lines.] - That, in aid of the construction of the Grand Coulee Dam project, authorized by the Act of August 30, 1935 (49 Stat. 1028), there is hereby granted to the United States, subject to the provisions of this Act, (a) all the right, title, and interest of the Indians in and to the tribal and allotted lands within the Spokane and Colville Reservations, including sites of agency and school buildings and related structures and unsold lands in Klaxta town site, as may be designated therefore by the Secretary of the Interior from time to time: *Provided,* That no lands shall be taken for reservoir purposes above the elevation of one thousand three hundred and ten feet above sea level as shown by General Land Office surveys, except in Klaxta town site; and (b) such other interests in or to any of such lands and property within these reservations as may be required and as may be designated by the Secretary of the Interior from time to time for the construction of pipe lines, highways, railroads, telegraph, telephone, and electric-transmission lines in connection with the project, or for the relocation or reconstruction of such facilities made necessary by the Construction of the project.**

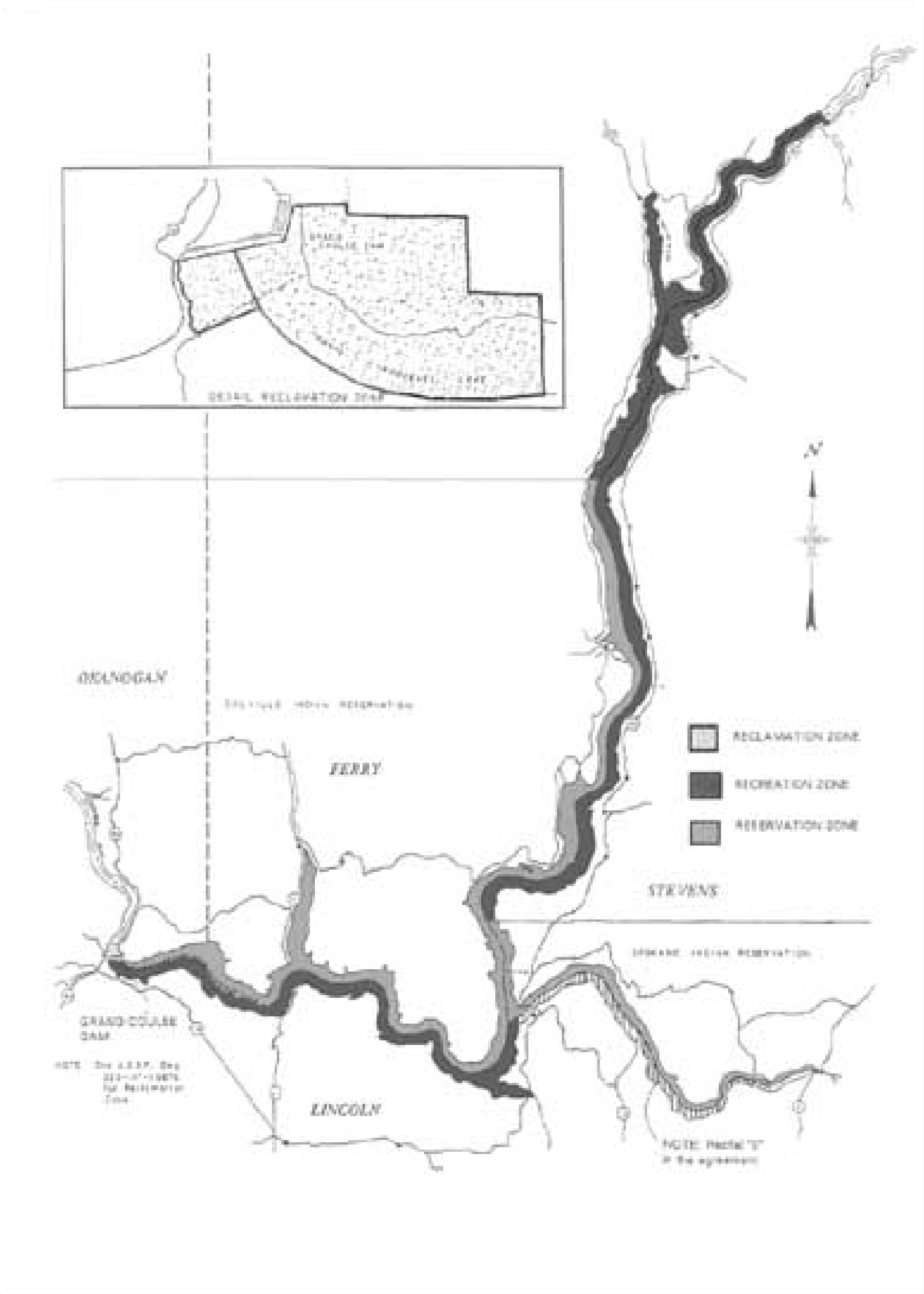
**Section 1 of the 1940 Act contained a key paragraph that has generated more confusion, controversy and pages of legal opinion than probably any other document pertaining to the Grand Coulee Dam project. It states:**

***"…The Secretary of the Interior, in lieu of reserving rights of hunting, fishing, and boating to the Indians in the areas granted under this Act, shall set aside approximately one-quarter of the entire reservoir area for the paramount use of the Indians of the Spokane and Colville Reservations for hunting, fishing, and boating purposes, which rights shall be subject only to such reasonable regulations as the Secretary may prescribe for the protection and conservation of fish and wildlife: Provided, That the exercise of the Indians' rights shall not interfere with project operations. The Secretary shall also, where necessary, grant to the Indians reasonable rights of access to such area or areas across any project lands…"***

## ACQUISITION OF INDIAN LANDS FOR GRAND COULEE DAM AND RESERVOIR

**An act to amend section 1, Act of June 29, 1940 (54 Stat. 703), for the acquisition of Indian lands for the Grand Coulee Dam and Reservoir, and for other purposes. (Act of December 16, 1944, ch. 601, 53 Stat. 813)**

**[In special circumstances lands may be taken above elevation 1310 - Lands taken for operation and maintenance.] - That the first paragraph of section 1 of the Act approved June 29, 1940 (54 Stat. 703), be amended to read as follows: "That, in aid of the construction, operation and maintenance of the Columbia Basin project (formerly the Grand Coulee Dam project), authorized by the Act of August 30, 1935 (49 Stat. 1028), the Act of August 4, 1939 (53 Stat. 1187), and the Columbia Basin Project Act (Public, Numbered 8, Seventy-eighth Congress, first session, 57 Stat. 14), there is hereby granted to the United States, subject to the provisions of this Act, (a) all the right, title, and interest of the Indians in and to the tribal and allotted lands within the Spokane and Colville Reservations, including sites of agency and school buildings and related structures and unsold lands. in the Klaxta town site, as may be designated therefore by the Secretary of the Interior from time to time: *Provided,* That no lands shall be taken for reservoir purposes above the elevation of one thousand three hundred and ten feet above sea level as shown by General Land Office surveys except in Klaxta town site and except where in the judgment of the Secretary of the Interior, special circumstances concerning the reservoir or its operation and maintenance require the taking of land above that elevation; and (b) such other interests in or to any such lands and property within these reservations as may be required and as may be designated by the Secretary of the Interior from time to time for the construction of pipe lines, highways, rail roads, telegraph, telephone, and electric-transmission lines in connection with the project, or for the relocation or reconstruction of such facilities made necessary by the construction of the project."**




The *Tri-Party Agreement* was signed on December 18th 1946. It divided the reservoir area into three zones: *Reclamation, Recreation* and *Indian*. The U.S.B.R. retained jurisdiction over activities in the *Reclamation Zone*, including recreation, although the agency was to consult with the *National Park Service* (NPS) on development of any recreational facilities there. The *Office of Indian Affairs* (OIA) had responsibility for both the *Colville* and *Spokane Indian Zones*, including issuing agriculture, grazing and log dump permits; fire prevention; and construction and maintenance, in consultation with the NPS, of any structures needed in conjunction with Indians' paramount rights. The OIA also agreed to provide the NPS with any help needed in its relations with individual Indians at the new recreation area.

**Left: caption: "Map showing Reclamation, Recreation, and Reservation zones at Lake Roosevelt. Although the map is dated 1990, the zones are essentially the same as the Reclamation, Recreation, and Indian zones defined in the 1946 Tri-Party Agreement."**

**Current firm constraints on the level of *Lake Roosevelt* stipulate certain conditions. First, the lake's maximum level is always 1,290-feet, while the minimum level is 1,208-feet (except under exceptional circumstances). Second, the maximum draft in twenty-four hours is 1.5-feet to reduce landslide potential. Third, the minimum pool elevation by May 31st is 1,240-feet to provide safe and efficient irrigation pumping to *Banks Lake*. The *U.S. Army Corps of Engineers* and the U.S.B.R. signed formal flood-control rule curves in 1978 as part of the *Columbia River Treaty*. These are used in determining the lake level to store water to meet power generation demands; prevent downstream flooding; and protect anadromous fish by limiting downstream spills that raise nitrogen levels in the water and lead to gas-bubble disease. Increased flows are required April 15th to June 15th for smolt out-migration (known as the "water budget"), which can delay filling the lake until late June or early July. During the 1940s, when preliminary plans for recreation on the new reservoir were being put together, the various agencies were confident that the reservoir would consistently be at full pool; 1,290-feet, from June to October of each year. All special use permits included a clause stating that the water level of Lake Roosevelt could fluctuate a maximum of eighty-feet. The winter drawdown was expected to be to 1,240-feet, perhaps occasionally down as low as 1,210-feet. In fact, from 1941-1951 the drawdown did not exceed thirty-feet, and from 1952-1965 it stayed close to forty-feet each winter.**

# Land Clearing

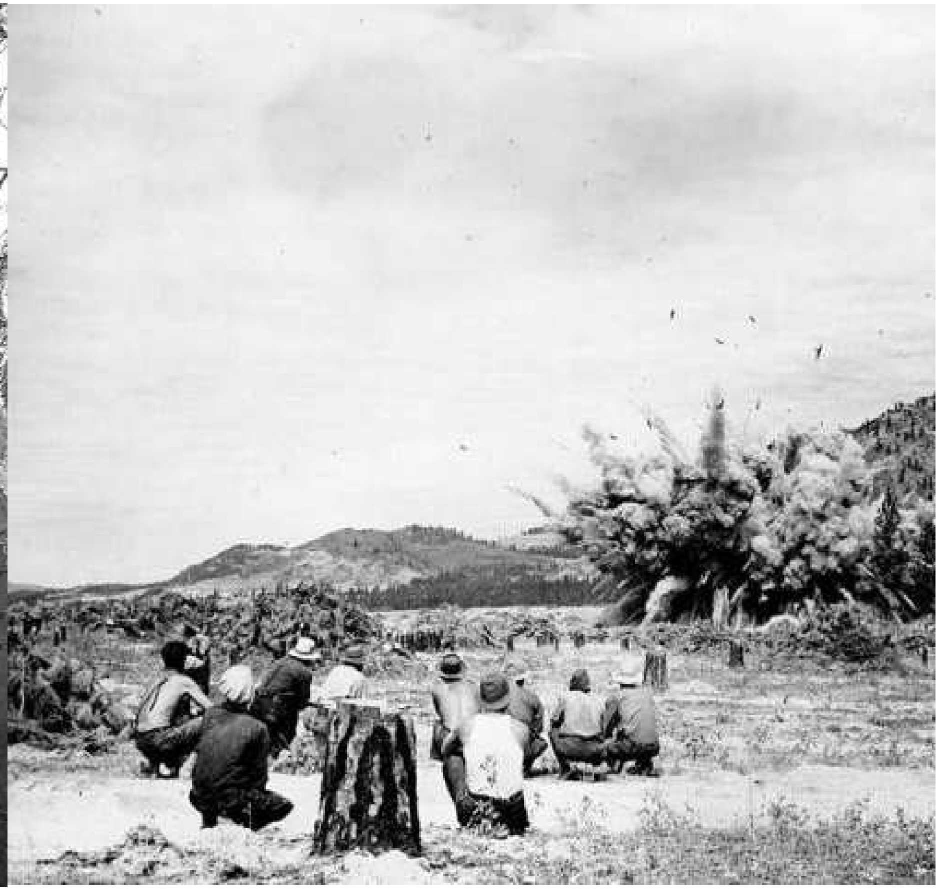
***“Reports are circulating that large crews of workmen will be employed next year clearing timber and brush from the area to be covered by water when the lake is formed after the high dam is completed…This work must be done before the high dam is completed, but is not included in the 1938 program. All timber and debris that might effect navigation on the lake or might cause injury to the dam or its equipment must be removed. There are about 150 miles of land to be cleared, and the Great Northern railroad near Marcus must be moved. This work will employ several thousand men. The plan originally was to employ the CCC, but it is likely this might be changed to give work to unemployed men under the same rules prevailing during construction…”***

***Spokesman-Review,*** **November 30th 1937**

**Clearing the reservoir area was one of the largest *Work Projects Administration* (WPA) projects ever undertaken. The clearing project was completed in December 1941, taking just over three years from start to finish. The WPA furnished all the labor, built the camps, and operated the mess halls while the U.S.B.R. supplied equipment and materials. Most of the area cleared lay between the low-water elevation of the *Columbia River* and its tributaries and elevation 1,290-feet, but clearing was done higher in upper reaches of the reservoir and in areas with landslide potential. Approximately 54K acres were cleared, over 11K acres grubbed (even the roots were dug up) and thirty-three million board-feet of merchantable timber harvested. When the work was completed, the government had spent $4.9 million on labor.**

**<u>Top Left</u>: caption: “Camp Kettle, largest of the eight camps built by the WPA to house the men clearing the reservoir site. At the height of its use, more than 1,300 men lived at this camp.”**
**<u>Top Right</u>: caption: “WPA workers boarding Gerome Ferry to take them to Camp Gerome, on the far side of the river. Note the tree stumps on the land that will be inundated by the reservoir.”**
**<u>Left</u>: caption: “Camp Ferry workers disembarking from barge after land clearing operat-ions, Columbia River, Washington, 1940”**

**The height of *Grand Coulee Dam* and the maximum level of the reservoir were determined by the elevation of the *Columbia River* at the Canadian border. The water level in the lake is not allowed to rise above 1,290-feet; otherwise, it would back water into Canada. In the early 1930s, U.S.B.R. surveyors marked the 1,290-foot high-water line to show the land to be cleared of trees, brush, and other objects that could present hazards to boaters or to the water intakes behind the dam. The clearing procedure varied with elevation. Between 1,250 and 1,290-feet, most combustible or buoyant material was uprooted, pulled, or grubbed for complete removal, then piled and burned (small brush was cut off flush with the ground, and non-combustible material was razed and placed in pits). Between 1,200 and 1,250-feet, stumps were cut no more than six-inches above the ground. Between the Columbia River and 1,200-feet, stumps were cut no more than two-feet above the ground. Building foundations, walls, and chimneys were razed, and brush less than three-feet high was left as it was.**

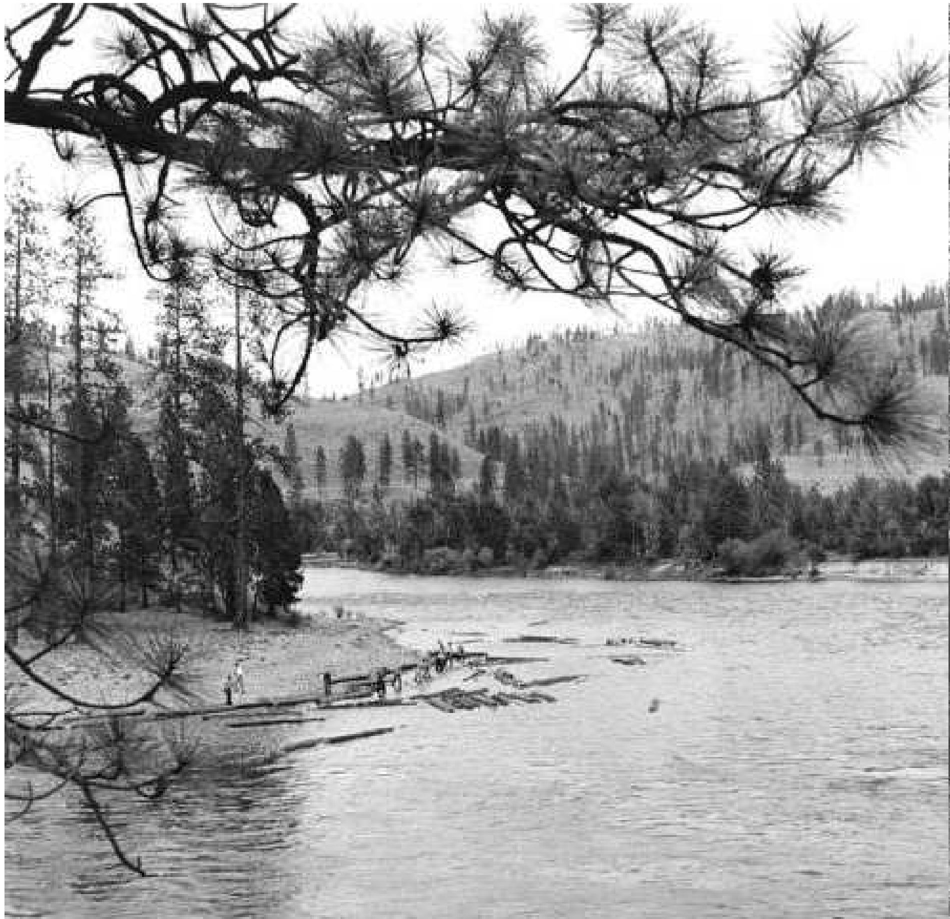
**<u>Top Left</u>: caption: "Unloading dynamite across the river from Camp Gifford, 1940"**
**<u>Top Right</u>: caption: "Blasting stumps across the river from Camp Gifford, 1940"**
**<u>Left</u>: caption: "Last tree felled in Camp Gifford clearing area by WPA crews, 1941"**

**Timber cruising to estimate the amount of merchantable timber was done in the late 1930s. The timber within the reservoir area was logged by WPA crews, skidded to the river, and floated downstream where it was sold to the highest bidder. In 1939, the *Lincoln Lumber Company* bid $2.25 per thousand board-feet for this timber. The company's mill was located at the mouth of the *Spokane River*, so timber cut downstream ended up being burned or otherwise disposed of. This lumber company's plant close to the river had to be dismantled when the backwaters advanced. The trees in the many peach orchards along the river were uprooted and burned.**

**Left: caption: "Logging in Oropothem Creek - Rigging, 1940"**

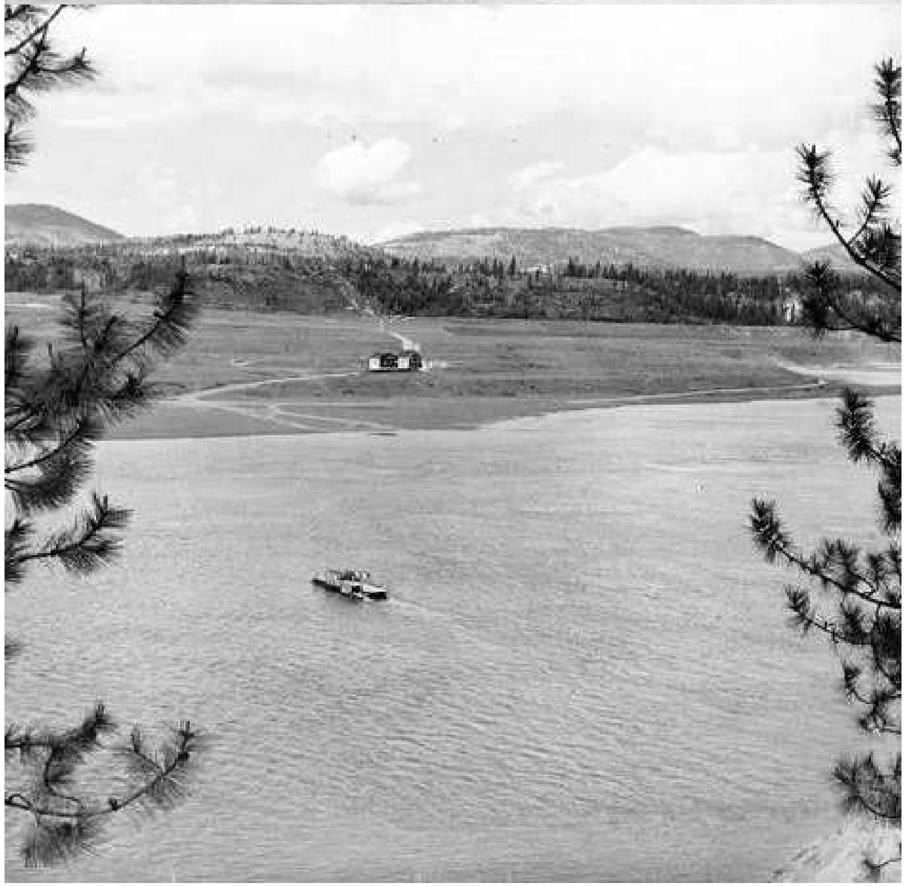
**<u>Above</u>: caption: "Caterpillar tractors used by WPA in clearing the Grand Coulee reservoir are shown lined up for service beside the old Highway-22 on the flat midway between the towns of Daisy and Rice, during final clearing operations in the Camp Gifford area. Lake water formed by the Columbia river backing up behind Grand Coulee dam will soon cover this area."**

**<u>Left</u>: caption: "Logging in Oropo-them Creek with a cater-pillar, 1940"**



**<u>Top Left</u>: caption: “Floating felled logs, ca. 1939”**
**<u>Top Right</u>: caption: “Floating saleable timber downstream, ca. 1939”**
**<u>Left</u>: caption: “Clearing project logs at the mill, ca. 1940”**

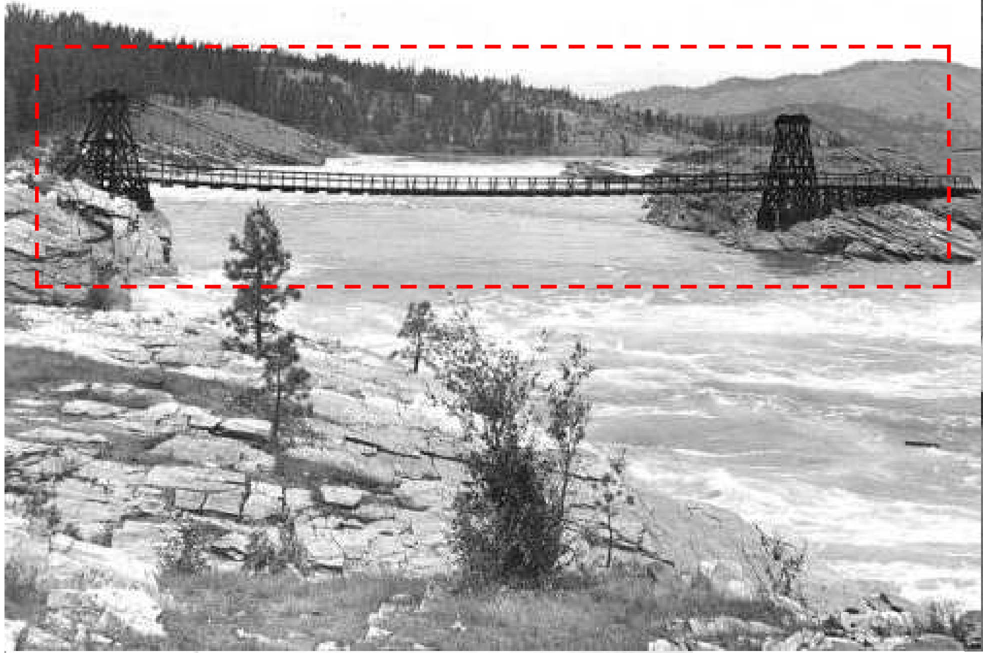
**<u>Above</u>: caption: "Clearing activities in the reservoir area above the dam, Washington, 1939"**
**<u>Left</u>: caption: "Burning brush and tree limbs, 1939"**

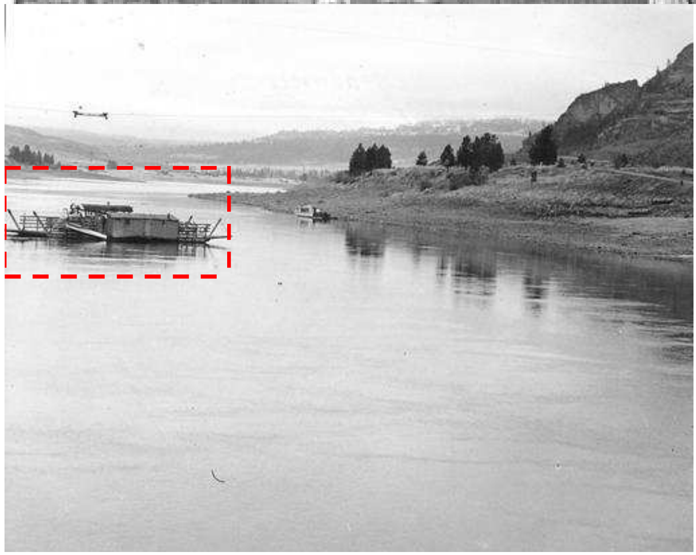


The U.S.B.R. began surveys for the re-location of railroads and roads in the reservoir area in 1935, and contractors began constructing the realignments that spring. ***Great Northern Railway*** branch lines to Nelson, British Columbia and to Republic, Washington, had to be re-aligned. Old roads within the reservoir area were kept open as long as possible. Approximately ninety-miles of state highways were reconstructed under supervision of the Washington State (the U.S.B.R. supervised the construction of relocated county roads and then turned them over to the counties). New highway bridges were built. Affected roads on the two Indian reservations totaled approximately thirty-three miles. Old railroad bridges were dismantled and new ones constructed. Public utilities and industrial sites had to be relocated or purchased. Washington State provided a ferry at the mouth of the ***Sanpoil River*** (Keller Ferry), and the private ferry at Gifford-Inchelium continued operation. The old cable ferries had to be replaced by power ferries because of the lack of current in the new reservoir.

Top: caption: “Indian town of Inchelium, ca. 1939”

Bottom: caption: “Moving Inchelium High School gymnasium, Washington, ca. 1941”





**<u>Top Left</u>: caption: “Old bridge on the Columbia River near Kettle Falls, Washington, June 1940”**

**<u>Top Right</u>: caption: “Ferry NES-PELEM, probably on the Spokane River, ca. 1940”**

**<u>Left</u>: caption: “San Poil or Keller Ferry, Columbia River, Washington, ca. 1940”**

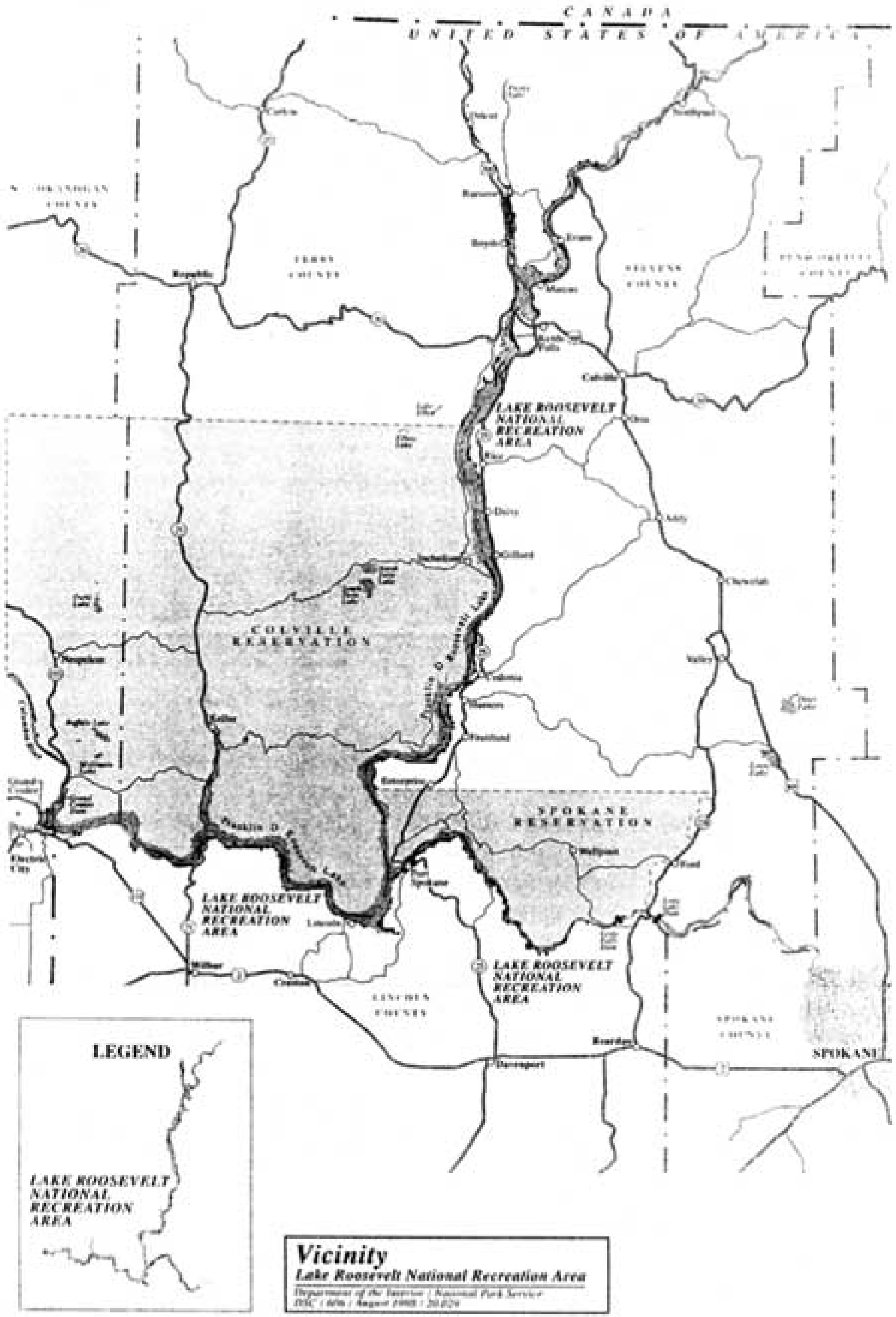
**In April 1941, the federal government declared the reservoir land clearing operations a *National Defense Project*, which intensified the push to complete the work. Contractors built the dam faster than anticipated and the WPA was hard-pressed to complete the clearing on time. The last tree was cut July 19, 1941, near *Kettle Falls*. The work at Kettle Falls then consisted of grubbing and burning and dismantling camp buildings, but the clearing had not been completed when water began flowing over the site.**

**<u>Left</u>: caption: “The last tree to be felled in the Camp Gifford clearing area was this yellow pine which was located in a densely forested area along the old river highway between the towns of Rice and Daisy. WPA officials and others came to witness the felling of the lone tree. Rising backwater behind Grand Coulee dam of the Columbia river is expected to cover this flat by the middle of July. The Columbia river is about ¾ mile in the distant background.”**

**<u>Right</u>: caption: “WPA workers returning to camp with a newsreel photographer recording the scene during the Grand Coulee Dam construction, ca. 1940”**

On June 1st 1942, a crowd gathered to watch the first trickle of water flow down the spillway face of ***Grand Coulee Dam***. The reservoir was full at the downstream end, but it took another six weeks to reach the 1,290-foot level all the way up the reservoir. The clearing project was done. The still waters of the ***Columbia River Reservoir*** (soon to be known by locals as "Lake Columbia") now lay where the ***Columbia River*** had once flowed.

**Left: caption: "WPA cleared lake bottom on Spokane river, near Detillion, showing part of the Grand Coulee reservoir which WPA crews have cleared of all trash and debris. Water is already slowly creeping up the banks of the river and will soon cover the entire bottom to the tree line on either bank.**




**The construction of *Grand Coulee Dam* had far-reaching effects in many realms besides power generation and irrigation. The creation in the late 1930s of a reservoir where there had once been a river dramatically affected the lives of many living in the area. The lake also created new recreational opportunities, leading to the establishment of a national recreation area to serve both local residents and visitors.**

**<u>Left</u>: caption: "Map of Lake Roosevelt National Recreation Area"**

***"The general scenic effect of the Reservoir Area is pastoral rather than spectacular, and a variety of conditions present ever-changing effects. Vistas tend toward broad landscapes with long stretches of the reservoir flanked by green roll-ing hills receding toward distant mountains."***

***National Park Service*, 1944**

**Left: caption: "Aerial view of Grand Coulee Dam, April 1940. The Grand Coulee extends to the right in the distance."**

***"Traveling through the Roosevelt Lake country, in the northeast corner of Washington state, is enough to make a modern motorist nervous. No view is blocked by a billboard, a hot dog stand or a Kozy Kabin Kamp. He may cross two Indian reservations without a chance to buy native beadwork from Japan. If he stops to eat lunch or take a swim, nobody shows up to tell him he's on private property or to collect for parking. Most travelers just aren't used to such treatment…As tourists discover Roosevelt Lake - and as the small towns discover the tourist - the freshness of the country may disappear. Meanwhile the sightseer finds himself in an anachronistic setting, removed by many years from today's formal 'recreational area,' where he can enjoy an uncluttered view and can stop to fish or camp where he pleases."***

***Byron Fish*, *Ford Times* (1954)**

**<u>Left T&B</u>: scenic vistas and recreational activities in the *Lake Roosevelt* country**


UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
COULEE DAM
NATIONAL
RECREATION AREA
HEADQUARTERS

# In the Hearts of the People

***“The designation of this monument to the President’s name has been done with a feeling of pride and yet with a deep sense of humility, recognizing that his greatest monument is in the hearts of the people”***

***Harold L. Ickes*, Secretary of the Interior**

**RE: early in 1939, a Spokane newspaper was flooded with suggestions for naming the lake that was beginning to form behind *Grand Coulee Dam*. Possibilities included “Lake Beautiful,” “Lake President” (in honor of the nation’s highest office) and “Lake Reclamation.” One disgruntled citizen had several suggestions including “Devil’s Lake” and/or “Bankruptcy Lake.” For the “weak-minded idol worshipers,” he proposed naming features of the lake “Roosevelt Bay,” “Ickes Isle” and “Eleanor Point.” In 1940, the *National Park Service* followed the U.S.B.R.’s lead by referring to the lake as the “Columbia River Reservoir.” The U.S.B.R. suggested the change to “Franklin D. Roosevelt Lake” in April 1945, following the four-term president’s death, Secretary of the Interior Harold Ickes informed Mrs. Roosevelt personally of the name change honoring her late husband.**

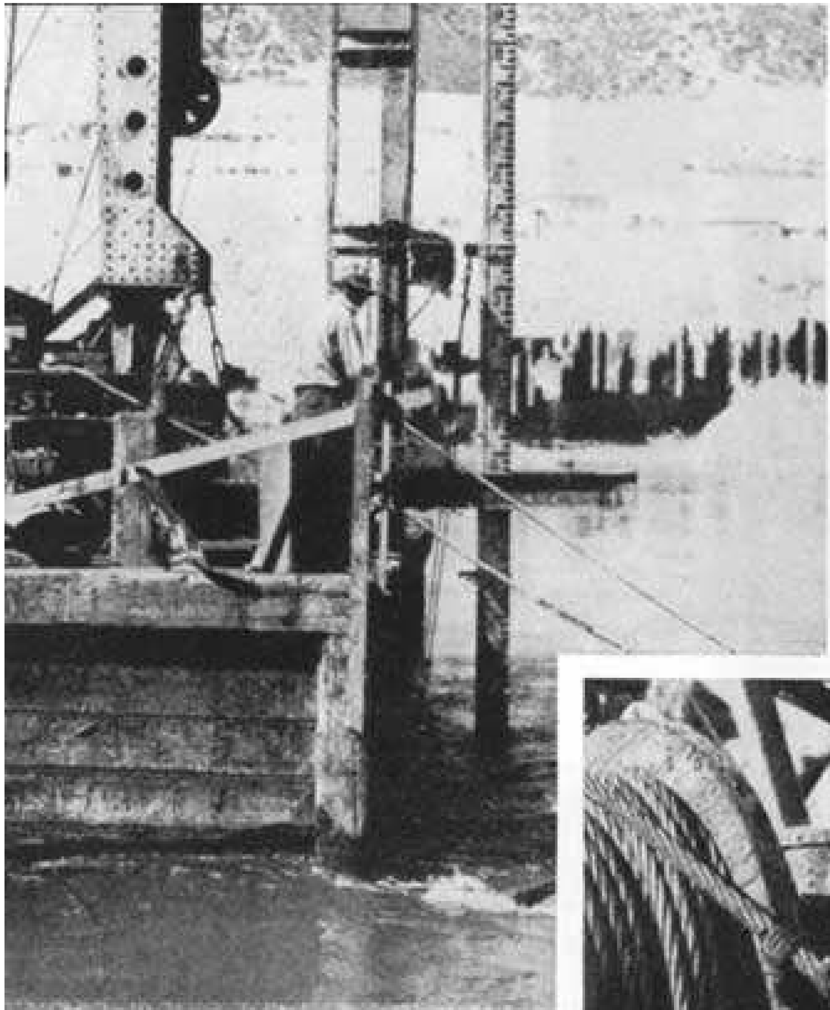
**During WWII, the Coast Guard established a patrol base on *Lake Roosevelt* in order to enforce motorboat and navigation regulations and to aid the federal guard in protecting the dam and other government property. By the end of 1942, the Coast Guard's forty men and four motorboats were doing regular patrols upriver to the mouth of the *Spokane River*, with occasional trips to Marcus and Northport (National Guard personnel did boat patrols for a few years after the war). The Coast Guard also installed directional lights as navigation aids. In 1949, the *U.S. Coast and Geodetic Survey* completed a standard navigation chart of Lake Roosevelt. No markings, however, were placed on the water to designate the Indian Zones established by the 1945 solicitor's opinion.**

**<u>Above</u>: caption: "Coast Guard patrol base about half a mile upstream from Grand Coulee Dam, December 1942. The former Camp Ferry barge served as quarters. Reclamation later leased this facility to the Grand Coulee Dam Yacht Club."**

# Building a Better America

***"…An army of men, reaching so far a maximum enrollment of more than 7,000 in the front rank at the dam site, is building Grand Coulee Dam. Behind those in the front rank are other battalions which cannot be seen from the vista houses on the rim of the Columbia River Canyon. They work in forests providing lumber; in mines and steel mills providing pipe, piling, reinforcement bars, etc.; in foundries and factories making machinery and equipment; on farms producing the food for these workmen; and for railroads which pour the products of all their labors through the funnel and into Grand Coulee Dam…"***

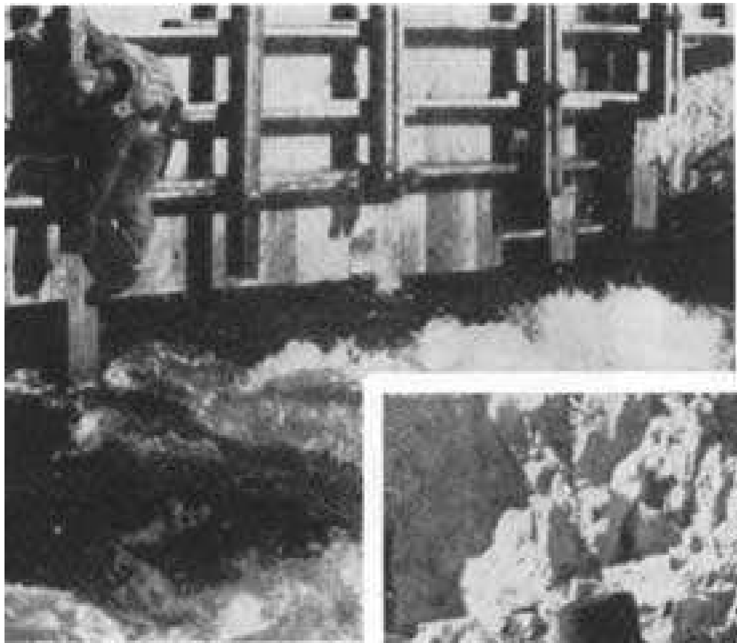
***U.S. Bureau of Reclamation* (ca. 1937)**



***"…An amazing number of things go into the construction of such a dam. They range from tacks to dynamite caps, from divers' helmets to turbines, and they are gathered from almost every locality within, the United States…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left T&B</u>: caption: "The contours of the river bed were determined accurately by soundings and cribs for the cross-river coffer-dams were built to fit them. Riggers, with their ropes and cables, were indispensable fig-ures in the construction crews."**



***"…So, while Grand Coulee Dam is the principal structure of a great, long-term undertaking of tremendous social significance, its construction has an immediate social value in that it gives millions of man-hours of work at prevailing wages throughout the country. It has sent an army of men marching back to work each day since the dam was started, back to work at the job of building a better America…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left T&B</u>: caption: "In spite of the unprecedented use of machinery and power, men of a great variety of crafts were employed, and much manual labor was required in building the base of the dam. Final clearing of bedrock was done by hand."**

# The Model Towns



***"…On the opposite banks of the river rose Mason City, the all-electric model town housing the workers, and 'engineers' town,' with its spacious administrative buildings, near the foot of the Government railroad grade…"***

***Popular Science,*** **February 1936**

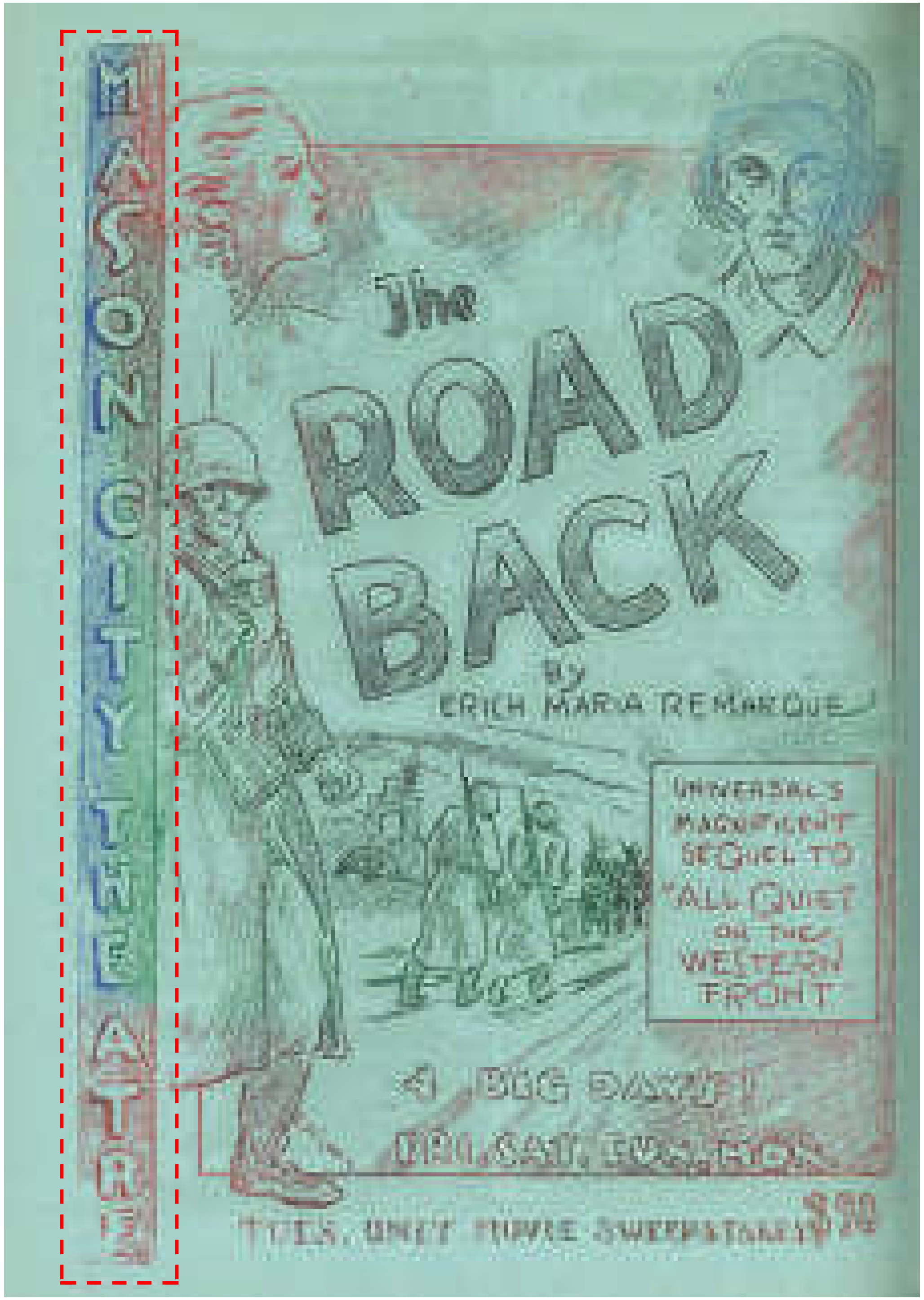
**<u>Above L&R</u>: U.S.B.R. Administration Building, Engineers' Town**

**<u>Left</u>: caption: "Tennis anyone?"**

# All-Electric

***“…Mason City, intended to be a temporary town, is built of assembled houses, every one of which is heated and serviced completely by electric current supplied by the contractors for three tenths of a cent a kilowatt hour. Bills for complete heating, cooking, and other uses ran about eight dollars a month last winter. The town is being used as a huge experimental field laboratory for testing out electrical service for domestic use. Under supervision of scientists from the State College of Washington it is now, for the second winter, being made the scene of experiments in off-peak storage of electrically generated heat for use during the twenty four hours of the day…”***

***Popular Science,*** **February 1936**



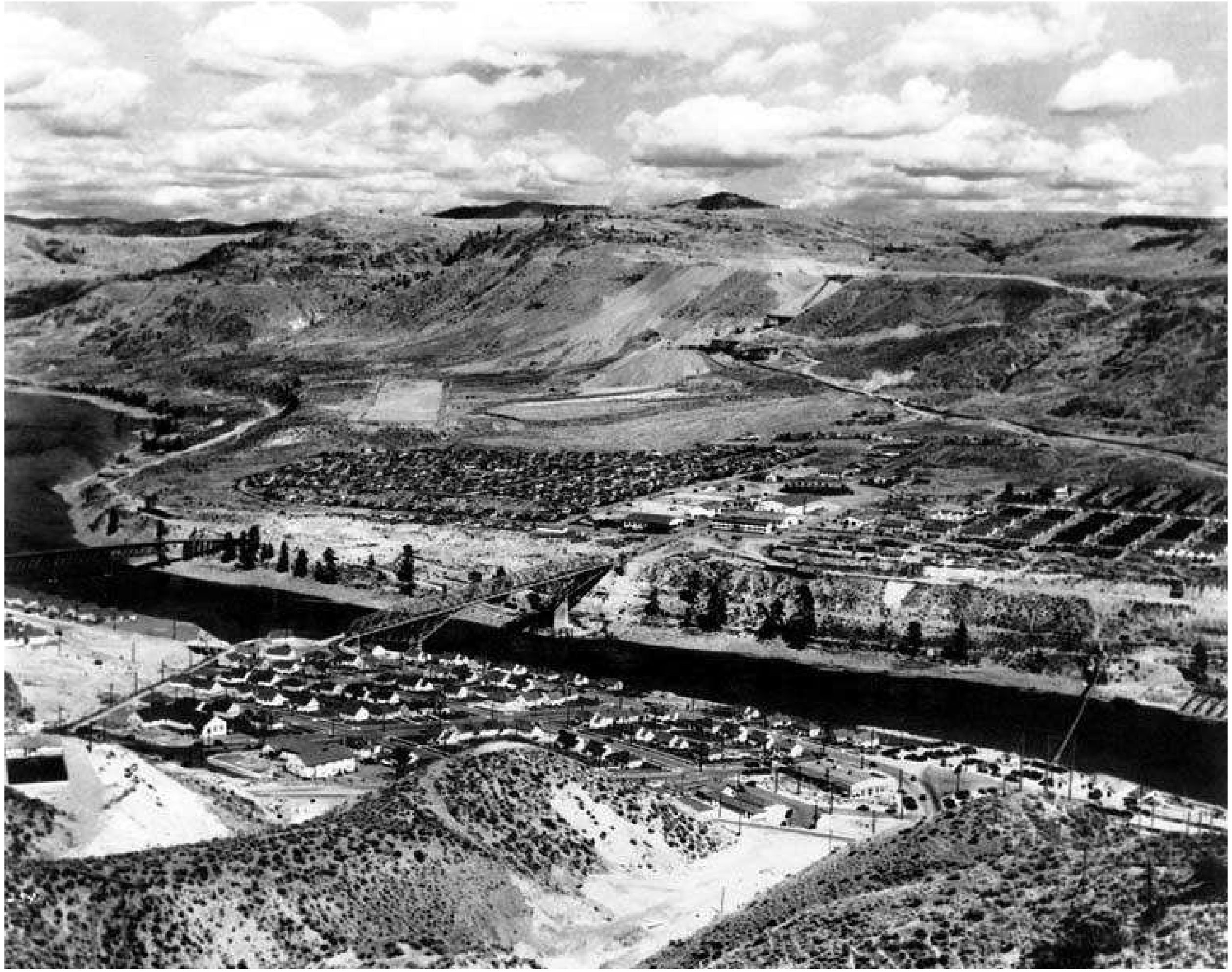

***"…Except in the very largest buildings, such as the hospital, department store, and recreation hall, there is no provision for any but electrical heating in Mason City. Long before the dam is completed, the Columbia Basin Commission expects to prove that the ultimate settlers in this great, reclaimed region cannot do otherwise than use electricity for every task to which it can be applied. Feed grinders, machine shops, and every domestic app-liance will be serviced, and it is planned to price this power at less than a cent a kilowatt hour…"***

***Popular Science,*** **February 1936**

**Left: ad appearing in the *M.W.A.K. Columbian* for a film showing at the *Mason City Theatre***

***"A marked contrast to the picture presented two years ago, when the MWAK was preparing to start construction operations, is seen in the panorama of the dam site today…Mason City was only a vision in the offices of the MWAK architects, and bridges across the river were unknown. Cars were transported across the river by ferry. Government town was a barren triangle on the west shore…Outside of core drilling and some of the preliminary excavation, little had been completed…In the two years past, enormous steps have been taken by the contractors and the government. Two towns have been completed. A huge coffer dam has been completed, all of the overburden has been removed, a mammoth gravel plant installed, two concrete mixing plants set up, nearly 1,000,000 yards of concrete poured and thousands of other, lesser tasks finished…the era of tremendous expansion of the town sites is past and efforts and efforts will be confined to their improvement in future…"***

***Spokesman Review,*** **August 6th 1936**



# Leashed Lightning

***“Washington State College will conduct what is said to be the greatest electrical house heating experiment in history at mason City on the Grand Coulee dam site, according to plans worked out by the college in cooperation with the MWAK Company, dam builders. More than 300 buildings in the city by the dam will be heated electrically, the entire year through, on a scale greater than that ever attempted before. Air con-ditioning for providing cool home interiors will be studied on a smaller scale…”***

***Spokane Chronicle,* October 11th 1934**

***"…Under the plans, the MWAK company, in building its houses, will insulate two with one-inch Thermax, two with plaster, two with aluminum foil, two with xonolite, two under standard MWAK specifications and two entirely uninsu-lated…"***

***Spokane Chronicle,*** **October 11th 1934**

***"…Admittedly, experiments in adapting off-peak loads for heat storage are in their infancy. The State College of Washington experts last winter devised a storage oven, filled with bowlders and insulated with mineral wool, with suitable dead-air spaces. Into these they 'shot the juice' until a working temperature from 500 to 600 degrees was found to be about right for providing a steady, comfortable temperature in winter…"***

***Popular Science,* February 1936**

***“…The oven consists of a four-inch interior wall of brick laid up with mortar, outside of which, at a distance of three inches, is a four-inch wall of hollow tile. The space between is filled with insulating material. Diatomaceous earth mixed with Portland cement and water to give a solid heat insulation, is employed to reduce heat loss through he floor. Bowlders used in filling the oven, range in weight fro three to sixty pounds…”***

***Popular Science,*** **February 1936**


**<u>Left</u>: caption: "Electricity Transforms The Home. A kitchen at Mason City, equipped with all electrical conveniences. The drawing shows construction of experimental heat-storage oven to use off-peak current loads for heating in winter. At right, an oven installed for trial in a house at the dam-site village."**

***"…All of this apparatus, including the heat-storage oven in the basement of a selected home, a complete conduit system, and thermostatic controls, is being refined and partly re-designed this winter, as complicated instruments register the relations between current input, cost, thermal output, air con-ditioning, and the score of other factors that must be con-sidered in making leashed 'lightning' serve faithfully the home of tomorrow…"***

***Popular Science*, February 1936**

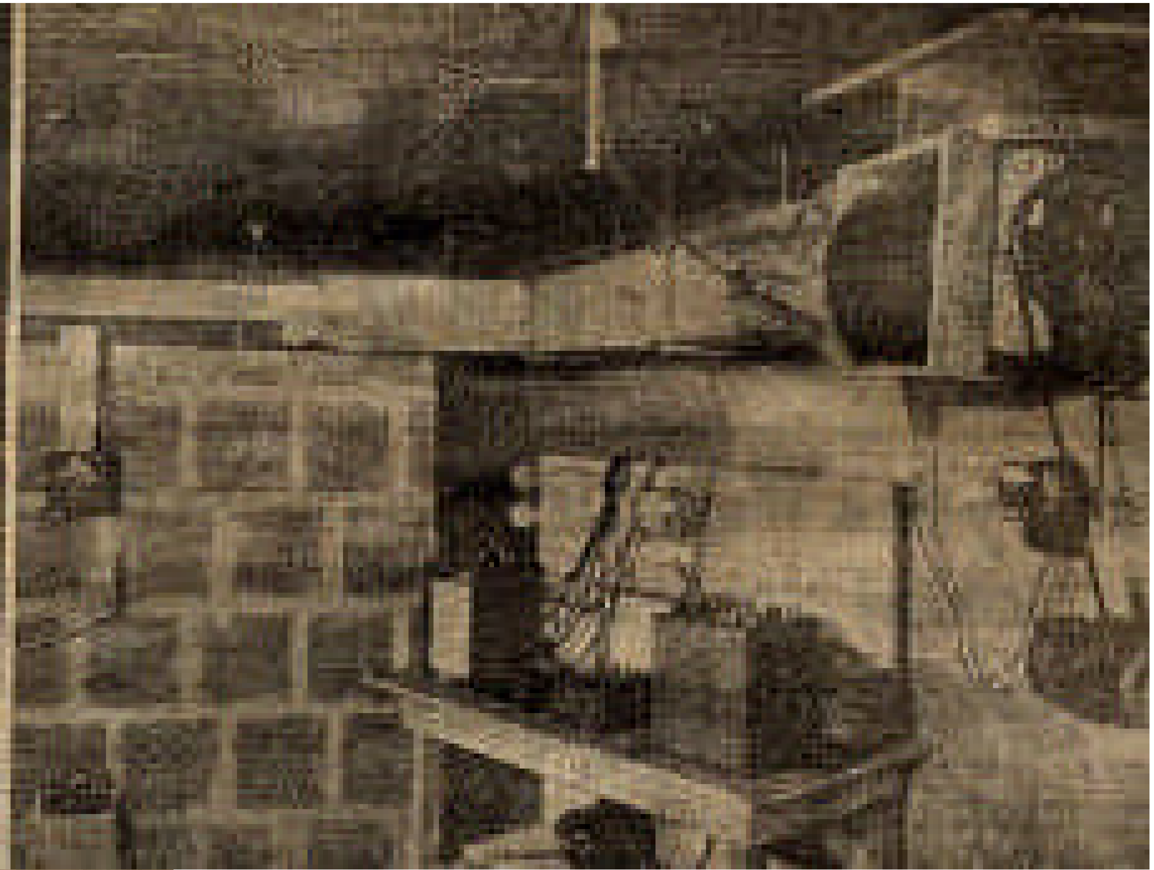
***"…In these homes…special recording equipment will be placed and the house heating units in the test homes will be metered separately from the lighting and other electrical elements. Compartments will be built on rear porches of the homes to house part of the recording equipment and registering devices will be placed at different places in the homes to determine evenness of heat and other details. From tests, which will cover three years estimated for completion of the low dam, Washington State College expects to prove with definite data the practicability or impracticability of house heating by electricity."***

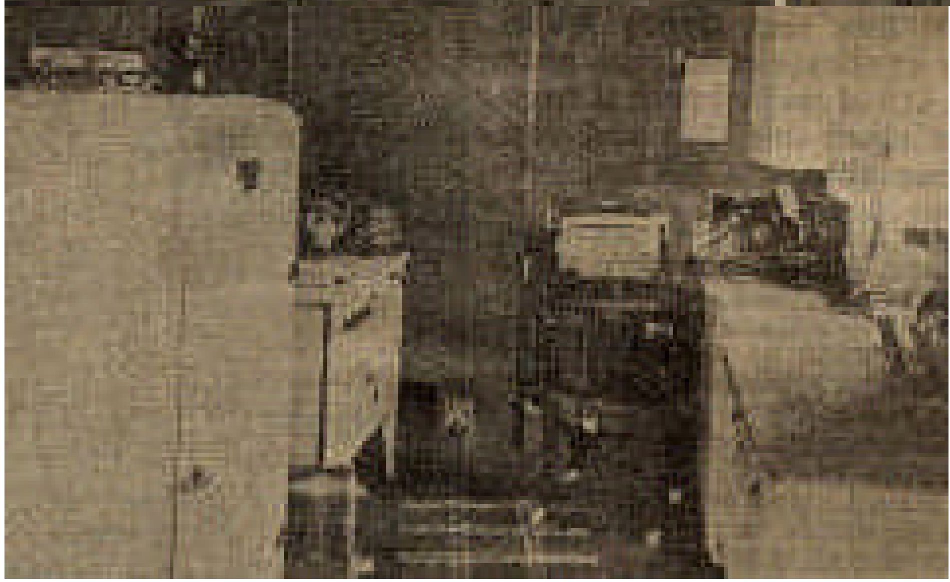
***Spokane Chronicle,* October 11th 1934**

# A Thing of the Future

***"…For the first time since mason City became the world's first all-electric city – the utopia for electric companies and electrical appliance manufacturers – the actual cost per house for heating by electricity was made public. It was revealed yesterday that the average cost per house, this including both three and four-room houses, was $8 per month. This sum is taken as an average for the past two months, the 30-day period just concluded being abnormal in the extent of low temperature. It was estimated that the cost for a year, with light months during the summer, will be from $54 to $55 per year…has proved conclusively that all-electric cities are a thing of the future, the immediate future…"***

***The Wenatchee Daily World,*** **January 28th 1935**





__Above & Left__: caption: "The picture in the upper left corner shows where the family in this model all-electric home at Mason City, MWAK town at the Coulee dam, will spend some of the most enjoyable hours. But the electric furnace and equipment at the upper right are most important in helping to make the living room cozy and comfortable. At left is a view in the all-electric kitchen. The model was recently completed and furnished as an experiment in cooperation with Washington State College (***Spokane Chronicle***, June 3rd 1935)

# Change of Plans

*"Chimneys may be erected in Mason City houses this summer as a result of an increase in electrical power rates in the contract the Washington Water Power Company has offered the Consolidated Builders, contractor for the completion of grand Coulee dam. Electric heat was used exclusively in Mason City by the MWAK Company, which is completing the dam foundation. The only chimneys in the town were those for a range in the mess hall and in homes of a few company officials…"*

***Spokane Chronicle,*** **March 5th 1938**

***"…'We can no longer supply electricity at the price the MWAK Company was paying,' J.E.E. Royer, general manager of the Washington Water Power Company, told the Chronicle today. 'The MWAK contract was made during the worst part of the depression. The contractors were in need of a large quantity of electricity and our company needed the money.'...MWAK paid a flat $10,000 a month guarantee, plus an energy charge of 2½ mills…"***

***Spokane Chronicle,* March 5th 1938**

***"…An increase of 25 percent in the 'demand' charge for electricity used for power and 40 percent in the 'energy' charge for kilowatt hours used for other purposes is provided in the contract offered…Officials of the new contracting firm have not decided whether they will use electric heat if the new power contract is signed. Stoves may be installed or a central heating plant may be used…"***

***Spokane Chronicle,* March 5th 1938**

# For the Ages to Come

***"…There are parts of our culture that stink with phoniness. But we can do some wonderful things too. That dam is one of them. If our generation has anything good to offer history, it's that dam. Why, the thing is going to be completely useful. It's going to be a working pyramid. I just want to help build it…"***

**RE: excerpt from *The Dam***

***“…Man is turning back the Columbia 300,000 years, into the ancient bed where it fretted for an age or two while a glacial dam held it away from the old ‘Big Bend.’ From the Big Bend to which the river returned, he is patiently swerving its course once more, to serve him and his children for ages to come…”***

***Popular Science,*** **February 1936**

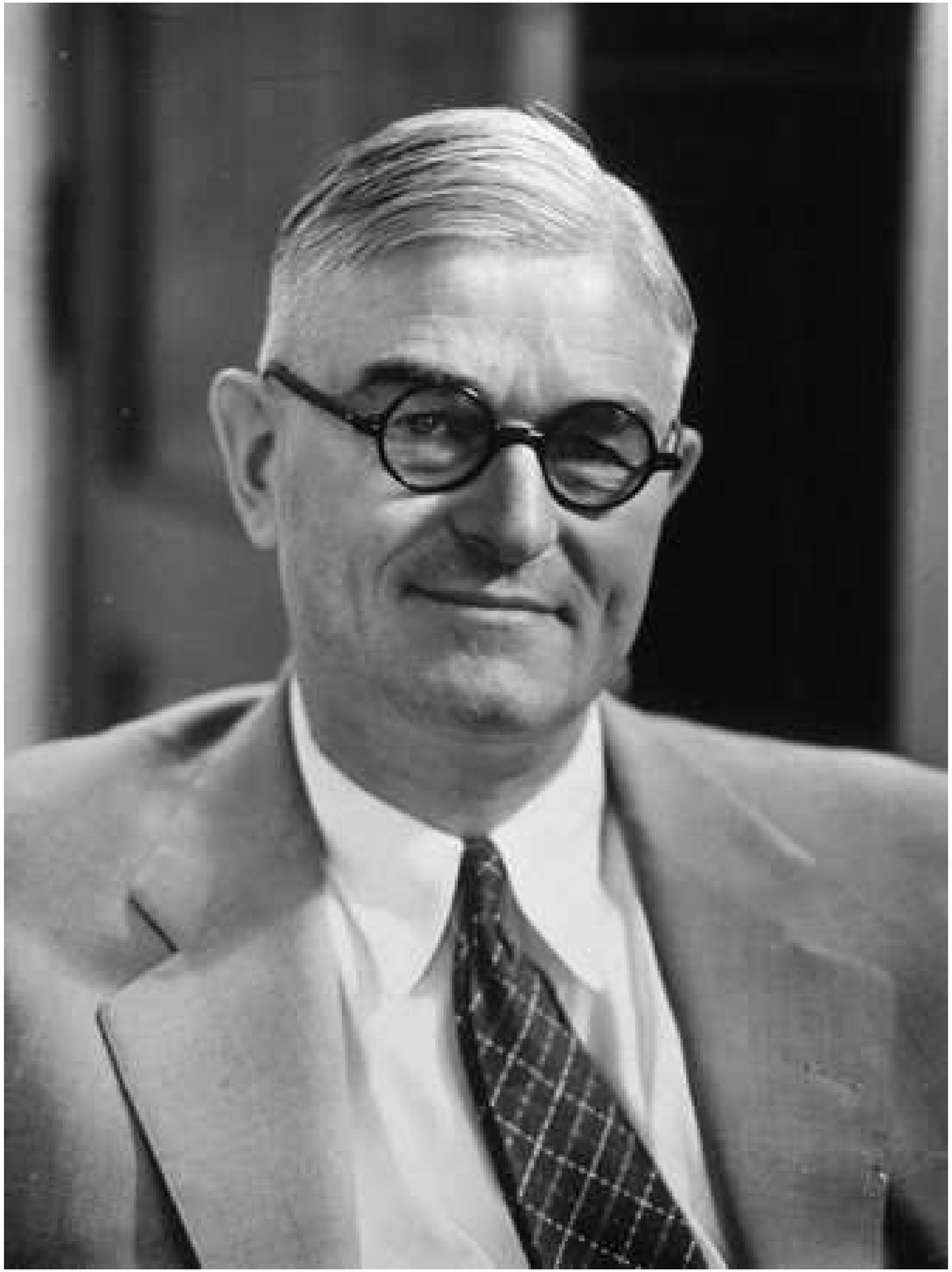
# The Wonder That *Will* Be

***"…For I dipped into the future,***
***far as human eye could see.***
***Saw the vision of the world***
***and all the wonder that would be…"***
***Alfred Lord Tennyson,* Poet**

# Part 14

# The Straight-Gravity Type

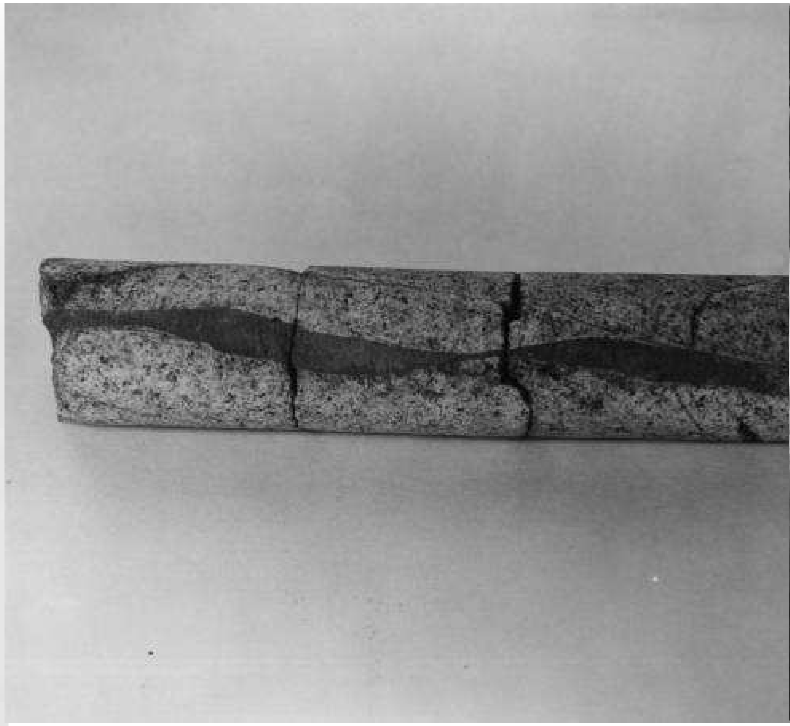
# Design & Supervision



*"…The Grand Coulee Dam was designed, and the Columbia Basin irrigation works are being designed, by the Bureau of Reclamation, United States Department of the Interior. Supervision and inspection of the work are under the direction of Secretary Harold L. Ickes of the Department of the Interior and Commissioner John C. Page of the Bureau of Reclamation, and are carried out by Chief Engineer Raymond F. Walter of the Bureau of Reclamation, with headquarters at Denver, represented by Construction Engineer Frank A. Banks in charge of the field office at Coulee Dam, Washington…"*

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Frank Arthur Banks, Chief Government Engineer of the Construction of Grand Coulee Dam"**



*"…Drilling of holes three feet in diameter into the bedrock of the foundation area is at an end. Eight of the holes were bored. The granite cores are stored for later investigation, if necessary. The deepest hole is down 68-feet. The general run of them were 30-feet. All holes are being filled with concrete…"*

***Spokesman-Review,*** **June 20th 1937**

**Above Left: caption: "Sample core showing seam, January 1945"**

**Above Right: caption: "Dam testing, February 1938"**

**Left: caption: "Drill core sample against white background, January 1945"**

# Construction Contracts

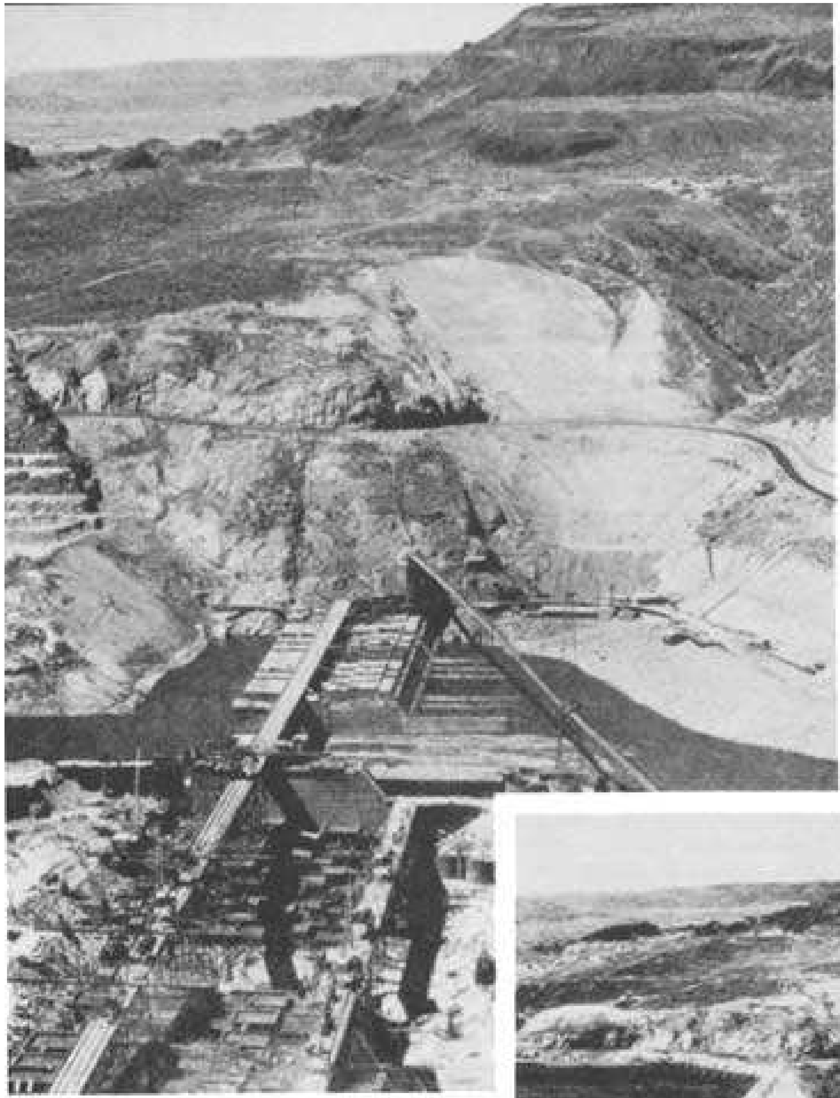
***"…The contractor on the construction of the base of the dam was the Mason-Walsh-Atkinson-Kier Co., made up of the Silas Mason Co. with headquarters in New York, the Walsh Construction Co. of Davenport. Iowa, and the Atkinson-Kier Co. of California, and commonly known as the MWAK Co. The contract for the completion of the dam was let by Secretary Ickes on January 28, 1938, to the Consolidated Builders, Inc. It is composed of the members of the MWAK Co.; the Morrison-Knudsen Co., Boise, Idaho; J.F. Shea Co., San Francisco; McDonald & Kahn, San Francisco; Pacific Bridge Co., San Francisco; Henry I. Kaiser, Oakland, Calif.; and Utah Construction Co., Ogden (the firms included in the Six Companies, which built the Boulder Dam); and the General Construction Co., Seattle, which built the Owyhee Dam…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Design Overview

***"…The Grand Coulee Dam is of the straight-gravity type, depending entirely upon the weight of the structure to resist the pressure of water behind it, tending to overturn it or to cause it to slide on its base. The river canyon is too wide for a dam of the arch type. At each side of the 1,650-foot centrally located spillway section, which is surmounted by control gates spanned by concrete arch bridges, will be a powerhouse and abutment section, each more than a thousand feet long. The finished dam will be 4,300-feet long at the crest and about 3,000-feet long at the base. The base is 500-feet wide, and covers about 30 acres. The dam will be 30-feet thick at the crust, and will be surmounted by a 30-foot highway. From lowest bedrock, the height will be 550-feet to the crown of the roadway; and the water surface above the dam will be raised about 355-feet above low water-level. Galleries in the dam for inspection, gate control, cooling, grouting, drainage, and other purposes will have a combined length of about 8 miles…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**



<u>Left T&B</u>: caption: "Top, left: Activity at the Grand Coulee Dam was at its peak in the summer of 1937 with more than 7,000 men at work. The base of the dam was nearing completion when the above view, looking west into the Grand Coulee, was taken. Bottom, right: The finished dam as it will appear from the same view-point."

# Elevations

***"…The river bed at the side of the Grand Coulee Dam is approximately 910-feet above sea level. The low-water elevation in the river is about 933-feet, and the average high-water level about 978. Bedrock, under a deposit of clay and boulders forming the river bed, was found generally at about elevation 875, but three deep gorges, one extending to elevation 761.5, were found. The general elevation of the floor of the Grand Coulee is about 1,500, and the walls of the coulee about 2,300-feet above sea level. The lands to be irrigated vary in elevation from about 1,300 near Ephrata to 400-feet near Pasco. The top of the dam will be at elevation 1,311.08, and the parapet at elevation 1,315. The crest of the concrete in the spillway will be at elevation 1,260, and the tops of the control gates at 1,288…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# It is Spectacular

***"The trail of the dark-gray, lava-thick concrete, from where its various parts are first gathered to where it finds its final resting place in a dam is always a colorful one, but at Grand Coulee, where the MWAK Company plans to install equipment second to none, it is spectacular…"***

***The Wenatchee Daily World,* June 25$^{th}$ 1935**

***“…Plans for the construction of the two mixing plants, methods of transportation and other items were revealed for the first time today…Included in the set-up are such big items as these: a 3,500-foot long suspension bridge with two towers looming about 300-feet into the air weighing 66 tons; 10 cement silos of 5,000 barrels each, ten 10-ton diesel-electric locomotives, two big five-story mixing plants with four-yard mixers each, two steel trestles on each side of the river 1,500-feet long, weighing in steel 9,100 tons, and eight giant whirleys and hammerhead cranes. A 36-inch conveyor will carry the various grades of sand and gravel from the storage bins (near the ball park) to the east mixing plant and via a huge suspension bridge to the west side plant, to be located a few feet downstream from the axis of the dam…”***

***The Wenatchee Daily World,*** **June 25th 1935**

***"…The east and west side mixing plants will be similar in size, octagonal in shape, 100-feet high and 44-feet wide across the octagon. The structures will be of steel – 200 tons of it in each. The conveyor will dump its aggregate load into a rotating spout located in the top of the plant and deposit each of the several grades of material into the proper storage bins. The material is then drawn from the bottom of the bins into seven automatic weight-batchers for four grades of gravel, one of sand and two of cement. A separate batcher is provided for water…"***

***The Wenatchee Daily World*, June 25th 1935**

***"…The operator starts the weighing cycle by the shifting of a master lever, opening the filling gates. When a predetermined weight is reached each gate closes automatically. From there it is dropped by a revolving spout into any one of the four 4-yard mixers…The mixers dump the concrete into a hopper and the hopper into 4-yard containers located on a flat-car, pulled by a diesel-electric locomotive. It is taken on trestles to the area where the concrete is to be placed and lowered in four-yard buckets by whirleys (the same as used in the cofferdam building) and hammerhead cranes…"***

***The Wenatchee Daily World,*** **June 25th 1935**

***"…The plant has a working capacity of 640 yards per hour. Figuring a 500 hour month it will be able to manufacture 320,000 cubic yards per month – a huge total…"***

***The Wenatchee Daily World,* June 25th 1935**

***"…On the top of the hill, near Grand Coulee, will be built ten 5,000 barrel silos, eight of them for the various blends manufactured by different companies and two for blending the products from the eight other silos. A screw conveyor, with cross connections to the eight silos will mix the different company grades and take it to the two storage silos. From there it will be pumped by air into an 11-inch pipeline, with a pressure of 100 pounds, to both the west side plant and over the suspension bridge to the east plant. The cement set-up is capable of handling 600 barrels per hour…"***

***The Wenatchee Daily World,* June 25th 1935**

***"…Portable pumps will be used to unload the railroad cars, in which the cement is shipped in bulk. The whole arrangement is said to be the most advanced yet perfected by the construction world."***

***The Wenatchee Daily World,*** **June 25th 1935**

**Left: caption: "Portable pump used for unloading cement shipments directly from railcars"**

# Machine Made

***“You press a button and build a dam! That was the impression of a layman after spending a day in the labyrinth of construction operations at Grand Coulee dam site where the world’s largest water control structure is under way…”***

***Spokane Chronicle,*** **May 25th 1936**

***"…Grand Coulee dam will machine-made. Man is an important factor in the vast operations in the wide canyon of the Columbia, but construction engineers are agreed that man alone could never build the dam. Without modern machinery, they say, man would be helpless in the face of tremendous natural obstacles which must be overcome…"***

***Spokane Chronicle,* May 25th 1936**

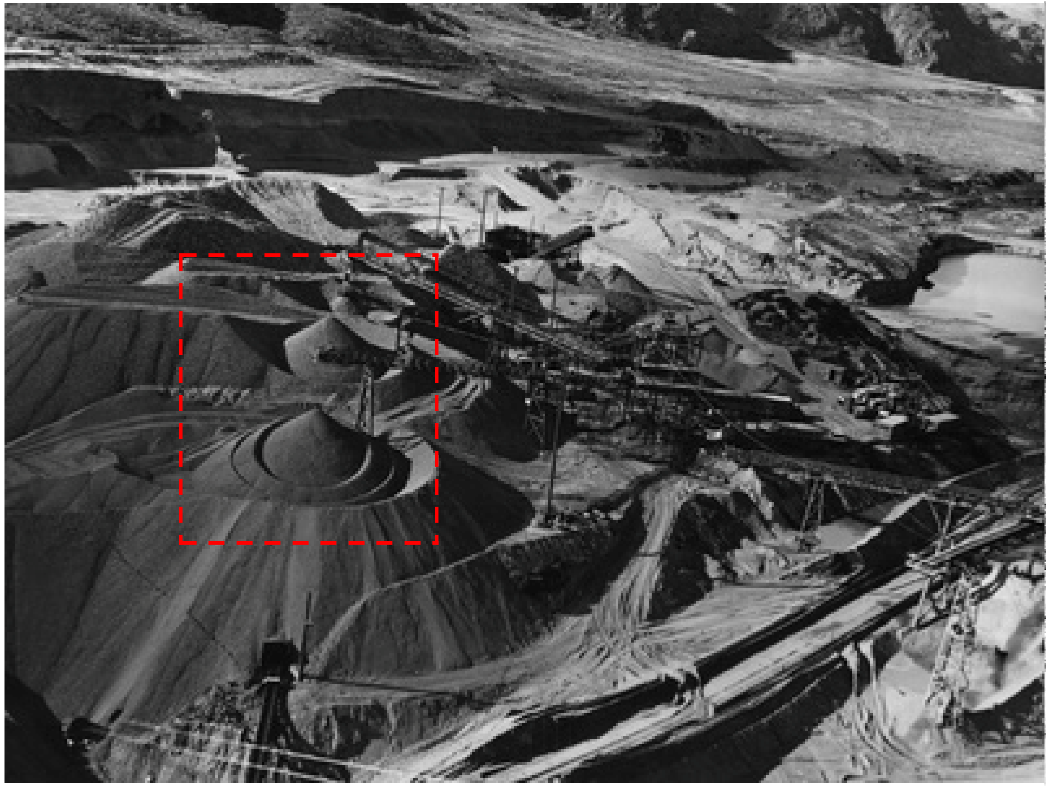
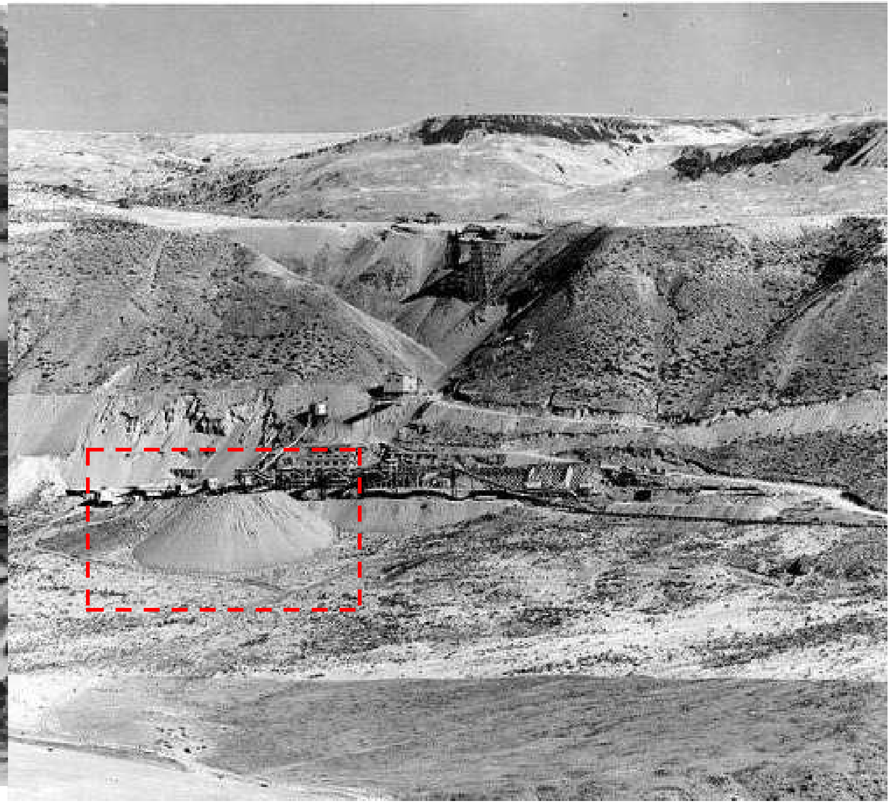
***"…In other days and on other dams, cement delivers in bags was mixed by hand with aggregate hauled by teams, and the resulting concrete was placed in a foundation area dug out with pick and shovel. At Grand Coulee, the cement arrives in boxcars; is mixed by the most modern of machinery with aggregate delivered by great shovels and conveyor belts, and the resulting concrete is placed in a foundation area carved out by Titanic engines whose source of power is a waterfall a hundred miles away…"***

***Spokane Chronicle,*** **May 25th 1936**

# Concrete Aggregate

***"…Sand and gravel are obtained from a pit furnished by the Government and operated by the contractor, a mile and a half below the dam site on the east side of the river and 800 to 1,000-feet above it. Pit-run material is delivered by electric shovels, through grizzlies which reject boulders too large to be handled on a belt, to an extensible system of belt conveyors by which material can be transported from any part of the pit to a raw stock pile above the processing plant. The washed gravel, separated into four size ranges, 6 to 3-inches, 3 to 1-1/2-inches, 1-1/2 to ¾-inches, and 3/4 to 3/16 inches, and the sand, ranging in particle size from 100-mesh to 3/16-inch, are stored in separate piles below the plant, and moved as required over a 48-inch belt conveyor to stock piles near the east end of the dam 5,965-feet away. The aggregate required at the west side mixing plant was transported across the river on a 36-inch convey or carried, during the constructing of the base of the dam, by a suspension bridge about 4,000-feet long. The pit contains a large excess of sand, and about 50 percent of the material excavated is rejected. In furnishing aggregate for the contract for the base of the dam, about 3 million yards of sand went to waste. On the completed dam, the excess sand to be handled will exceed 10 million yards…."***

***Popular Mechanics,* April 1940**

# Nature Was Kind

***"…As cement is needed in the giant concrete mixing plants, the 'houses of magic,' an operator in either of the towers manipulates a gadget and immediately a blast of air starts the desired cement through large tubes leading from the silos to the mixing plant. Nature was kind to the Grand Coulee in that it placed a mound of sand and gravel within a mile of the dam site. The usual thing is for sand and gravel to be dug from a pit. At Grand Coulee the top of a hill is shoved aside, to be carried by gravity to the very door of a gravel washing plant. One power shovel and a short length of conveyor belt serve to start the gravel down the hill…"***

***Spokane Chronicle,* May 25th 1936**

***"…Sand and gravel are secured from a deposit more than a mile away and 20,000 gallons of water per minute are used to wash the materials clean. Two thousand to twenty-seven hundred tons of these aggregates are transported to the dam every waking hour over a system of conveyor belts. The largest of these, an endless band of cotton and rubber two miles long, weighs eighty tons…"***

***Popular Mechanics,* April 1940**

***"…Automatic machinery in the washer plant gives the sand and gravel a bath, separates out three grades of gravel and three grades of sand, blends the latter into a single mixture and piles the various items in stock piles. An excess of sand is shoved out on a growing tailings pile. The washing is done by jets of water under high pressure which remove clay and dust…"***

***Spokane Chronicle,*** **May 25th 1936**

# Million-Dollar Investment

***“Water, water everywhere – that’s the sight that meets the eye of visitors in one of the world’s largest screening and washing plants – the million-dollar MWAK investment…”***

***The Wenatchee Daily World,* October 12th 1935**

***"…Nozzles spout here and nozzles spout there, water is churned by one awe-inspiring machine, then by another, top floor, bottom floor, inside, outside, water, water everywhere, 20,000 gallons of it a minute. Cut down into seconds, the maximum flow through the plant will be about 333 gallons or about 700 ordinary house-buckets full every time the watch ticks. Or, raised into hours, one million two hundred thousand gallons, equaling 28,000,000 gallons per 24-hour day…"***

***The Wenatchee Daily World*, October 12th 1935**

# Washing the Water

***"…The heavy flow is required to pass the sand through the screens and also to wash the gravel and sand from its rough form as found in the high Brett pit into three grades of sand and four of gravel. Two big pumps, built on a wooden pile trestle extending several hundred feet into the Columbia river, along the road to Nespelem, each are capable of discharging 2,500 gallons per minute, boosting the water 670-feet to the storage tank near the screening plant. However, through a system of clarifiers, about 80 percent of the water pumped can be used over again, saving considerable expense in pumping. After the water leaves the screening plant it travels to two big clarifying tanks where two churn-like mechanisms scrape the sludge toward the middle, where three pumps take it out. The water is then used over and over again for screening. The water carried out by moist sand and gravel is replaced by the river pumping plant…"***

***The Wenatchee Daily World*, October 12th 1935**

*“…The gravels are separated by a series of gigantic shakers. The sand is put through the equivalent of a cream separator. The sand is rotated in a bath of water, the coarse grade gravitating to one outlet, the medium to another and the fine to a third. Pumping of millions of gallons of water 690-feet upward from the river to the washer plant is an expensive item. The cost is reduced in part by ‘washing the water’ in two large settling tanks. The partially clarified water is used over and over…”*

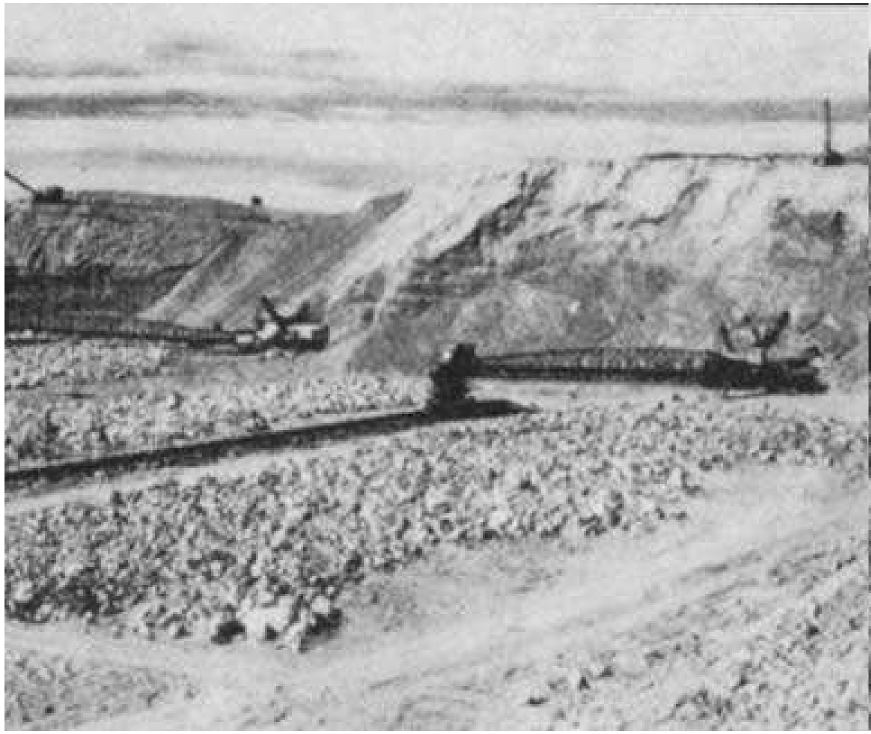
***Spokane Chronicle,*** **May 25th 1936**

***"…Ironically, the old Columbia itself furnishes the water needed for the concrete block which some day will disturb its natural course from mountain to sea."***

***The Wenatchee Daily World,* October 12th 1935**

***"…The gravel and sand stock piles are above a tunnel in which a conveyor belt operates. Four thousand feet away – back of the ball park in Mason City – stands an operator who, by pressing a button, causes sand or gravel to fall away from a given stock pile onto the conveyor belt to be whisked to a second stock pile…"***

***Spokane Chronicle,*** **May 25th 1936**



**<u>Top Left</u>: caption: "Electric shovels and belt conveyors move 25,000 yards of pit-run sand and gravel in a day"**
**<u>Top Right</u>: caption: "A conveyor 5,965-feet long carries washed sand and gravel from screening plant to stock piles at the dam"**
**<u>Left</u>: caption: "East side aggregate conveyor (June 1935)"**

# Almost Automatic

***"…It's all very vast; too vast for the layman to grasp in all its many details, and, yet, the methods of control are relatively simple. A few men at key points supervise the operations of thousands of men and hundreds of mechanical giants. These key men seem to be human beings without nerves, whose powers of concentration are developed to a surprising degree and whose reactions in emergencies are almost automatic…"***
***Spokane Chronicle,*** **May 25th 1936**

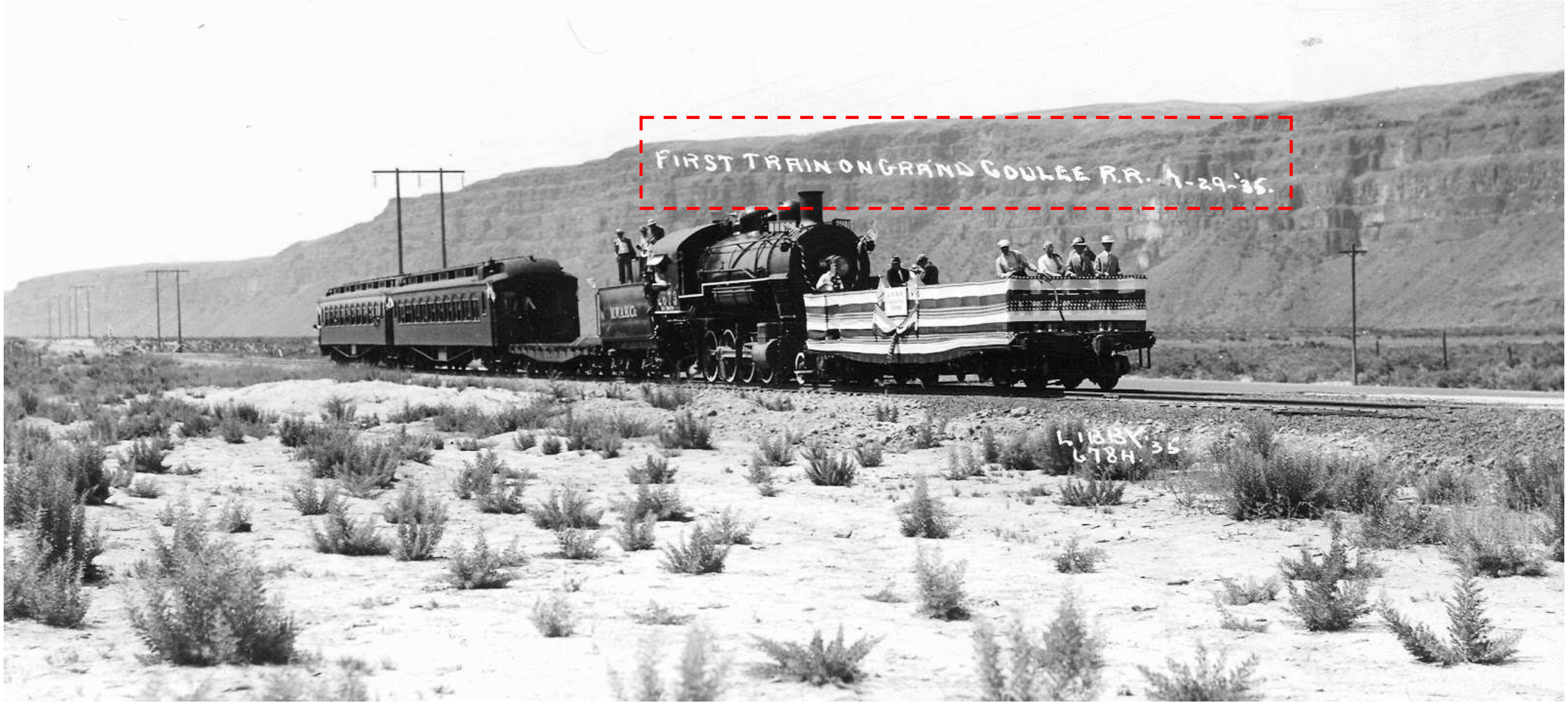
***"…To the layman, among the most phenomenal humans at the dam site are the operators of the huge power shovels and cranes. These men use both hands an both feet to operate a multiplicity of levers – the brain centers of their giant steeds. Errors of a fraction of a second in human reactions might result in the wrecking of machinery and the taking of lives. Throughout the vast workings, there are other equally vers-atile humans who do things and equally spectacular, but they are far from the public's gaze…"***

***Spokane Chronicle,*** **May 25th 1936**

# Push Button Specialists

***"…Construction operations in connection with the building of the dam are scattered widely over the continent. Steel and other metals come from the eastern states, belting from the middle west, cement and lumber from Washington mills and lesser items from almost every state. To assemble all this material as it is needed is a matter of 'pushing button; specialists. The telephone and telegraph lines are busy every day in the week directing the movement of supplies to the dam site…"***

***Spokane Chronicle,* May 25th 1936**




***"…These goods arrive at the dam site by truck and railway car, over a special highway and a special railroad each 30 miles long. No hand touches the vast quantities of cement which arrive daily in railway box-cars. A giant vacuum cleaner sucks the cement from the cars, sending it through pneumatic tubes to great steel storage tanks which greet the visitor from the left-hand side of the highway a short distance toward the dam site from the town of Grand Coulee…"***

***Spokane Chronicle,* May 25th 1936**



**<u>Above</u>: caption: "First train on Grand Coulee R.R. , 1-29-35"**

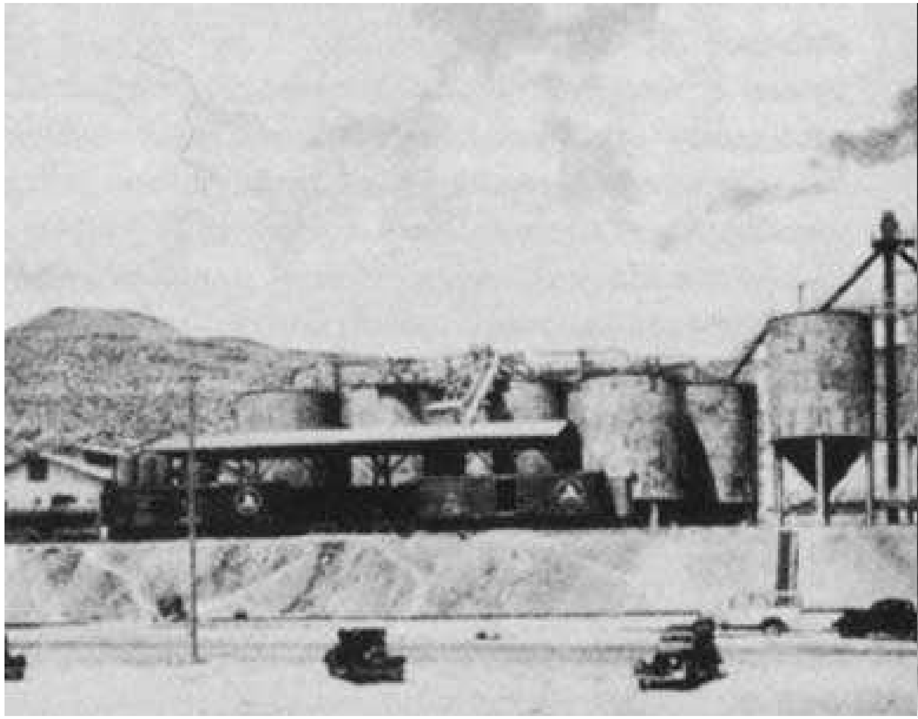
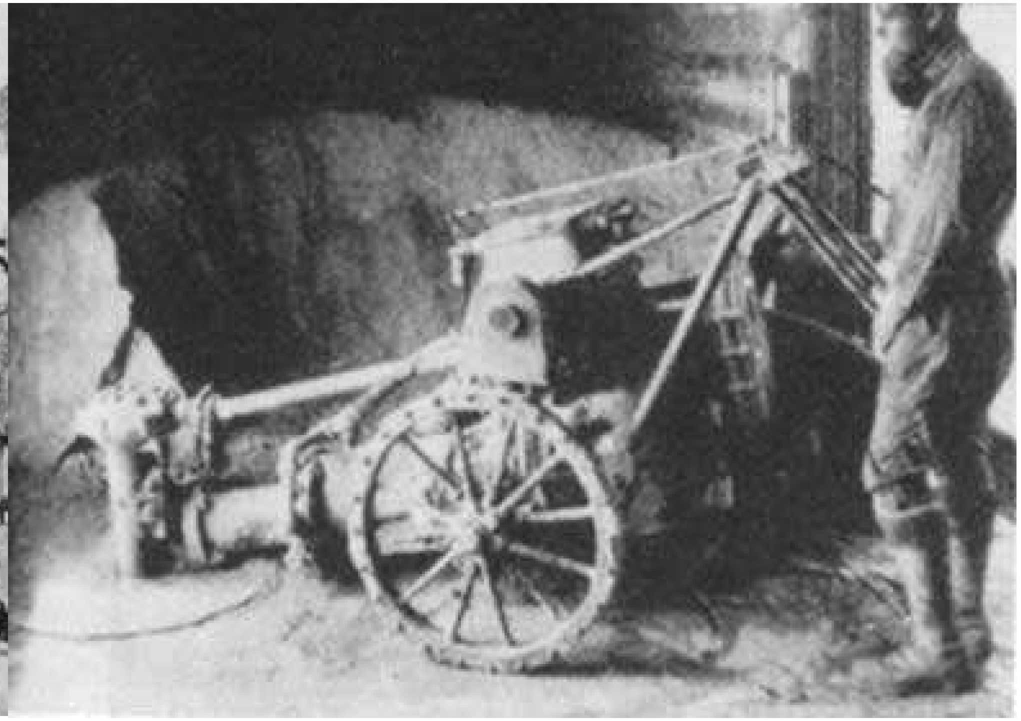
***"…To the layman, cement is a heavy, gray rock flour which gets hard when mixed with water. To the dam builder, cement is as varied as are the different types of flour used by the housewife in her kitchen. Some types of cement are designed for one purpose, and some for another. The different types received at Grand Coulee are stored in separate silos. Just as the housewife blends various types of flour, so, too, the dam builders blend the various cements. This is done in special silos…"***

***Spokane Chronicle,* May 25th 1936**

# Cement

***"…About 12 million barrels of cement will be used at the dam, a total of nearly 4 billion pounds or about 48,000 carloads. The daily use has exceeded 60 carloads, and a total of about 960 trainloads will be required. The making of the cement will require the quarrying, crushing, and grinding to a fineness exceeding that of flour, of about 3 million tons of limestone, and the consumption of enormous quantities of power, supplies, refractories, and fuel. The cement, ground into particles less than one four-hundredth of an inch in size, will expose a surface of over 150,000 square miles, an area more than three times that of the State of Pennsylvania…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

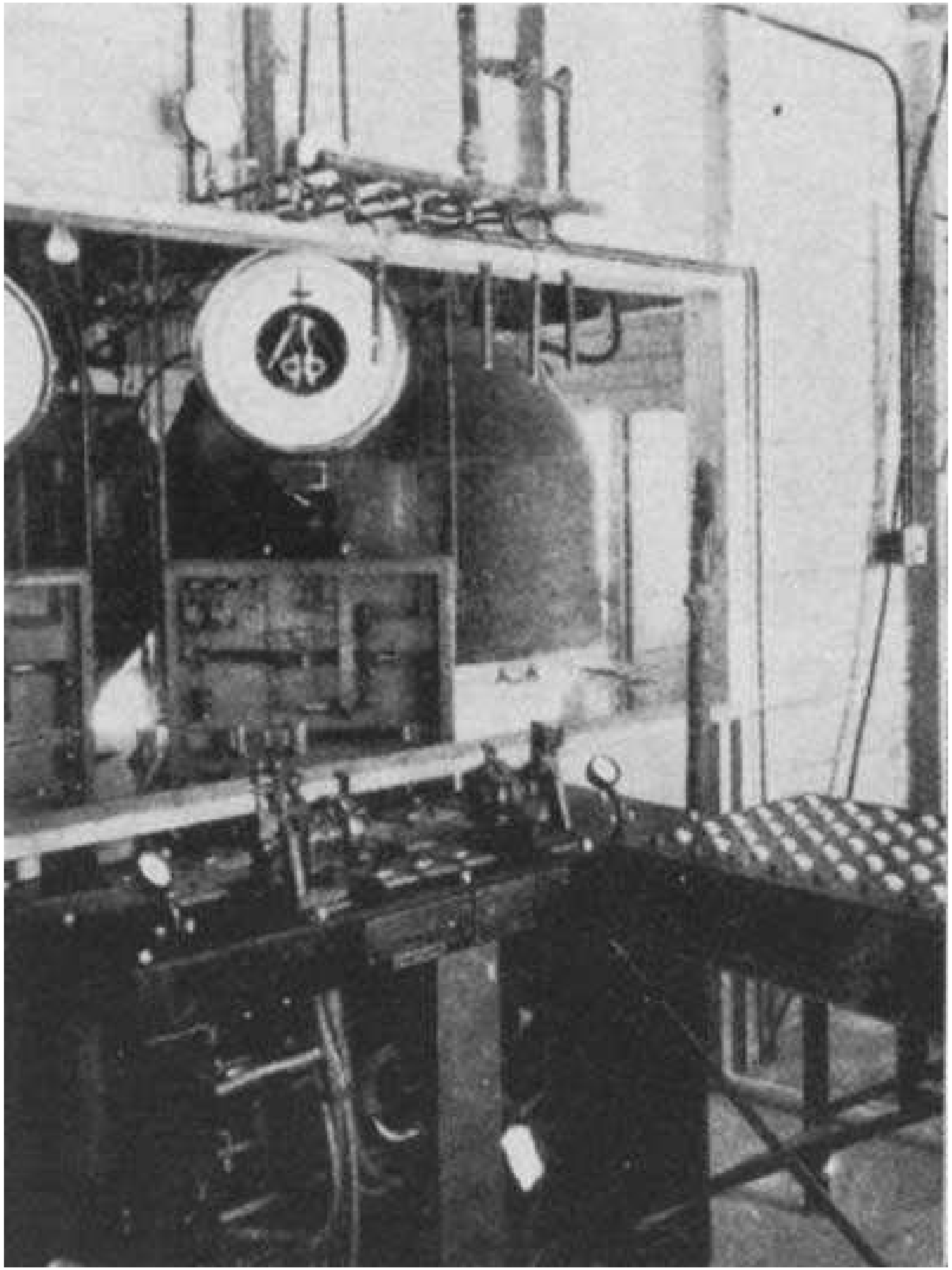
 

***"…Cement, purchased by the Government, is shipped in bulk in boxcars from five cement plants in Washington, unloaded through hose and pipe lines by means of cement pumps, stored in 11 steel silos with a total capacity of 55,000 barrels, and blended for uniformity in color and other characteristics before being used. Mixed with air under pressure, it is transported from the blending silos through an 11-inch pipe to the concrete mixing plant 6,200-feet from the blending silos. During the construction of the base of the dam, the cement pipe line crossed the river an a suspension bridge which also carried the belt conveyor supplying sand and gravel to the west mixing plant. …"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "'Modified' cement of five brands, blended here, is pumped by compressed air through a 6,200-foot pipe line to the concrete mixing plant"**

**Right: caption: "Bulk cement unloaded from boxcars by a machine that blows it through hose and pipe - as much as 60 cars a day"**

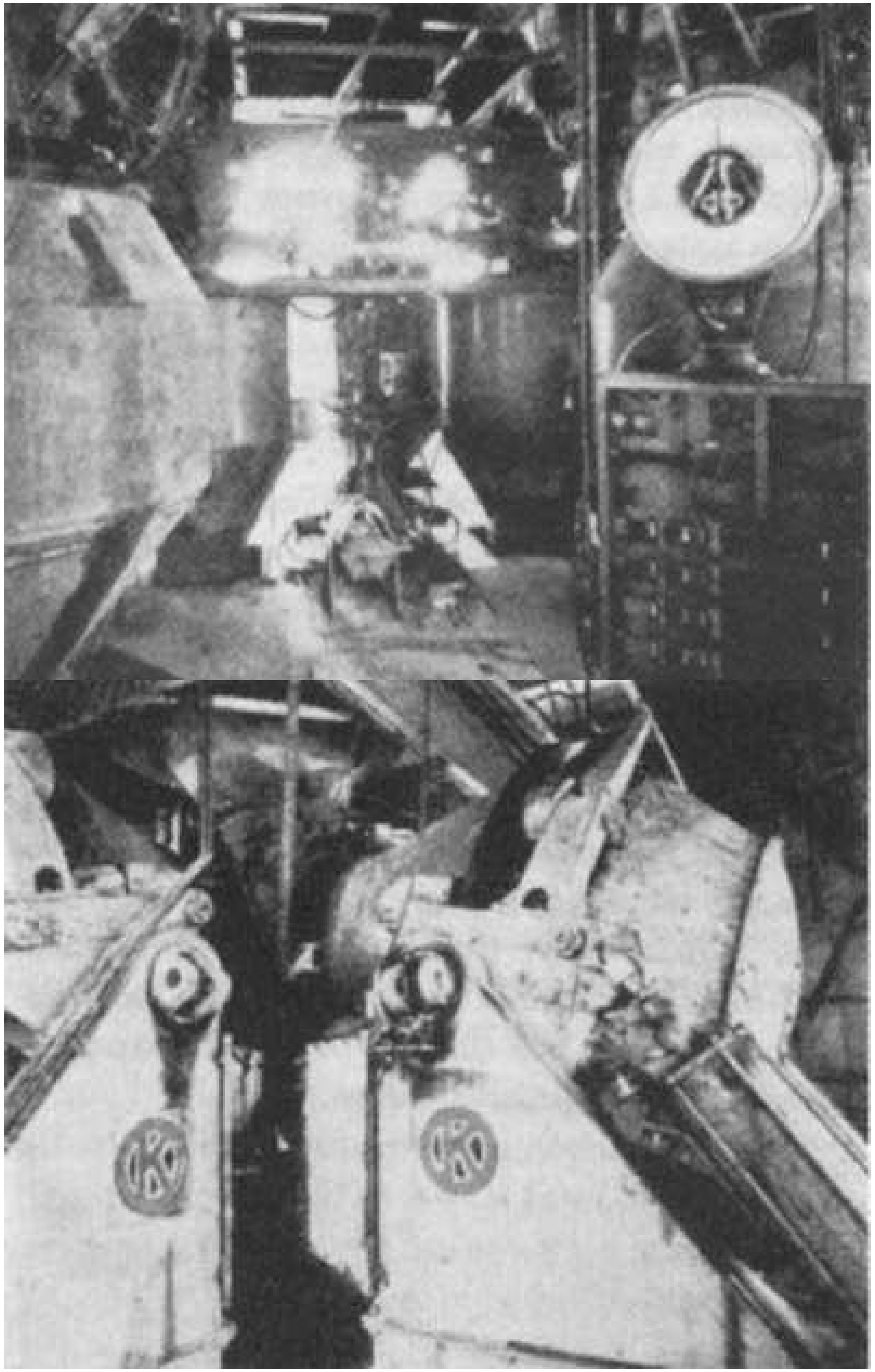


*"…Sixty to one-hundred box-cars of bulk cement arrive at the dam every day. From the storage silos this cement is blown at a speed of 100 miles per hour through a fourteen-inch pipe to the mixing plants a mile and a quarter away. The two mixing plants each contain four four-yard mixers. These are controlled by push buttons at a central office…"*

***Popular Mechanics,* April 1940**

**Left: caption: "Operating bench (left), lamp signal table (right), and graphic recorder for the one-man control of the concrete mixing plant"**

# Concrete Mixes



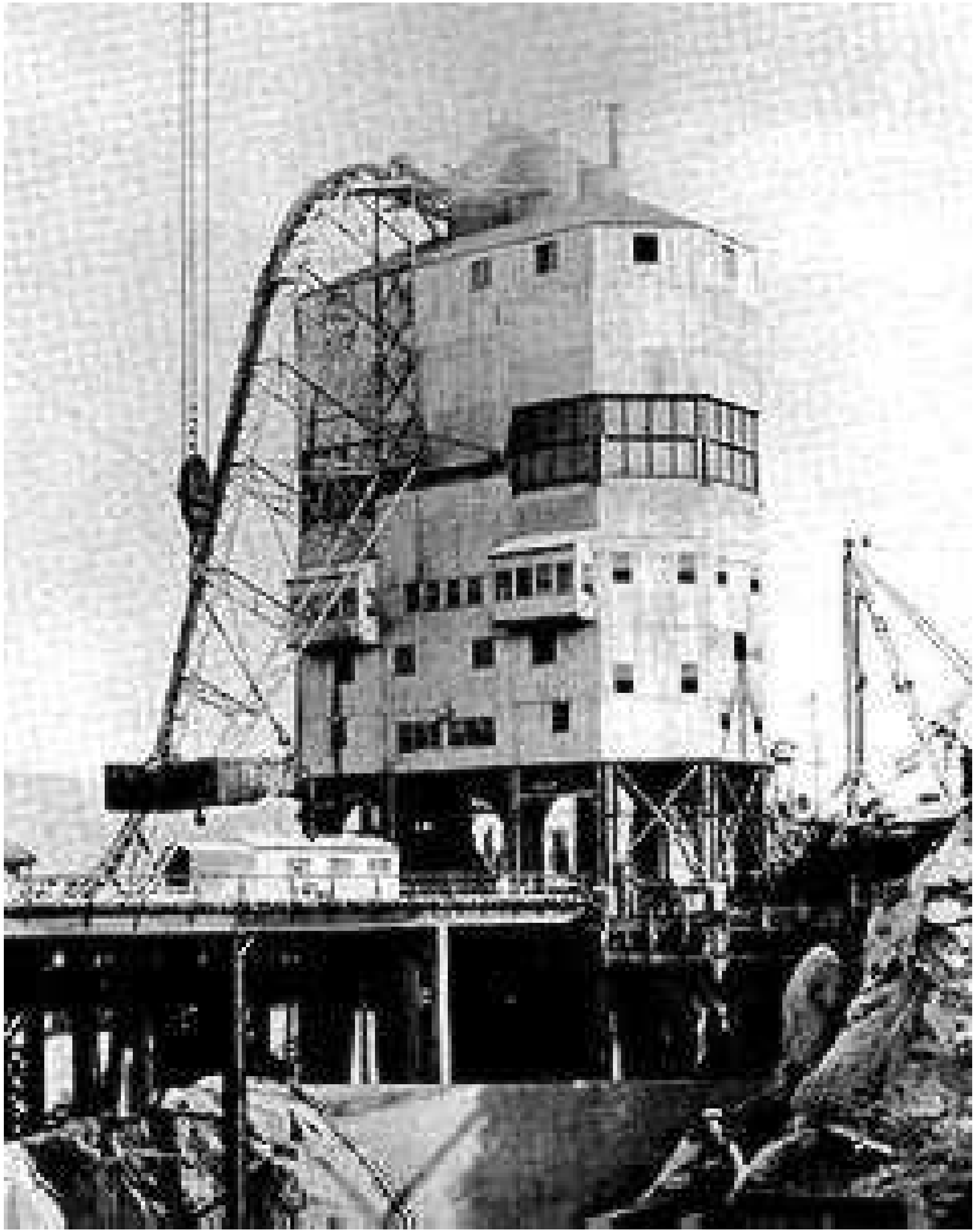
***"…The job of greatest magnitude an the Grand Coulee Dam is that of making and placing concrete - 20 million tons of it. To serve various purposes and to suit a variety of conditions, mixes of two classes are used: Class A, maximum size aggregate 3/4, 1-1/2, or 3-inch depending upon position; water-cement ratio 0.90 by volume; strength 3,000 pounds per square inch at 28 days. Class B, mass concrete for interior of dam and toe; maximum size of aggregate 6-inch; minimum cement content 1 barrel per cubic yard; maximum water-cement ratio 1.00 by volume; strength 2,800 pounds per square inch at 28 days…."***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**<u>Top</u>: caption: "Cement, water, and aggregate for different concrete mixes are weighed out automatically by multi-beam scales"**

**<u>Bottom</u>: caption: "Four massive mixers receive their 4-yard charges, mix them, and dump them by remote control"**

# Concrete Mixing Plants

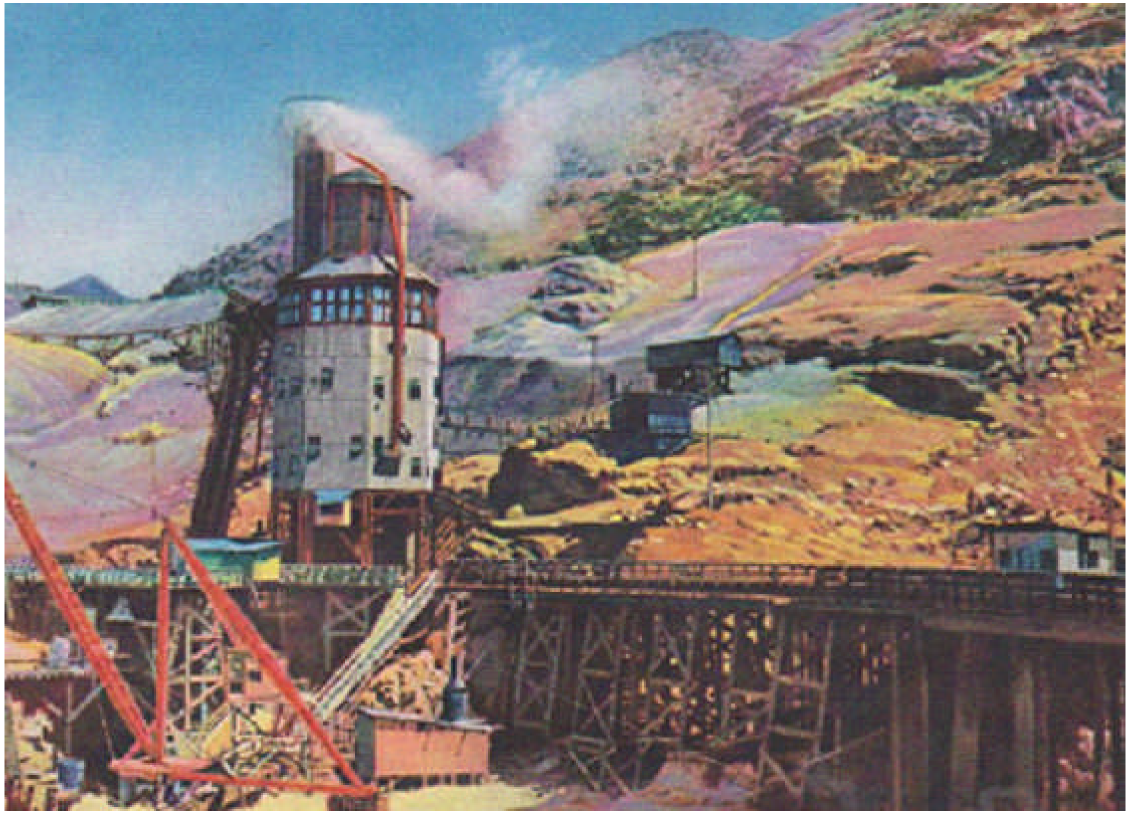


***"…Concrete is mixed in two plants, octagonal tower-like structures 44-feet wide and more than 100-feet high, one originally located an each side of the river. At the top of each plant are two bins for cement, one for sand, and one for each of the four sizes of gravel used. By means of electrically operated devices, under push-button control by one operator, water, cement, sand, and gravel of each size, in quantities appropriate to the mix required, are automatically weighed out for each batch and delivered to one of four 4-yard mixers in each plant, graphic records of all components and the consistency of each batch being automatically recorded…."***

***U.S. Bureau of Reclamation* (ca. 1937)**

**Left: caption: "Giant concrete factory, capable of turning out enough concrete in one month to build a two-lane highway more than 250 miles long"**

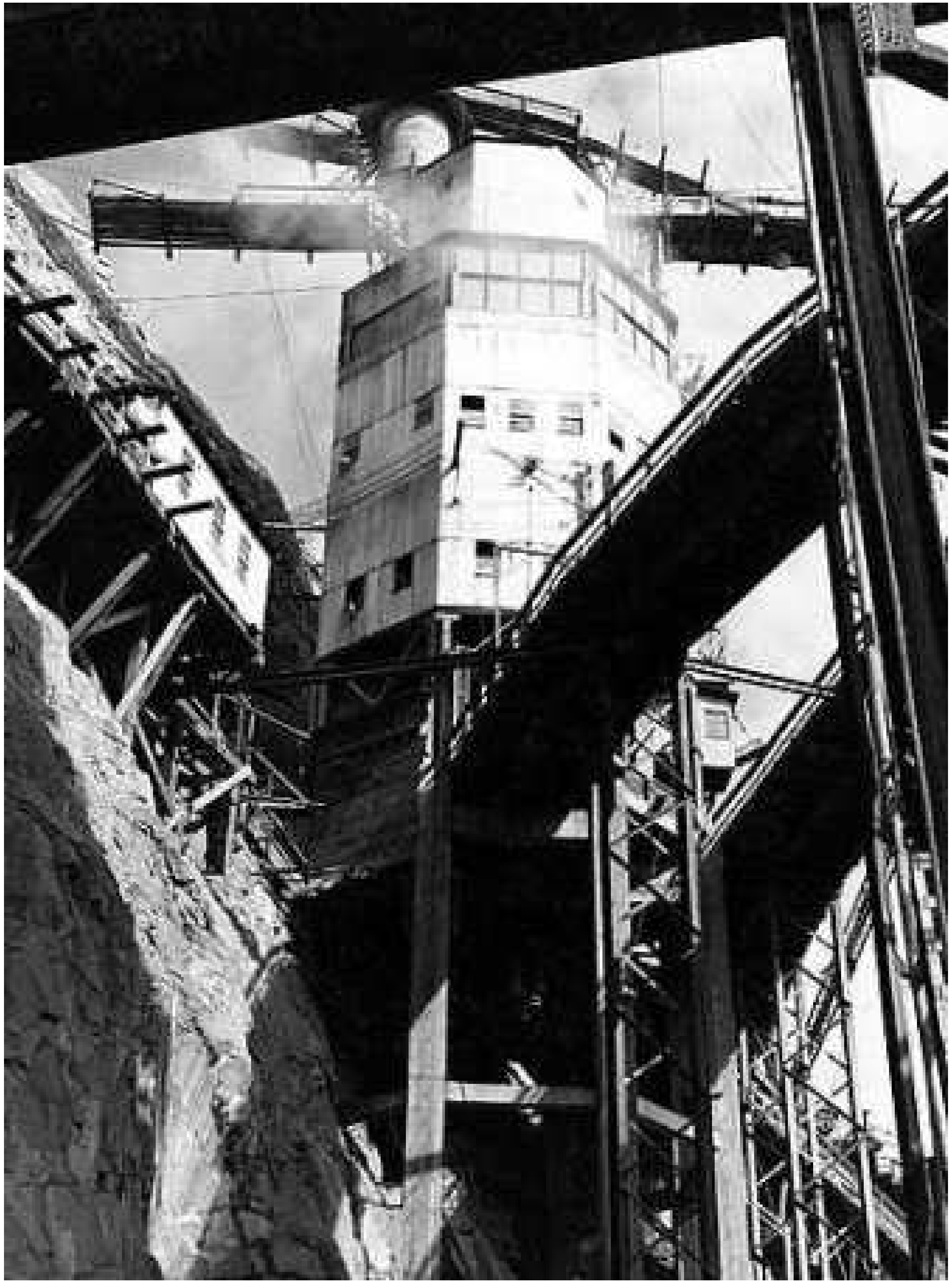
# Houses of Magic



***"…Today the nerve centers of the dam are in the two roaring, vibrating 'houses of magic' where the concrete that goes into the dam is mixed. Into these houses pour endless streams of aggregates every hour of the night and day. Between them, 'Eastmix' and 'Westmix' digest 15,000 barrels of cement, 21,750 tons of sand and gravel, and 360,000 gallons of water every day. On an average, 15,000 cubic yards of concrete are mixed and placed in a twenty-four-hour period…With both mixing plants in operation, a cubic yard of concrete is added to the dam every five and one-half seconds…"***

***Popular Mechanics,*** **April 1938**

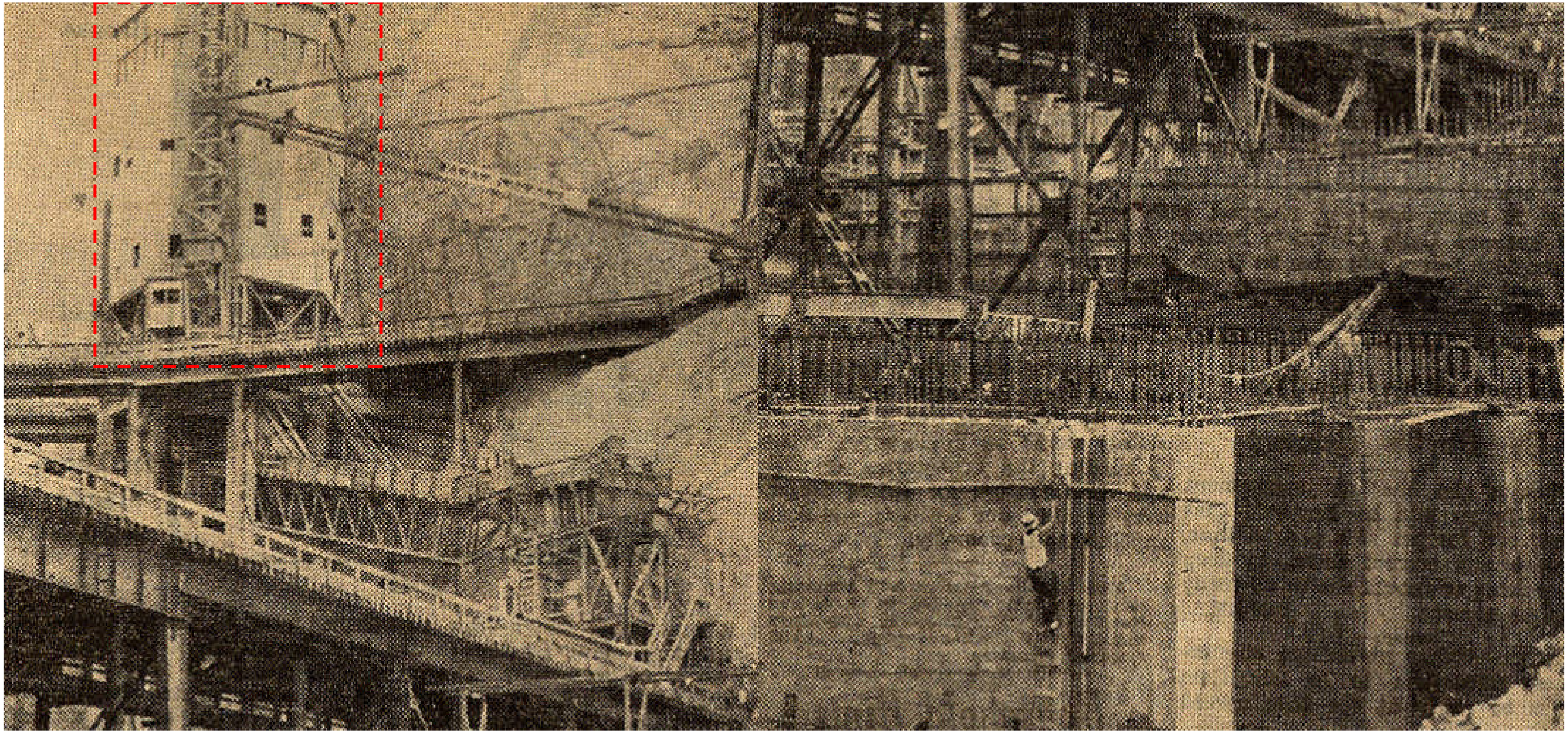
**Above: caption: "East side mixing plant. At top are sand and gravel bins, below the hoppers are four concrete mixers, all controlled from one central point"**



***"…In the house of magic, the concrete mixing plants at either end of the dam site, are other operators who in turn cause sand and gravel to flow to their institutions over special conveyor belts. Manipulate a little gadget, and the sand and gravel falls from the bottom of the pile onto a moving belt to be rushed off to the waiting bin in the mixer plant…"***

***Spokane Chronicle,*** **May 25th 1936**

**Left: caption: "Concrete Mixing Plant"**



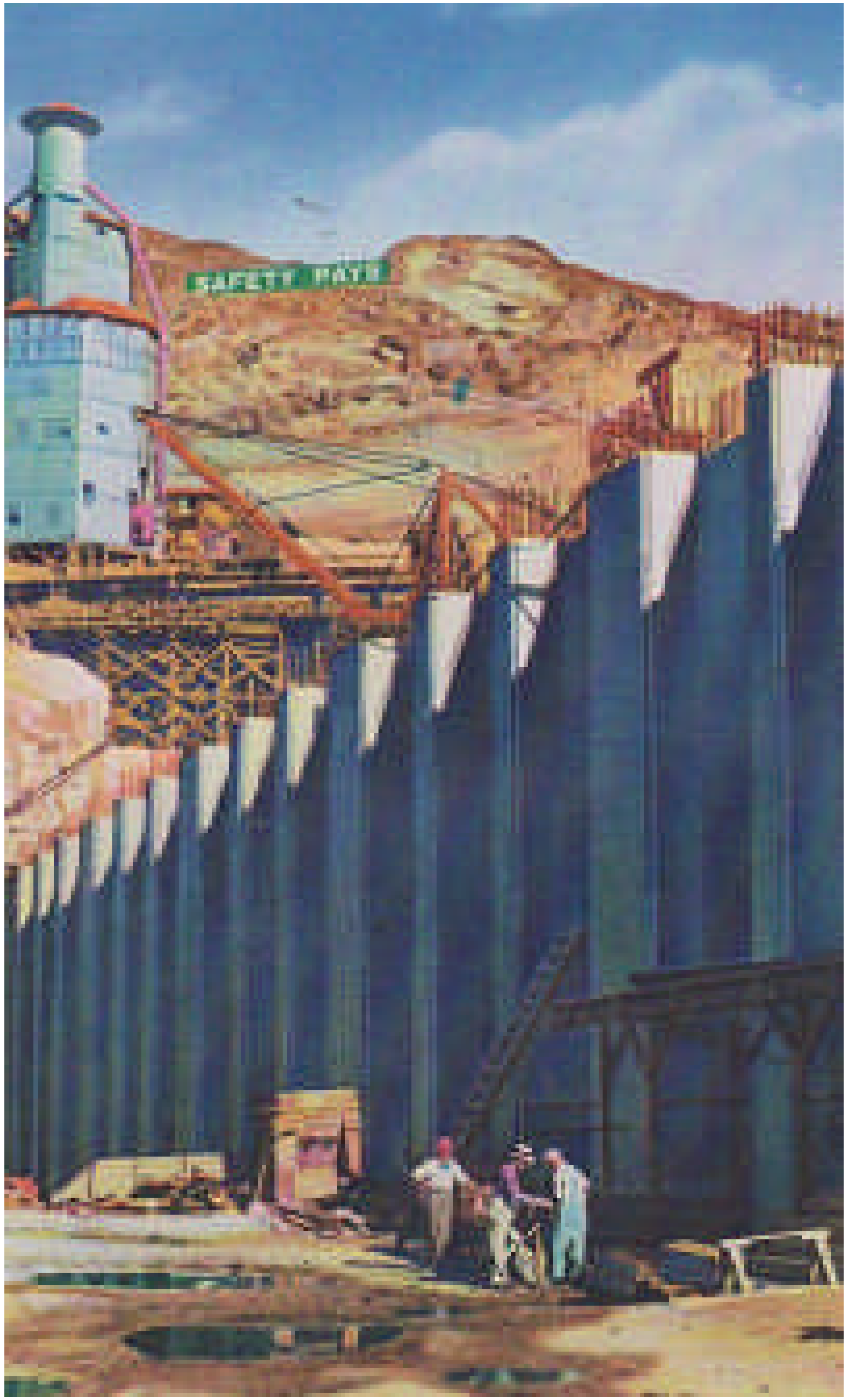
***“Gradually the giant mass of concrete is mounting skyward as the foundation of the Grand Coulee high dam works its way toward the ‘House of Magic,’ where electrical operations are responsible for the proper mixture of the concrete. The ‘House of Magic’ is the barrel-shaped building at the top of the picture.”***

***Spokane Chronicle,*** **July 6th 1936**

***"…The favored few who are permitted to venture into either of the houses of magic are the ones who get some realization of the 'push the button and build the dam' idea, and of the speed with which operations are being carried forward. The man with the shovel and mixing board, who used to work laboriously at the task of mixing concrete by hand has been superceded by a master craftsman who uses his brain to guide the controlled movements of gargantuan concrete mixers of the barrel type…"***

***Spokane Chronicle,* May 25th 1936**

# Like Birds in a Nest



***"…If a government inspector should accompany you to the eight-sided, eight-story 'Eastmix' plant you would climb into the ear-splitting din of a gloomy room where four four-yard revolving mixers alternately gulp meals of cement, rock, and water from a central feeding chute and then, two minutes later, tilt over and discharge their loads of finished concrete into another chute that carries the material to buckets resting on flatcars below…"***

***Popular Mechanics,*** **April 1938**

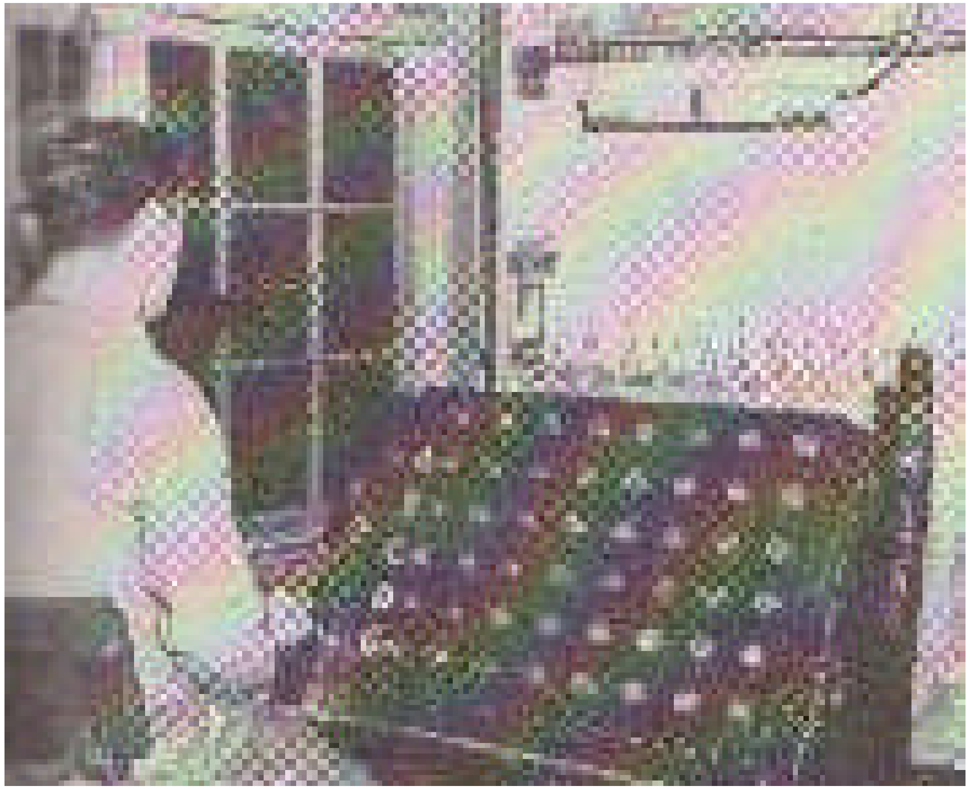
**Left: caption: "Base of east side powerhouse and, above it, the east side mixing plant"**

***"…Above the mixing chamber, in the comparative quiet of a glassed-in office, the chief mixer controls and regulates each batch of concrete. His office is almost as complicated as the cockpit of a transcontinental passenger plane. Flickering red and green lights on a dispatch board tell him which crews far out on the dam want concrete, and the amount and type of material they need. In front of him and above his head are push-button controls and valves by which the automatically measured doses of water and materials that go into the mixing machines are released, as well as time controls that automatically stop and dump each batch at the right time…"***

***Popular Mechanics,* April 1938**

***"…Each of the mixing plants has four huge mixers. Each of which handles a four-yard mix at a time. They stand facing each other on a floor high up in the tower. Above them is a wide-mouthed nozzle which makes contact first with one of the huge mixed drums and then with another. Through this nozzle there flows just the right amount of cement, sand and gravel and water to make a four-yard batch of concrete. Watching the operation reminds one of a nest in which four young birds are being fed by the mother bird, who pokes her head down from the top, her beak depositing worms within the beaks of the waiting birds…"***

***Spokane Chronicle,* May 25th 1936**



***"…A keen-eyed youth, standing before a table on which are enormous flashing lights, open valves, pulls loops of wire and pushes buttons. He is the brains behind the operations of the concrete mixers. He knows to a pound the consistency of each batch. His work is done with unbelievable speed…"***

***Spokane Chronicle,*** **May 25th 1936**

**Left: caption: "Control board which makes mixing of concrete almost automatic"**

*"…Every action is timed to the split second. Sixteen seconds are allowed for loading a mixture, two minutes for mixing, and six seconds for the mixer to discharge its load. Thirty-two yards of concrete are mixed by the two plants every two and one-half minutes…"*

***Popular Mechanics,* April 1938**

***“Concrete will be poured ‘around the clock’ in Grand Coulee dam forms, without a halt except for mechanical breakdowns. The MWAK Company, builders, ordered a three-shift, 24-hour work day effective when equipment is ready for full-swing concrete pouring. Three seven-hour shifts now are working. Mixing plants will be able to produce 12,000 cubic yards a day…”***

***Spokesman-Review,*** **December 10th 1935**

# A Century From Now

***"…Against one wall of the chief mixer's office a dozen electrically operated steel pens ink jagged lines on the moving paper of a huge graph, telling the mixer as a visual check the exact amount of materials that go into each batch and the viscosity of the finished concrete…"***
***Popular Mechanics,*** **April 1938**

***"…At his right is a fascinating, recording robot, which makes a record of every gallon of water, every pound of cement and quantity of aggregate which enters into each batch of concrete, and records the precise minute at which each batch was sent on its way to its place in the dam. This complicated series of records is kept by a time-clock marker and a series of wavy lines on a wide sheet of paper, which moves slowly upward from one roll to another. By turning on a light in a transparency under the moving paper, a complete tabular key is brought into view permitting quick and accurate reading of the record. By referring to this roll of paper a century from now, it will be possible for engineers to know the exact consistency of any batch of concrete at any given point within the vast, complicated structure of the dam…"***

***Spokane Chronicle,*** **May 25th 1936**

# Never Been Done Before

***"Fabricated lumber totaling 1,540,000 board-feet for the forms in which concrete for the dam will be poured, has been ordered from Weyerhauser timber interests by the MWAK Company, it was announced today. As far as MWAK officials know, fabricating of concrete forms is a new departure in dam construction. It has never been done before…"***

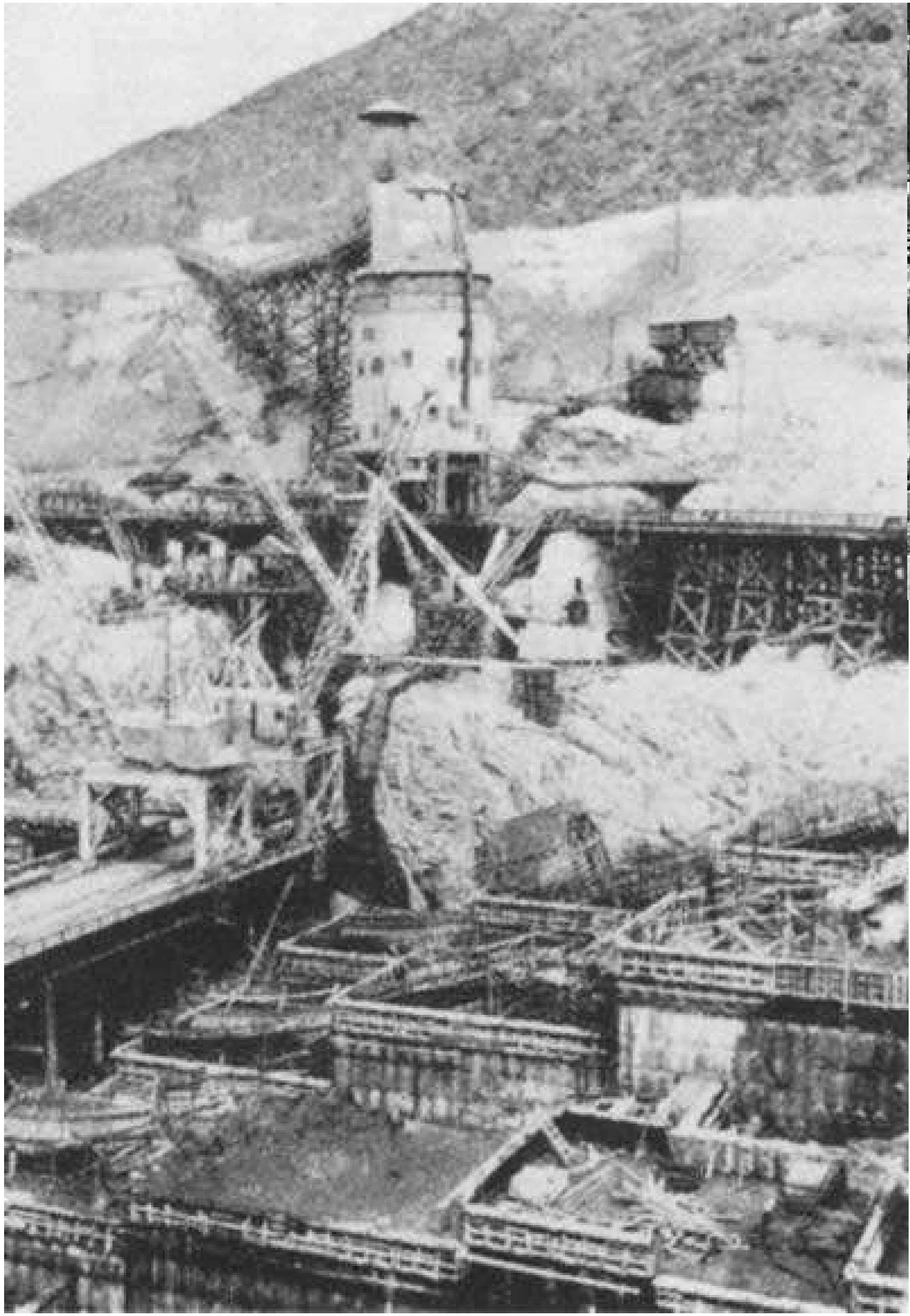
***The Wenatchee Daily World,*** **November 25th 1935**

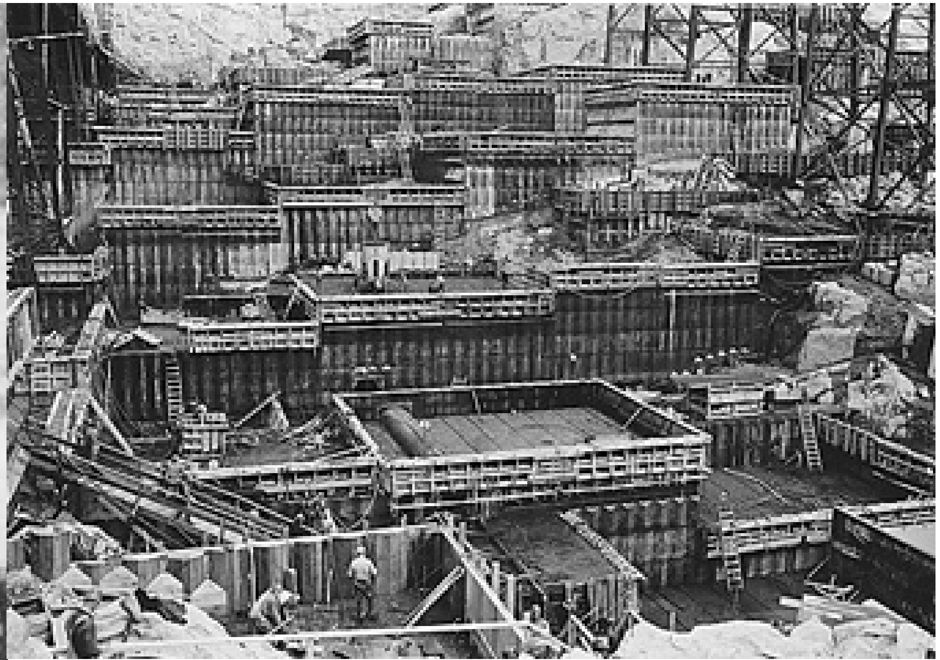
***"…The boards, whaling and timber will be cut into exact sizes at the Weyerhauser plant in Cle Elum and shipped to the dam site, numbered, so that all carpenters have to do is fit the pieces into the final shape of the forms. The company said that the procedure of having the lumber cut in an equipped plant rather than rough lumber brought to the dam site and fitted here, would prevent warping of lumber by summer sun and other weather elements. It is planned to keep all fab-ricated lumber in use, holding concrete, which will keep the necessary moisture in the lumber to prevent warping…"***

***The Wenatchee Daily World,*** **November 25th 1935**

***"…There will be ten distinct types of forms in the million and a half feet. The first of the shipments are due to start arriving in a week and a half to two weeks, officials declared. Only enough will be brought to concrete the west portion of the dam and other shipments for the east side and river section will be brought in later, spreading the shipments over about a year's time…"***

***The Wenatchee Daily World,* November 25th 1935**





***"…about 200 variations in the types of concrete forms will be needed to cover the whole job of the foundation…"***

***Spokesman-Review, Dec. 17th 1935***

**<u>Above</u>: caption: "The construction of a group of concrete blocks near the east end of the Grand Coulee Dam (April 1937)"**

**<u>Left</u>: caption: "In columns 50-feet square, the concrete is built up in terraces of 5-foot lifts in mov-able Forms"**

***"…The fabricated forms will not be used on the forms to be placed on the uneven bedrock. Only when the concrete-placing has reached the point where a uniform block can be poured, not altered by granite outcroppings, will MWAK use the Weyerhauser lumber. The fabricated forms will be moved upward as the dam construction progresses. A form will hold the concrete until the 72 hours of setting are up and then re-constructed on top of this concrete for another pour or raise of five feet…"***

***The Wenatchee Daily World,*** **November 25th 1935**

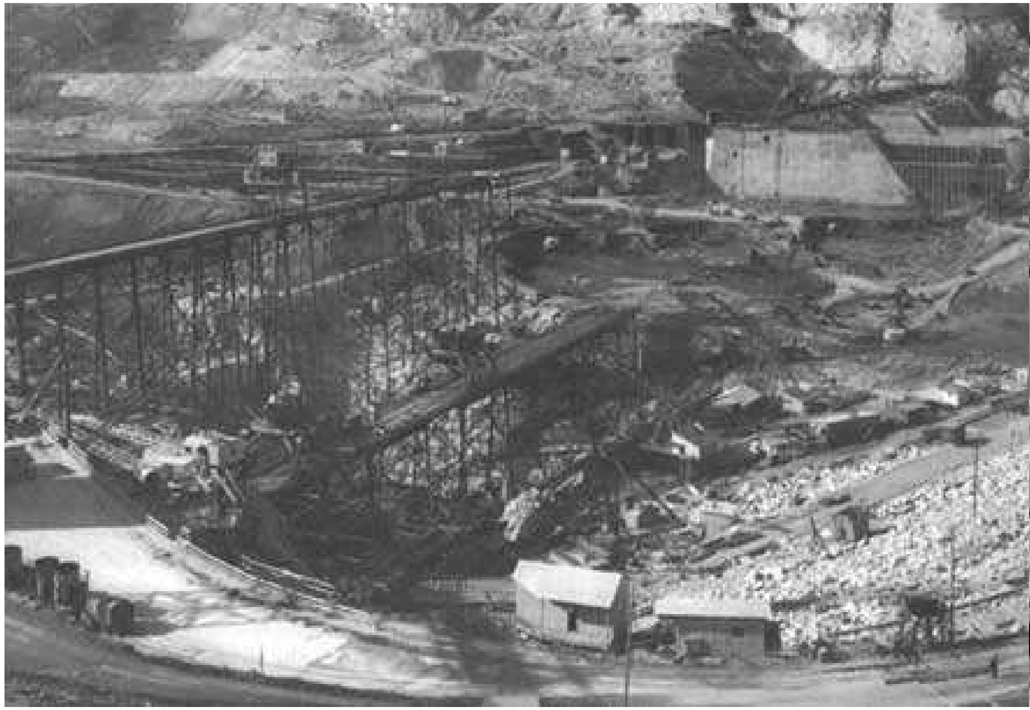
# Concrete Placing

***“…Mixers deliver their charges into 4-yard, bottom-dumping buckets, which are hauled away by 10-ton Diesel-electric locomotives, four to a car on standard-gauge railway tracks on steel trestles…”***

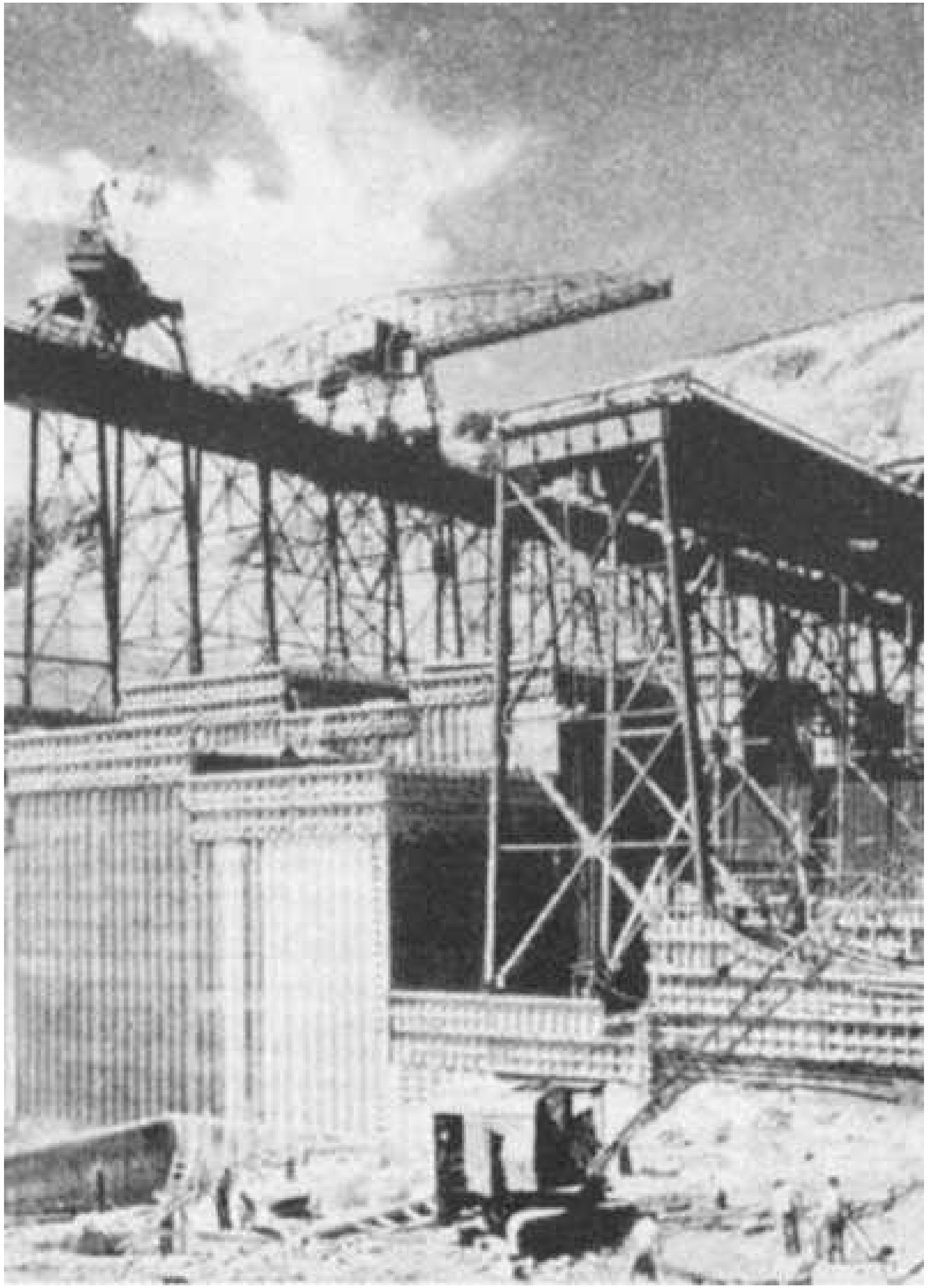
***U.S. Bureau of Reclamation* (ca. 1937)**

***"…There will be two steel trestles, one 93-feet downstream from the face of the dam and one 235-feet below that. The first trestle will be about 160-feet high from bedrock and the second 85-feet. The floors will be about 30-feet wide, or wide enough to carry three standard gauge railroad tracks and one whirley track. The first section of the trestles on the west shore will be 1,300-feet long but ultimately they will reach clear across the river, a length of 3,000-feet. There will be 100 tons of steel in the construction. The towers of the trestles will remain in the dam even after it is finished, concrete being poured all around them…"***

***The Wenatchee Daily World*, June 25th 1935**



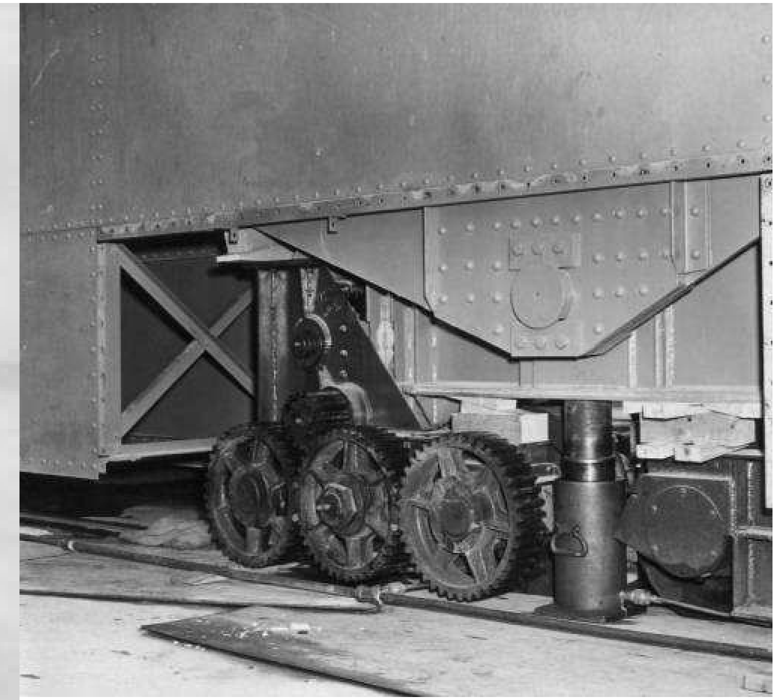
**<u>Left</u>: caption: "This is the dam as it looked in late 1936 from the river's east bank. Trestles in the left foreground mark the present line of the dam. The area is enclosed by a cofferdam and the river is flowing through the partially completed section of the dam in the upper right of the picture."**
**<u>Right</u>: caption: "Construction of Grand Coulee Dam, ca. 1936"**



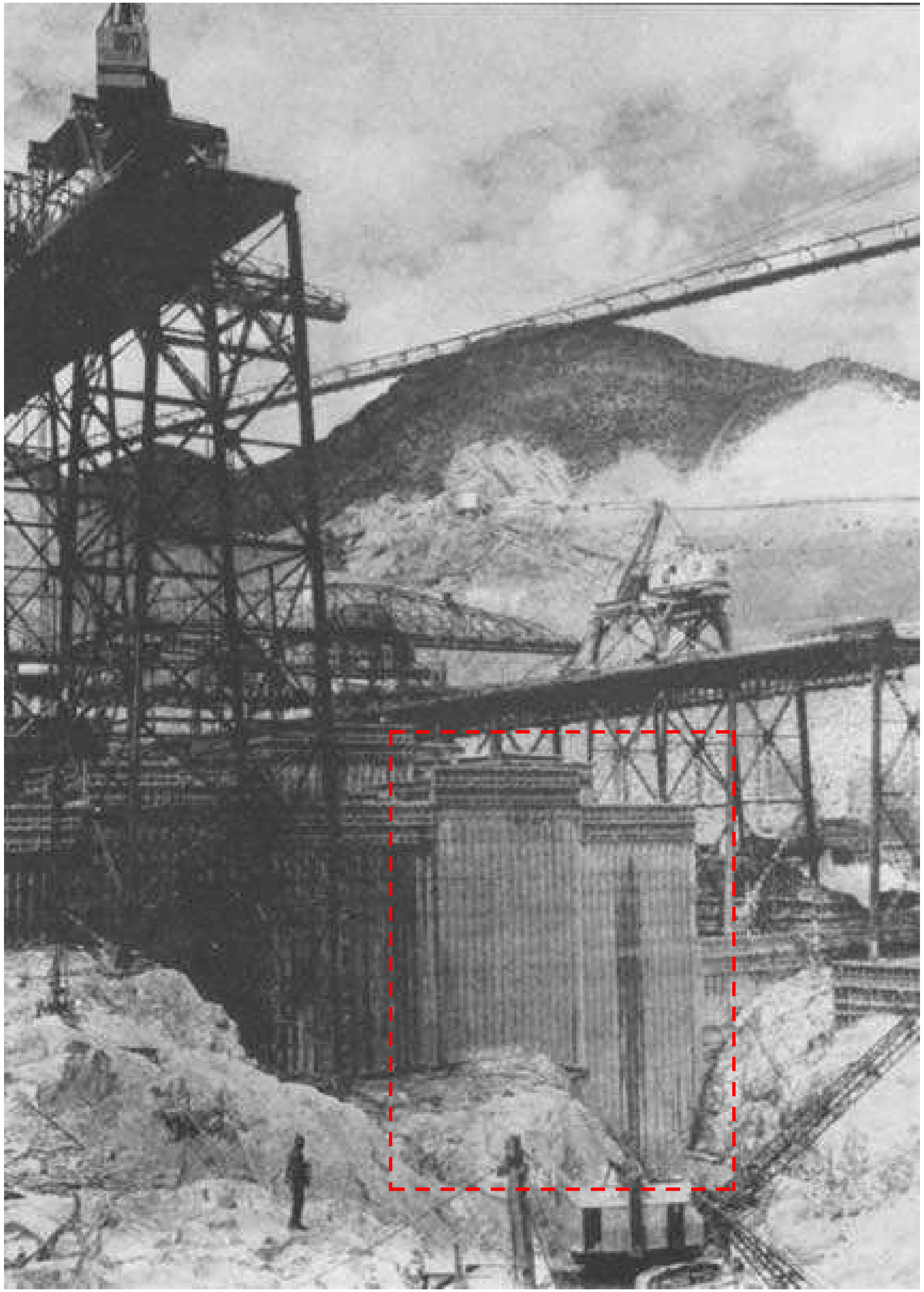
***"…Huge cranes, with a reach of 115-feet or more traveling on the same trestles, remove the buckets from the cars, swing them out over the rising structure, and lower them into the forms, where workmen dump them through specially shaped hopper bottoms and ingenious valves, designed to prevent the segregation of coarse and fine aggregates, and to control the rate of deposition…."***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left</u>: caption: "Two 3,000-foot steel trestles averaging 95 and 175-feet in height were used in placing concrete in the foundation"**



**<u>Above</u>: caption: "Gear system used in moving large crane on top of dam. These gears are connected to wheels resting on track that extends entirely across dam."**
**<u>Left</u>: caption: "One hundred and fifty ton gantry crane being tested. Crane is lifting a thirty-seven and one half ton concrete block. This machine was built by Star Manufacturing Company of Tacoma, Washington and is installed on tracks reaching across the top of the dam."**



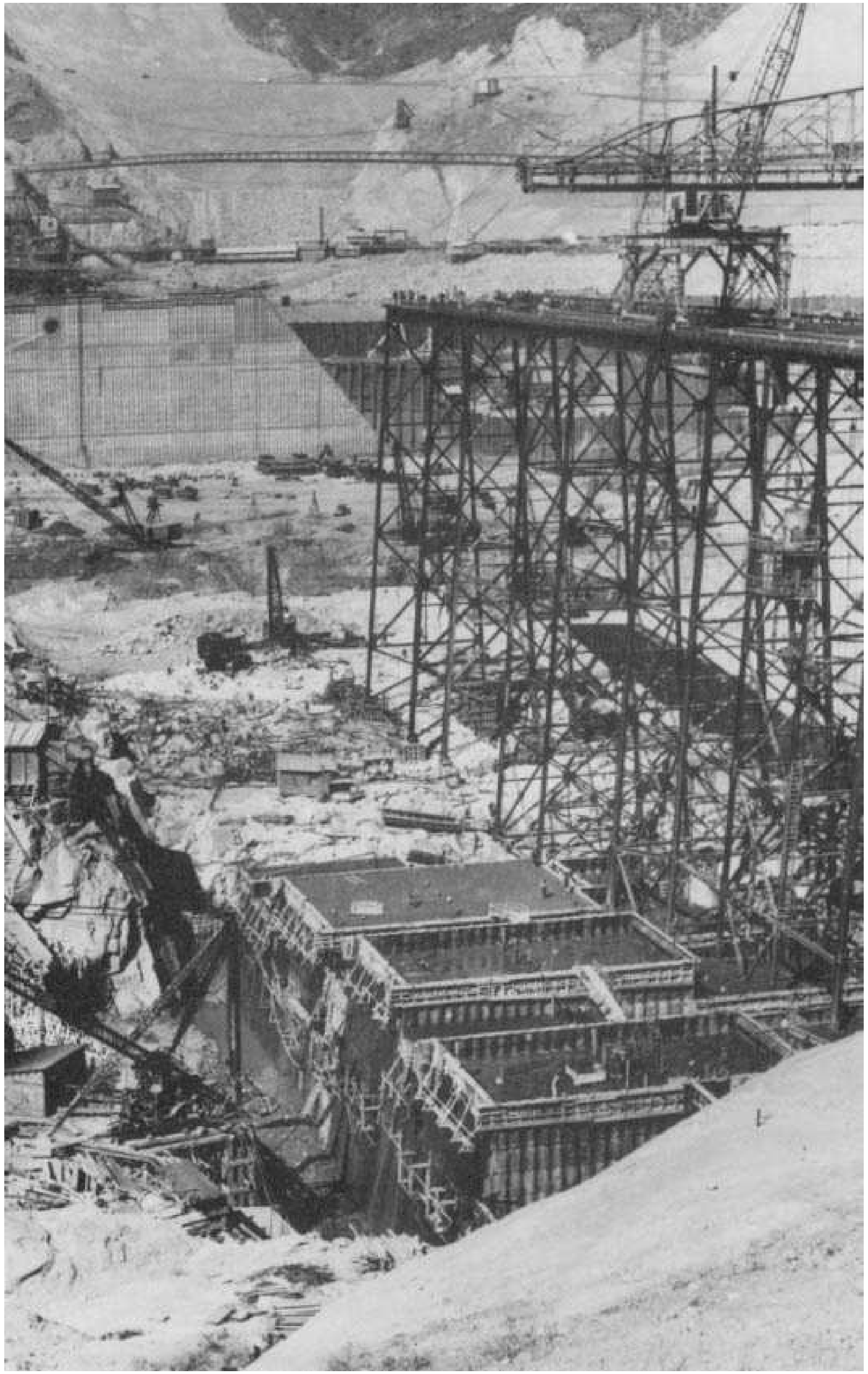
***"…Although the dam will be a monolithic structure, it is constructed in blocks 5-feet thick and varying in area from 50-feet square in the spillway section to 25 by 34-feet at same points in the powerhouse sections, successive lifts in any column being placed at intervals of not less than 72 hours. Adjacent columns are locked together by a system of vertical keys on the transverse joints and horizontal keys on the longitudinal joints…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**Left: caption: "As firm, clean bedrock was exposed, high steel trestles were built out from abutments, and from them long-arm cranes placed concrete in 'lifts' 5-feet thick and 50-feet square"**

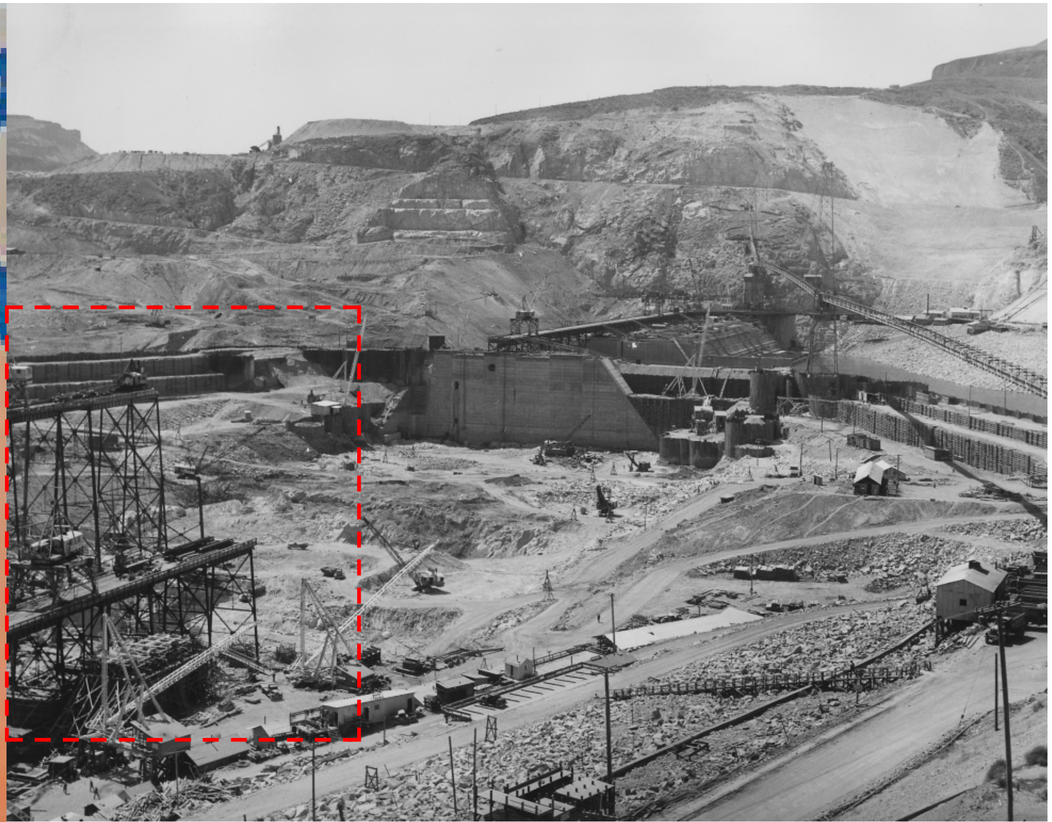
__Left T&B__: caption: “Four-yard batches of concrete, in huge steel buckets, were lowered into the forms by long-arm cranes. After at least three days, each lift was scrupulously cleaned with sandblast, air, and water before another was laid on it. Scouring surface with sand-water-compressed-air blast before pouring concrete results in stronger, watertight union.”

**Top Left: caption: "Looking northeast over west side high and low crane trestles, note the cantilever cranes, at Grand Coulee Dam (November 1936)"**
**Top Right: caption: "East mix plant with high and low crane trestles on either side at Grand Coulee Dam (December 1936)"**
**Left: caption: "Steel trestle and movable cranes atop for placing concrete (ca. 1936)"**



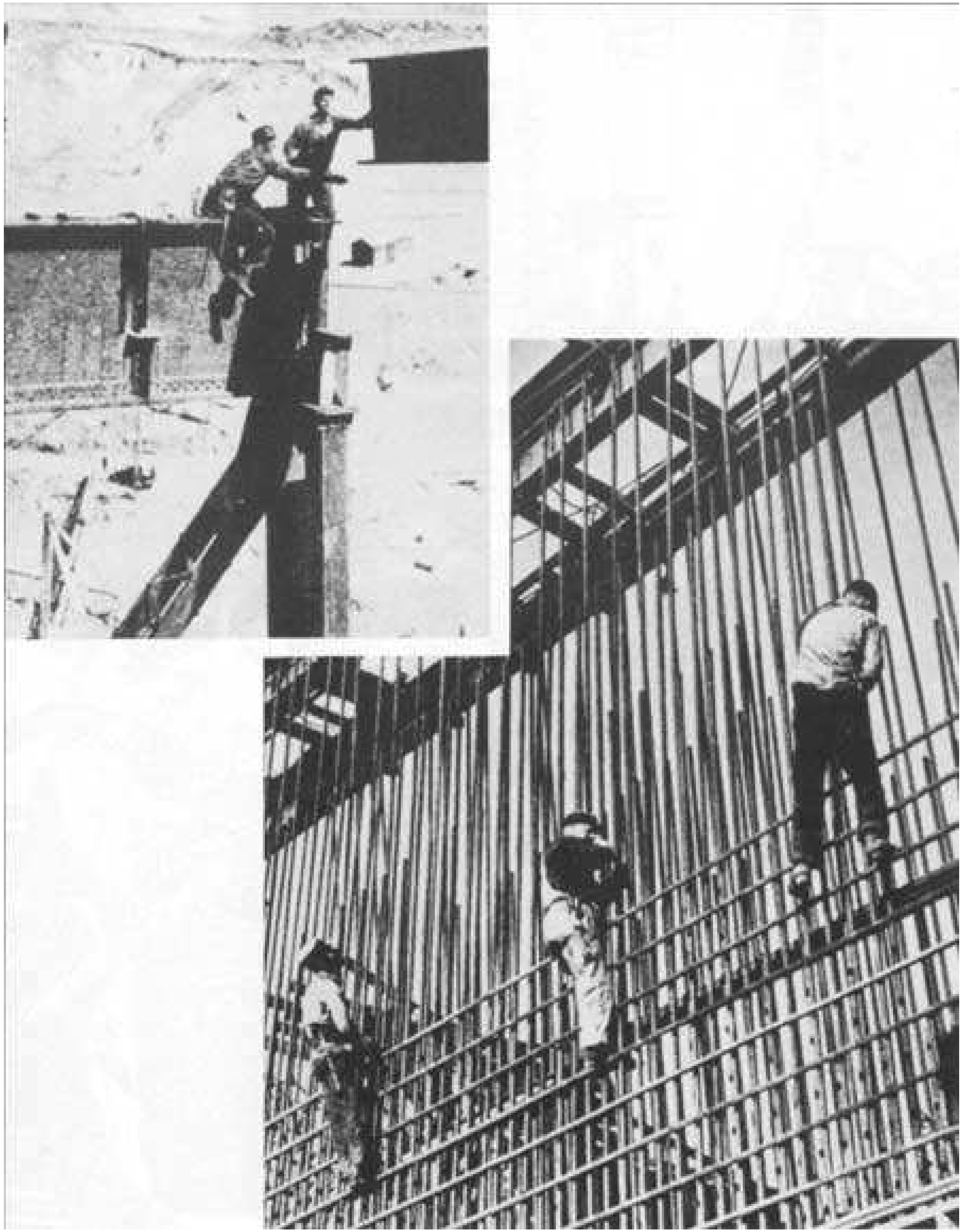
***"…The placing of concrete in the Grand Coulee Dam was started in December 1935. Seven hundred thousand cubic yards were placed by June 30, 1936, 2 million yards by April 15, 1937, and more than 4 million yards in less than 2 years. As much as 9,290 cubic yards were placed in 1 day from one mixing plant. The maximum record for a day was 15,844, and for a month, 377,135 yards. With two mixing plants running at full capacity, concrete could be placed at the rate of 1 cubic yard every 5-1/2 seconds…."***

***U.S. Bureau of Reclamation*** **(ca. 1937)**



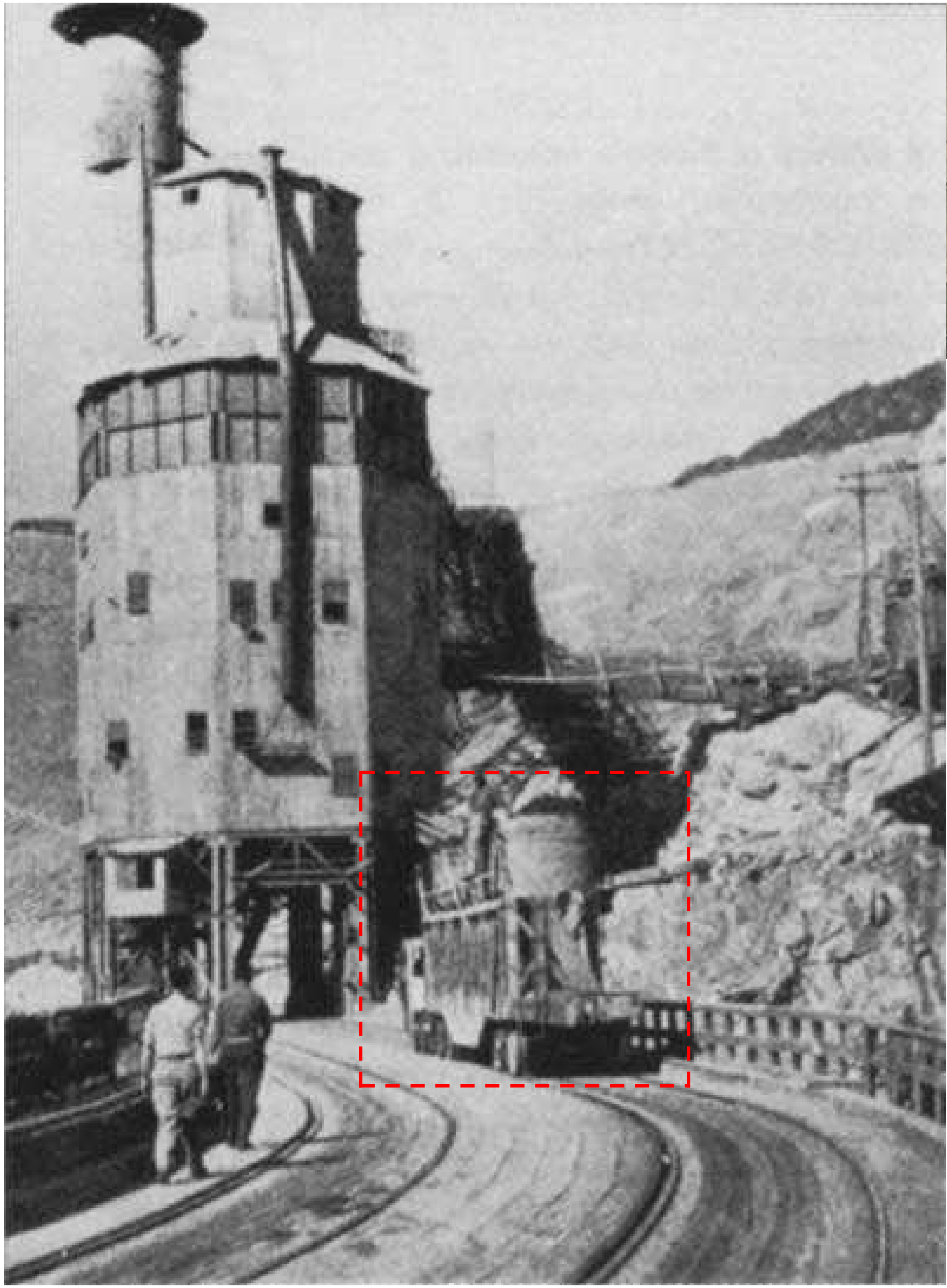
**<u>Above</u>: caption: "High and low trestles under construction (at left of photo)"**

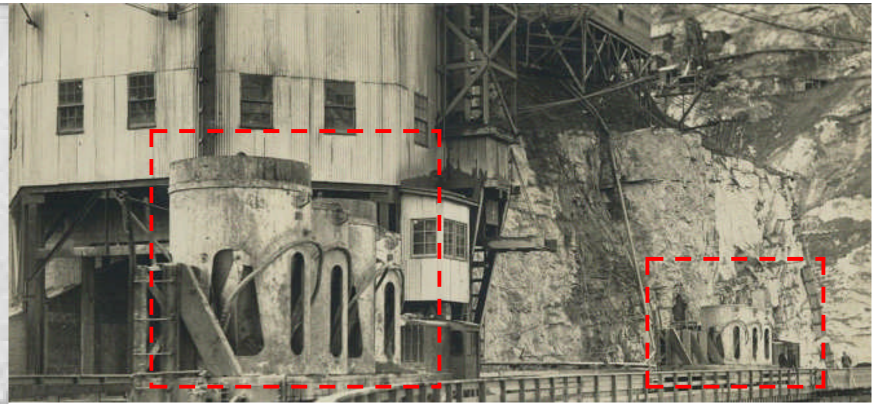
**<u>Left</u>: caption: "Support of trestle for dam work which will be swallowed by rising con-crete"**



**<u>Left T&B</u>: caption: “Twin steel trestles, 3,000-feet long and averaging 95 and 175-feet in height, were built across the canyon - and buried in the concrete they carried. Over 75 million pounds of reinforcing steel will be required.”**

# Where it's Needed

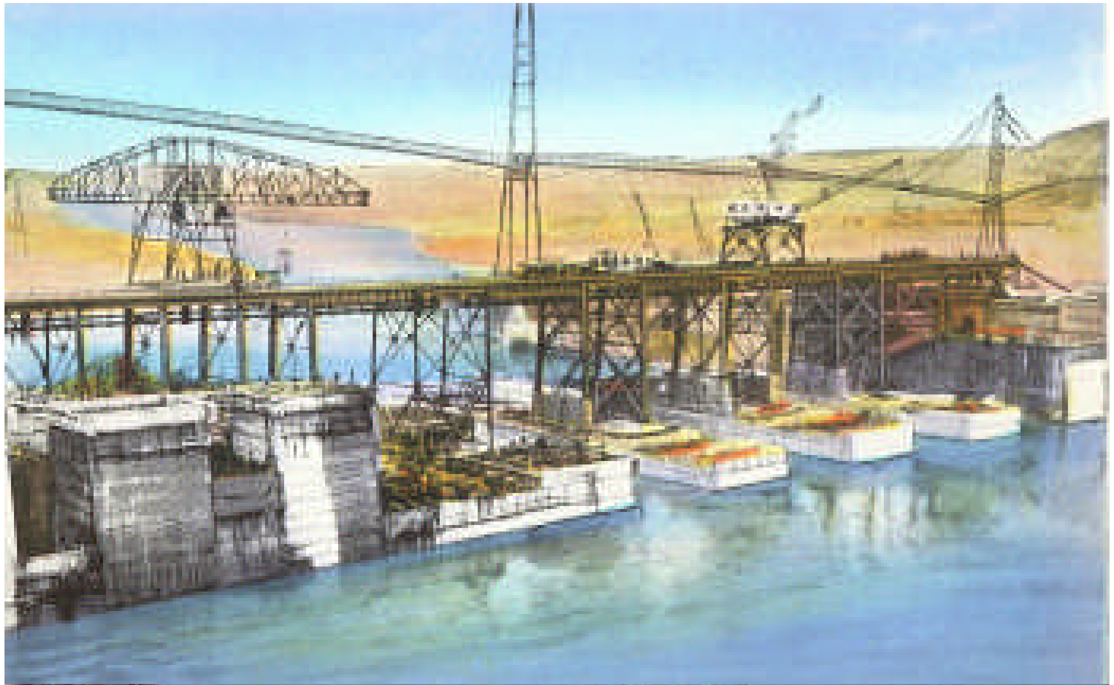


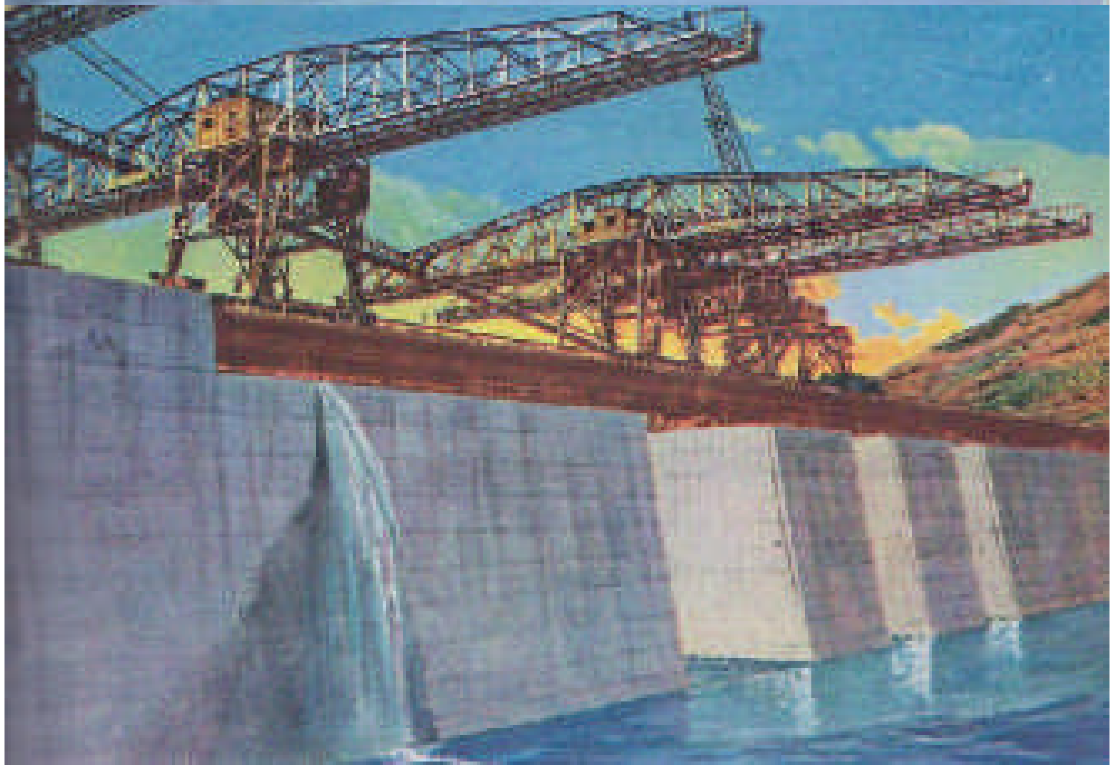


*"Infant brothers of the big Diesel-electric streamline locomotives are playing an important part in the building of Grand Coulee Dam. On a four-track 'railroad' that is perhaps the world's shortest, running 1,000 to 1,600-feet from the mixer to the pouring crane, a fleet of little four-cylinder locomotives of standard gauge, powered by Caterpillar Diesels with electric drive, haul the concrete trains over the dam. The 'train' consists of four concrete buckets on a single flatcar. The engines are equipped with multiple controls so that the operator can drive his load from six different points on the cement car or from the engine cab."*

***Popular Mechanics*, May 1941**

**Above & Left: caption: "Concrete buckets on railway flatcar"**



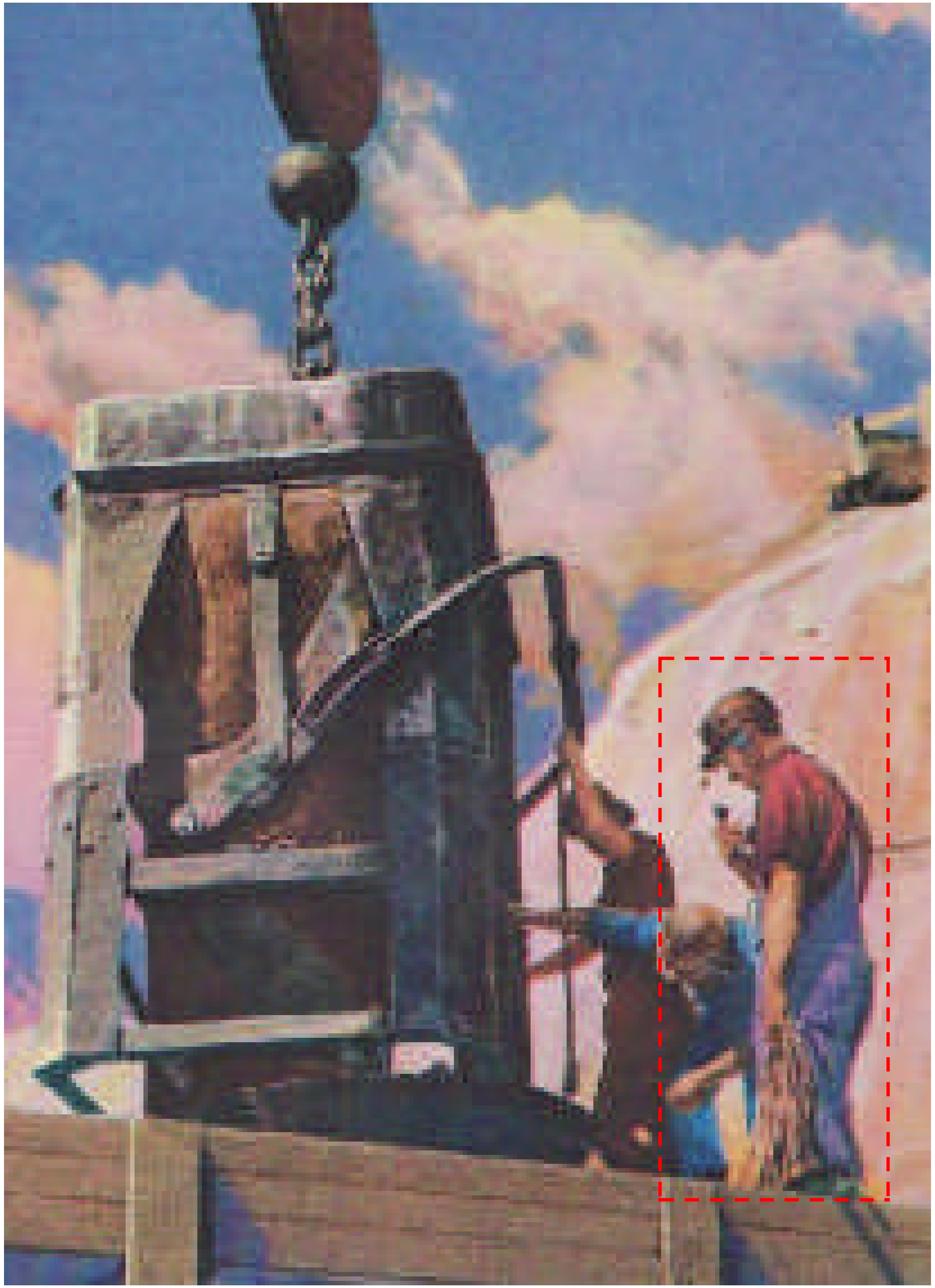


***"…Down below, the loaded flat-cars are taken in tow by a locomotive and are switched to the track that leads to that part of the dam where concrete is needed. At the end of the trip the tackle from a hammerhead crane or a gantry crane noses down, picks up a four yard bucket of concrete as lightly as a feather, and swings it out and down to a waiting crew…"***

***Popular Mechanics,* April 1938**

**Top: caption: "Upstream face of Grand Coulee Dam Foundation"**

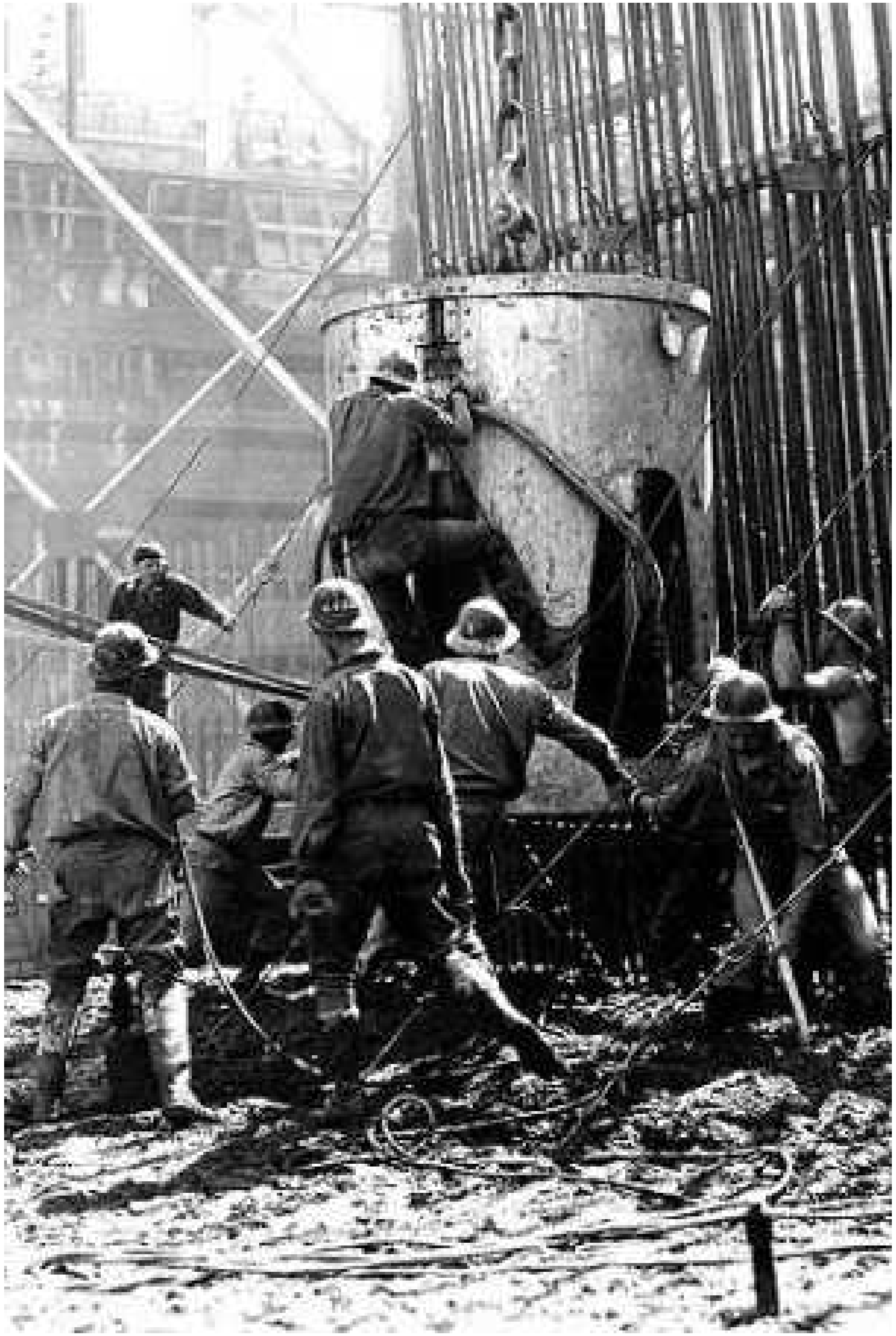
**Bottom: caption: "Traveling cranes by which concrete is delivered, from tracks on steel trestle supporting them, into the forms"**



***"…The foreman of the crew wears a telephone set inside his 'iron hat' so that he can tell the crane operator, who may be possibly out of sight far above him, just where to place the big bucket…"***

***Popular Mechanics,* April 1938**

**Left: caption: "Giant concrete bucket dumped by opening gate in the bottom"**



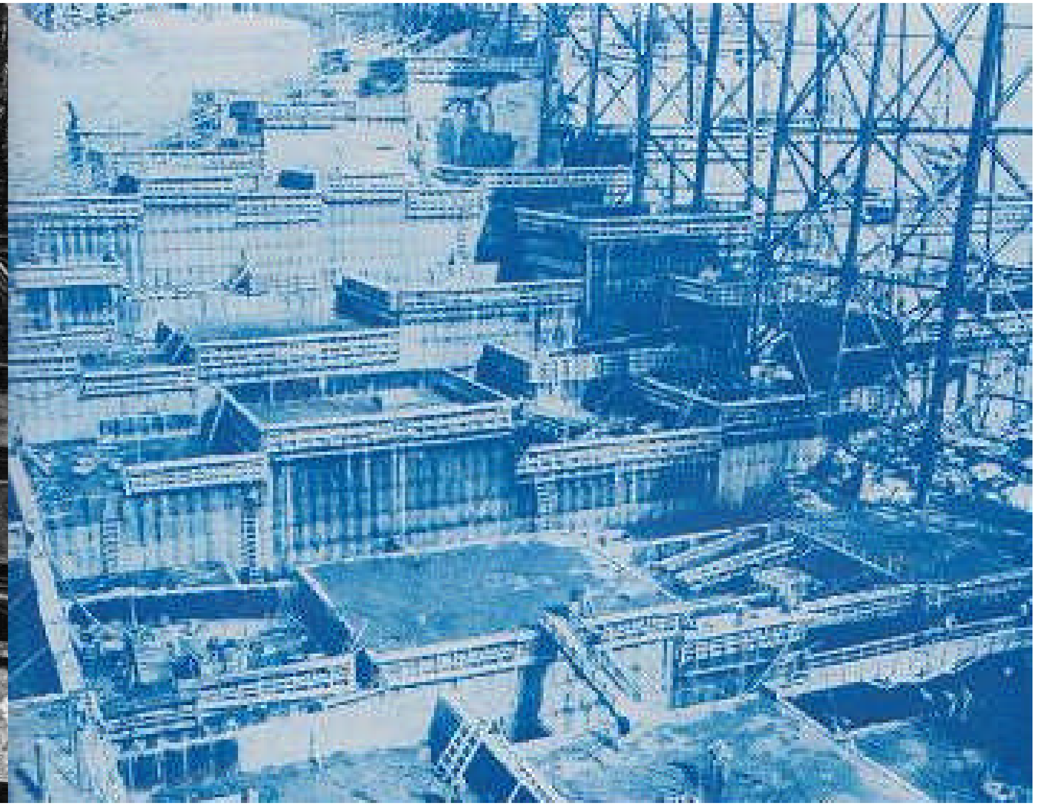
***"…By 'pushing a button,' the motorman on a small diesel-electric locomotive spots the bucket-laden flat car to a designated spot in the vicinity of concrete-placing operations. Another operator, high in the heart of a giant crane, 'pushes other buttons' and the buckets of concrete are whisked up like feathers to be deposited in the deep workings. A workman pulls a giant lever, and the bucket drops its contents. The first actual contact of man with concrete or its components takes place after the concrete has been deposited in the dam. Workmen swarm over the slithering mass with mechanical tampers. Actually, these men are button pushers who operate electrical devices…"***

***Spokane Chronicle,*** **May 25th 1936**

**<u>Above</u>: caption: Man works with concrete during construction of Grand Coulee, July 1940"**

**<u>Left</u>: caption: "View of concrete drying"**

# On the Square

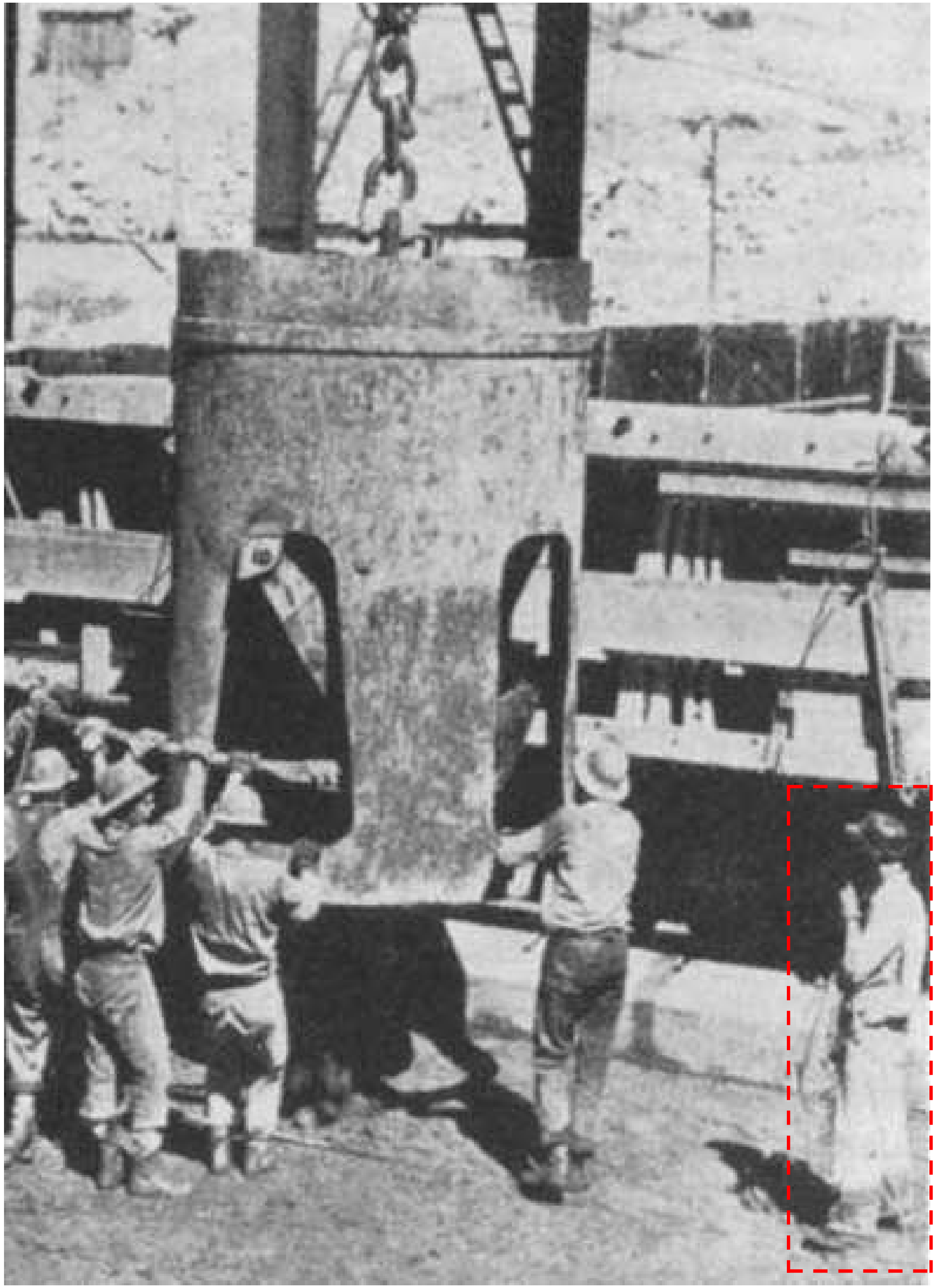


***"...The dam grows in five-foot 'lifts' of wet concrete, placed in alternate blocks measuring up to fifty feet square. The forms that hold each block are shaped to provide vertical keys so that when concrete is poured in the intervening blocks the adjoining masses become locked and tied into each other. With both mixing plants in operation a cubic yard of concrete is added to the dam every five and one-half seconds…"***

***Popular Mechanics,* April 1938**

**<u>Left</u>: caption: "Alternating blocks measuring up to fifty-feet square form the concrete core of the dam"**

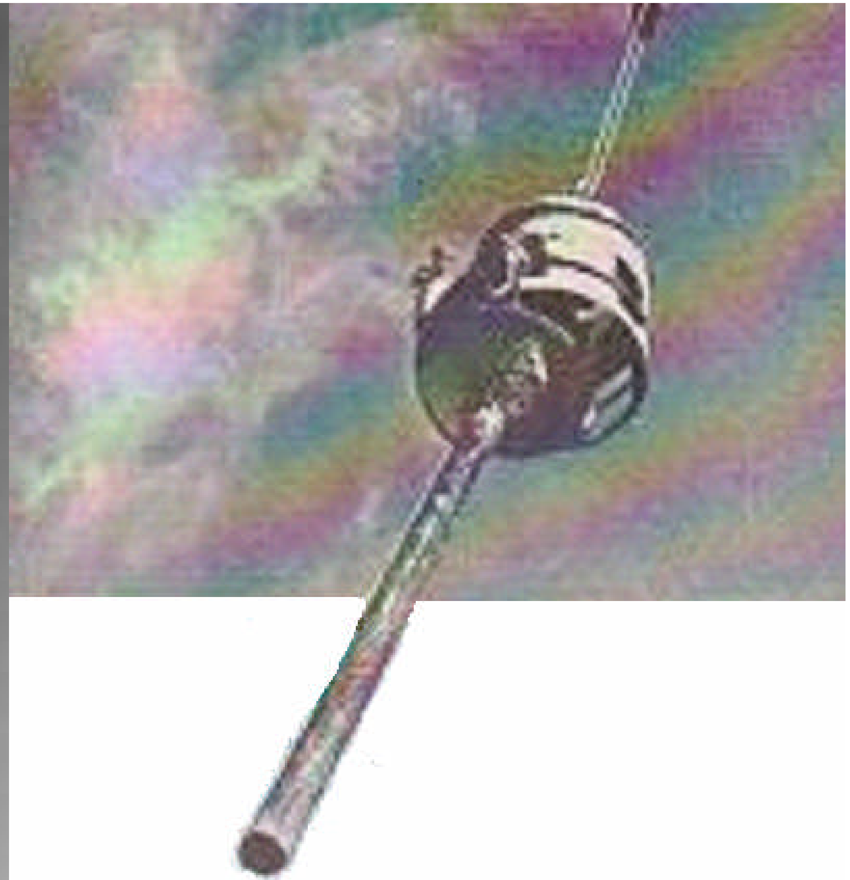
**<u>Right</u>: caption: "How the dam is built in 'Lifts'"**



***"…As the dam grows, in 5-foot 'lifts,' placed in any column at intervals of not less than 72 hours, the steel trestles are buried, and forever lost…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left</u>: caption: "Eight-ton batches of concrete are handled by huge overhead cranes, directed by telephone-signalmen 'on locat-ion'"**



***"…The concrete is poured in huge interlocking blocks, one block being allowed to cool for a time before neighboring blocks are poured…"***

***Popular Mechanics,*** **August 1942**

**Above & Left: caption: "Placing concrete in hopper with tubular spout for pouring concrete into wall forms"**

***"Some of the romance of the old days has come back to glorify the cause of common labor. It has come to attention at Coulee dam, where a crew of men poured 8,400 cubic yards of concrete in one day, before work was shut down, to set a national record. This kind of work, reminiscent of the spirit of competition which made a picturesque page of construction history in the early part of the century, is a gratifying indication that men again are taking pride in achievement. These men might have 'strung out their jobs' by slow work which would have extended the time of construction. But they are made of the stuff Americans like to have in their being. This comes at a time when too many men, their spirit broken by being dependent, feel that the world now owes them a living. During the last week 1,000 men have added to the MWAK payroll. Work soon will be humming again at high pitch. Other records will be assailed. Americans, living in a land of opportunity for the individual, will do work which is a credit to the name 'American.'"***

***Spokane Chronicle,* March 12th 1937**

**<u>Above</u>: caption: "A crew of 'pud-dlers' goes to work on a newly poured bucketful of concrete with pneumatic vibrators. The purpose of the vibrators is to keep the concrete flowing to avoid the formation of voids (pockets) in the concrete."**

**<u>Left</u>: caption: "'Vibrators,' thrust into the stiff concrete, cause it to spread without segregation of comp-onents"**

# Concrete Cooling

***"…The reaction which takes place between water and cement in concrete always results in the evolution of heat. During a large part of the year relatively warm materials are used in making concrete. The dam must ultimately reach a temperature close to that of the river bed, practically constant throughout the year, and considerably below that of the concrete when placed. Unless the heat of cement hydration is dissipated as it is liberated, a massive concrete structure will rise in temperature and expand in size over a period of months. As the temperature afterwards falls toward its ultimate value, contraction occurs and shrinkage cracks appear. Structural weakness may be caused, and leakage will result if shrinkage cracks remain unsealed…."***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…In order to prevent damage from expansion and subsequent shrinkage, and in order to permit the final sealing of all contraction joints by grouting before the dam is completed, more than 2,000 miles of 1-inch, thin-wall steel tubing is being set in the concrete, and cooling water is circulated through it. The pipes are set 5-feet apart vertically and 5-feet 9-inches horizontally, and are parallel to the faces of the dam. The cooling water circulated through the dam will carry away heat in excess of that liberated in burning 30,000 tons of coal. The maximum temperature reached within the dam is 55 to 65 degrees above that of the concrete when placed. The final temperature of the dam will be about 50° F…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***"…Two thousand miles of steel tubing are being set in the concrete so cooling water can be circulated through it to carry off the heat created by the chemical action of cement hydration…"***
***Popular Mechanics,*** **April 1938**

**Left: caption: "This photo shows one of the large cement buckets transporting a load of concrete to the spillway area of the dam. Notice that the dam was constructed as a series of blocks each of which was about fifty-feet square and five-feet tall (the block numbers are still used for reference). Pipes embedded in the fresh concrete carried cooling water from the river to remove heat generated by the cement as it cured (a/k/a "Heat of Hydration"). The pipes were later filled with grout. The photo was taken on November 14th 1939."**

***"…Cold river water is circulated through pipes that are buried in the mass. This helps shrink the block down closer to its final dimensions. Later these pipes are pumped full of cement and rich cement is also forced down into the expansion joints between the blocks, welding the dam into one immense monolithic structure…"***

***Popular Mechanics,* August 1942**

# Concrete Cleaning

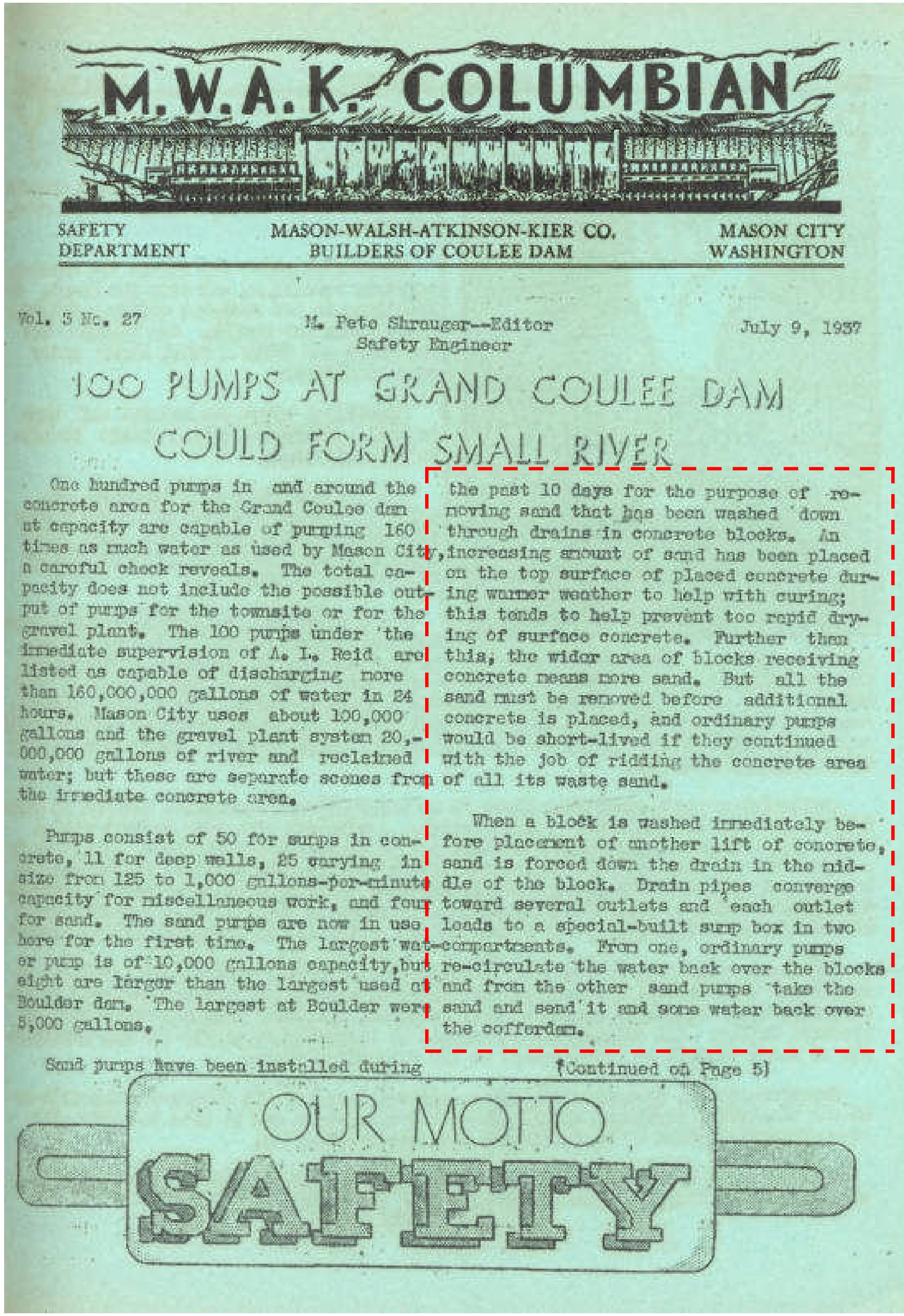
***"…The most consistent unanticipated expense was that of 'cleaning up' after each pour of concrete in the dam foundation. On this work the government specifications are most rigid, and are enforced 100 percent as a matter of assuring a perfect dam. What is known as 'laitance' forms on the surface of each new concrete pour. This must be disposed of before additional concrete is poured on the surface. To accomplish a 'clean job' means an air and water process involving 125 pounds pressure, sand-blasting, steel brushing, washing and then removal of all water by the use of sponges, thus producing a perfectly dry surface…"***

***Spokane Chronicle,*** **December 7th 1937**

# Concrete Curing

***"…Electric heaters will keep the newly poured concrete warm. If the concrete freezes before the 'set' or about 72 hours after it is poured, inferior blocks will result. First plans for preventing such freezing involved the use of hot water for mixing. The new plan calls for steel-frame 'canopies' over each of the 50x50-foot forms. They will be roofed with ply-board and canvas will form the walls. Electric heaters will be set up inside…"***

***Spokesman-Review,* December 10th 1935**



M.W.A.K. COLUMBIAN

SAFETY DEPARTMENT | MASON-WALSH-ATKINSON-KIER CO. BUILDERS OF COULEE DAM | MASON CITY WASHINGTON

Vol. 3 No. 27 | M. Pete Shrauger--Editor Safety Engineer | July 9, 1937

# 100 PUMPS AT GRAND COULEE DAM COULD FORM SMALL RIVER

One hundred pumps in and around the concrete area for the Grand Coulee dam at capacity are capable of pumping 160 times as much water as used by Mason City, a careful check reveals. The total capacity does not include the possible output of pumps for the townsite or for the gravel plant. The 100 pumps under the immediate supervision of A. L. Reid are listed as capable of discharging more than 160,000,000 gallons of water in 24 hours. Mason City uses about 100,000 gallons and the gravel plant system 20,000,000 gallons of river and reclaimed water; but these are separate scenes from the immediate concrete area.

Pumps consist of 50 for sumps in concrete, 11 for deep wells, 25 varying in size from 125 to 1,000 gallons-per-minute capacity for miscellaneous work, and four for sand. The sand pumps are now in use here for the first time. The largest water pump is of 10,000 gallons capacity, but eight are larger than the largest used at Boulder dam. The largest at Boulder were 5,000 gallons.

Sand pumps have been installed during the past 10 days for the purpose of removing sand that has been washed down through drains in concrete blocks. An increasing amount of sand has been placed on the top surface of placed concrete during warmer weather to help with curing; this tends to help prevent too rapid drying of surface concrete. Further than this, the wider area of blocks receiving concrete means more sand. But all the sand must be removed before additional concrete is placed, and ordinary pumps would be short-lived if they continued with the job of ridding the concrete area of all its waste sand.

When a block is washed immediately before placement of another lift of concrete, sand is forced down the drain in the middle of the block. Drain pipes converge toward several outlets and each outlet leads to a special-built sump box in two compartments. From one, ordinary pumps re-circulate the water back over the blocks and from the other sand pumps take the sand and send it and some water back over the cofferdam.

(Continued on Page 5)

OUR MOTTO SAFETY

**<u>Left</u>: caption: "…Sand pumps have been installed in the past 10 days for the purpose of removing sand that has been washed down through drains in concrete blocks. An increasing amount of sand has been placed on the top surface of placed concrete during warmer weather to help with curing; this tends to help prevent too rapid drying of surface concrete. Further than this, the wider area of blocks receiving concrete means more sand. But all the sand must be removed before additional concrete is placed, and ordinary pumps would be short-lived if they continued with the job of ridding the concrete area of all its waste sand. When a block is washed immediately before placement of another lift of concrete, sand is forced down the drain in the middle of the block. Drain pipes converge toward several outlets and each outlet leads to a special-built sump box in two compartments. From one, ordinary pumps re-circulate the water back over the blocks and from the other sand pumps take the sand and send it and some water back over the cofferdam."**

***"Fresh concrete on the Grand Coulee dam is put 'under wraps' and steam heated when severe weather threatens to freeze the new-poured concrete before it sets properly. In the lower right corner of the photograph can be seen a huge canvas canopy covering a pour in Block 26 of the Columbia river dam during a cold spell. Steam is injected under the canvas to keep the section warm until set."***

***Popular Mechanics,* June 1936**

**<u>Left</u>: caption: "Shooting live steam under the canvas 'blanket' keeps new-poured concrete of the Grand Coulee dam from freezing before it has set properly"**

***“Several blocks of concrete near the west abutment which froze last week before the initial set had taken place will be dynamited out as soon as mild weather sets in. The MWAK Company was unable to keep the temperature of the several raises of the material above 40 degrees Fahrenheit, the minimum permitted under the stringent rules of the Bureau of Reclamation. The canvas-covered canopies and heaters were insufficient to protect the concrete against the sudden extreme cold…”***

***Spokesman-Review,* February 11th 1936**

# Pressure Grouting

***"…Thousands of sacks of cement will be forced into the rock in addition to thousands of sacks to be pressed into the concrete of the dam itself, mostly between the various forms used to build up the dam."***

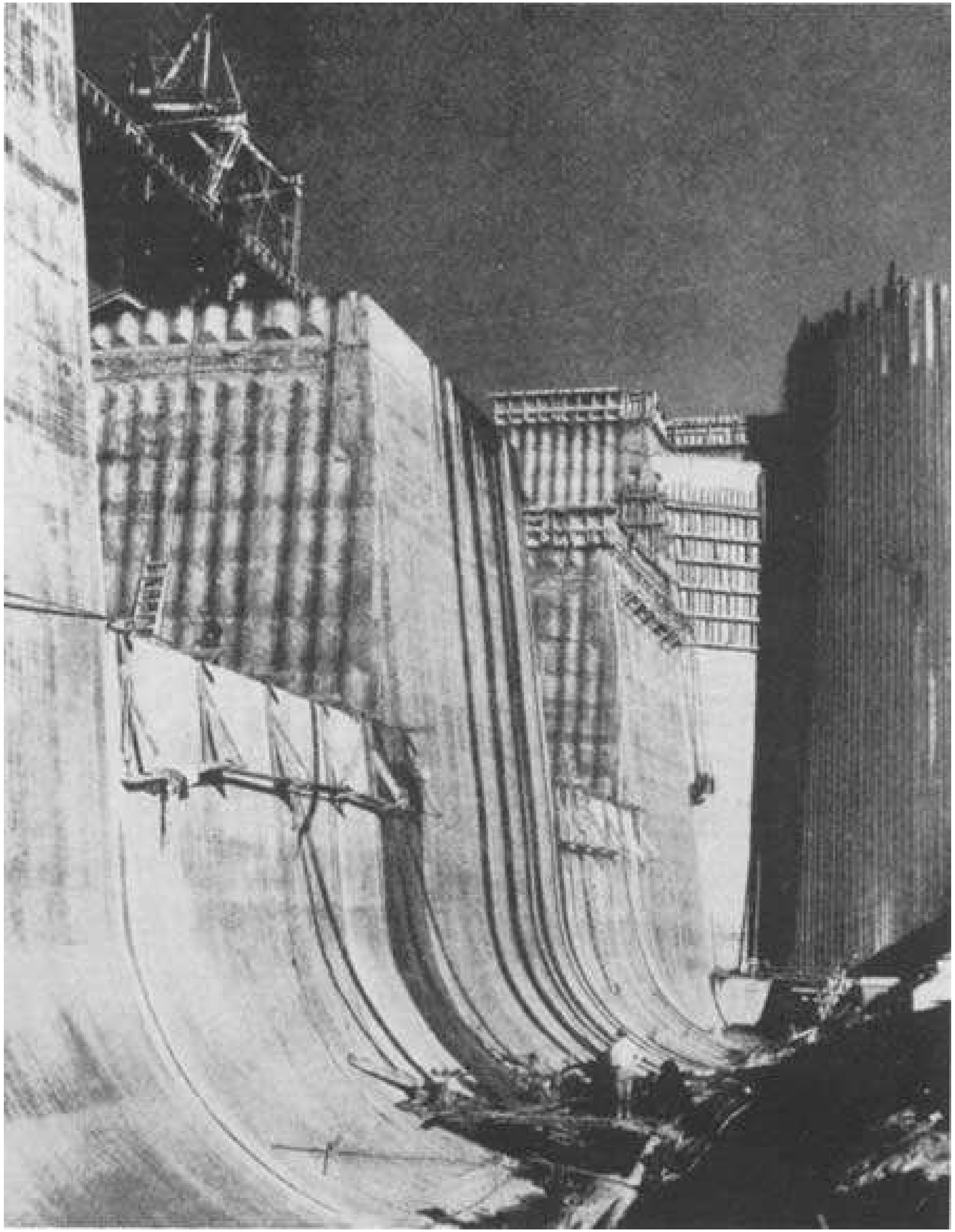
***The Wenatchee Daily World,* November 16th 1936**

***"Grouting, the process of sealing tiny cracks and crevices in the bedrock under the dam, will not be confined in sealing the rock alone, it was said here today by engineering officials. The process will be continued even after the concrete has been poured up to the higher levels, the engineers said. The concrete when poured into the forms is warm, and there is a certain amount of contraction when the mass cools, leaving small joints between the sections of the dam. These joints will be filled with a fine mixture of cement and water, in a manner similar to that used in sealing the rock below the dam. The structure of the dam will be filled with tiny tubes for carrying the cement to the proper places. Pressure will then force it into the joints to seal them. There will be no expansion joints in the completed structure. The heat of the sun, even in 100-plus summer temperatures, will have little effect on the dam, penetrating only a short distance, and the cold in winter will likewise have little effect, engineers said."***

***Spokesman-Review,* November 21st 1935**

***“Construction of a new cement screening plant, with especially fine screens to be used for grout material for contraction joints, was started by the MWAK Company this week near the cement storage plant at the top of the hill. The structure will be 24 by 96-feet, and will contain apparatus down to a 200-mesh screen. The material will be used in a fine mixture for sealing the joints between blocks of the dam. This process of grouting will be started as soon as the screening plant is completed. MWAK is doing the work under USBR supervision…”***

***Spokesman-Review,*** **May 5th 1937**



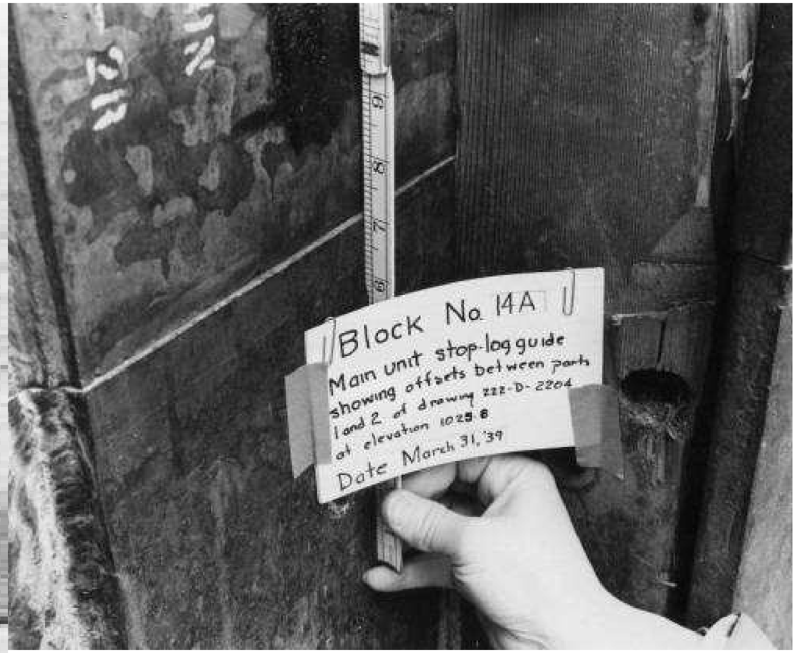
***"…After the concrete is cooled and shrunk grout of cement and water is forced into the contraction joints, opened between the columns by the contraction of the concrete, through a pipe distribution system embedded in the concrete as it is being poured, thus forming a solid, monolithic structure. The shrinkage of the concrete, though it opens a crack only three thirty-seconds of an inch wide between adjacent blocks, aggregates about 8-inches in the length of the dam…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Blocks are interlocked with vertical keys along transverse joints and with horizontal keys at longitudinal joints. Grout later fills and seals openings formed at such joints when blocks are cooled and shrunk"**

***"…Crews employed by the Bureau of Reclamation have used 22,000 sacks – about 1,100 tons – of cement to fill contraction points in the west end of the dam. More than 250,000 square feet of adjoining areas were solidified. A sack of cement served to unite about 115 square feet. The dam was cast in units to facilitate contraction while the concrete cooled. The temperature of the mass was brought to normal by forcing river water through hundreds of miles of pipes buried in the dam."***

**Spokane Chronicle, July 1st 1937**

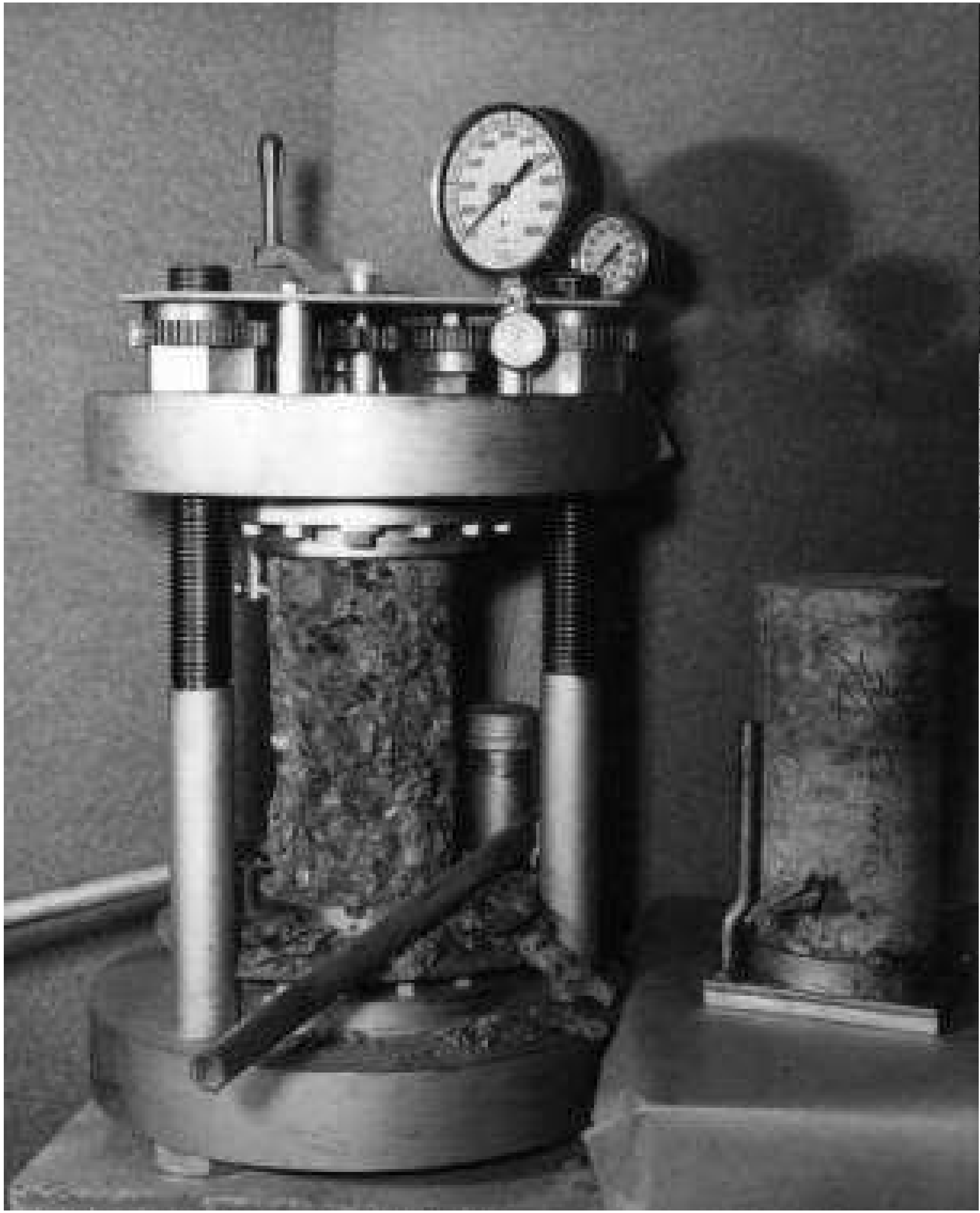



**<u>Above</u>: caption: "Main unit stop-log guide showing offsets between parts 1 and 2 of drawing 222-D-2204 at elevation 1025.8"**

**<u>Left</u>: caption: "Close up view of a man gauging offsets between concrete units"**

# Getting it Right

**<u>Above & Left</u>: caption: "Gov't. inspector filling cylinder with concrete sample at plant for slump test, June 1940"**



***"…From time to time cored samples from inside the mass will be subjected to break-down tests, just to keep track of the dam's strength as it ages…"***

***Popular Mechanics,* August 1942**

**<u>Above</u>: caption: "Concrete specimens for testing"**

**<u>Left</u>: caption: "Testing a concrete specimen - it appears to have failed"**

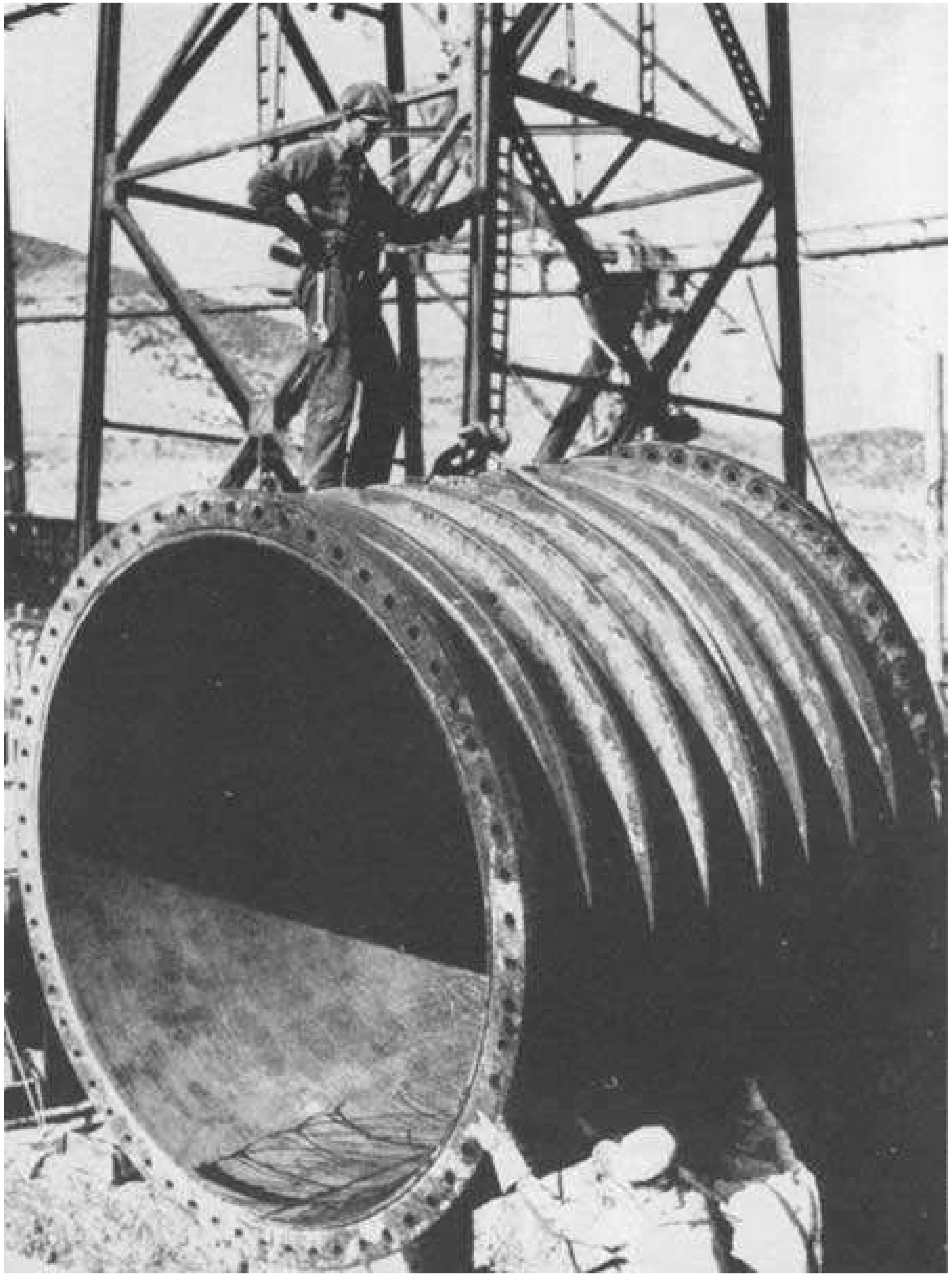

D-3410-E

# Spillway & Outlets

***"…Between the powerhouse sections at the ends of the dam is a spillway section 1,650 feet long over which water not required for storage or for power generation or irrigation will be allowed to flow, forming a spectacular waterfall twice as high as Niagara. The rate of flow, and to a certain extent the quantity of water held in storage, will be controlled by 11 drum gates at the crest of the spillway each gate 28-feet high and 135-feet long. The spillway will have a capacity of a million cubic feet a second; and, if that capacity should ever be realized, it will be necessary to dissipate at the foot of the dam the energy of the falling water equivalent to 32 million horsepower. This will be accomplished, and erosion of the river below the dam will be prevented, by an upwardly curved bucket at the toe of the dam, where a trough 100-feet wide and 30-feet deep is formed behind a concrete wall across the river bed at elevation 900, 33-feet below low tail-water surface…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

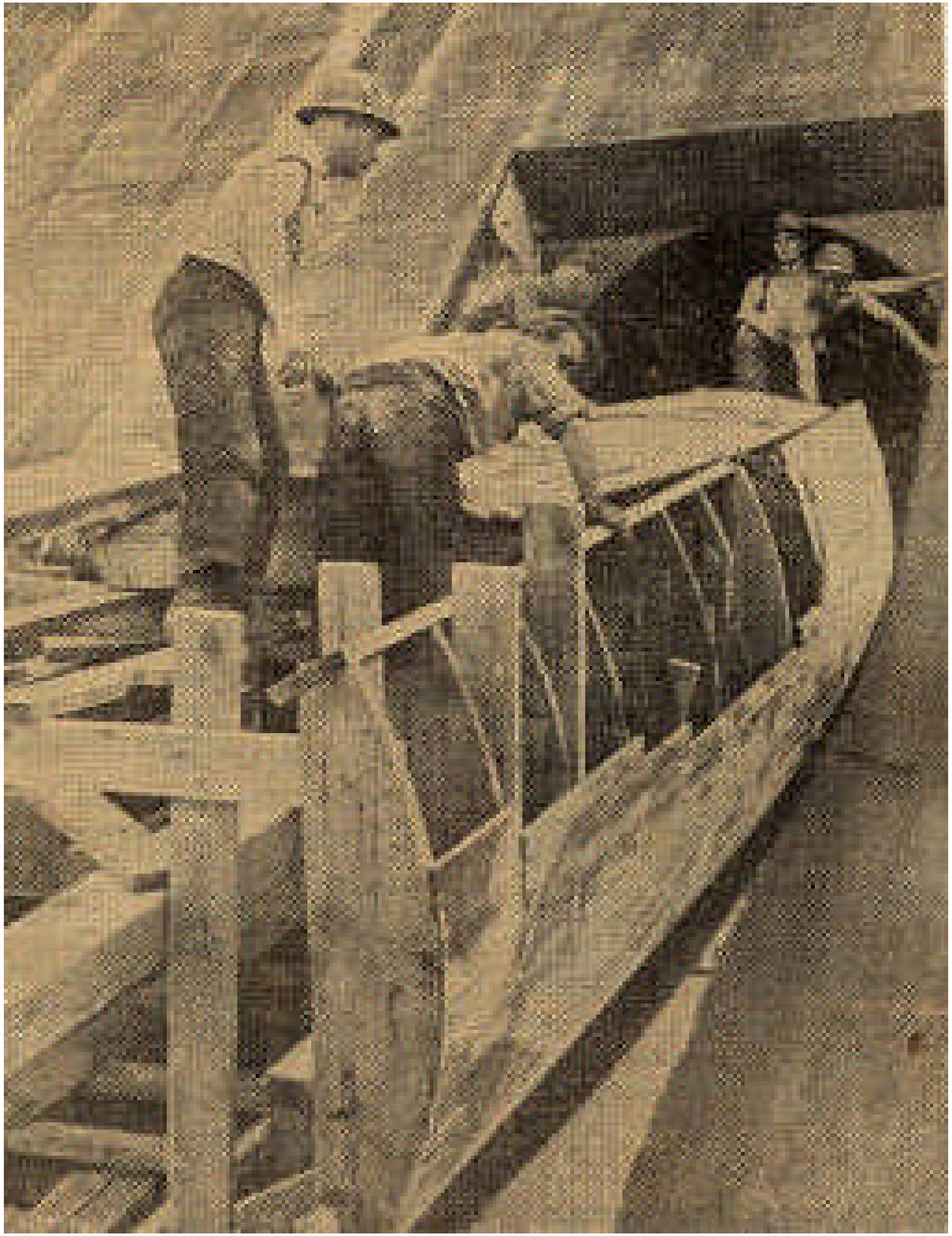
<u>Top</u>: caption: “One of eleven 500-ton drum gates on top of dam, which will divert flood waters over the spillways”
<u>Bottom</u>: caption: “Photograph shows two workmen standing inside one of the dam's large spillway drum gates. As can be seen, the drum gates are hollow inside. The 135-foot long, 28-foot tall gates are buoyant (float) and they are raised and lowered by controlling the level of water in chambers beneath them.”



***"…Through the dam there will be sixty 8-1/2-foot gate-controlled outlet tunnels, twenty at elevation 934, the approximate level of low water, twenty at elevation 1,034, and twenty at elevation 1,134. The tunnels are arranged in pairs, and their entrances are protected by trash racks. The upstream ends of the outlet tunnels are lined with heavily ribbed semi-steel conduits, set in the concrete as protection against erosion and the effects of cavitation, which will be reduced or eliminated by the scientific shaping of the entrances to the tunnels…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

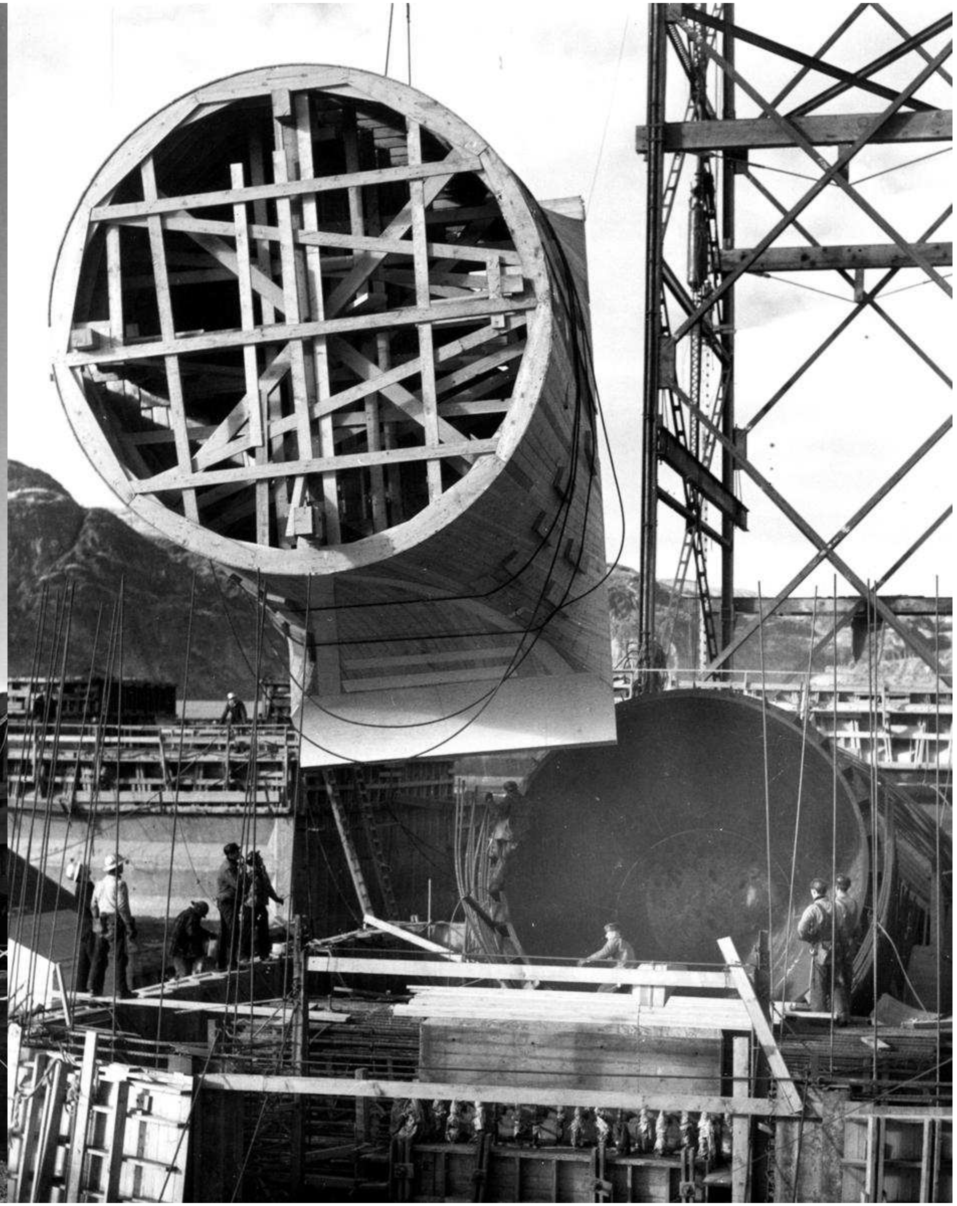
**<u>Left</u>: caption: "Heavily ribbed semi-steel conduits line the entrances to outlet tunnels, the first flared out in a mathematical curve to prevent erosion. Two mammoth valves will control the flow of water in each tunnel"**



**<u>Left</u>: caption: “More than a mile, 6,000-feet, of outlet tubing (which are the cylind-rical objects seen in this recent photograph taken at the Grand Coulee dam site) are to be built in giant Grand Coulee dam by the MWAK Company. The forms shown here are used to create the tubes in the spillway section of the dam. Their purpose is to control the level of the lake behind the dam. Three sets of ten pairs each are to ne built in the completed spillway. Each tube will be eight and one-half feet in diameter with the 60-feet on the upstream end to be lined with steel.” (*Spokane Chronicle*, July 26th 1937)**

**<u>Above</u>: caption: “Two and a half miles of cylindrical forms will be required for the 8-1/2-foot outlet tunnels”**

**<u>Left</u>: caption: “Looking out across spillway section from a 12-foot control cable gallery”**



***"…A ring-follower sliding-leaf valve, hydraulically operated, and an electrically operated 'paradox' valve, with leaf and wedge on rollers, will control the flow of water so each tunnel for the purpose of regulating the flow of the river in seasons of low water, or emptying the storage reservoir. The 60 tunnels have a combined length of about 2-1/2 miles. The outlet tunnels will have a capacity of 253,000 cubic feet per second and the turbines fully loaded will pass 81,000 second-feet. These, with the spillway will have a total capacity nearly three times the maximum recorded flow of the river, and nearly double the estimated flood of 1894…"***

***U.S. Bureau of Reclamation***
**(ca. 1937)**

# And So it Goes

***"…And so it goes through all the workings of the great dam. Men serve as the brains to operate machines which do most of the actual physical work. Without these machines it would not be possible to build the Grand Coulee dam."***

***Spokane Chronicle,*** **May 25th 1936**

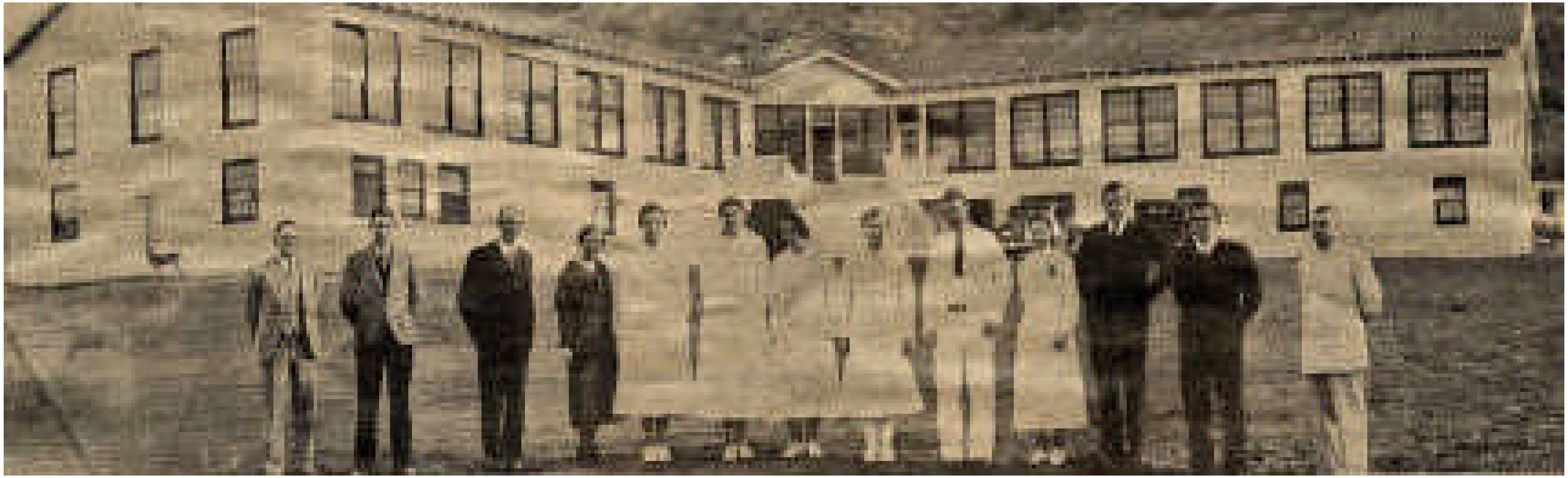
# Part 15

# Death Be Not Proud

# Cracking Up

***"Two hundred and fifty-one employees of the MWAK company were injured during September, a report of the company revealed today. Of this number none was fatal and only twenty-two were serious enough to call for compensation for the victim, the report said. Only twenty-two of the accidents caused workmen to be laid-off more than three days. The injuries were classified as follows: Burns, fifteen; eyes, thirty-eight; falling objects, twenty-six; falling workmen, twelve; strains and sprains, forty-one; lacerations, contusions and abrasions, 101; flying objects, eleven; pinched between objects, seven."***

***Seattle Post-Intelligencer*, October 16th 1935**



**Above: caption: "It is a pleasure to 'crack up' at Mason City; the MWAK Company has just completed one of the most modern hospitals in the northwest. All equipment represents the latest scientific development in medical science. The hospital covers 14,000 square feet of floor space, has two surgeries, an X-ray room, dentist office, seven wards, five private wards, doctors' offices, nurses' rooms, a diet kitchen and a solarium. The picture shows the hospital and its staff of 'men in white,' as well as 'women in white,' who handle all the men, caught in too hazardous contact with danger." (*Spokesman-Review*, March 10th 1936)**

# TRAIN MANGLES COULEE WORKMAN

MASON CITY, Wash., April 28.—(Special.)—James C. Slete, 27, is near death in the hospital here as a result of an accident this morning which cost him his right foot, left leg and left arm at the elbow.

Slete, brakeman on a diesel-electric concrete train used by the MWAK for hauling concrete to the dam foundation, was thrown under the wheels of the train when he attempted to swing onto the last car after throwing a switch. His right foot slipped off the step and under the wheels.

The force of his fall threw his body under the train, the wheels passing over his left leg, severing it near the thigh, and passing up his side and severing his left arm. The injured man was conscious until he reached the hospital. Little hope is held for his recovery.

Slete, whose home is at Everett, has been working at the dam site a year. His employment card shows he was recently married. His wife is residing in Wallace.

**(*Spokane Chronicle,* April 28th 1936)**

## Jackhammer Man Hurt.

Harold T. Davis, jackhammer man for MWAK, suffered a severe cut on his face and a possibly fractured jawbone, when he was struck by fragments of a rock this morning.

A granite boulder rolled down a steep slope and broke into several pieces when it struck the bottom. Davis was hit by one of the flying fragments.

**(*Spokesman-Review*, December 22nd 1935)**

# DISASTER ENDS GALLERY "TOUR"

## Worker Falls 50 Feet Inside Block 40—Car License Arrests Decrease.

GRAND COULEE DAM, Jan. 7.—An exploratory trip to see what the galleries in the dam looked like yesterday resulted in serious injuries to Roy Young when he fell 50 feet down a well inside the concrete of block 40.

A broken leg, shattered foot and other undetermined injuries were suffered. Officials said X-rays could not be taken until Young recovers from the shock.

The accident happened during the lunch hour. Young, working with a gang removing the timber backwall of the cofferdam, decided to take his first trip inside the dam. He was unfamiliar with the plan of the galleries and wells. He fell from the 950 level to the 900 level, officials said.

Young, who operated a butcher shop here two years, was one of the oldest of the "new pioneers."

**(*Spokesman-Review*, January 7th 1937)**

# 100-LB. ICICLE FALLS ON MAN

WILBUR, Wash., Feb. 20.—Yesterday as Carl F. Schaefer worked at the Grand Coulee dam, a 100-pound icicle dislodged on the high trestle of the west side, fell 170 feet and hit Schaefer's head.

He was taken to the Mason City hospital, where it was discovered he had a bad gash on the head, many painful bruises and a broken shoulder blade.

He was released from the hospital about 5 p. m. and within an hour was en route to Wilbur, where he was initiated by the Odd Fellows last night.

**(*Spokesman-Review*, Feb. 20th 1936)**

## WORKMAN BATTERED IN COULEE MISHAP

MASON CITY, May 22.—(Special.) —George Thallheimer of Mason City suffered a broken jaw bone, lost a number of teeth and had his mouth torn open half way to one ear in an accident on the MWAK operations Wednesday night.

The MWAK safety department reported it had not yet learned how the accident took place. Thallheimer is said to have become entangled in some manner with a coupling of an electric shovel.

(*Spokane Chronicle,* May 22nd 1936)

**FEBRUARY WITHOUT FATALITY.**

GRAND COULEE DAM, March 13. (AP)—February passed without a fatal accident at the Grand Coulee dam, the MWAK company safety department reported today. Only 27 compensable accidents, which cause the victim to lose three or more days, were reported.

(*Spokesman-Review*, March 13th 1936)

## FACE BADLY MANGLED BY ELECTRIC SHOVEL

GRAND COULEE DAM, May 22. (AP)—With his jaw broken, several teeth gone and his cheek torn, George Thallheimer, MWAK company workman, was in the Mason City hospital today. Company officials reported that Thallheimer became entangled in the couplings of an electric shovel Wednesday night.

**(*Spokesman-Review*, May 22nd 1936)**

## LOSES HIS HAND

COULEE DAM, Jan. 9.—(Special.)—Ben Butterton of Almira, working for the MWAK, suffered the loss of his hand when he caught it in the machinery of a concrete mixer. Butterton was attended by Dr. Ross D. Wright of the Mason City hospital. He is well known at the dam site, being one of the first men to be put to work on the dam last year when work first began.

**(*Spokane Chronicle,* January 9th 1935)**

## Leg of Injured Man Saved by Doctors

MASON CITY, June 17.—(Special.)—Don McDonald of Bellingham MWAK workman who was hit and partially buried in the soft concrete last week, will not lose a leg, Mason City hospital doctors said.

McDonald suffered two broken legs in the accident. He was pinned under a bucket in the concrete for more than an hour.

J. W. Meyers of Walla Walla suffered a more serious injury in the same accident than was at first believed. He sustained a spinal fracture and will be in the hospital from eight to 10 weeks and will be unable to work for about six months.

H. H. Ziegler of Kelso, the third injured worker, has multiple cuts and lacerations. He lost a finger.

The neck and back of Louie Rhodes of Coulee City, who broke his neck in a dive into Blue lake Sunday, was put in a cast yesterday. He will remain in it for about three months.

**(*Spokane Chronicle,* June 17th 1936)**

## Torches Used To Free Injured Man Under Huge Boom

GRAND COULEE DAM, Jan. 25.—How Marvin Palenuk, 25, of Bremerton, a piledriver man for the MWAK, escaped with his life after being hit with a 120-foot crane boom, was still the greatest source of amazement among the working men and witnesses yesterday afternoon.

Palenuk, who suffered a severe cut in back of his head, two broken arms and a broken leg, was working under the derrick when a cable broke supporting the boom. Palenuk ran but the boom struck him as he was running away. The heavy steel frame was straight up and not lifting anything when the cable broke.

It was necessary to dig under the boom and to cut a portion of it in two with torches to get Palenuk out.

**(*Wenatchee Daily World,* January 25th 1935)**

## WORKMEN KNOCKED OUT BY 11,000-VOLT SHOCK

GRAND COULEE DAM, April 25. (AP)—Two reclamation bureau engineers working on the Grand Coulee dam narrowly escaped death from electrocution by an 11,000-volt power line today. Both were slightly injured.

Don B. Fuller, 22, Walla Walla, a chainman, suffered head injuries when when he fell 10 feet from an embankment after his "rod" touched the wire.

Kenneth E. Hydorn, 28, former Boulder dam workman, was shocked. Both men were made unconscious for a time, but neither was burned.

Seemingly Fuller's "rod" touched the line and the electricity traveled down the wet pole to the ground and to Hydorn's end of the chain.

(*Spokesman-Review*, April 25th 1936)

## INJURED BY LOADED CONCRETE BUCKET

GRAND COULEE DAM. — Three workmen at Grand Coulee dam were injured Wednesday, last week, when a loaded concrete bucket dropped on them in the west side pouring operations.

Don McDonald, Bellingham, suffered broken legs and bruises; H. H. Ziegler, Kelso, lost a finger and was bruised, and J. W. Myers, Walla Walla, suffered bruises. All were taken to Mason City hospital.

(*Spokane County News,* June 19th 1936)

# COULEE BLAST INJURES TWO, WRECKS PLANT

Two Grand Coulee workmen were injured Thursday night in an explosion that demolished what is believed to have been the largest acetylene generating plant in use in private industry.

The injured were Richard Elmgreen, E1807 North Crescent, Spokane, and Alvin Terry of Wenatchee. They were thrown to the ground by the force of the explosion, but escaped serious injury because they were out of direct line of concussion. Their faces were singed.

**(*Spokane Chronicle,* February 21st 1936)**

COULEE DAM, Feb. 19.—(Special.)—Charles Elliott, oiler of Almira, and Dalton Webb of Spokane, shovel operator, narrowly escaped death last week-end when the shovel on which they were working in the slide area for David H. Ryan was partially buried by a slide, it was learned yesterday.

About 300 cubic yards of hardpan broke loose from a high, steep wall at the bottom of which the shovel was engaged and pinned the two men inside. It was necessary to obtain a torch from the MWAK to cut through the steel to release the men. Elliott was cut up considerably and Webb suffered a sprained knee.

The mass came down without warning. A soap-seam, the like of which has caused the huge slide in this area, split open and down came the avalanche. The men could not escape the earth and were pinned inside the cab. A few more yards of material and a fatal accident might have taken place.

**(*Spokane Chronicle,* Feb. 18th 1935)**

# The M.W.A.K. Safety Dept.


**<u>Above</u>: the original (MWAK) hospital at *Mason City* (ca.1936) <u>Left</u>: this illustration appeared in the *Grand Coulee Dam* news-letter: *The M.W.A.K. Columbian Safety Newsletter*, in May of 1940. It was part of the "Safety Pays" initiative to help reduce worker injuries. The newsletter was distributed to workers from 1938 to 1941.**


***"Six winners in the MWAK Company's first safety slogan contest were announced today. Some of the slogans are to be placed at the entrance of the new east shore walkway. Each will receive first prize awards. A.L. Parker and gang – 'Don't let the ambulance bring you back up' and 'Safe today – do it again tomorrow.' C.F. Brown – 'Watch you step as I watch mine; you have one life, I have nine' (to be painted on a black cat). Harry Feldham and Day Reynolds – 'Safety pays more than compensation – be careful" and 'You are returning this way because you were careful today." Dave Smith – 'It pays to be careful – ask the man who wasn't.' P.J. Roddy – 'More workmen are killed' or 'More work-men are kareful' (the first letters of the words spell 'MWAK')."***



***Spokesman-Review*, April 10th 1937**

# You Might Be Next!


***"An exploding stick of dynamite today dangerously injured Clarence Lamphier, 32, jack-hammer man for MWAK, when his pneumatic drill struck the explosive in a hole in granite bedrock. One leg was amputated in the Mason City hospital, where surgeons worked several hours in an effort to save his life. He was badly weakened by loss of blood. Safety department officials said that the dynamite seemingly had been placed for a previous blast and had not exploded or already had been placed for the next blast. Recently married, Lamphier lived at Electric City…Hospital officials said his condition was serious."***

***Spokesman-Review*, March 30th 1936**

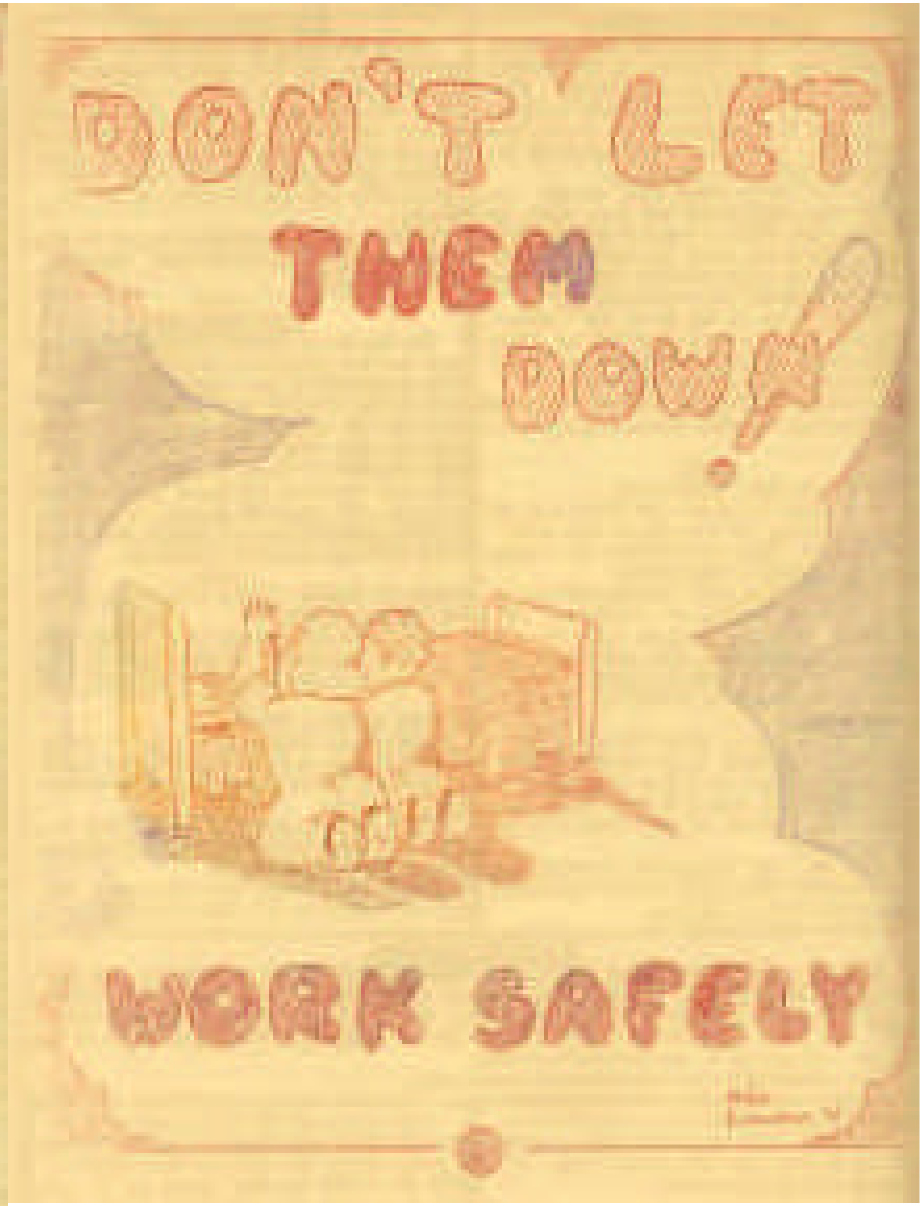
**Left: from the *M.W.A.K. Columbian Safety Newsletter***



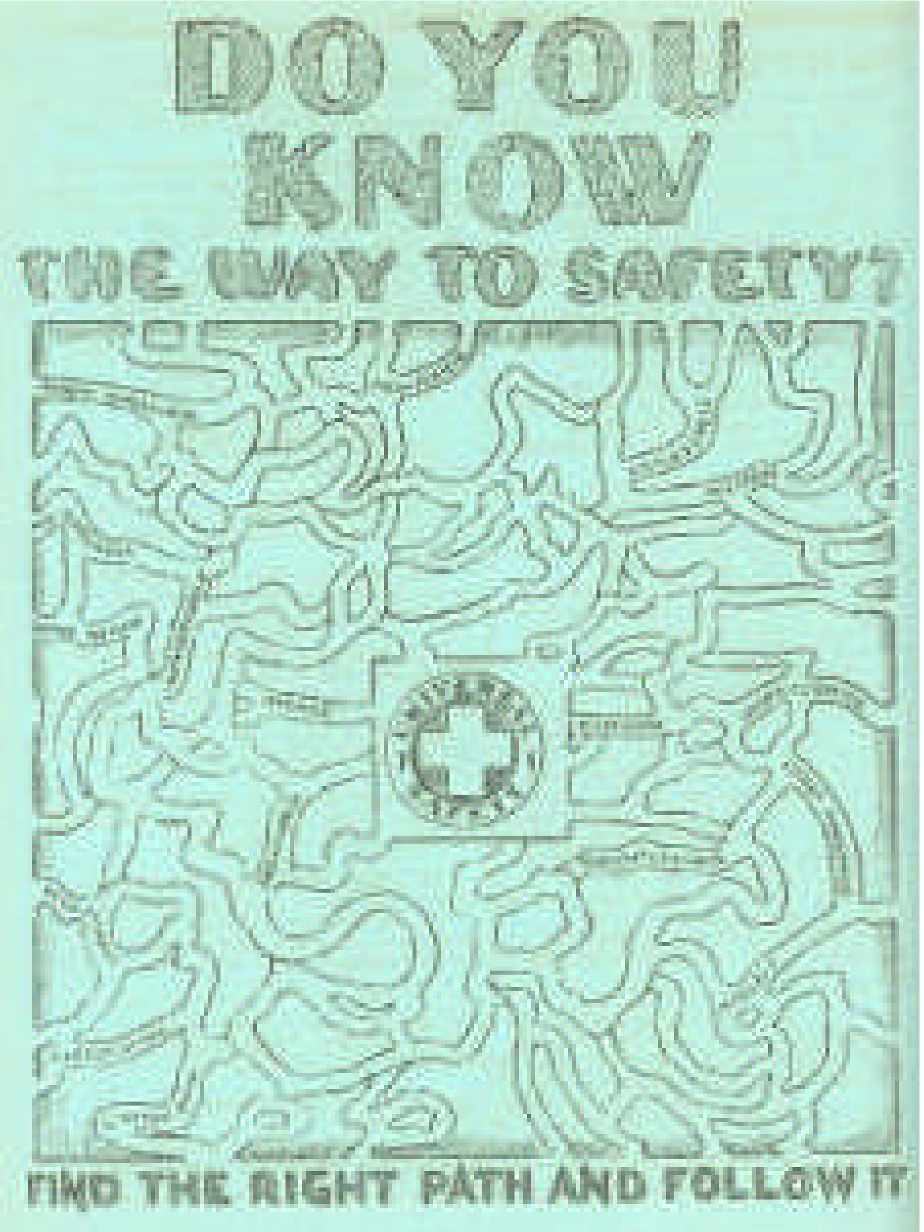
**(from the *M.W.A.K. Columbian Safety Newsletter)***



**(from the *M.W.A.K. Columbian Safety Newsletter*)**

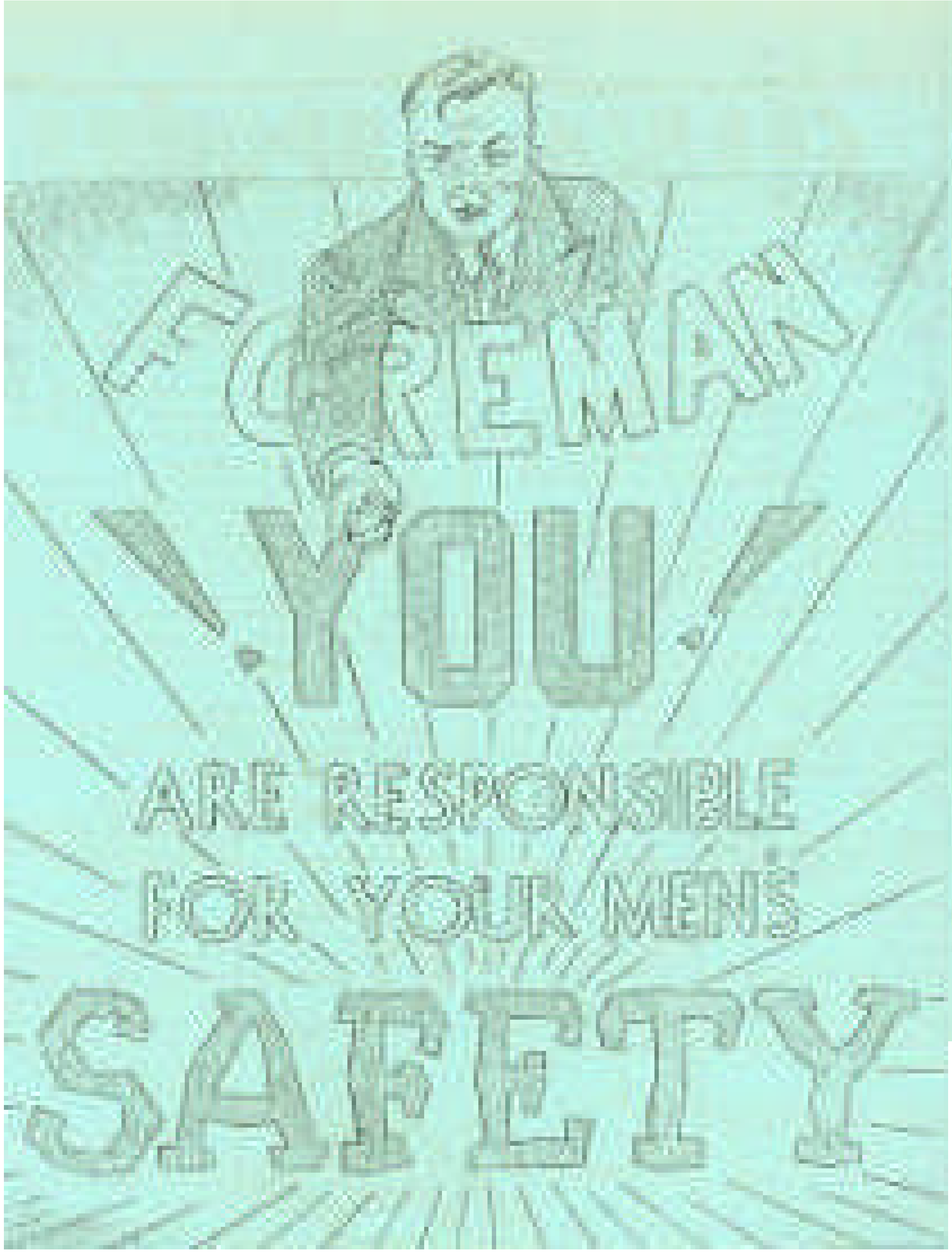

**(from the *M.W.A.K. Columbian Safety Newsletter*)**

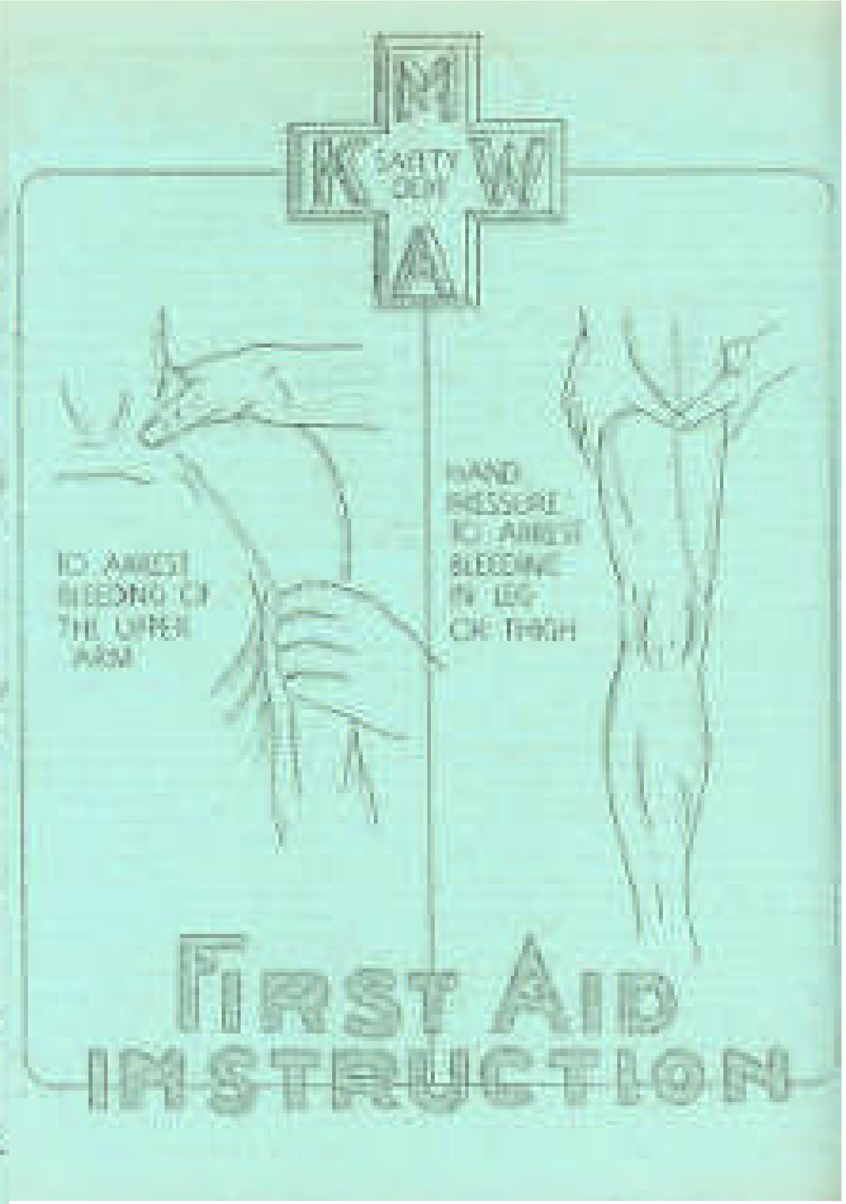




**(from the *M.W.A.K. Columbian Safety Newsletter)***



**(from the *M.W.A.K. Columbian Safety Newsletter)***

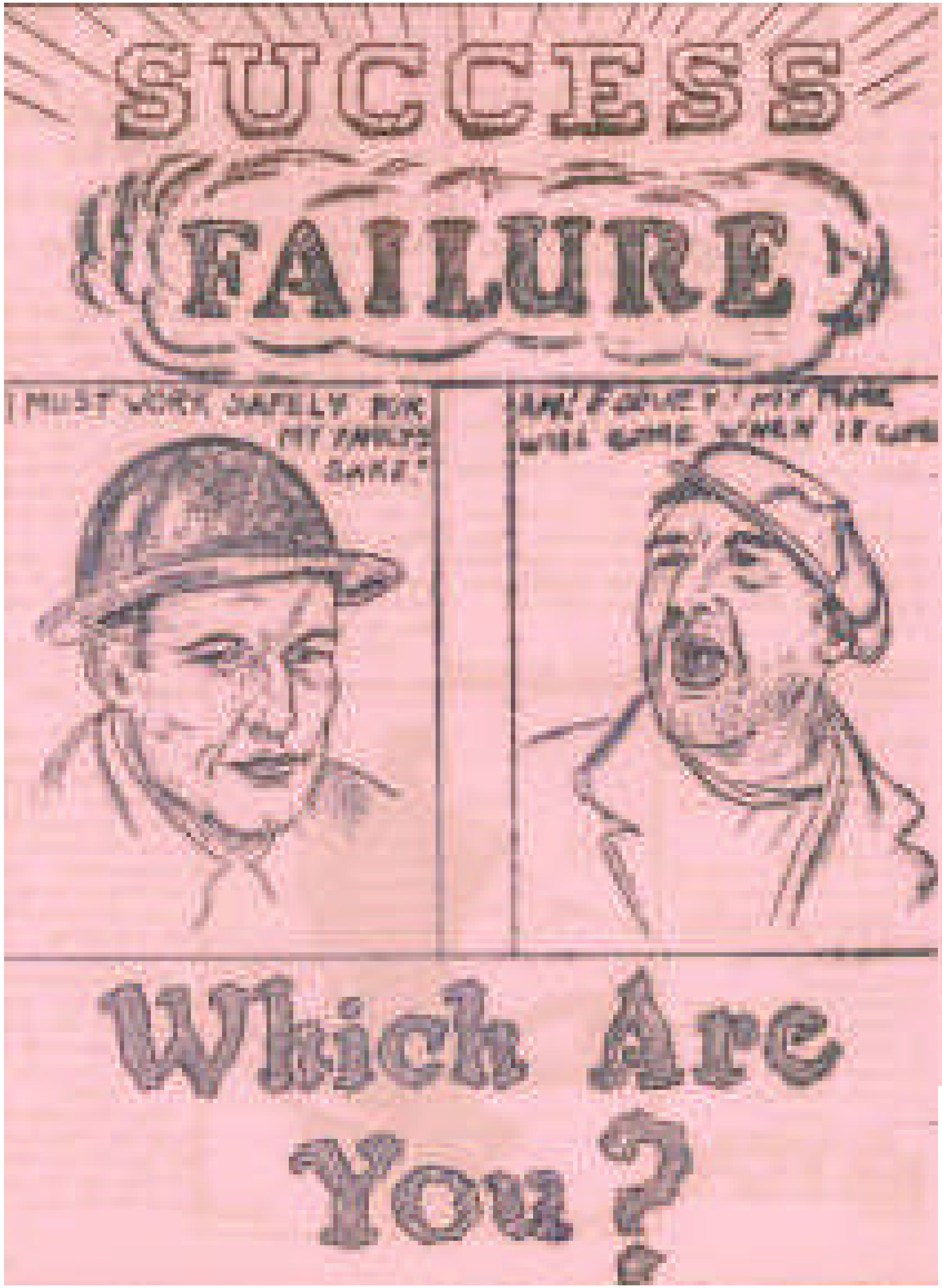


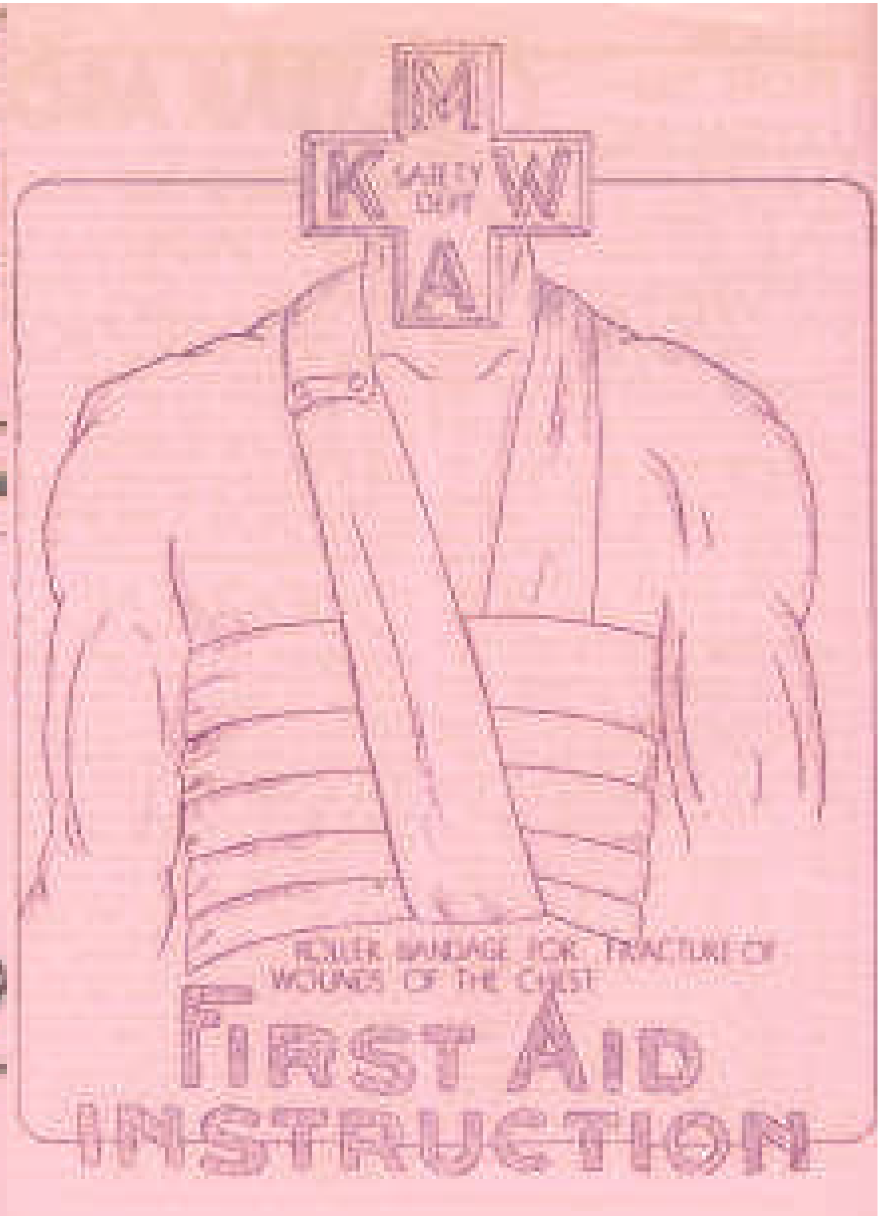




**(from the *M.W.A.K. Columbian Safety Newsletter)***



**(from the *M.W.A.K. Columbian Safety Newsletter*)**

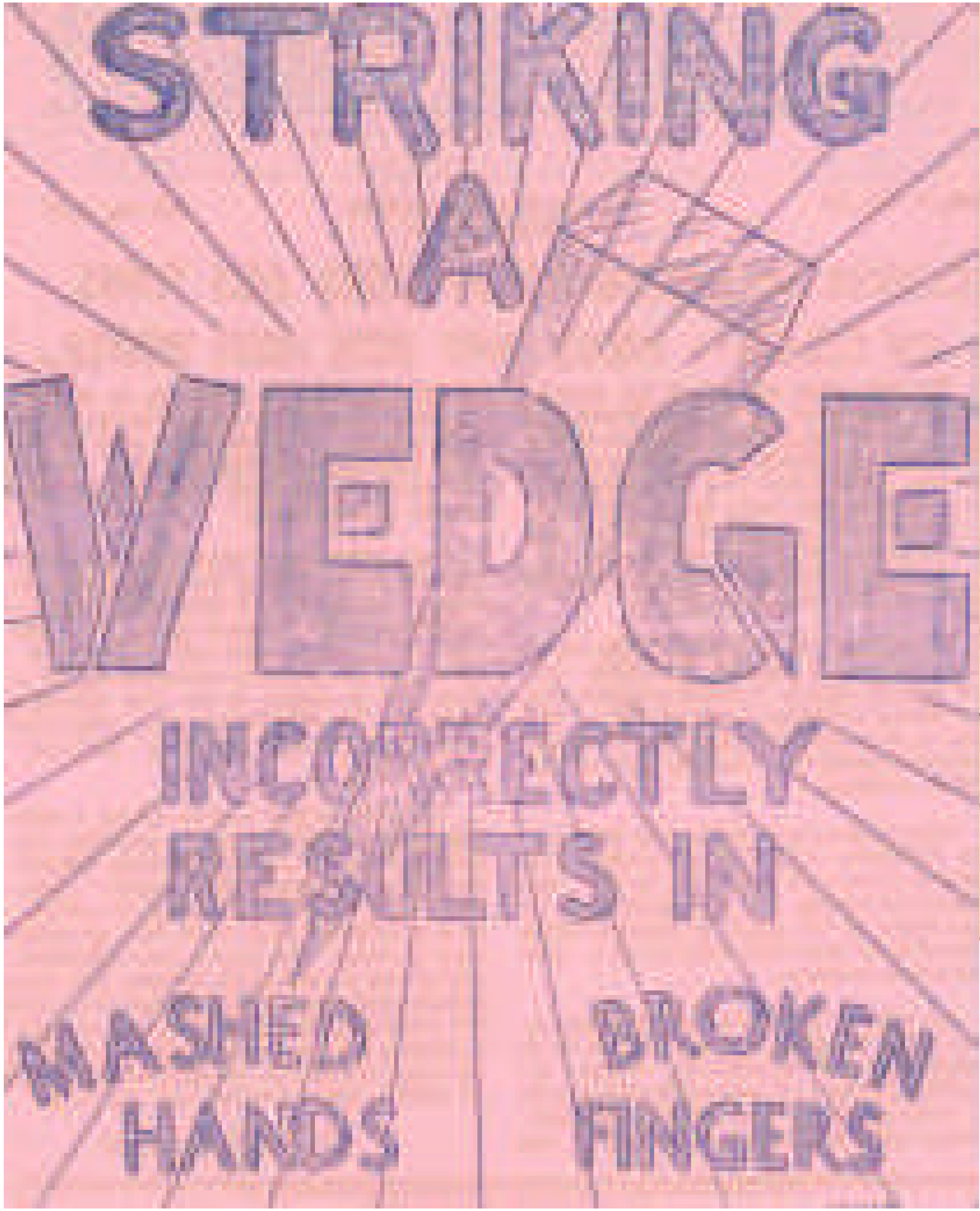


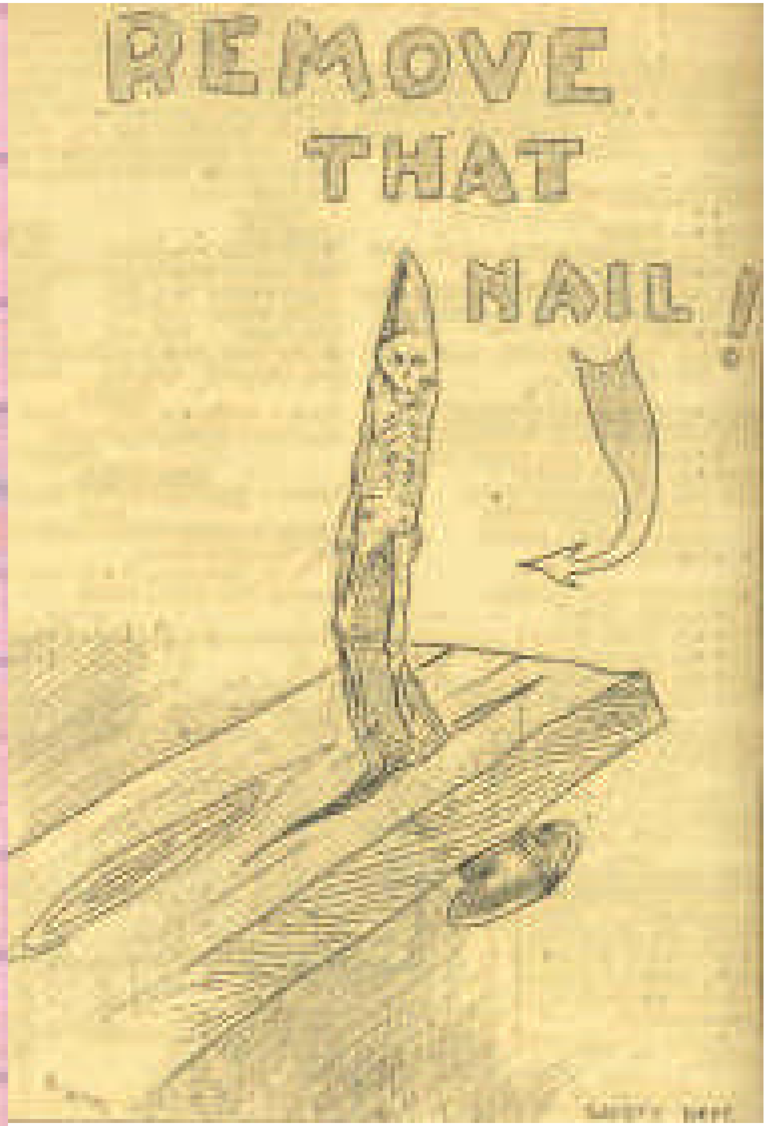




**(from the *M.W.A.K. Columbian Safety Newsletter)***



**(from the *M.W.A.K. Columbian Safety Newsletter*)**




**(from the *M.W.A.K. Columbian Safety Newsletter*)**

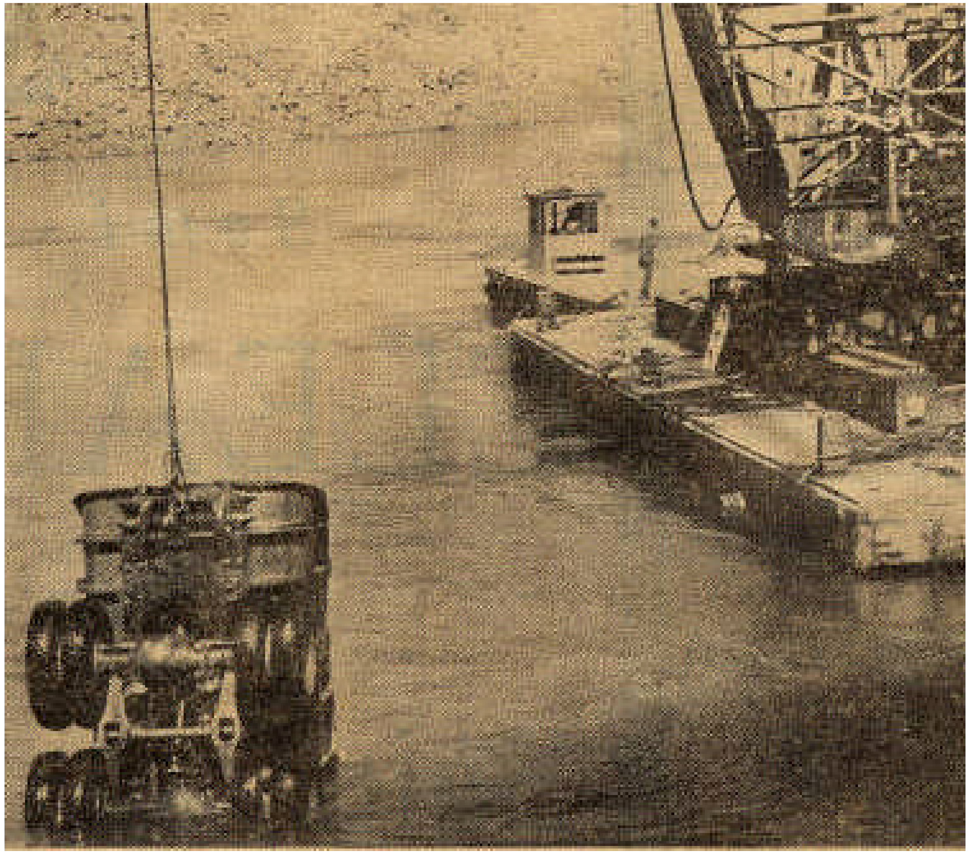

***"Iazoer Kazanovich, 40, of Cle Elum, a M.W.A.K. laborer, is in critical condition at the hospital, due to an injury received from a heavy 'skip' bucket hitting him on the head. Infection developed after an eye was removed. He is reported near death."***

***Chelan County Courier*, January 31st 1936**

**<u>Left</u>: from the M.W.A.K. Columbian Safety Newsletter**


**<u>Left</u>: caption: "Seventy-seven people died in accidents during the construction of *Grand Coulee Dam*. However, this was well below the average for construction sites at the time. More people will die on the 'speedball highway' leading to the dam than at the dam construction site."**

**<u>Right</u>: caption: "Grand Coulee Dam construction site sign: 'Construction Area – EXTREME DANGER – Positively No Admittance – KEEP OUT (photo taken by Margaret Bourke-White)"**

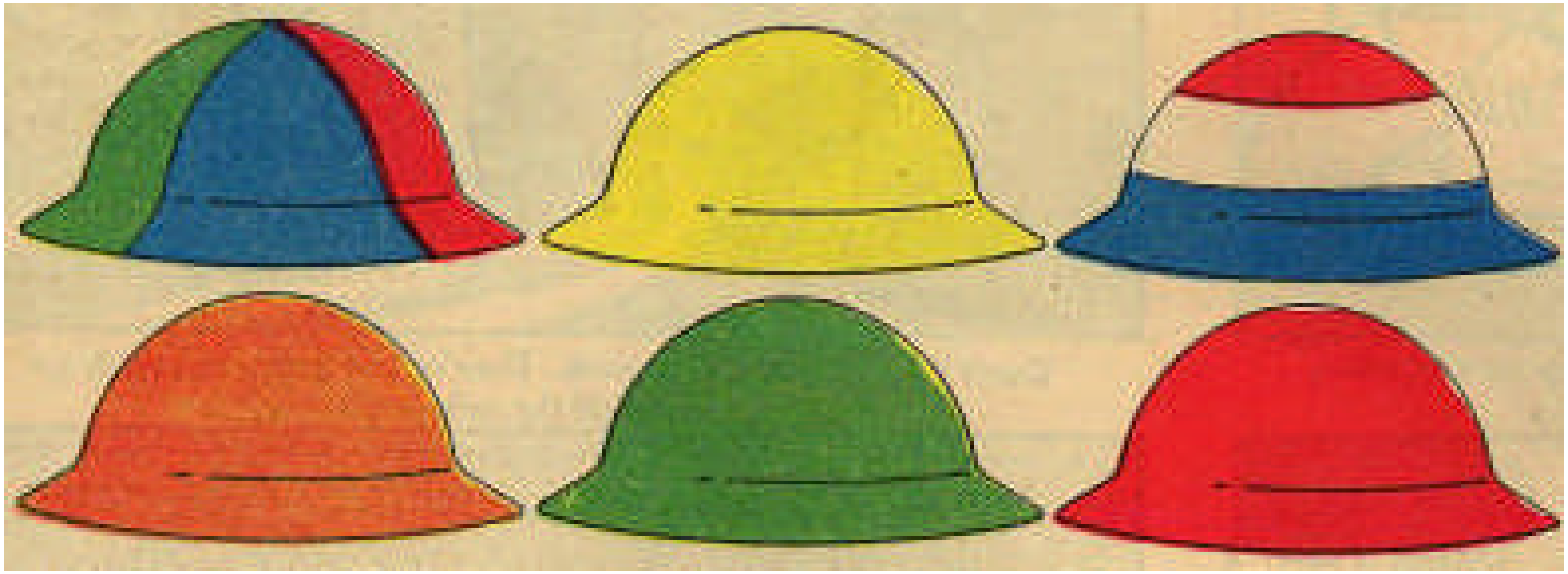


Left: caption: “Retrieving this huge truck from the bed of the Columbia river at the Grand Coulee dam presented only a minor problem to officials of MWAK, who, having built the foundation for the mightiest dam in the world, regarded this as only a minor incident. The truck went overboard last summer as it skidded off a trail. When salvage crews get ready, this crane was moved into position and a wire rope attached to the submerged machine. In a few minutes the truck was swung over the side – on the river bank.” (*Spokesman-Review,* December 16$^{th}$ 1937)

# Metallic Millinery

***“The safety department of MWAK has worked out a colorful array of headgear, but scenic effect was not considered in the least. To the informed, each hat or helmet designates a workman of a particular type. It facilitates identification and it may make it easier for foremen to locate their crews and to know, at a glance, if a workman is somewhere on the job where he does not belong. Helmets of steel, or ‘tin hats,’ have been used almost from the start of construction. These are to protect workers from objects falling on them from higher portions of the work, In fact, these tin hats have saved numerous lives. In other cases, they have prevented serious injury. The company furnishes the metallic millinery, but the men are charged up for them…”***

***Spokesman-Review,*** **July 1st 1937**



***"There are sixteen official hat classifications on the job, thirteen of them tin hats. Each has its distinctive color or color combination. The designations follow:***

- ***Blower men – Silver hat with red cross over the crown;***
- ***Cooling pipe men – Green hat;***
- ***Electricians – Red, green and blue;***
- ***Hose repairmen – Orange;***
- ***Carpenters, laborers and concrete men – Red;***
- ***O.K. men – Red, white and blue in horizontal bands;***
- ***Hook tender – Blue;***
- ***Metal men – Blue with white spot on top;***
- ***Safety department – White with red cross in front;***
- ***Pipe fitters – Yellow;***
- ***Grout pipe men – Silver.***

***Spokesman-Review,* July 1st 1937**

**<u>Above</u>: caption: "Left to right (top); Electricians, pipe fitters and O.K. men.
Left to right (bottom): Hose repairmen, cooling pipe men and carpenters, laborers and concrete men."**

***"The plan of having workmen wear vari-colored hats to indicate the type of job they follow is causing builders of the Grand Coulee foundation dam no end of trouble. A trace of vanity, unexpected from thorny-fisted construction laborers, probably is the cause, said MWAK Company officials. As soon as the order came out, the workmen took it upon themselves to color their 'hard hats.' Instead of a systematic color scheme, the laborers began appearing with gaudy splashes in a myriad of hues and designs. The company issued another order. Workmen must wear the prescribed color and designs on their hats."***

***Seattle Times*, April 1st 1937**

# Labor Relations

***"Workmen at the dam site will be required to contribute one percent of their wages each week to compensate them during periods of unemployment, as required under the Unemployment Compensation Act of the state which went into effect January 1, 1936…Under the act, the employer shall contribute two percent of each employee's wages to the fund and each employee shall contribute one percent of his wages…"***

***The Wenatchee Daily World,*** **January 3rd 1936**

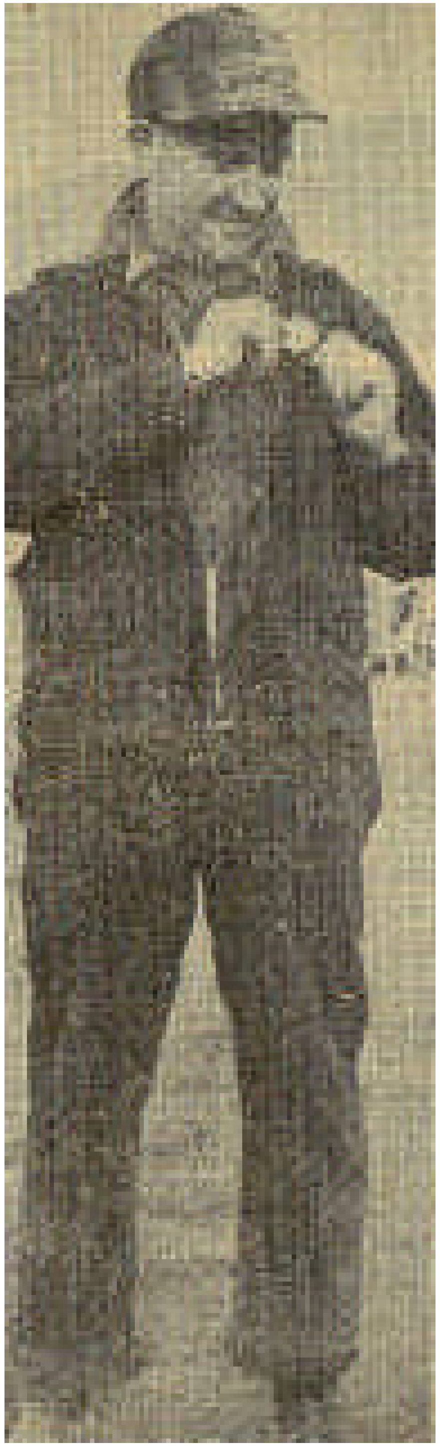
***"About $6,300,000 has been paid out in wages by the Mason-Walsh-Atkinson-Kier company…Workman for the company have labored more than 7,000,000 hours, figures show. The average weekly payroll of the firm, during peak employment periods, is about $100,000…"***

***Wenatchee Daily World,*** **March 14th 1936**

**Left: caption: "Pay-day at Grand Coulee"**

***“Envoys of the American Federation of Labor launched a vigorous drive at a mass meeting Thursday night to organize Grand Coulee dam’s army of 5,000 common and semi-skilled laborers into one big craft union. The campaign is in direct opposition to the membership drives of the C.I.O. and the newly incorporated Federation of Construction Employees. Enough members were signed by the A.F. of L. representatives Thursday night to apply for a charter for ‘The Construction and General Laborer’s Union.’ George Lish, organizer of the new union, and Paul Frederickson, president of the Washington Building Trades Council, in addressing the mass meeting, said 50 cents an hour for common laborers is a ‘starvation’ wage. They declared the coast scale is 90 cents…William Hillyer, C.I.O. organizer, told the Chronicle’s Grand Coulee correspondent 1,600 workers have signed with the C.I.O.”***

***Spokane Chronicle,*** **June 25th 1936**



***"L.R. Roestel, president of the Spokane Building Trades Council, said today that union labor will demand a thirty-hour week on the Grand Coulee dam 'after the present contract for the foundation is completed.' Such a week will be adopted throughout the state by his union on January 1, he said. 'The thirty-hour week provision bill will not affect the present work on the dam foundation, but it will affect work on the high dam, if and when it is started,' Roestel said."***

***Seattle Daily Times,*** **December 16th 1936**

**Left: caption: "Here's positive proof that 'brass' is as good as gold. Al Sinrud is seen pinning his badge or 'brass' as it is called at the Grand Coulee dam site, on his work coat preparatory to going to work for the MWAK Company. He is one of several hundred men being added to the payroll following the winter's layoff of two months. MWAK is adding the workmen gradually and now has more applicants for work than jobs." (*Spokesman-Review,* March 2nd 1937)**

***"The agreement covers only five months, until the present MWAK Company contract expires. We want to be in position to get a union agreement under the new contract."***

**A.F. of L. Official (July 30th 1937)**

***“Grand Coulee dam construction became an American Federation of Labor ‘closed shop’ union job today…the C.I.O. registered vigorous protest with the U.S. government...the MWAK Company announced signing of the contract, whereby all of its 5,621 employees ‘shall be members in good standing’ with the A.F. of L...”***
***Spokesman-Review,*** **July 31st 1937**

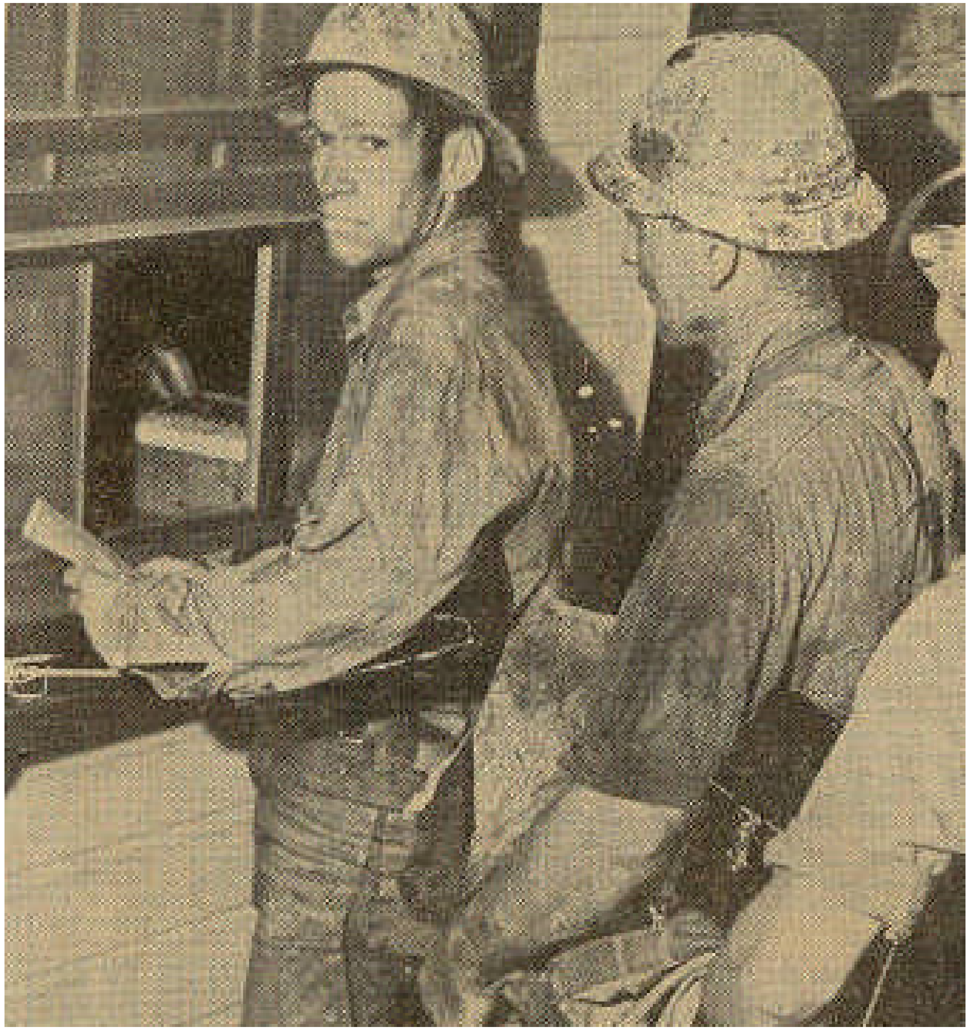
*"Why should I put out $25 to join a union? What becomes of the money we pay? How much goes to the benefit of the working man? I stand for individual Americanism. This is a free country. Why can't we think and act for ourselves? All these labor leaders do is stir up a lot of trouble. They squawk about 50 cents an hour for common laborers. Why, if a man is any good at all, he's immediately shoved up to a higher wage level. Fifty cents an hour is more than a lot of them are worth. If they're not getting enough money, why not form a committee of the working men and go to the company officials and present the case? I'm not going to join any union and I'm going to stay on the job just as long as I can."*

***Daniel M. O'Reilly,*** **MWAK Driller (August 1937)**

**Left: caption: "Among those who worked their way up while MWAK built the foundation of the Grand Coulee dam is W.M. Gibbs, trestle foreman, one of the oldest men on the job. He began as a laborer when the contractors first started in October, 1934, but was promoted to trestle foreman supervising concrete transportation." (*Spokesman-Review*, January 15th 1936)**

***"We wish to protest the contract or agreement signed by T.J. Walsh for the MWAK Company and the representatives of the A.F. of L. as not being representative of the majority of the men employed on the job…According to the Wagner Labor Act, the A.F. of L. must have 51 percent of the employees in its membership to be permitted to bargain collectively. We of the C.I.O. claim a larger membership than the A.F. of L. at the dam. Workmen should know they are protected by the Wagner Act and cannot be forced to join any union, whether C.I.O. or A.F. of L."***

**C.I.O. Official (July 30th 1937)**



***"The C.I.O. has asked President Roosevelt and other government officials to close down the Grand Coulee dam project. A shutdown, C.I.O. leaders claim, is necessary to permit an investigation of the 'closed shop' agreement the MWAK Company signed Friday with the American Federation of Labor…"***

**(*Spokane Chronicle,* August 3rd 1937)**

**<u>Left</u>: caption: "It comes out here – over a half million dollars every month in the form of pay checks for Coulee dam workmen, but this big flood of cash may possibly be sharply curtailed if the threatened C.I.O. strike takes effect, and if it recalls from work the 2,000 men C.I.O. leaders claim as members of their organization." (*Spokane Chronicle,* August 9th 1937)**

***“The Interior Department and the Bureau of Reclamation have been, and are remaining, absolutely neutral, and all government employees at the site of Grand Coulee dam and elsewhere have been instructed to maintain the impartial and neutral attitude which has been adapted.”***

***Harold L. Ickes,*** **Secretary of the Interior (August 1937)**

***“Immediate danger of a Committee for Industrial Organization strike at the gigantic federal Grand Coulee dam project appeared ended today by a union vote to table the issue…outlined a shift in tactics to a drive for public support…The labor controversy at the dam was precipitated by the agreement entered by MWAK with the A.F. of L. for an exclusive ‘closed shop.’ The C.I.O. claimed a larger membership and contended an employee’s election should be ordered…”***

***Seattle Post-Intelligencer,*** **August 11th 1937**

***“Two special government agents are investigating the labor controversy at Grand Coulee dam…W.W. Flournoy Jr. and B.G. Hancock, from the Seattle WPA office, have been instructed to make a complete report on the C.I.O. – A.F. of L. dispute to Secretary of the Interior Ickes. Flournoy and Hancock said they in no way will act as conciliators or arbitrators…the C.I.O. continued its plan to win public sympathy in its threat to strike in protest of the ‘closed shop’ contract signed by the MWAK Company with the A.F. of L…”***

***Spokane Chronicle,*** **August 11th 1937**

***"…An average of nearly $800,000 a month was paid this spring to workers employed by MWAK Company…Crews were increased in July and August, and it is believed payrolls for the two months will be close to a million dollars each. Including the salaries of superintendents and foremen, the average hourly wage last spring was 86 cents. Without including the former, the average was 84 cents. The average work week was 36 hours."***

***Kellogg Evening News,* September 2nd 1937**

***"Carl R. Schedler, referee for the Department of Labor, spent the entire day here checking employment records with MWAK and the Bureau of Reclamation to verify testimony offered at the public hearing yesterday to ascertain the prevailing wage at the dam…Workmen on the dam and the businessmen of the dam site were elated as the result of the hearing, for it is generally believed that a higher wage will be paid under the new contract…"***

***Spokesman-Review,*** **October 13th 1937**

***"…The A.F. of L. agreements provide for minimum wage of 75 cents an hour for common labor, compared to the 60 cents an hour rate contained in the Bureau of Reclamation specifications. Wage rates for other classifications of labor are similarly higher and are said in most instances to average 15 cents an hour above the specified scale. The general increase in the wage scales is estimated at 23 percent…"***

***Spokane Chronicle,*** **December 10th 1937**

***"…The agreements are ironclad in so far as the American Federation of Labor is concerned and practically eliminate any possibility of strikes. One clause specifies that the A.F. of L. 'will treat as nonexistent' any picket lines, regardless of whether they are affiliated or not with the American Federation of Labor. One young labor leader pointed out 'we have put a straight-jacket upon ourselves. But that is what we wanted to do.'…"***

***Spokane Chronicle,*** **December 10th 1937**

***"Workmen on the dam and merchants of the dam site area were jubilant today over the announcement the Interior Construction Company, the low bidders on the new contract, had agreed to a higher wage scale than that specified by the federal Department of Labor. It is generally understood that the new schedule will be approximately 27 percent higher…Under the new contract most of the work will be performed by skilled labor and little common labor will be used, which will mean that the average wage will be higher than at the present time…"***

***Spokesman-Review,*** **December 13th 1937**

***"In spite of an agreement between the low bidders on the next Grand Coulee dam contract and the American Federation of Labor, the specter of labor strife loomed ominously yesterday when reports reached Spokane that the C.I.O. had protested further consideration of the low bid submitted by the Interior Construction Company…Representatives of the C.I.O. are said to have maintained that the specifications upon which the bids were called provided for a minimum wage of 60 cents an hour for common labor…It is contended by the C.I.O. that prior to submitting bids, the contractor agreed with the A.F. of L. to fix the minimum at 75 cents an hour, thereby closing the door to negotiations with the C.I.O., which has insisted upon a higher minimum scale that that acceptable to the A.F. of L…At C.I.O. headquarters it was contended a majority of the workmen had joined the C.I.O., and there was some talk of demanding an election under the Wagner Act to determine which organization should represent the men in collective bargaining. During the construction of Boulder dam, the Six Companies, composed of the same concerns affiliated in the Interior Construction Company, were blacklisted by the A.F. of L."***

***Spokesman-Review,*** **December 14th 1937**

***"There is one place where visitors to the dam site can get an idea of the scale of the project, and that's the mess hall…when they hear that the gigantic mess hall can seat 1,000 men at one time, they begin to see what an enormous place the project is. Scores of cooks and assistants are necessary to prepare the meals. Waiters are employed in dozens to wait on tables. Meals are served four times a day, each man is checked by number as he enters, and the meals are charged against his check each week…"***

***Grand Coulee News,*** **Nov. 15th 1935**

**Left: caption: "It takes a lot of Bologna for 1,200 lunches. Spread out in front of these three youths are 620 slices of bread for 310 sandwiches. Into each lunch for men going on shift go two sandwiches, two cookies, a piece of pie and two kinds of fruit."**


**<u>Left</u>: caption: "Because of the many shifts building Grand Coulee Dam, almost continuous service is maintained in the mess hall. Here is a view of one of the wings in the main dining room, seating 512 persons. Another seats 288. One thousand Sunday visitors often share tables with the 5,000 dam builders." (*Seattle Times*, May 30th 1937)**

**<u>Right</u>: caption: "Feeding Coulee Dam's 5,000. A board holding eleven pies is shoved in the oven while Soren Juul prepares more. Nice cases of fruit (apricot at this baking) fill the 438 pies needed for one meal. When the oven is loaded there are seventy-three pies baking." (*Seattle Times*, May 30th 1937)**

# The Grand Coulee Mystery

***“…a modern traveler to the dam would be hard pressed to find any evidence of the sacrifices made to see it completed. No monument or plaque exists to honor the men who died creating it; until recently, no comprehensive list even existed of the men’s names and how they died. That by itself may register as a simple if unfortunate oversight. But in fact, the lack of a memorial at Grand Coulee is the result of a strange chapter in the dam’s history…”***

***The Spokesman-Review,* May 25th 2014**

***"...In 1938, a monument did exist with names of those who'd died up to that point, standing along what was then the main thoroughfare through Grand Coulee. It was 10-feet of Georgia granite, with room for 75 names, and commissioned by the local American Legion. A beautiful tribute, by all accounts. But the monument stood there for only two years. In June 1940, the people of Grand Coulee found the granite pillar, all seven tons of it, gone, the concrete pedestal all that was left to indicate it was ever there to begin with…"***

***The Spokesman-Review,*** **May 25th 2014**

**Left: caption: "A monument honoring those who died while building the Grand Coulee Dam stood along the main thoroughfare in Grand Coulee between 1938 and 1940"**

***"…In April 1938, the Grand Coulee American Legion commissioned Colville monument maker John Citkovich to build the monument. They wanted it ready to be unveiled on Memorial Day, and Citkovich had the granite shipped to Spokane by train from Georgia. Working around the clock, he finished the piece, ten and a half feet tall and six feet wide at the base, in less than a week. The names of the dead were cast onto small bronze plates and screwed into the rock. He delivered the monument, 'shrouded in secrecy' according to news accounts, on May 25, 1938. He also had a bill: $1,725. In today's dollars, that works out to about $29,000. No small amount, especially during the Depression, but there's no evidence that the price tag caused sticker shock…"***

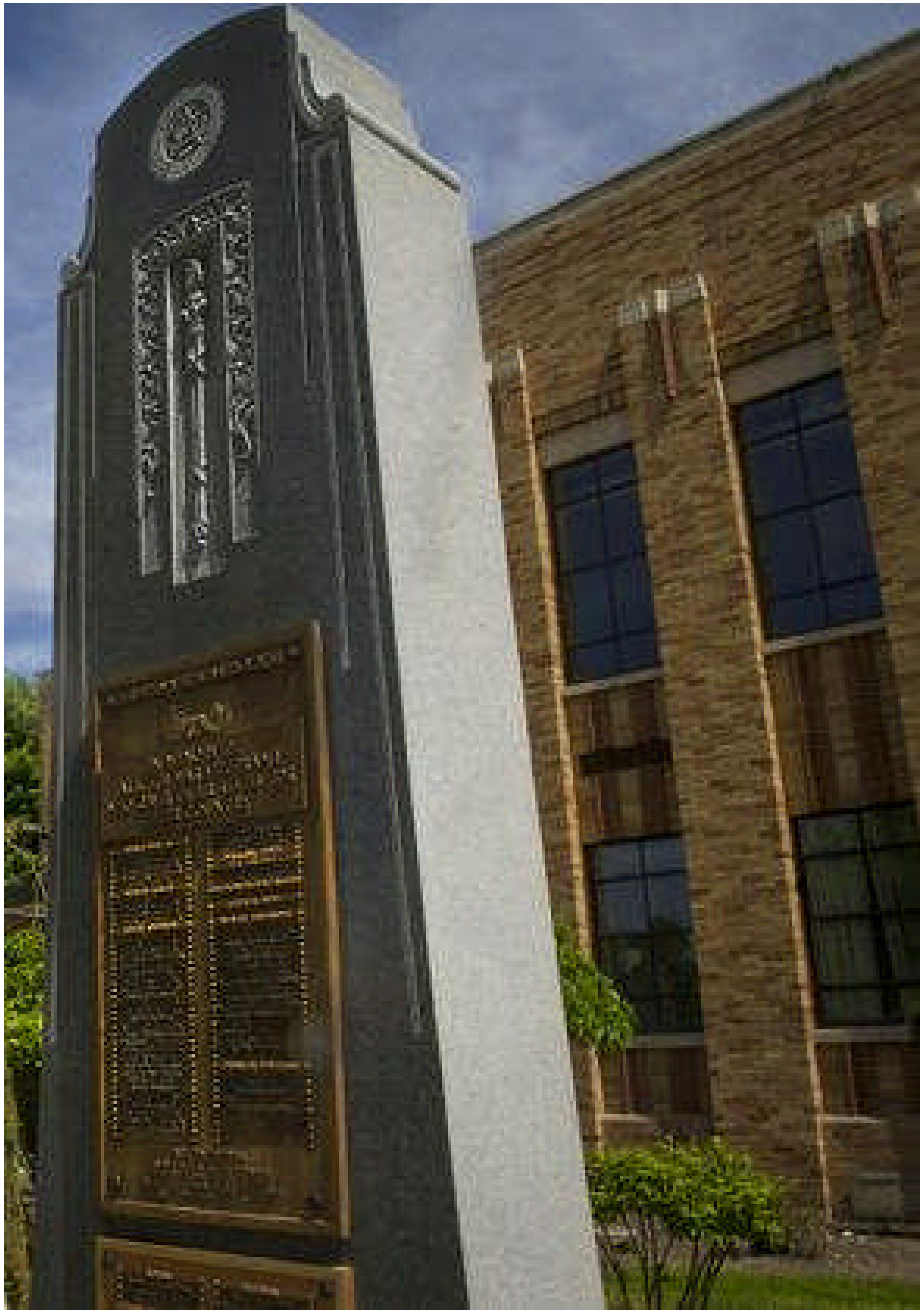
***The Spokesman-Review,* May 25th 2014**

***"…It certainly didn't dampen the Memorial Day party thrown that year at Grand Coulee, which featured an appearance by the governor and free barbecue, along with the unveiling of the monument. As the Spokane Daily Chronicle noted, construction on the dam didn't stop for the holiday; rather, visitors were invited to marvel as men holding jackhammers dangled against the cliffs, loosening rock to make way for more dam. By that weekend, forty-nine men had died on the project…"***

***The Spokesman-Review,* May 25th 2014**

***"…But after the food was gone and the governor headed back to Olympia, things quickly soured between Citkovich and the Grand Coulee American Legion. The Legion had paid the monument-maker a $200 retainer, but by June the next year, Citkovich hadn't received a dollar more. The city and civic organizations begged Citkovich for more time, and he obliged. He believed in the cause, he said, and wanted to help honor 'the heroism of those who have given their lives to make possible the largest structure ever built by man.' Another year passed. Still no money had been paid. Finally, the Legion offered to settle with Citkovich for $500. No dice, Citkovich said. If he was going to sell the thing for a bargain, he'd rather have it in his own community…"***

***The Spokesman-Review,*** **May 25th 2014**



*"…Citkovich's son, Jack Citkovich, died in 2010, but before he did he told a local historian about the daytime raid he got to tag along with as a boy. His father brought the 14-year-old, two other men, and a big hoist on a flatbed truck. And some guns. 'We expected trouble so we took rifles along, but no one challenged us and we drove up to the monument, loaded it up and just drove off with it,' he remembered. It was taken back to Colville and dropped where it stands today: In front of the Stevens County Courthouse…"*

***The Spokesman-Review,*** **May 25th 2014**

***“…The plaques with the names of those killed at the dam were removed and probably donated to a metal drive for the war. New names were attached, those of Stevens County residents who’d died fighting for the country. To this day, a plaque that states the monument is dedicated to the men who died at Grand Coulee remains on the monument, but is covered up by a smaller plaque saying it was dedicated to Stevens County’s war veterans…”***

***The Spokesman-Review,* May 25th 2014**

***"…While it's not certain why the American Legion wasn't able to come up with the money to pay for the monument, the most likely scenario seems to be embezzlement. Around the same time the payment problems came to light, the commander of the Legion disappeared…The money disappeared about the same time he did…The assumption is he took it…"***

***The Spokesman-Review,* May 25th 2014**

# It’s Just Like Driving a Car

***"…The huge insurance coverage required for a Golden Gate bridge, a Norris or Grand Coulee dam, an Empire State building, or one of the government office structures in Washington is divided up among several companies. On federal projects no one company may insure a portion of the risk greater than 10% of its combined capital and surplus, which fixes a limit of about $1,500,000 on the largest amount any one American company can carry. Casualty companies usually divide a $100,000, $500,000 or $1,000,000 contract into tenths, spreading the risk among ten companies. A $2,000,000 policy may be divided into twentieths. In this way the companies avoid the added perils due to concentration of the risk in one small territory, where a single accident might wipe out all of the men employed…"***

***Popular Mechanics,* July 1937**

***“Classed by insurance companies as ‘extra hazardous employment,’ work in Grand Coulee dam’s construction danger zones is no more dangerous than driving on the highways, recently prepared records reveal. A record of the number of auto fatalities to Grand Coulee dam people was compared with a list of the number of people killed while at work for the MWAK Company on the Columbia river project. The contractors’ company has had nineteen fatalities since construction work at the gigantic dam began almost two years ago. During that time, records show, nearly as many local people lost their lives in automobile accidents while driving on the highways leading to the dam…”***

***Spokane County News,*** **August 7th 1936**

# First to Die


***"…Charles Flosberg, 48, Clayton, Wash., was the first man to lose his life under the contract of the MWAK here. He died in Spokane today of injuries received when he fell 25-feet from a light pole here Saturday. He suffered a spinal injury, fractured ribs, broken collar bone and other injuries. He is survived by his widow and six children. He was a line-man…"***

***Spokesman-Review,*** **December 5th 1934**

**Left: from the *M.W.A.K Columbian Safety Newsletter***

# I’m Going to Get Killed

***“James McAllister, 28, of Gresham, Oregon, was killed late Saturday night as the result of a 30 to 40-foot fall onto the granite bedrock from one of the higher forms of the west side concrete checkerboard. McAllister was picked up in an ambulance and rushed to Mason City hospital, dying about two hours after arriving there. Company records show that he was one of the first foremen to go to work for MWAK, lately being in charge of a crew working on the clean-up of bedrock near the forms. The fatal accident is the company’s 19th and brings the total for the entire dam site to 22. Close friends of McAllister said he had a premonition of his death. He told them during the afternoon preceding his death: ‘I feel I’m going to get killed on that job.’ He repeated similar remarks several times. So strong was his belief, they said, that he planned to quit soon. He was a recent graduate of an Oregon college.”***

***The Wenatchee Daily News,* March 25th 1936**

# It Was Nasty

***"…Susan Dechant, 69, has become an expert on the men who died building Grand Coulee Dam. Who they were, what they did, how they were killed. Now when people come to the dam with questions about a relative they think died at the job site, they're often told to call Dechant. 'It was the laborers that were pretty much the ones being killed,' Dechant said, 'knocked off the dam, crushed by equipment.' 'I've got a file of what they were dying of and it was nasty,' she adds…The deadliest years were 1936 and 1937, according to data collected by Dechant. Each of those years, seventeen men died, or about one every twenty-one days. Dechant said most of the deaths got a line or two in the local papers, if that. 'So-and-so was killed doing such-and-such. That was it.'…"***

***The Spokesman-Review,*** **May 25th 2014**

**Left: Kettle Falls historian *Susan Dechant***

# Only 15 Men Killed On Job In Two Years Construction

GRAND COULEE DAM, Dec. 17.—With more than two years of construction, one year of it with a payroll hovering around the 3,000 mark most of the time, and with a speed of operation unequalled in the state's history, the number of fatal accidents, 15, at the dam site since work began September, 1933, shows the "safety of the job."

Of the 15 workers killed at the dam site, 11 were employed on the M W A K payroll. The concentrated cofferdam and excavation construction during February created more than usual hazard and resulted in the loss of several lives.

Included in the list of men not killed on the M W A K job is the drowning of two Indians who were stringing wire across the river, the death of a lineman for the three engineers due to heat exhaustion, and the death of a laborer on the Crick and Kuney job who burned a dynamite box, caused a cap to explode, walked several hundred feet and then slumped down dead.

The company, through the state, pays for all accidents which cause men to be laid off from work more than three days.

The state department of labor and industry checking industrial insurance, opened an office in the Columbia Basin office Monday under Jim Webbe.

(*The Wenatchee Daily World,* **December 17th 1935**)

# So-and-So Was Killed Today

# GEARS MANGLE WORKER'S BODY

GRAND COULEE DAM, Feb. 15.—The Grand Coulee project's 33d fatality occurred last night when John Engibritson, 52, Osborne, Wash., fell into the conveyor belt gears.

Engibritson's death was the 30th fatality for the MWAK since the company took over the dam construction work.

The accident was discovered when parts of the body fell near two welders at work under the machinery. Engibritson presumably fell into the gears at the junction of three laterals of the conveyor belt system.

He is survived by his widow, Ethel, and two children. The family formerly lived at Ronald, near Cle Elum, Wash.

(*Spokesman-Review*, February 15th 1937)

Friday, Simon E. Hedland, MWAK truck spotter, was fatally injured when a large piece of clay from a truck being unloaded at the conveyor belt grid struck him on the head. He died while being taken to the company hospital in an ambulance. Death was believed caused by a broken neck. He has a brother living at the dam and relatives in North Dakota.

(*Grand Coulee News*, February 18th 1937)

# Rigger on Dam Job Dies From Injuries

MASON CITY, June 5.—(Special.)—E. L. Brockway, 35, MWAK rigger, formerly of Seattle, died in the Mason City hospital at 9 a. m. today of injuries suffered Friday when he was struck on the head by a rock which fell from the low construction trestle while he was working in the foundation area of the Grand Coulee dam.

Although his skull was fractured, the metal hat he was wearing was said to show no marks of the impact.

Brockway is survived by his widow and two minor children, all residents of Grand Coulee.

The fatality was the 35th in MWAK company operations, and the 38th since construction was started here in 1933.

(***Spokane Chronicle*, June 5th 1937)**

**DIED FROM INJURY AT DAM**

GRAND COULEE DAM.—Walter Lash, 21, of Bremerton, a MWAK company laborer, died at Mason City hospital from an injury received from a fall four days after he had started work. His skull was fractured, and spinal meningitis developed. Since operations started about two and a half years ago there have been 17 deaths from accidents, of which 13 were MWAK employees.

(***Chelan County Courier*, January 31st 1936)**

## George Hunter Is 12th MWAK Victim; Dies of Injuries

GRAND COULEE DAM, Jan. 2 (Special)—George A. Hunter, 40, Kirkland MWAK jackhammerman, died at 12:30 this morning at the Mason City hospital. He suffered a broken back last Friday when a large chunk of clay fell on him. He lingered near death since the accident, but was reported to be improving yesterday.

Hunter's death makes the twelfth MWAK fatality, and the sixteenth at the dam since the job began. This is the first fatal accident since July.

(*The Wenatchee Daily World,* **January 2nd 1936)**

## WORKER AT DAM KILLED ON RAILS

GRAND COULEE DAM, March 21. (AP)—A flat car loaded with buckets of concrete ran over and killed William Johnston, 40, Grand Coulee Dam railroad worker, today.

The accident was not witnessed, but the operator of the locomotive hauling the car said he saw Johnston was in the clear as the train passed a switch. The mangled body was on the tracks 15 minutes before it was discovered.

Johnston formerly lived at Soap Lake, Wash. He had no known relatives. His was the 15th fatal accident to employees of the MWAK company, builders of the foundation dam, and the 19th since the project was started.

(*Spokesman-Review,* **March 21st 1936)**

# DAM SITE SLIDE BURIES WORKER

## Daniel E. Meade, 36, Spokane, Dies Under Avalanche of Land.

MASON CITY, Wash., Dec. 24.—Daniel E. Meade, 36, Spokane, was killed at 7 o'clock this morning when he was buried under a small slide of earth on the east shore of the river. He was employed by the MWAK as a truck spotter.

Meade's death was the third fatality at the dam site in a week. He was the 28th MWAK employee to be fatally injured, and the 31st since operations were started here.

According to safety engineers, Meade was directing the placement of trucks for a shovel biting into a 40-foot bank when a mass of fine sand broke loose from the top, completely covering him. He was uncovered within about 10 minutes, but had died of suffocation.

His home address was given as the Pedicord hotel, Spokane. He was single and listed no dependents.

**(*Spokesman-Review,* December 24th 1936)**

# 1 KILLED, 1 HURT AT COULEE DAM

**By Associated Press.**

GRAND COULEE DAM, April 3.—Tom Halvorsen, 29, a timber framer on the Grand Coulee dam project, was killed late today when the boom of a crane snapped while lifting timbers near the west cofferdam, hitting his head.

Halvorsen leaves his widow and a year-old child. His death was the 16th among employees of the Mason-Walsh-Atkinson-Kier company and the 20th on the project since work started.

Walter D. Whitehall, 20, East Wenatchee, was injured critically by a falling crane boom. He fell 12 feet into a timber crib, after being hit on the leg. He is unmarried.

**(*Spokesman-Review,* April 3rd 1936)**

# CARPENTER DIES IN FALL AT DAM

GRAND COULEE DAM, Nov. 23. (AP)—A 15-foot fall from a high concrete block was fatal today to Alex. J. Bruce, 52, Seattle, a carpenter on the Grand Coulee dam. His back was broken.

The MWAK company safety office said the man presumably slipped as he was tightening bolts on the block Friday night. His widow, a daughter at Seattle and a son at Portland, Ore., survive. The body will be taken to Seattle for burial.

Bruce's death was the 28th since construction of the foundation dam was started.

**(*Spokesman-Review,* December 23rd 1936)**

# MWAK WORKMAN FATALLY INJURED

MASON CITY, Dec. 21.—(Special.)—James A. Biles, 48, Omak, died this morning in the company hospital from injuries suffered Sunday when he fell from a flat car on the government railway at the dam site. His hand slipped while unloading a big timber, and he fell backward against a switch, fracturing his skull, according to safety engineers. He was the 27th MWAK employee to be fatally injured. He is survived by his widow and four minor children.

**(*Spokane Chronicle*, December 21st 1936)**

# FORMER OMAK MAN IS KILLED

GRAND COULEE DAM, Oct. 12. (AP)—Injuries received in a truck accident three weeks ago on the Grand Coulee dam project were fatal today to Thomas Lewis Cosi, 37, Grand Coulee.

The former Omak resident died in the Mason City hospital of chest and kidney injuries and a heart ailment.

He was a truck driver for the MWAK company, the general dam building contractor. Cosi was crushed between the truck and a spoil bank when he leaped to get away from the sliding vehicle. His injuries were reported at the time as not critical. His widow and one child survive.

Cosi's death was the 26th at the dam site in more than two years of construction work.

**(*Spokesman-Review,* October 12th 1936)**

# INJURED ASOTIN YOUTH DIES IN MWAK HOSPITAL

MASON CITY, Wash., April 15. — (Special.) — James Rayburn, 21, MWAK laborer, died last night from injuries received Sunday night when a concrete bucket struck him on the head fracturing his skull. He was employed on one of the concrete blocks. The youth never regained consciousness after being struck. His home was at Asotin, Wash.

This is the 17th fatality on the MWAK workings and the 21st since the dam site operations started.

**(*Spokesman-Review,* April 15th 1936)**

## 41ST FATALITY AT COULEE DAM

GRAND COULEE DAM.—Paul Danielson, 33, employed as a rigger's helper at the dam, was thrown down 85 feet onto concrete when the boom of his crane-car suddenly tipped over through the railing of the high trestle, killing him instantly, Saturday afternoon, last week.

The MWAK safety engineer's office reported Danielson was operating the movable crane car, known as a "cherry-picker," which was being used to lower steel reinforcement bars down to the lower blocks of the west side concrete work.

Without warning, officers said, the crane suddenly tipped forward, crashing the boom through the guard rail and down on the concrete. The impact of his body was so hard, witnesses said, that the bones of his feet were driven through his shoes.

Danielson started work about two weeks before he was killed, coming to the dam site from St. Francis, Kan. The fatality is the MWAK's 38th and the 41st since work started at the damsite.

**(*Washington Farm News,* September 22nd 1937)**

## COULEE CLAIMS ITS 34th VICTIM

GRAND COULEE DAM, Mar. 3.—(AP)—Losing his balance, Jack Bergeman, 25, formerly of East Wenatchee, fell 60 feet to his death last night from a steel trestle on which he was working. His was the 34th fatality at the damsite.

**(*Ellensburg Evening Record,* March 3rd 1937)**

# STOVE EXPLODES; WORKER IS DEAD

MASON CITY, Oct. 2.—(Special.)—George Davis Crocker, 29, of Minneapolis died of severe burns this morning, the result of an explosion of an alcohol stove, in the MWAK mess hall, with which he and a companion, also badly burned, were singeing some of the 4000 chickens to be fed to the huge crowd attending the visit of President Roosevelt today.

Sidney John Martin, 31, of Milwaukee, is also in serious condition, according to the safety engineer's office. The men noticed the alcohol stove burning low, so without turning out the flame they started filling the tank with a five-gallon container.

The resulting explosion set the men's clothes afire. Martin's blazing apparel was quickly extinguished but Crocker ran around and couldn't be caught for several seconds. Fellow workers then extinguished the fire with blankets. This is the dam site's 44th fatality.

**(*Spokane Chronicle*, October 2nd 1937)**

# FATAL DAM ACCIDENTS NOW TOTAL FOUR DOZEN

GRAND COULEE, Wash., Nov. 24. (AP)—Edmond B. Terry, 45, rigger for the Mason-Walsh-Atkinson-Kier company, Grand Coulee foundation dam builders, died today from a fractured skull.

Terry, whose death was the 45th fatality among the company's employees, and the 48th since the dam was started, was injured Sunday when he fell 60 feet from a construction trestle to a concrete block.

Terry's home was in Barnsdall, Okla.

**(*Spokesman-Review,* November 24th 1937)**

## SIXTH MAN KILLED AT COULEE DAM SITE

### Worker Hurled Into River When Boom Snaps; Fail to Find Body

GRAND COULEE DAM, March 7.—The body of Tom Newton, 45, sixth man to be killed at the Coulee dam, was still missing after an all-day search yesterday and part of the night.

Early Wednesday a boom on one of the big MWAK cranes snapped and crashed into piling on which Newton was working.

He was thrown into the water, and attempts to recover his body have failed.

He was registered as a single man, beginning work on January 28. His home was Forks, Wash.

**(*Spokane Press*, March 7th 1935)**

## BODY OF RIGGER FOUND IN RIVER

GRAND COULEE DAM, Wash., May 6. (AP)—The body of Tom Newton, 45, a rigger, knocked into the Columbia river from the cofferdam here two months ago, was recovered 16 miles downstream by Indians today. The body was identified by an MWAK company badge on the clothing.

**(*Spokesman-Review,* May 6th 1935)**

# Fourth Man Killed on Coulee Dam Job

COULEE DAM, Feb. 19.—(Special.)—Louis Belley, 35, of Synarep, in Okanogan county, was killed instantly yesterday afternoon in the coffer-dam area on the west bank of the river, when a load of steel sheet piling, being swung from a tall crane, hit him in the back of the neck.

Doctors said a vertebrae had been snapped. Belley went to work for the company as a common laborer on October 25, and promoted himself into a rigger's job. He was single.

It is the fourth accident since MWAK started operations and the seventh since dam site work began, September, 1933.

Albert Frase, 45, of Grand Coulee, dropped dead in a local restaurant Sunday from what was said to be heart failure. Efforts are being made to find his relatives.

(*Spokane Chronicle*, **February 19th 1935**)

# PUYALLUP MAN KILLED ON GRAND COULEE JOB

GRAND COULEE DAM, Wash., Oct. 31 (AP)—High voltage from a power line ran down a loading cable and electrocuted Albert Cook, 27, of Puyallup, on the Grand Coulee dam project yesterday. He was a rigger for the M. W. A. K. company.

The tragedy occurred when a crane boom touched the 11,000-volt line. The M. W. A. K. safety engineer's office reported Cook was killed as he leaned against a steel-bodied dump truck which touched the cable.

His death was the 27th in the two years of construction work at the dam site.

(*Oregonian*, **October 31st 1936**)

# BIG FORM FALLS ON COULEE MAN, SNUFFS OUT LIFE

MASON CITY, Wash., Aug. 18. —(Special.)—Warren W. Pickle, 20, MWAK foreman, was killed Monday night when struck by a heavy panel of concrete form being loaded on a truck. A cable broke, dropping the panel on Pickle, who died shortly afterward of internal hemorrhages.

He was from Oroville, where a sister, Mrs. Thomas Bailey, resides. His father lives in Harrington and a brother is a member of the Mason City fire department.

This was the first fatal accident since May 23, it was reported.

**(*Spokane Press*, August 18th 1936)**

# TRACTOR CRUSHES COULEE WORKER

COULEE DAM, June 12.—(Special.) —John Huntsberger, 21, a laborer, died this morning from internal injuries suffered last night when a huge tractor backed over him while he was working on the conveyor system.

Huntsberger gave his address as Grand Coulee. His only known relative is John Huntsberger Sr. of Sunburst, Mont.

There have been 13 fatal accidents in the dam site area since work was started here nearly two years ago. Nine lives have been lost in MWAK company operations.

**(*Spokane Chronicle*, June 12th 1935)**

# Accident Bugbear Into Hibernation

GRAND COULEE DAM, May 27.—Ed Sorger, state safety inspector for the state department of labor and industries, visited the Grand Coulee dam project this week and reported "a steady and consistent improvement" in the reduction of accidents.

Sorger made a study of mishaps of the last two months and commended the MWAK company for the improvement. The last two months have been free of fatalities and the lost-time accidents have been less severe.

(*The Wenatchee Daily World,* **May 27th 1937**)

***"…By most accounts, the last life claimed by the Grand Coulee Dam was that of Howard Gumm. The day he died, July 27, 1984, the Teamster was hauling dirt along Lake Roosevelt in an effort to stabilize shores near the dam when the slope Gumm was working on gave out. He, along with his massive truck and 1.3 million cubic yards of dirt, sloughed into the lake. At his memorial, his son Randy said, his father's Thermos, hardhat and lunchbox stood in proxy of the body. Those possessions had floated to the surface of the lake following the disaster, but his body has never been found. Before Gumm, there had been 81 men killed while working on one of the most massive public works projects this nation has ever seen, which began in New Deal earnest in 1933…"***

***The Spokesman-Review,* May 25th 2014**

***"…Along with the falls and run-ins with equipment, men died in explosions, were drowned, buried in slides, and electro-cuted. One man died of heat exhaustion. Seventy-eight men died working on the original dam. Three more died building the third powerhouse, where work started in the late 1960s. Howard Gumm would make number eighty-two…"***

***The Spokesman-Review,* May 25th 2014**

# The River Was Angry That Day

***"…George Hunter, a jackhammerman, had his back broken by a chunk of clay. Gerald F. Coble, a 32-year-old signalman, was struck by a heavy steel bucket. Ronald H. Tegmeier's death in 1938 got a little more attention, given his notable background…"***

***The Spokesman-Review,*** **May 25th 2014**

***"…Tegmeier, a former nationally known marathon swimmer from Tacoma whom the Wenatchee Daily World described as '200 pounds of young Tarzan,' was working as a lifeguard at the dam, ready to rescue anyone who fell into the river while working. Tegmeier, the paper said, had no fear of the 'surging, swirling' waters of the Columbia at Grand Coulee. He'd gained a name for himself on the work site when he swam from Keller Ferry to the dam site in three hours, a distance of 25 miles. He'd fallen into the rapid river twice before while working, and both times had 'come out smiling.' But his final day, as he was patrolling the waters below a cofferdam on a motor boat, his motor gave out and his boat was sucked into whitewater. That day, he never emerged. 'Yesterday that giant river was angry,' the Wenatchee Daily World concluded…"***

***The Spokesman-Review,*** **May 25th 2014**

**Left: caption: "Brawny men of steel who raise the skeleton of Grand Coulee Dam. The trick vests are for unexpected drops into the water."**

***"…Dechant, who's also done extensive research into the men now listed on the monument in Colville, said she doesn't judge Citkovich for taking back the monument, nor Stevens County. The country was just coming out of the Depression, after all, and he had a right to be paid…"***

***The Spokesman-Review,* May 25th 2014**

# That Sort of Thing

***“…the Federal Bureau of Reclamation supports Dechant’s efforts, but has strict rules regarding what it can spend money on. The bureau ‘generally does not construct monuments and that sort of thing,’ Dechant said. ‘While we’re very interested in her work…I’m not sure we could actually contribute to erecting the monument. But it would be nice to see in the community here.’…”***

***The Spokesman-Review,*** **May 25th 2014**

# Still Does

***"…'It needs a better ending,' Dechant said. 'I feel strongly they need to be remembered for what they did. It's a huge sacrifice that benefited millions of people. Still does.'…"***

***The Spokesman-Review,* May 25th 2014**

# And Soonest Our Best Men With Thee Do Go

***"In tribute to Silas B. Mason, one of the builders of this great hydro-electric project, the roar of construction will be silen-ced here tomorrow for five minutes during funeral services at Lexington, Ky. Mason, chairman of the MWAK Company, holders of the dam construction contract, died of heart trouble here Tuesday night. Whistles will be blown at 2 p.m. at the start of the period of silence. Nearly 5,000 workmen will lay down their tools. The flag in Mead circle, in the heart of Mason City, the town named for the contractor, will be at half staff until after the funeral."***

***Spokesman-Review,* April 19th 1936**

# Part 16

# Commence at Once

# Come Up and See Me Sometime

**Bids for the first stage of construction were opened in the auditorium of the *Spokane Civic Building* in front of a crowd of nearly one-thousand. Hundreds of job seekers had crowded into the city in anticipation. One of the bidders was the actress *Mae West*, who told the engineers that if they encountered any difficulties, they should *"come up and see me sometime."* Only two groups met the bid specifications. The front runner was *Six Companies, Inc*., a group that included *Kaiser Construction* and the *Morrison-Knudsen Company*. The contract was awarded instead to a consortium known by the acronym MWAK (*Silas Mason Company, Inc.; Walsh Construction Company*, and *Atkinson-Kier Company*).**

**Above: caption: "Fred K. Jones, at the podium, President of the Spokane Chamber of Commerce in 1933 and 1934, presided over the opening of bids for the construction of the Grand Coulee Dam on Riverside Avenue in front of the Chamber of Commerce Building on June 18, 1934"**

***"…The following work will be included in the contract, the bid call for which was announced Monday by the United States Bureau of Reclamation in Denver: Excavation of all types, 496,300 cubic yards; overhaul, 850,000 station cubic yards; back fill, 2,500 cubic yards; concrete, 600 cubic yards; dry rock pavement, 1,200 square yards; laying of 30,000 pounds of reinforcing bars; laying of 4,250 linear feet of corrugated metal pipe for under-track drainage; erecting 78,000 feet of timber, board measure; driving 1,800 linear feet of piling; construction of 60 miles of fence; laying of 34.5 track miles of ties and track; placing of 50,000 cubic yards of ballast…"***

***Spokane Chronicle*, May 1st 1934**

***“More than 50 percent finances of all the bonding companies in the country authorized to write bonds by the federal government were needed to guarantee the operations of the Silas Mason Company on the Coulee dam contract, it was learned here yesterday. The bid of the Mason-Walsh-Atkinson-Kier group was approximately $29,000,000”***

***Spokane Chronicle,*** **September 25th 1934**

***"…The original MWAK company bid was $29,303,000, but this was increased to about $37,000,000 through additional excavation and the order of the Bureau of reclamation changing the original contract from one for a low dam to an order for the high dam foundation…It is also known that the MWAK company bid was considerably below the estimates of the Bureau of Reclamation…"***

***Spokane Chronicle,* December 7th 1937**

# Auxiliary Construction

***“…In order to provide adequate transportation facilities, highways leading to the dam site were re-graded, widened, and hard-surfaced by the State; a hard-surfaced road from the Grand Coulee to the dam site was built by the Government; bridges across the river replaced a primitive ferry; and 32 miles of standard gauge railroad from Odair, on the Northern Pacific Railway near Coulee City, to the mouth of the Grand Coulee and into the river canyon were built by the Government, to be operated by the contractor. A 110,000-volt transmission line, 31 miles long, was built from the Washington Water Power Co.’s lines near Coulee City to Mason City by the contractor. Telephone and telegraph lines were built in by the Pacific Telephone and Telegraph Co. and the Western Union Telegraph Co…”***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***“Silas Mason, head of the Mason-Walsh-Atkinson-Kier Company, arrived from New York yesterday to sit in with his associates at a general conference on plans for the construction of the Grand Coulee dam and the awarding of numerous subcontracts for getting their 2,000-man camp built, together with the construction of a 30-mile power line from Coulee to the dam…”***

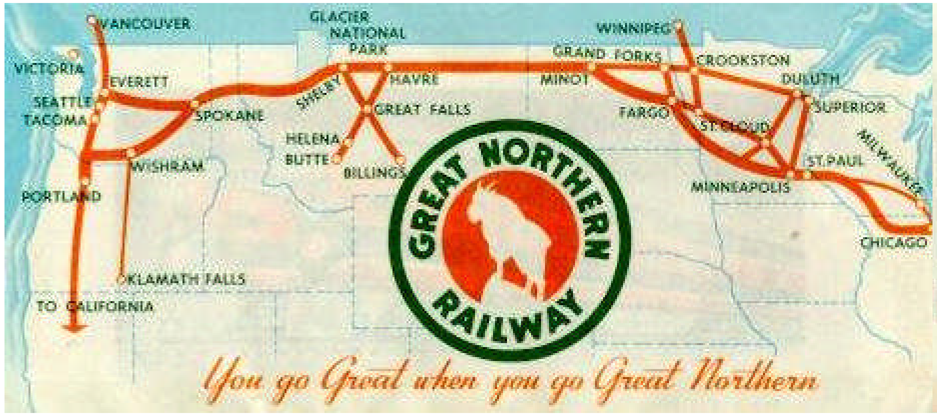
***Spokesman-Review,* September 26th 1934**

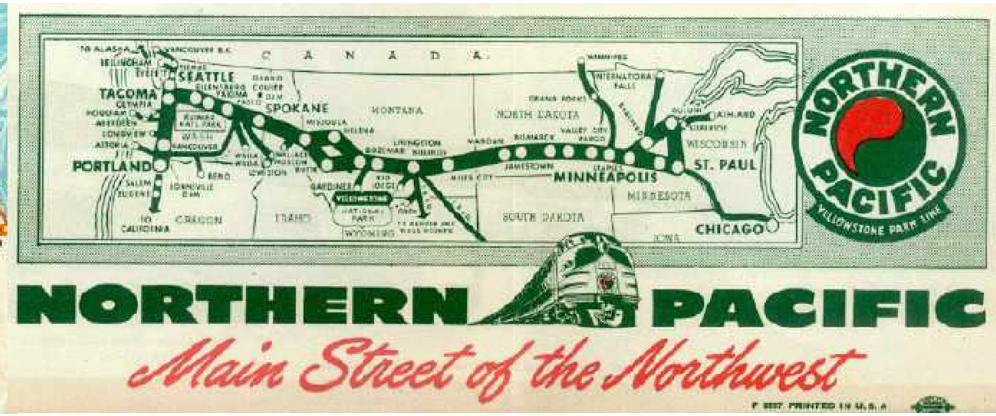
***"Millions of dollars will be handled within the next few years by the group of men pictured here. They are officers and heads of the Mason-Walsh-Atkinson-Weir Company, which has the $29,539,301 contract on the Grand Coulee dam construction job. This week the group met here together for the first time to arrange awarding of bids for some of the big construction jobs involved. Left to right, those pictured are: Seated – Silas B. Mason, Chairman of the Board; Guy F. Atkinson, First Vice President; T.J. Walsh, President; James O'Sullivan, Secretary of the Columbia Basin Commission and not a member of the construction firm; and W.E. Kier, Director. Standing – E.L. Kier, Secretary; M.H. Slocum, Superintendent of Construction; George H. Atkinson, Assistant Job Manager; M.J. Whitson, Second Vice President, and H.L. Myer, Job Manager."***

***Spokesman-Review,*** **September 25th 1934**

***"More than $3,000,000 in contracts for Grand Coulee dam necessities have been awarded through the offices of MWAK Company in the three weeks the executives have been in session here…One of the largest contracts is that let to Standard Oil Company through the Coulee Trading Company, the 'little sister' merchandizing organization for the MWAK. It will amount, exclusive of state and government taxes, to more than $750,000, it has been conservatively estimated. The Washington Water Power Company's contract for 'juice' during construction will be $400,000 or more…The White Pine Manufacturing Company of Spokane is getting about $200,000 for 350 houses and buildings which will make up Mason City…The Jeffrey Company of Ohio will get $300,000 for furnishing a big conveyor…Literally hundreds of thousands of dollars also will be involved in contracts of unannounced amounts…"***

***Spokane Chronicle*, October 17th 1934**

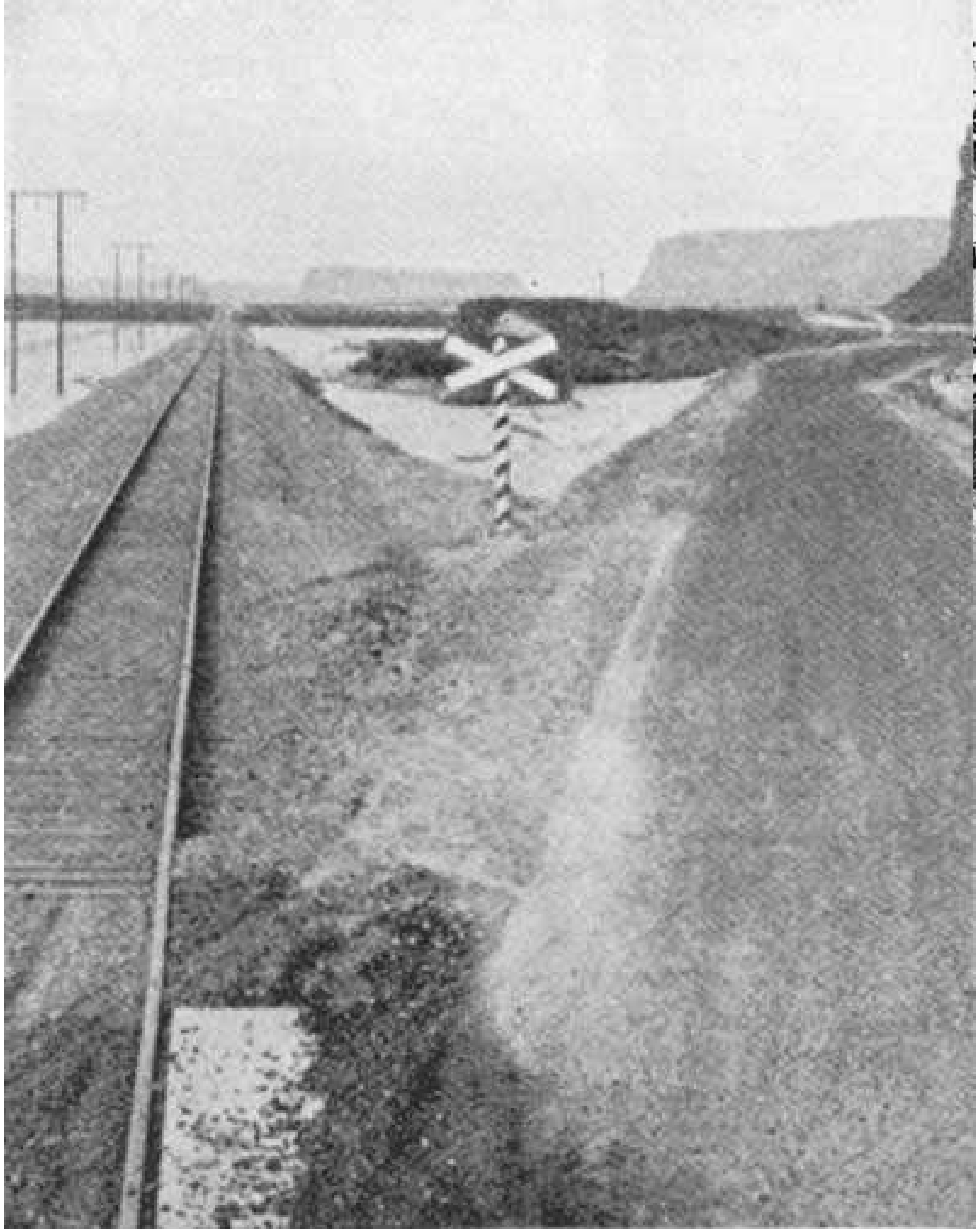





***"…To men with vision and imagination the Columbia Basin Project offers unlimited possibilities – vast power development, vast tracts of flourishing farms, employment for thousands, great inland waterway. The mammoth proportions of the undertaking are hardly comprehended by the average person, who is concerned only with everyday office or outdoor duties. Ralph Budd, president of the Great Northern Railway and next president of the Chicago, Burlington & Quincy, has given the first hint of the scope of auxiliary development which will accompany the dam building in Grand Coulee. Both the Great Northern and Northern Pacific railroads will build 20 to 35 mile extensions to the site of the dam, he believes. The Great Northern will tap the site above the Coulee, while the Northern Pacific will most likely tap the base of operations on the floor of the canyon. These two projects naturally will precede actual construction of the dam and will provide much employment. The Columbia Basin Project seems more and more a looming reality…"***

***Spokane Chronicle*, November 19th 1931**

**<u>Above</u>: caption: "Preparing bed with mules for laying ties for the railroad spur from Coulee City to Grand Coulee Dam (ca. 1935)"**
**<u>Left</u>: caption: "Supply Train. Coulee City - Coulee Dam Railroad"**




**<u>Above</u>: caption: “The Bureau steam locomotive at Grand Coulee Dam (December 1943)”**

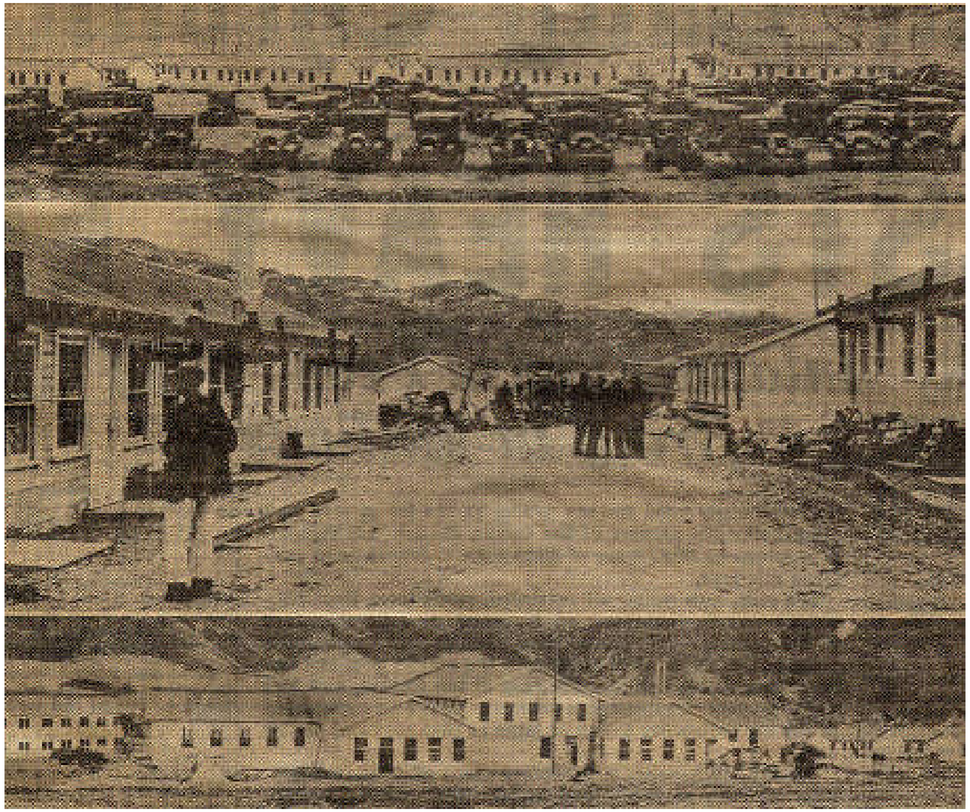
**<u>Left</u>: caption: “Thirty miles of railroad, highway, and transmission line were built up the Grand Coulee to the dam site”**

# A Place to Call Home

***"…To house the workers at the Grand Coulee Dam two towns were built, one on the west side of the river, Coulee Dam, commonly known as 'Engineers' Town,' by the Bureau of Reclamation, and one on the east side, Mason City, by the contractor…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

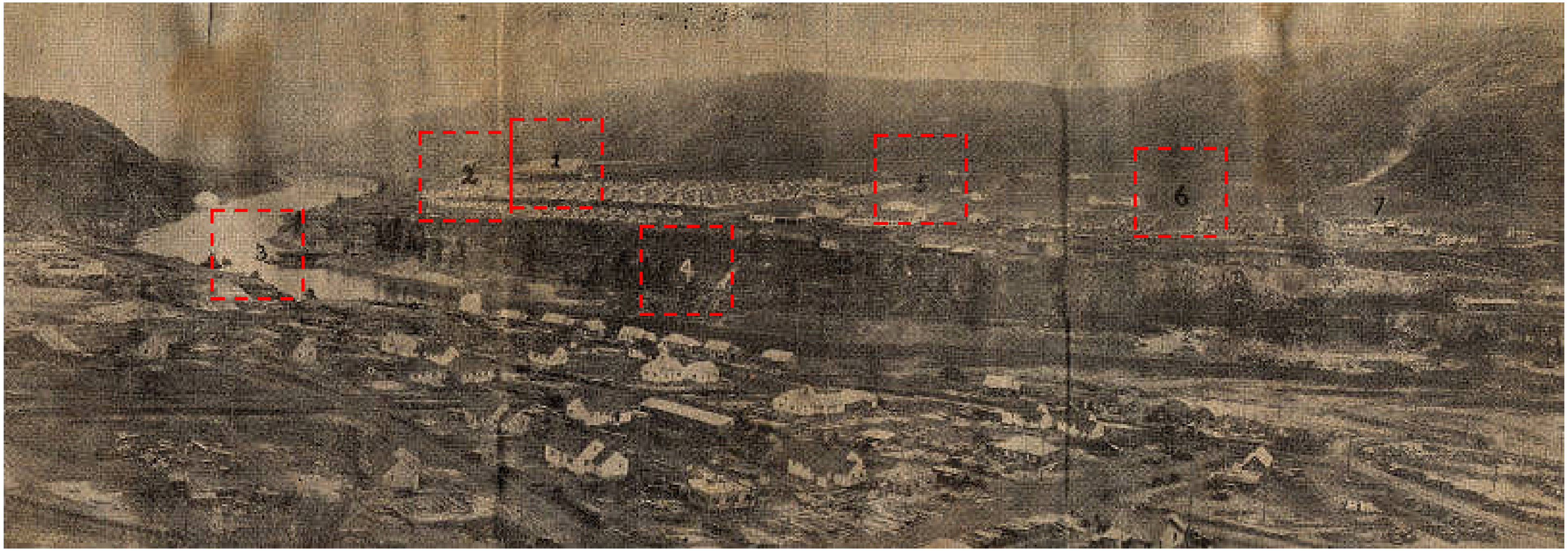
**<u>Above</u>: caption: "Workmen in Grand Coulee, Wash. hurry on November 9, 1933, to finish construction of a new building in town before winter begins. The town is located on the 'breaks' or table land above the Columbia river, about two miles from the site of the Grand Coulee dam."**



Left: caption: "A modern construction city has sprung into existence almost overnight at the Grand Coulee dam site. It is Mason City, the home of the MWAK Corporation, the organization which has the contract for construction of the first unit of the dam. The upper picture shows nearly a hundred automobiles in a parking lot beside a group of modern bunkhouses. The buildings are to be heated with electricity, but temporary stoves have been installed. Stove pipes are seen sticking from windows. The mess hall is shown in the lower picture. Scores of cottages for families will be erected on other pars of the town site." (*Spokane Chronicle,* November 6th 1934)

**<u>Top Left</u>: caption: "Coulee Dam, the Governments permanent town, and Mason City, the contractor's temporary town, located below the dam site"**
**<u>Top Right</u>: caption: "Mason City (Coulee Dam) in foreground with Engineers' Town across river and Grand Coulee top center (September 1946)"**
**<u>Left</u>: caption: "A distant view of Grand Coulee Dam showing the employee housing along the Columbia River, in Grand Coulee, Washington (April 1940)"**


MASON CITY
COULEE DAM
GRAVEL



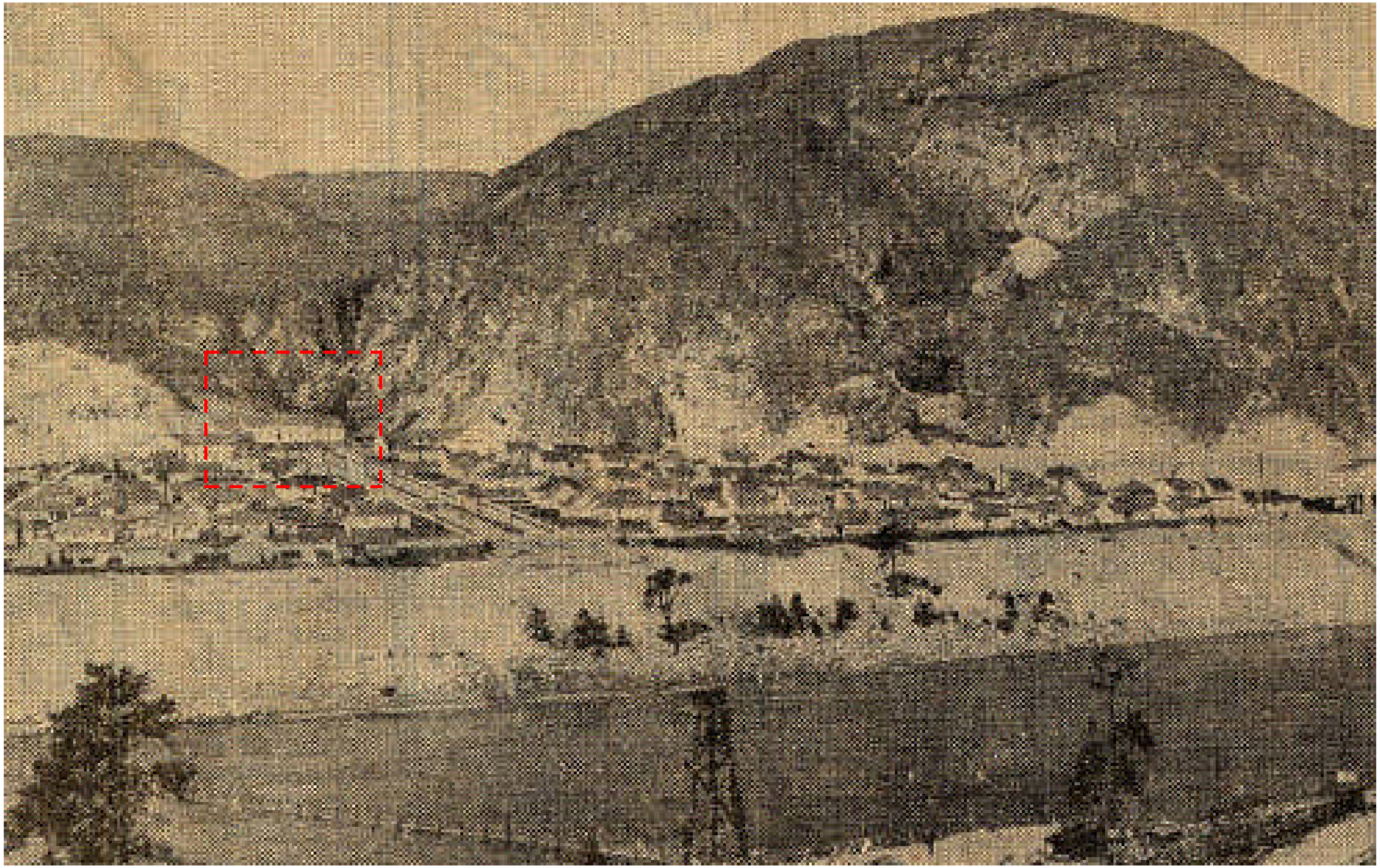

**<u>Above</u>: caption: "The magnitude and rapidity of town site growth at the Grand Coulee dam site is clearly shown in this panorama picture taken by a staff photographer last week. The river flows from right to left and the dam will cross about 200 yards upstream from the right hand edge of this picture. The unfinished town in the foreground is Administration city, home of government engineers. It will be a permanent city as the substantial looking houses indicate. Other points of interest have been numbered and are as follows: (1) Airport; (2) homes of married workers of Mason City; (3) railroad bridge under construction by MWAK; (4) permanent highway bridge under construction by Western Construction Co.; (5) MWAK commissary, post office, bank and general store; (6) dormitories for single men. The building to the left of the numeral is the hospital. Note also that there is not a single smokestack in Mason City. It is all electric." (*The Wenatchee Daily World*, February 22nd 1935)**

***"…Coulee Dam is to be a permanent town for the accommodation of employees on the Columbia Basin Project. It is provided with paved streets, concrete sidewalks, and appropriate water, sewer, and street-lighting systems, and is composed of 77 residences of 6 standard types and sizes, 2 large dormitories, administration building, schoolhouse, post office, garage and shop, fire station, and extensive warehouses and storage yards. To the north of the town site are 4 temporary dormitories and 57 temporary court-type 3-room houses for the use of Bureau employees…"***

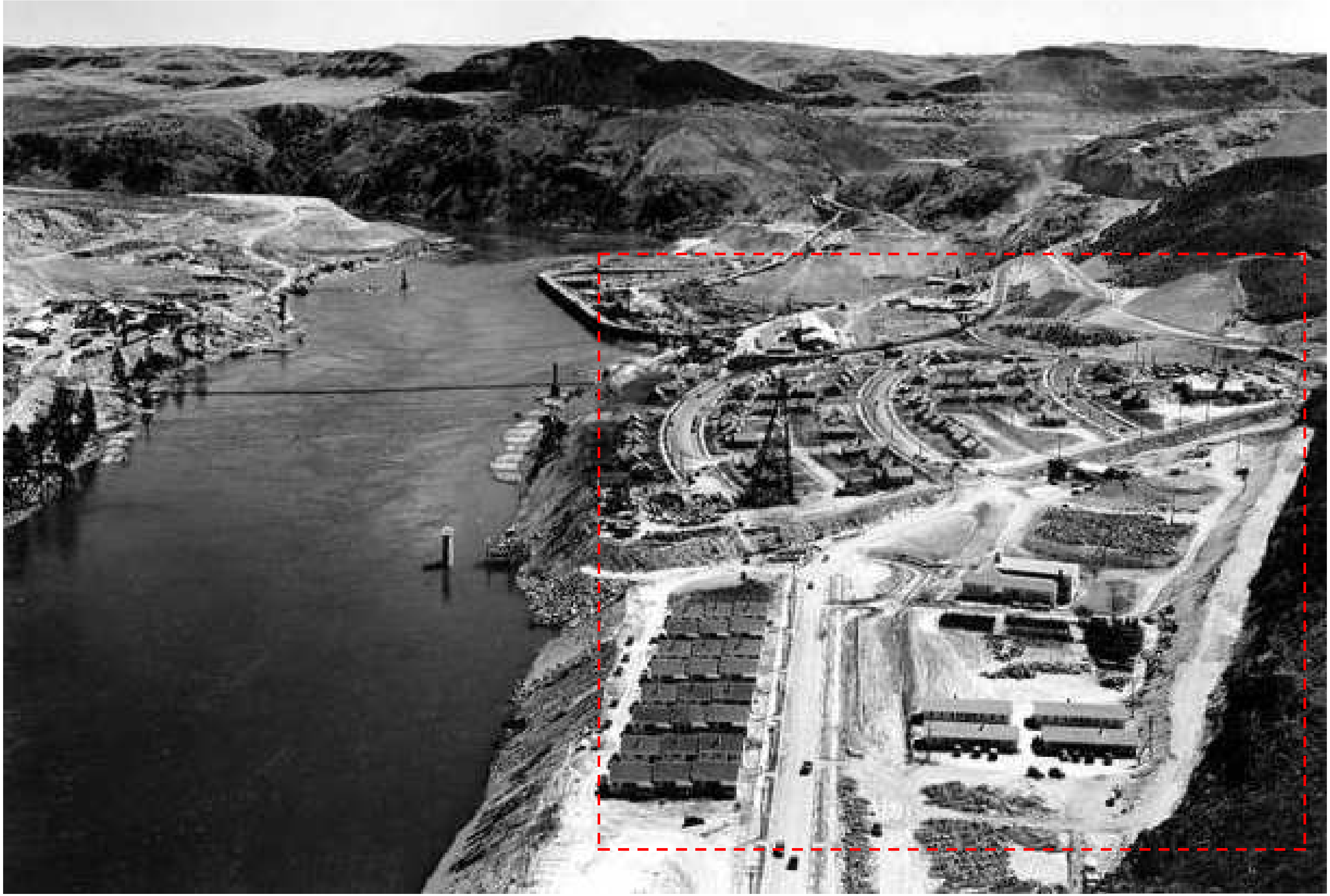
***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Top: caption: "Section of Grand Coulee, Wash., boom town near Grand Coulee Dam"**

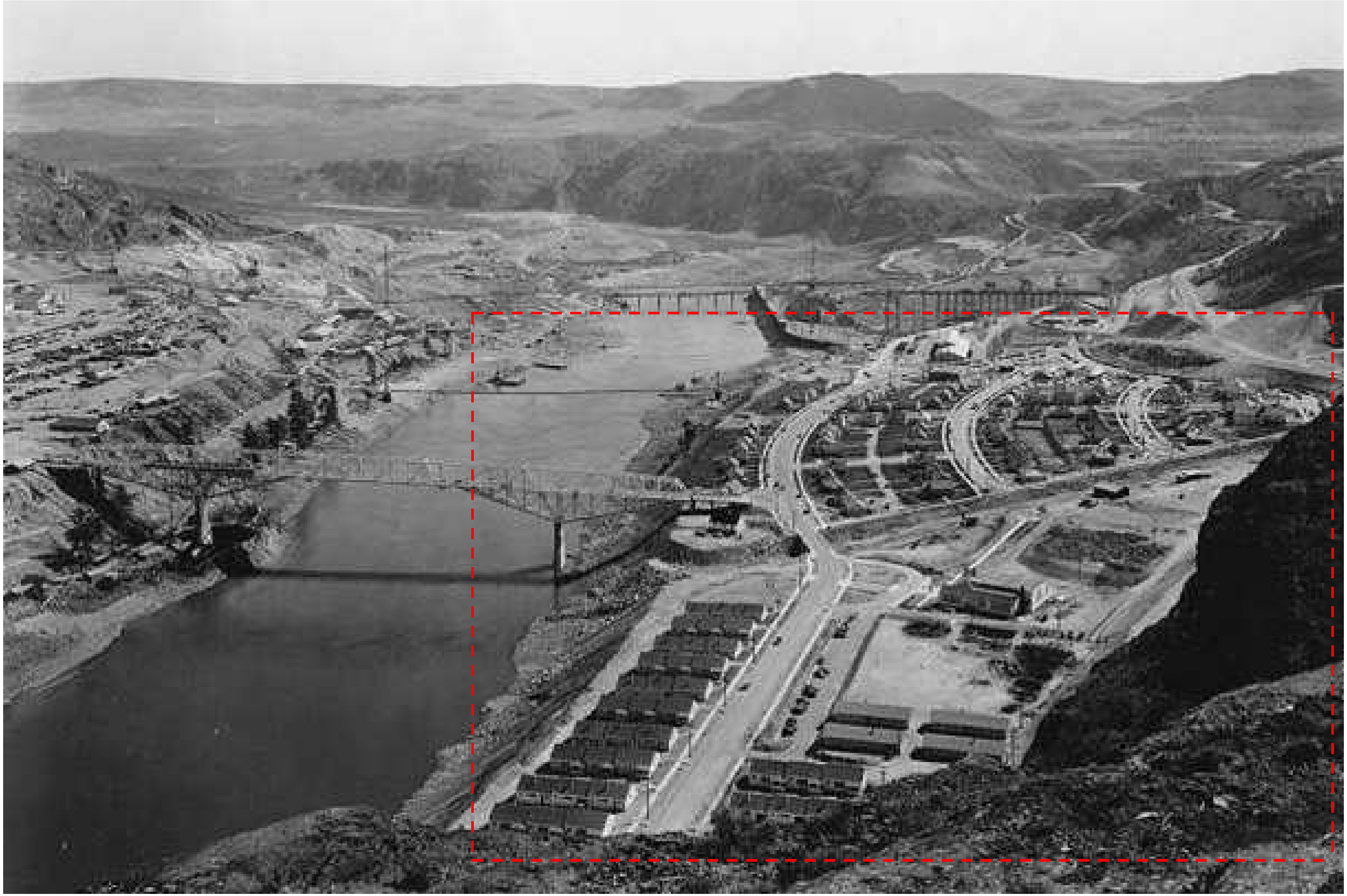
**Bottom: caption: "Street Lined with Homes of the Engineers of the Grand Coulee Dam"**



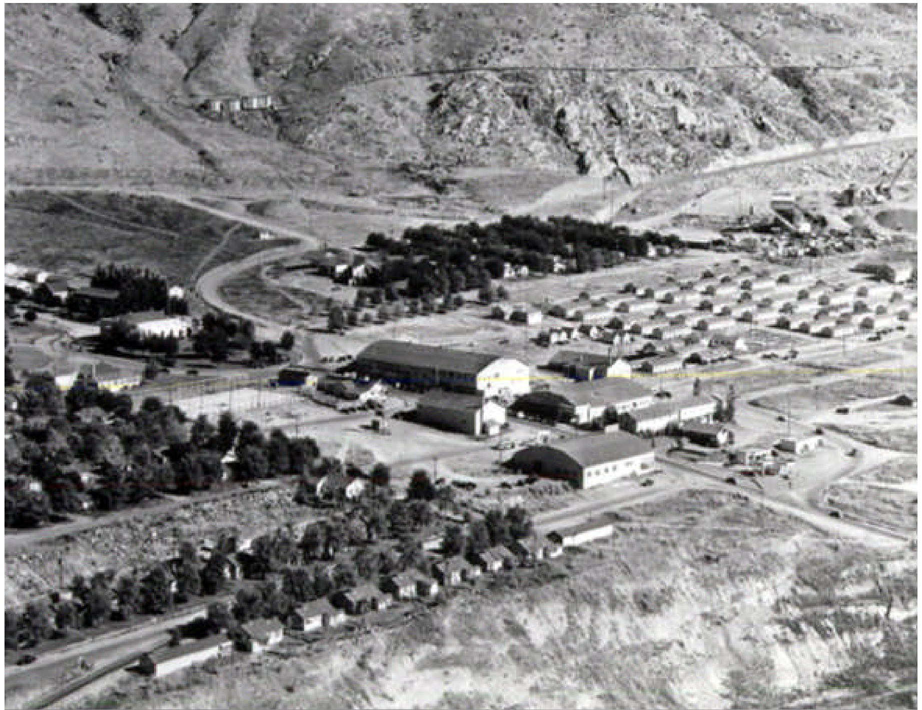
**<u>Above</u>: caption: "Although everything seems peaceful and quiet in the engineers' town at Grand Coulee, there are few places of greater activity. In the background is the large white office administration building of the Reclamation Bureau, from where Frank A. Banks, bureau's engineer in charge of Grand Coulee, supervises the construction of the dam. From his office, Mr. Banks can see every operation of the MWAK Company, as well as look down upon the town where his staff of government engineers reside." (*Spokane Chronicle*, May 6th 1936)**



**Above: caption: “Grand Coulee Dam construction site panorama, July 1935” (Engineers’ Town highlighted)**



**<u>Above</u>: caption: “Grand Coulee dam with the Engineers’ Camp in the fore- ground, Washington, 1942”** 1070

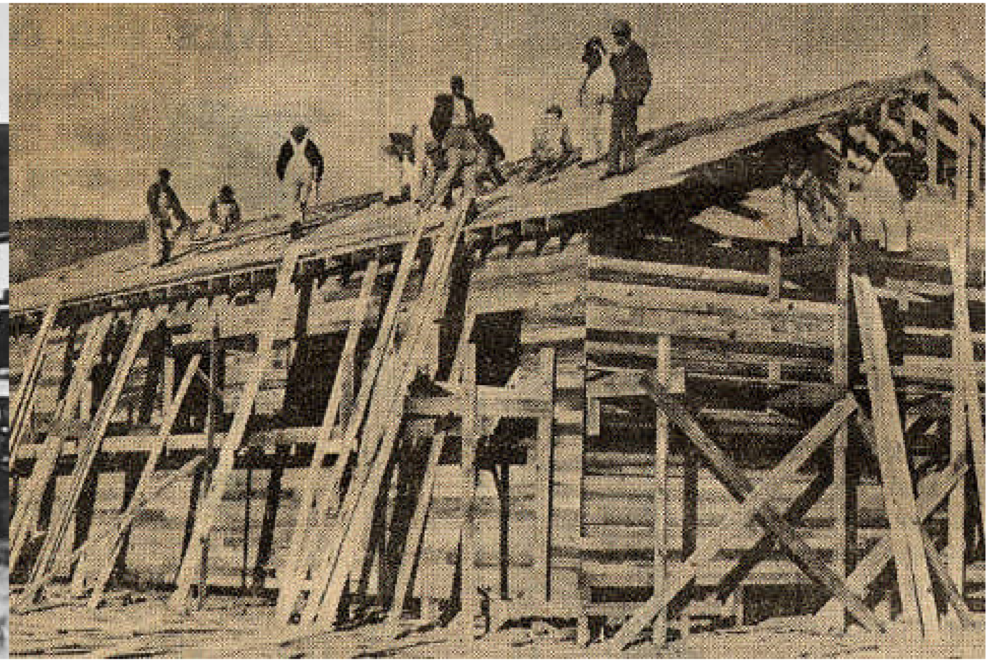



***"…Mason City was designed for only temporary service and is to be dismantled when the dam is finished. Consequently its houses and street improvements are of a less substantial character than those in Coulee Dam; but reliable and efficient water, sewer, and street-lighting systems were installed. There are 3 standard types of small houses, of one, two, or three rooms, with baths and kitchens or kitchenettes, 60 cabin-type dormitories to house 1,360 men, 2 dormitories for women employed in Mason City, a hospital, a hotel, schoolhouses, 2 churches, a laundry, stores, recreation buildings, office buildings, shops, warehouses, and storage yards, and a mess hall capable of seating 1,360 men at one time. The school system includes a high school and a grade school in which the first three grades are taught…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Top: caption: "Mason-Walsh-Atkinson-Keir (MWAK), the company that built the foundation for the dam, built Mason City for workers to live in. Named after Silas Mason, MWAK's head, it became the first completely electric city in the nation."**

**Bottom: caption: "B Street the Business District of the Town Built for the Construction Workers of Grand Coulee Dam"**

***"…The low rate for electrical energy and the temporary character of the contractor's town are responsible for the use of electricity for house and dormitory heating, as well as for lighting and cooking, in Mason City. At some distance from the dam site numerous towns have sprung up, and many of the workers on the project live in them. The total population in the vicinity of the dam in 1937 was about 15,000…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left</u>: caption: "Main Street in Grand Coulee, 1935"**

**<u>Right</u>: caption: "The pioneering spirit of cooperation is illustrated by the builders of this church in Mason City, pioneer town at the Coulee dam. Laborers are volunteering their services in construction of two similar churches in that community, one Catholic, the other interdenominational. Each structure will be 38-feet wide and 78-feet long. Wholesalers and manufacturers who have furnished MWAK with equipment in the past are donating all of the material for the building. Not an item in either church will be bought."**

***"Mason City, the contractors' town at Grand Coulee dam, is going to be sold to the Bureau of Reclamation for $25,000 by the MWAK company before the next Grand Coulee contract is awarded. The seemingly ridiculous low figure for the town that today houses thousands of workmen on the project is part of an agreement in the original MWAK contract whereby the federal government can 'equalize' things between all bidders on the second contract for completion of the dam. The MWAK contract also provides that the Bureau of Reclamation purchase for $100,000 part of the construction equipment, such as the stationary equipment, and pay $25,000 for transmission lines and power station that now provides electricity for operations. It is explained that the successful bidder on the second contract will purchase Mason City, permanent equipment and the power system…"***

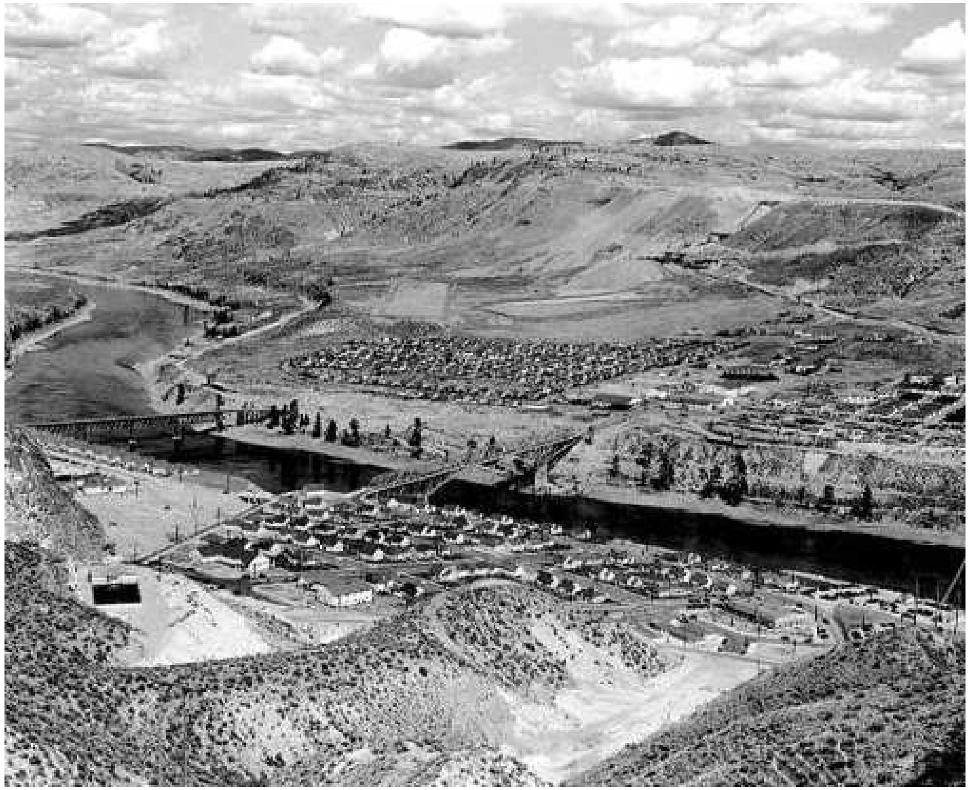


***Spokesman-Review,*** **August 17th 1937**

**In the summer of 1933, preliminary engineering work (financed by a grant of emergency relief funds) was begun under the direction of the U.S.B.R. (eleven engineering reports had been made prior to 1933) . In November 1933, the building of the *Grand Coulee Dam* was made a *Public Works Administration* (PWA) project (No. 9) and in December 1933, the first contract for construction work; the moving of about three million yards of overburden, was awarded. The contract for the construction of the base of the dam was let to the *Mason-Walsh-Atkinson-Kier Company* by U.S. Secretary of the Interior *Harold L. Ickes* on July 13th 1934, and on September 25th 1934, the contractor was directed to proceed with the work. Numerous other contracts for railway, highway, grading, building, and other work were let by the end of 1934.**

<u>Left</u>: on July 16th 1933, Washington State Governor *Clarence Martin* and *Jim James*, Chief of the *San Poil Indians* from the nearby *Colville Reservation*, join a gathering of three-thousand citizens along the *Columbia River* to drive in the ceremonial first stake, marking the beginning of the construction of *Grand Coulee Dam*. Approximately half of the new dam was built on the Colville Reservation, which had been established as a *Native American Reservation* in 1872. The new reservoir permanently submerged several Colville Indian villages and sacred fishing spots, including *Kettle Falls*.

# Mobilization



***"…Getting ready to build the dam was a major job in itself. Two towns, a 'contractor's town' and a 'government town,' were built on opposite sides of the river for the nearly 6,000 workmen and engineers…"***

***Popular Mechanics,*** **April 1938**

**Left: caption: "Construction Camp, Grand Coulee dam site, 1936"**

***"The company has provided in Mason City a modern, clean, sanitary camp for the benefit of its employees, who are invited to make full use of it up to the limit of its facilities. Living in camp, however, is not compulsory and there will be no discrimination against those who elect to reside elsewhere."***

***Harvey Slocum,*** **MWAK Superintendent**

**<u>Left</u>: caption: "A distant view of Grand Coulee Dam showing the employee housing along the Columbia River, in Grand Coulee, Washington April 1940"**

**<u>Right</u>: caption: "View of the dam with employee housing on both sides of the Columbia, May 1941"**

***“…Member contractors of the combine which bid with the Mason company will meet here this week to form a construction corporation for the project…The board of directors of this company will name one member to take care of the whole job…”***

***Spokesman-Review*, 1934**

***"…Francis Donaldson, chief engineer of the Mason company, came to Spokane from the east Monday night with orders to begin construction at once. He announced that Harvey Slocum has been named general superintendent and will build the dam. This was the first official word concerning personnel on the giant project…"***

***Spokesman-Review,*** **1934**

**Left: *Manley Harvey Slocum* (ca. 1937) – MWAK superintendent. A heavy drinker, he was later caught-up in a scandal involving a *Mason City* brothel.**

***"M. Harvey Slocum has resigned as superintendent for the MWAK Company, builders of the grand Coulee dam, it was announced here shortly before noon today by George Atkinson, job manager. The resignation was effective Friday, August 27. Mr. Atkinson announced he would combine Slocum's former duties with his own. It was indicated the title superintendent' might be discontinued. Mr. Slocum has won world-wide fame in engineering circles for his leadership here. He was with the MWAK Company from the start of operations, when first offices were opened in Spokane. He was credited with being the driving force behind the crews which broke world records in the construction of the huge cofferdams, which blocked out the Columbia river during construction operations, as well as for the titanic tasks which have followed at the dam site. Mr. Slocum could not be reached today for a statement."***

***Spokane Chronicle,*** **August 28th 1937**

***“…The mammoth first unit will be constructed at a cost of approximately $63,000,000. The contractors will receive $29,000,000, and the remainder will go for materials and supervision…The $5,000,000 performance bond was finally completed Monday…It was execution of this huge surety which caused the long wait…”***

***Spokesman-Review,* 1934**

***"…Mr. Slocum, Mr. Donaldson and George Atkinson, San Francisco contractor, who joined with Mason to bid on the dam, went to the project this morning to begin organization…'We will open offices in some Spokane building immediately,' Mr. Donaldson said. 'Our headquarters will be in the city for about two months, after which we will locate in the job.'…"***

***Spokesman-Review,*** **1934**

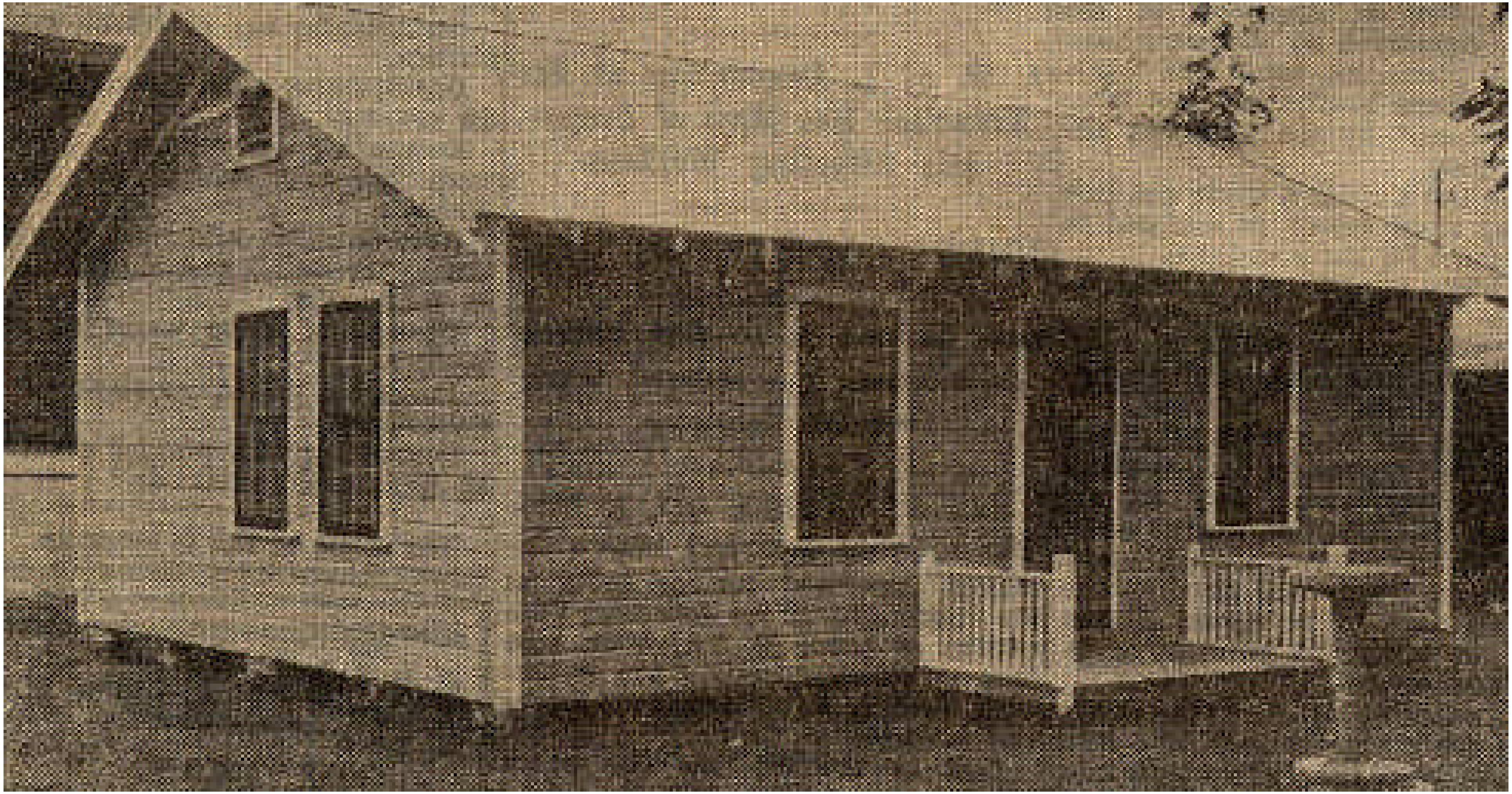
**<u>Left</u>: caption: "Prefabricated housing being assembled at worker camp and electrical poles being readied to receive electrical power at Grand Coulee Dam site"**

***"First work by the Silas Mason Company on the Grand Coulee dam was started at noon today…Rented tractor and scraper equipment were used today to start leveling the town site…Mr. Slocum said he will start a crew immediately sinking a test pit on the west bank of the river at the dam site. It will show depth of overburden, character of material to be excavated and distance to bedrock…Borings will be made at once on both sides of the river to determine the length of steel sheet piling needed for the cofferdam on the west side and about 700-feet on the east side will be in place this fall to divert the river so construction can begin on the ends of the dam. The tops of these diversion dams will be at least 985, 45-feet above low water, and resting on bed rock at level 840. This means the cofferdams will be about the height of a nine-story building…"***

***Spokesman-Review,*** **1934**

*"…Turning of the first earth today on the site of the town the Masons will build on the east bank of the Columbia at the dam marks the end of nearly two months' delay since bids were opened here June 18…Plans already completed include those for the town, a steel bridge the Masons will throw across the stream this fall, the general plant layout and the method of mixing and placing concrete in the dam…Foundations of the first houses in the new town will be laid in about two weeks. Before that time a complete sewer and water system will be installed, and streets will be graded…The new town will include five types of houses, designed by Juan Hargrove, architect at work here for the Masons the last four months…"*

***Spokesman-Review*, 1934**



**<u>Above</u>: caption: "This is the first picture of the type of house to be erected at Mason City for employees of the MWAK Company. The cottages will be common sights at Mason City in a few weeks, for the company awarded a contract to the White Pine Sash Company, Spokane, for 360 of them, estimated to total around $200,000, and involving 3,000,000-feet of lumber. The cottages will have three rooms and bathroom which includes a shower. There is a front and back porch, the latter including sanitary wash tubs. The kitchen will include an electric stove and refrigerator. Outside dimensions are 28x20-feet. The cottages will be shipped to the dam site in sections. Special derricks will lift the end, side and roof sections from trucks to building sites. Six men will form a crew to erect six cottages per day. The picture is of a 'sample' cottage at the White Pine plant." (*Spokesman-Review*, October 4th 1934)**

***"…With forty-three one-room houses erected, the MWAK Company is speeding construction of its newest 'subdivision.' Ditches also are being dug for water lines and for sewer pipes, holding up the erection of some of the houses until the lines are in place. The contractors will put up sixty-four of the 'one-roomers,' expected to rent for considerably less than the three and four room structures…"***

***Spokesman-Review,* February 14th 1935**

# To Get to the Other Side

***"…A large permanent highway bridge, a railroad bridge and a suspension bridge for carrying cement across the river had to be built, as well as several pile bridges and catwalks…"***

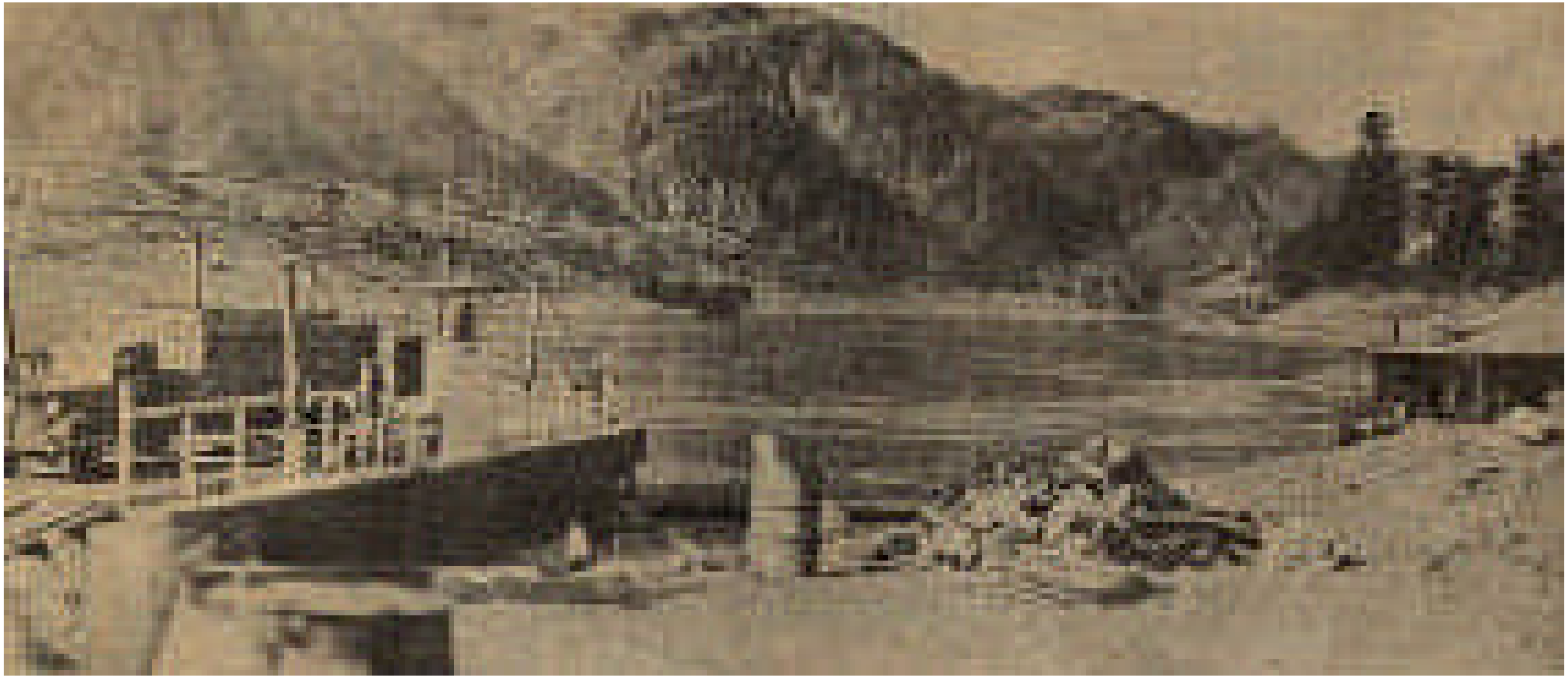
***Popular Mechanics,* April 1938**

***"…As there were no suitable roads leading to the dam site, new highways had to be built from Coulee City and Wilbur at considerable expense to the state…The heavy ice-floes which bent the temporary trestle across the Columbia forced MWAK to build a cat-walk at an expense of $10,000, which later had to be moved...Failure of the Western Construction Company to get one pier finished before high water last year delayed completion of the highway bridge by about eight months…"***

***Spokane Chronicle,*** **April 12th 1935**

***"…The rails will follow closely the present road up from Coulee to the dam site. Practically all the heavy traffic to the dam will be over one of the two. No other roads leading in are good enough to stand anything except passenger auto travel, Mr. O'Sullivan said. The rails and highway will descend the same grade from the head of the Coulee to the west end of the construction bridge, dropping about 600-feet in a mile and a half…"***

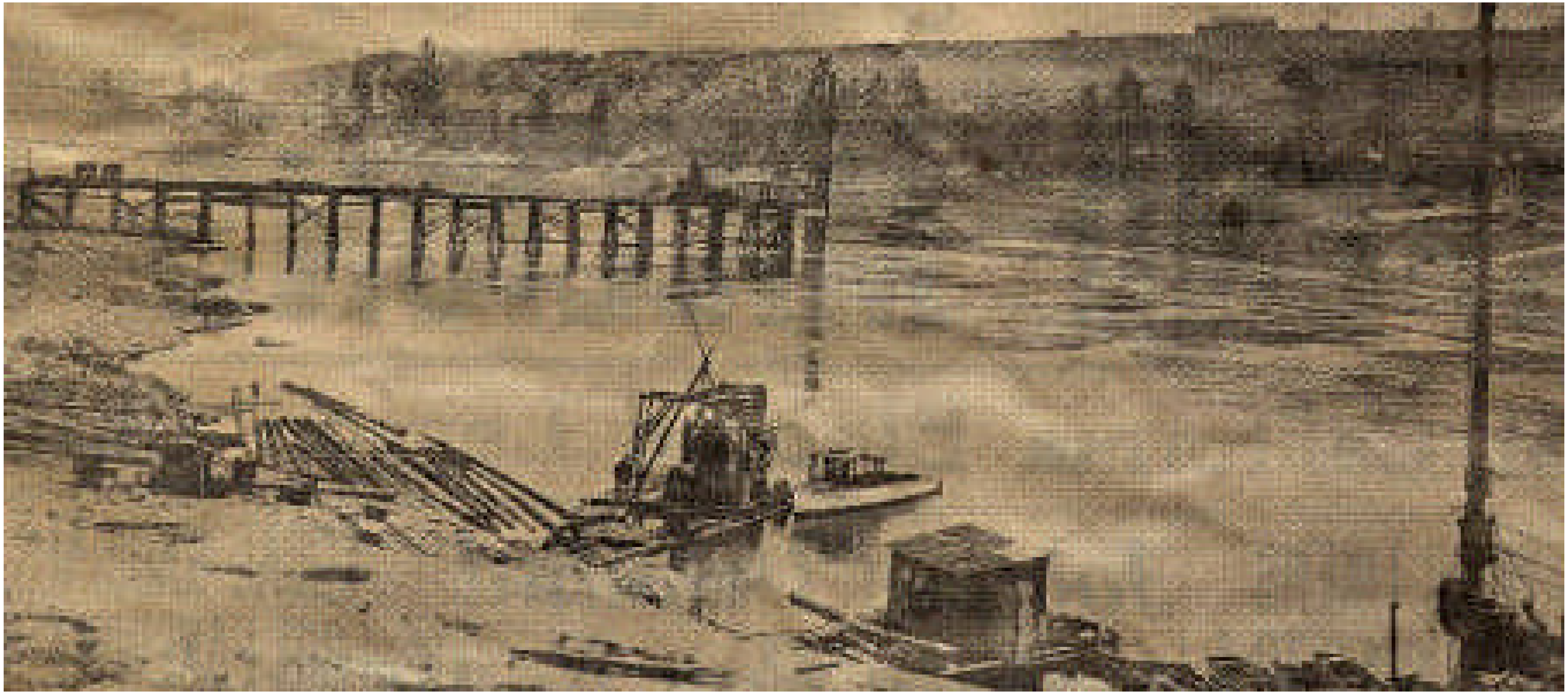
***Spokane Chronicle*, May 1st 1934**



**<u>Above</u>: caption: “Business is humming on the ‘waterfront’ at Grand Coulee dam site. Chief, the big six-car ferry, keeps the waters churning across the old Columbia at the scene where foundations now are being laid for a project which will put to shame the famed Muscle Shoals. On Thursday, bids will be opened for a state bridge to span the river and in the background of the picture here, the pilings for the approaches may be seen. Nearly 1,000 men now are working in the area near the dam site, with railroad construction, building of homes and business houses in Mason City, construction of a Standard Oil tank depot, and other business up and going. Officials of the MWAK Company, issue bulletins almost daily warning workmen not to journey across country to the dam in the hope of getting employment. Jobs are handled through federal agencies and residents have all the advantage in obtaining employment.” (*Spokane Chronicle*, October 17th 1934)**

***"…Starting upstream, the first span is the excavation conveyor trestle bridge, next is the suspension bridge, next the 11,000-volt electric wires furnishing Mason City with electricity. This span is the longest built on timber supports, more than 3,000-feet. The fourth span is the 1,110-volt electric line carrying energy from the main transformer bank to the private town sites of Grand Coulee and the west side construction area. The fifth crossing is the pipe carrying compressed air from the main compressor house on the east bank. The sixth is the catwalk for pedestrian use. The seventh is the highline used to construct the state highway bridge. Eighth is the state cantilever span. Span No. 9 is the cable used for gauging the river. The tenth and last is the MWAK combination highway-railway bridge, farthest downstream."***

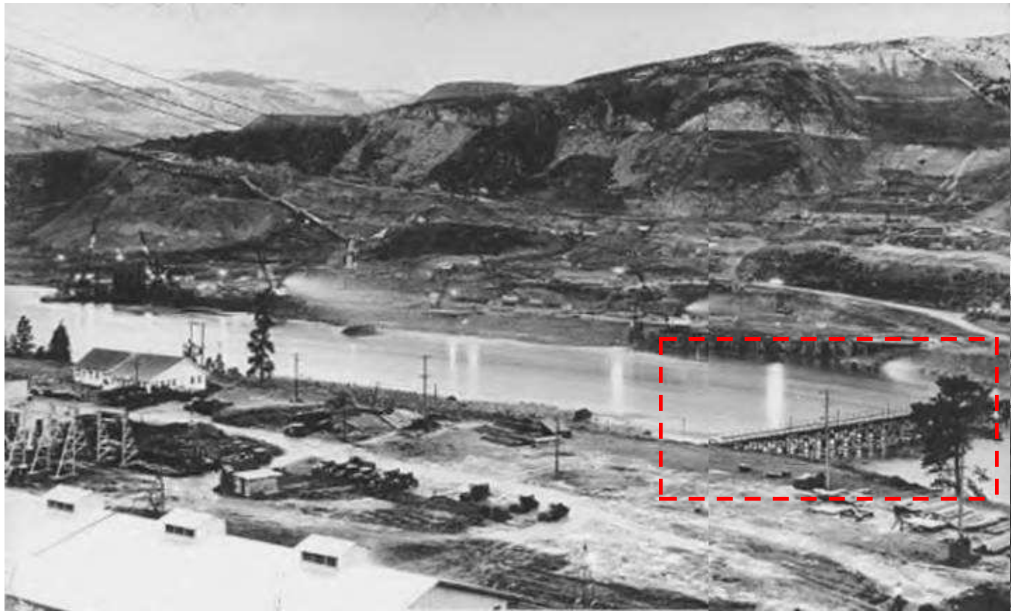
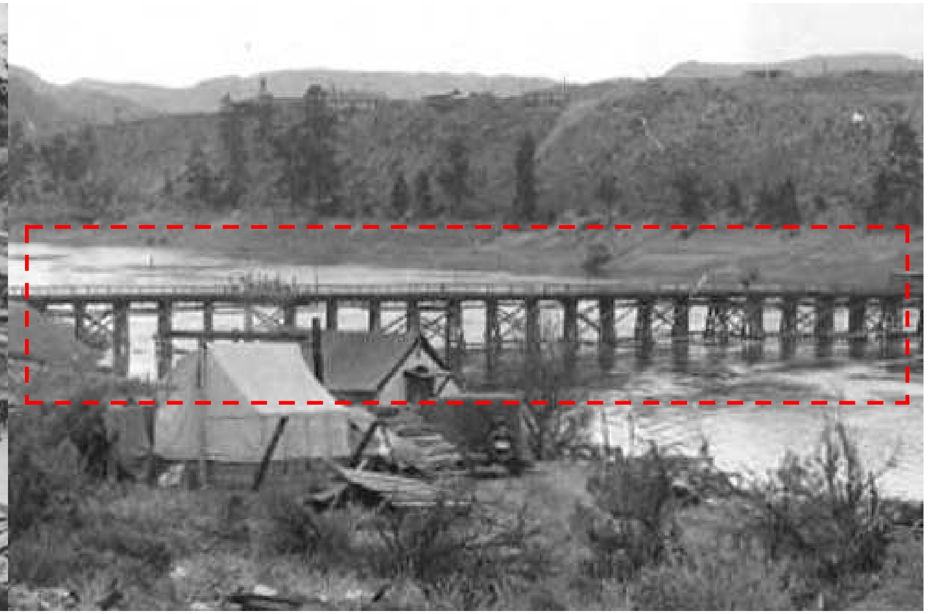
***Spokane Chronicle,* September 20th 1935**



**<u>Above</u>: caption: "Heavy trucks soon will be thundering across the bridge pictured here. It is the Grand Coulee dam bridge built by MWAK Company for its private use during construction of the $63,000,000 Grand Coulee dam on the Columbia river. According to schedule, the bridge will be ready for use Saturday. Tuttle Brother's ferry will continue to get the general run of traffic across the river. Careful scrutiny of the picture will reveal new buildings, construction work and general activities at the dam site. The picture was taken early this week, and the space between the bridge and bank at the right gives an idea of the construction speed." (Spokane Chronicle, October 24th 1934)**

*"All eyes yesterday centered on the temporary span of the MWAK Company, which truly looks 'temporary' at this time. The structure has a sharp bend in the middle caused by heavy ice pressure in back of it. The curve is about 10-feet at the deepest point. During the late afternoon yesterday only a 50 to 100-foot channel remained open in the stream. On the east shore a huge mass of ice has piled up against the timber bents and on the west bank a like avalanche is pushing against the frail supports. The open channel is three-quarters filled with ice and a cold spell would freeze the river over entirely. Some 200-feet upstream a 50-foot strip of ice already connects the shore portions. When thawing weather sets in the timber span will unquestionably be wiped out, officials predicted. Blasting was done in the frozen mass all day Sunday and again for a short time Monday, with no tangible results…Tuttle Brothers were working on the two ferries in an effort to get them in shape to handle the car traffic. Two barriers of ice, each 100-feet wide, on opposite shores, will hold up this service, however. The firm was also working frantically to save its houseboat, which has a huge floe against one side."*

***Spokane Chronicle*, January 22nd 1935**

***"About November 1, last year, officials of the MWAK stood on the shore of the Columbia and looked proudly at the first trestle ever built across the river, considered not a small achievement. Today the bridge, which was built in a little more than two weeks, was 'on the skids' and demolition of the structure has been started. Planned as an emergency measure, the bridge carried most of the $1,000,000 worth of materials and supplies that went into the contractor's town site. It was expected to last only until the ice 'went out,' but managed to serve the builders several additional weeks. The railings were being torn off today and preparations made to tear the structure down before high water swept it along and endangered the bridge piers downstream…"***

***Spokesman-Review,*** **April 17th 1935**

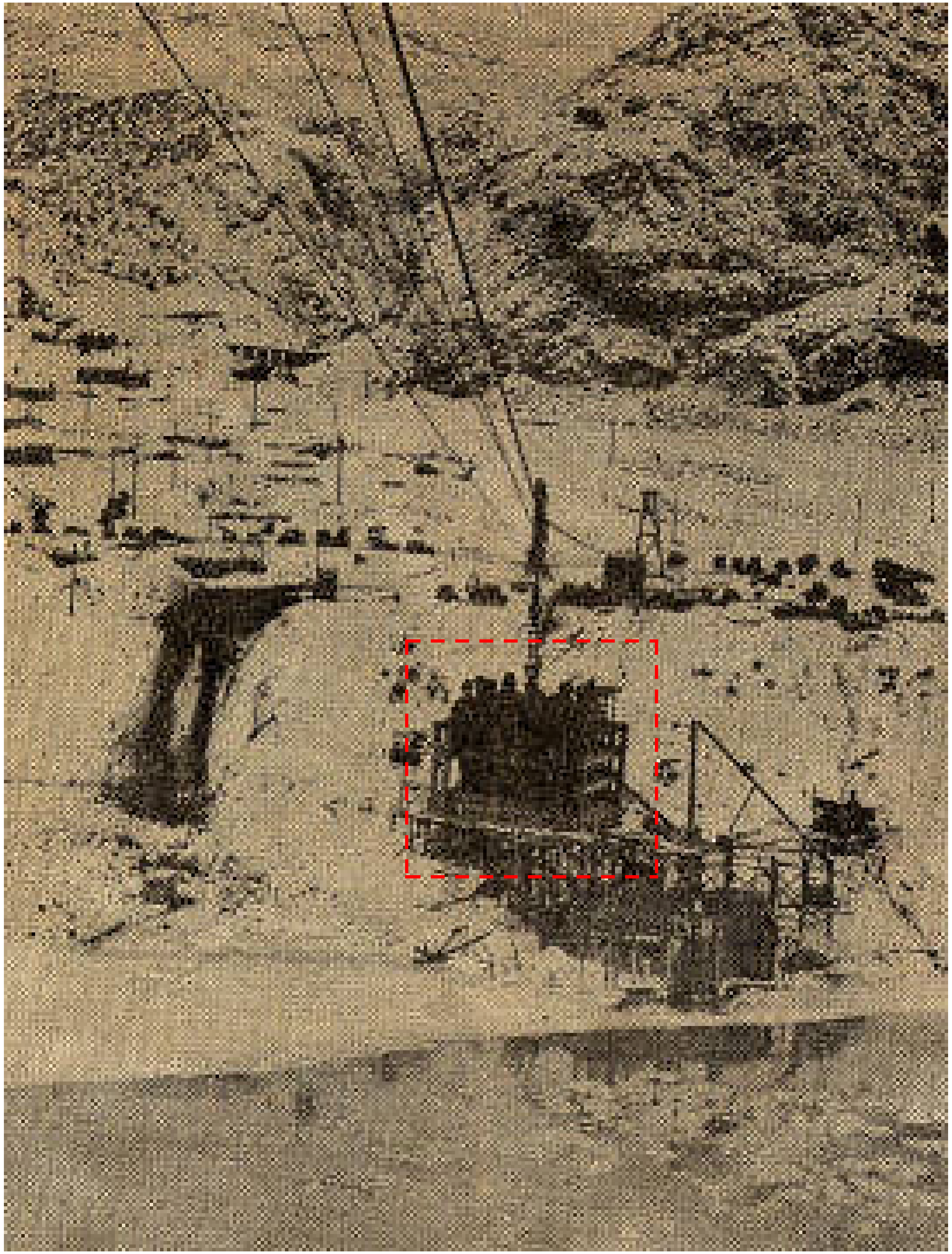


**<u>Above L&R</u>: temporary pile bridge (trestle)**

# But What if the Cable Should Break?

***“No skyride at the late world’s fair in Chicago had anything on the one now being furnished to willing and unwilling workers of the MWAK Company. While the suspension bridge is being built and ferries put in shape, men are being taken across the turbulent Columbia in a six-foot square platform, hung precariously, or so it seems, from a cable stretched 200-feet above the river level. Long lines of men stood on each shore yesterday ready to be taken across in groups of 10 to 12. There is no gate to the platform, the men all clamber over the sides. As the signal is given the structure goes skyward some 15-feet and then it is pulled out over the stream. Some 200-feet below the Columbia river floats by, carrying with it huge chunks of ice. Not matter how hard one tries, one can’t help but think ‘What if the cable should break!’”***

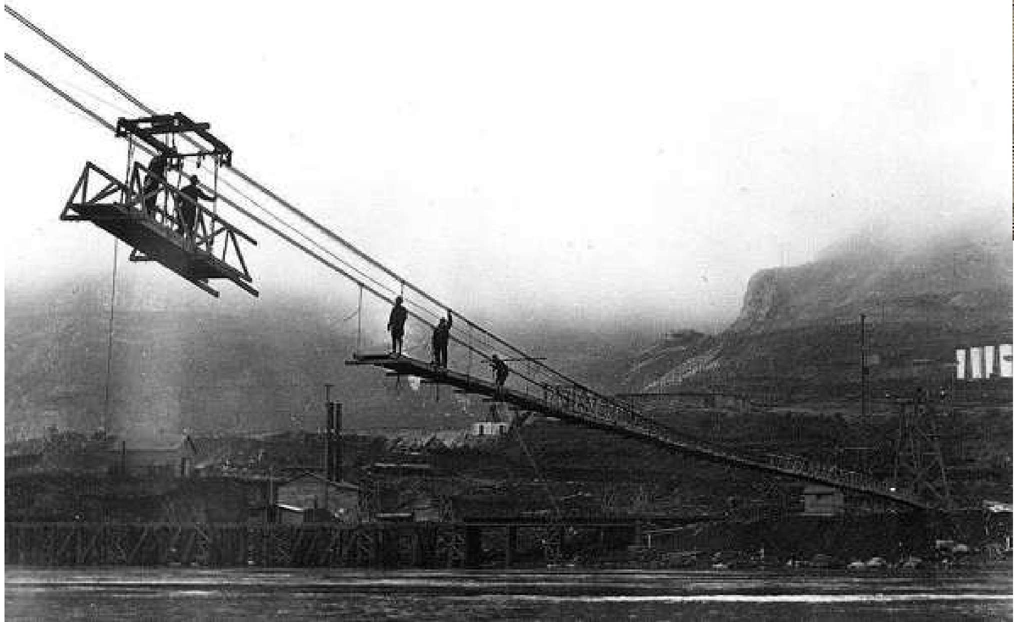
***Spokane Chronicle,*** **January 22nd 1935**

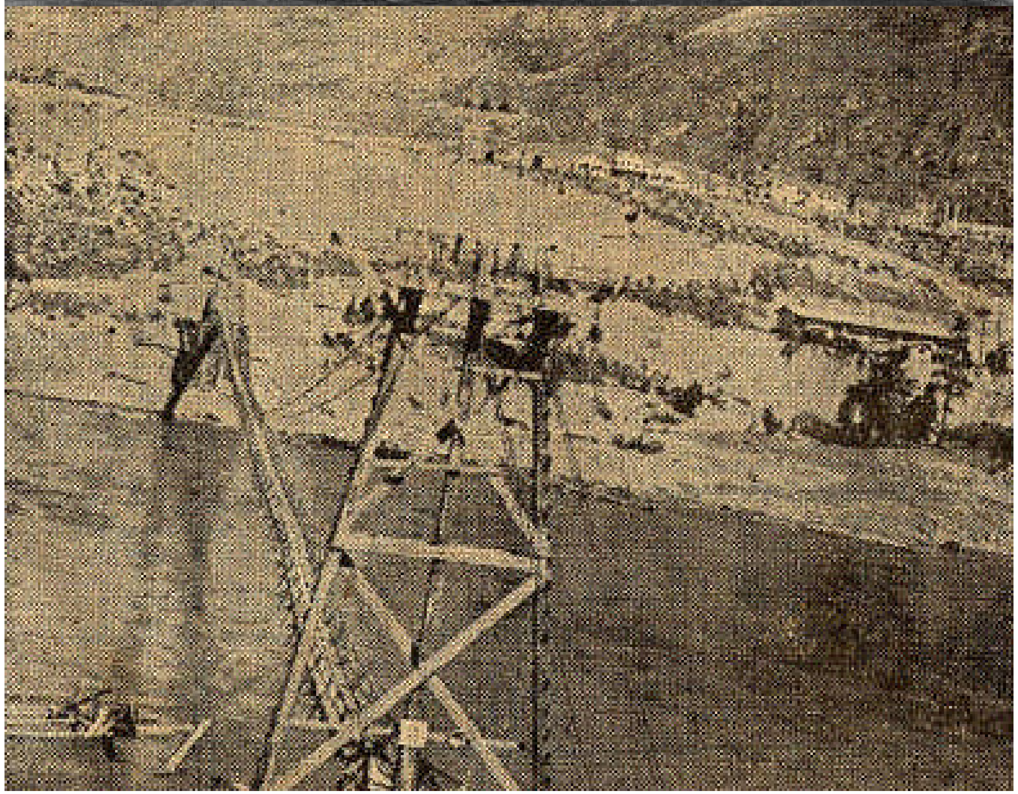


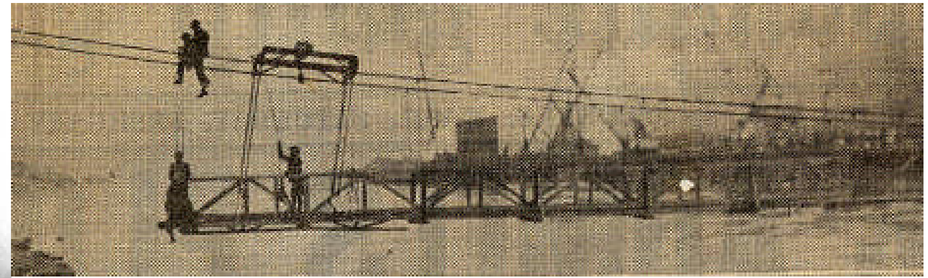
***"…The men were taken across the river in a hurriedly constructed platform hung on the bottom of the Western Construction Company cable used to carry the one yard concrete bucket. Food supplies were transported in the same manner…"***

***Spokane Chronicle,* January 22nd 1935**

**<u>Left</u>: caption: "This photo shows how workmen were transported to and from their work at Grand Coulee dam site while the temporary bridge of the MWAK Company across the river was closed to traffic because of threatening ice jams. The platform on which twenty men can stand, was hung to a cable of the Western Construction Company and sent back and forth across the river. The temporary bridge now is open to pedestrians but is still closed to vehicles." (*Spokane Chronicle*, January 26th 1935)**



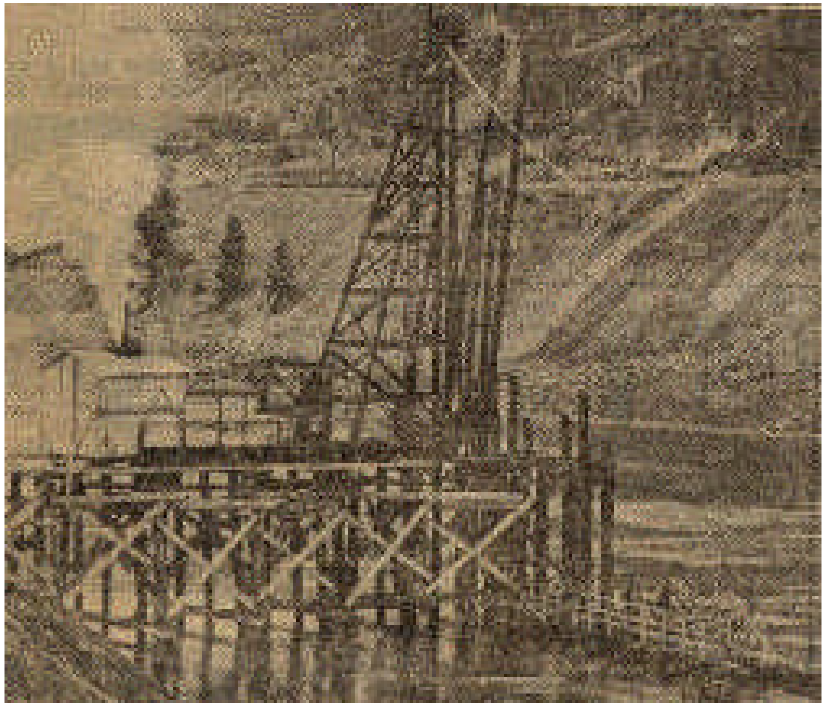




<u>Above</u>: caption: "'Let's go for a swing on the cat walk!' promises to be the favorite invitation of any nice boy to his nice girl when in the vicinity of the Grand Coulee dam site. The 'cat walk' is the suspension foot bridge across the Columbia river completed this week by the MWAK Company. The pictures show details of the cat-walk during construction" (*Spokane Chronicle,* February 2nd 1935)

<u>Top Left</u>: caption: "Contractors catwalk being built so workers could cross the Columbia River at the Grand Coulee dam site (February 1935)

<u>Bottom Left</u>: caption: "When approaching high water in the Columbia river caused the MWAK Company, General Contractors on the Grand Coulee dam, to abandon and dismantle their trestle bridge for foot passengers, they made it possible for their work-men to reach their jobs in any parts of the dam area by construction of a catwalk, shown in the picture. The picture, taken from the west coffer-dam site, shows Mason City in the background across the river, with a warehouse at the right, on the lower level, and above it the executive offices and mess hall." (*Spokesman-Review*, April 28th 1935)



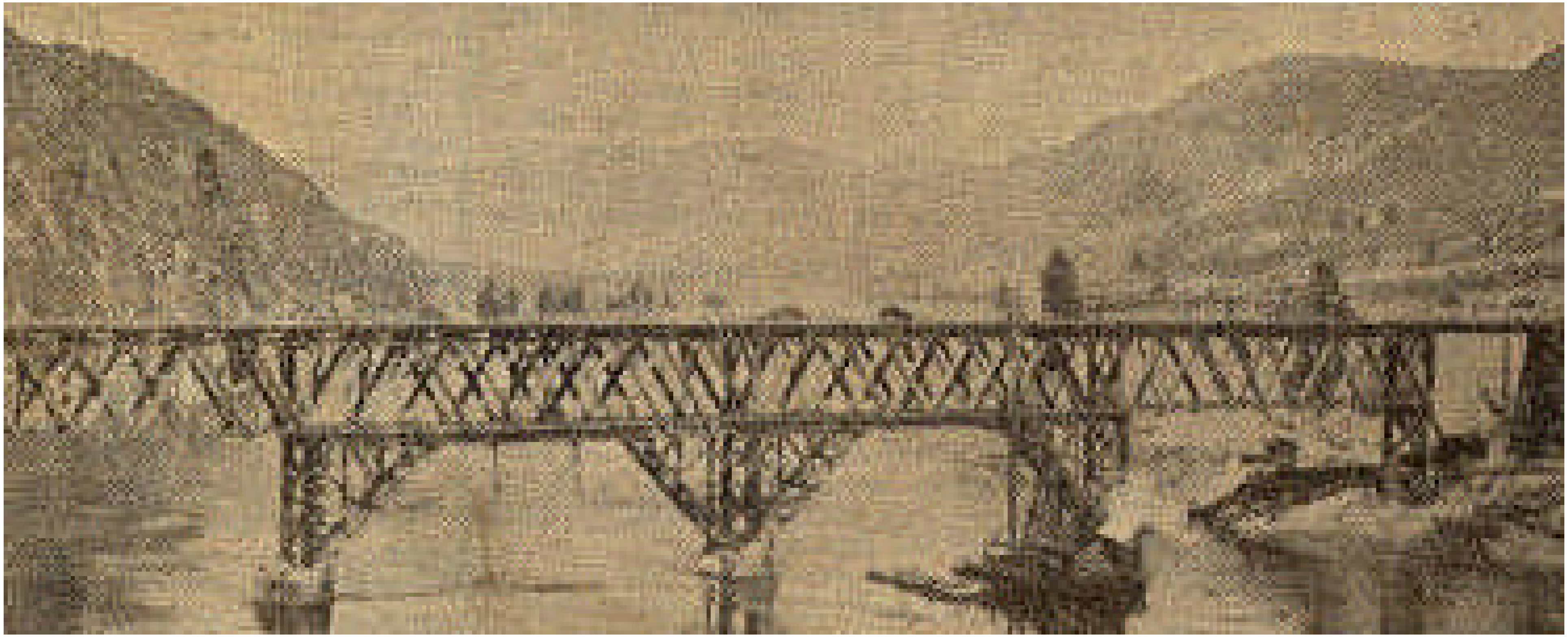
***"The big pile driver, which in two weeks pounded in the temporary trestle across the turbulent Columbia river here six weeks ago, began work today on the railway-highway bridge for the MWAK Company. By noon it was about 10-feet out in the water, a third of a mile from the dam site. The bridge, to be completed in two months, will be a timber truss type. The floor will be on elevation 1020, the level of the machine shop and concrete mixing plants near the east axis of the dam. When the temporary span is wiped out by ice or flood next spring, traffic will be diverted over the new structure. The state highway bridge will not be completed for another six months or so…"***

***Spokesman-Review*, December 5th 1934**

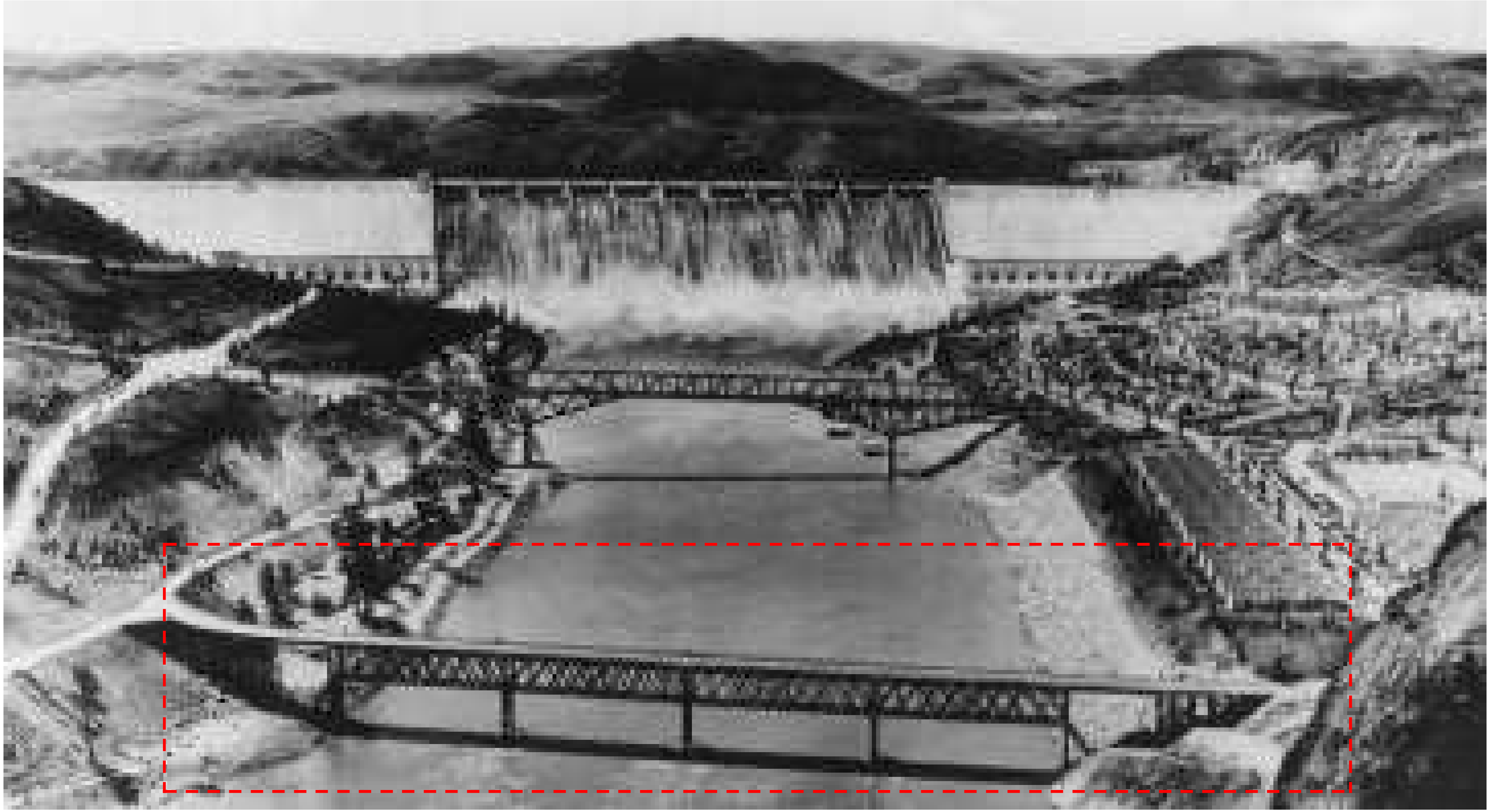
**Above: caption: "The photo shows construction of the new MWAK railway bridge, now nearly completed, with the pile driver at work driving supporting timbers far into the river bed clay" (*Spokane Chronicle*, December 17th 1934)**

***“The MWAK steel and timber truss railway-highway bridge under construction below the site of the state highway bridge, will be completed by February 28, it was announced today by C.D. Riddle, job engineer. Because of the short time until then and because of the low level of the water, it is quite possible, Riddle said, that the freight cableway, planned as an emergency measure if the trestle went out, will never be built. Anchors are in place and the necessary equipment, including the cables, is on the scene, so the cableway if necessary, could be set up in a few hours. The trestle was damaged less than originally feared, and unless there is another bad freeze-up will carry the traffic until the railway bridge is finished…”***

***Spokesman-Review,* February 1st 1935**



**<u>Above</u>: caption: "This bridge has just been completed by the MWAK Company about a half-mile below the Coulee dam. It is a dual railway-auto viaduct, with one set of rails and width for two cars, built on three steel-and-concrete piers, and is of timber-truss construction. The barge seen in mid-river was used in construction. The state highway bridge across the river at the dam will not be completed for three months, according to reports." (*Spokane Chronicle*, April 8th 1935)** [1106]



***"Traffic at the timber MWAK railroad bridge was stopped during part of the afternoon Wednesday while workmen repaired ailing timbers in the span. Slippage of piers and movement of the floor of the span has necessitated a quick repair of the structure. It is doubtful if the span will ever be used as a railroad bridge, there remaining very little shipping to be done from the west to the east shore and it being doubtful, engineers say, if the unstable east bank overburden would hold up the tracks and the loads thereon."***

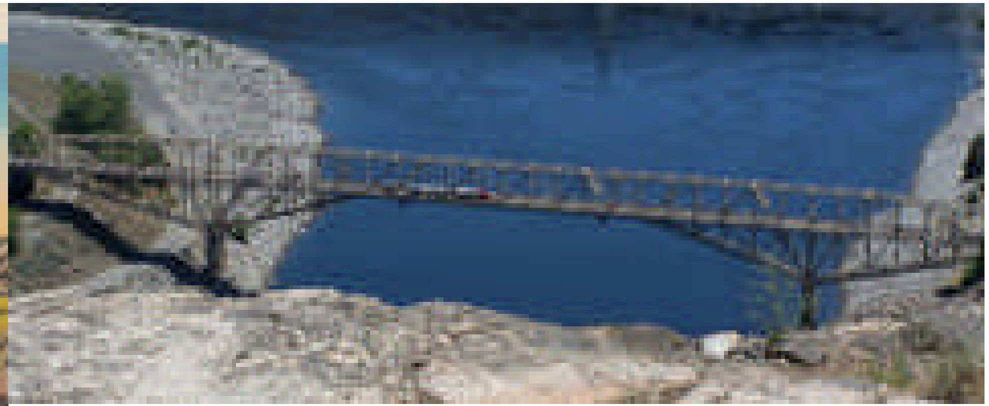
***The Wenatchee Daily World,* October 10th 1935**

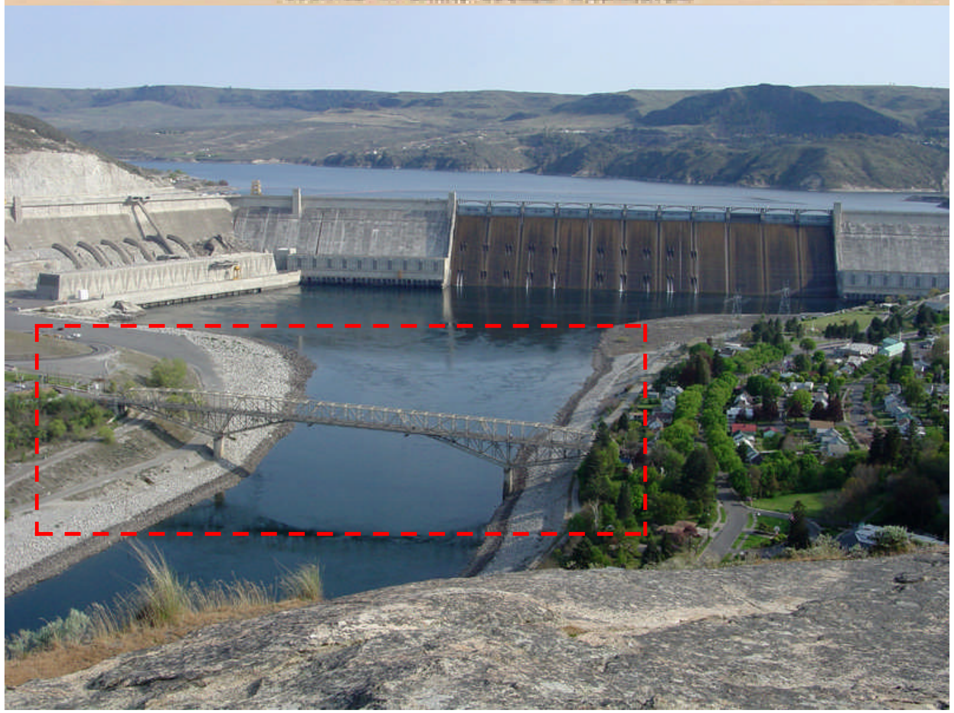
***"The MWAK railroad bridge, built at the start of company operations three years ago, may not be dismantled during the present contract. It was learned here today. The government has offered the company the privilege of tearing it down or making arrangements for the next contractor to remove it…The bridge has been used only partially for the purpose intended. It was to be a railway and highway bridge. A big tunnel was built through a granite bluff for the railway, but when a portion of the east bank slid and tilted the pier for the permanent highway bridge, the plan to lay a track was abandoned…"***

***Spokesman-Review,*** **December 30th 1937**

***“Connecting what will be soon the state’s newest towns, Mason City, and the government town for the engineers on the opposite sides of the river, is the state’s $450,000 cantilever bridge, under construction here…To obtain the sound foundation necessary to support the immense weight of the bridge, it was necessary to sink caissons to bedrock, through water, sand, gravel and clay to granite…The first work was the driving of piling for a false work on the east side and the removal of dirt by means of a ‘stiff-leg’ derrick and clamshell. Steel piling was also driven on the west side, as work was started beyond the water’s edge there…”***

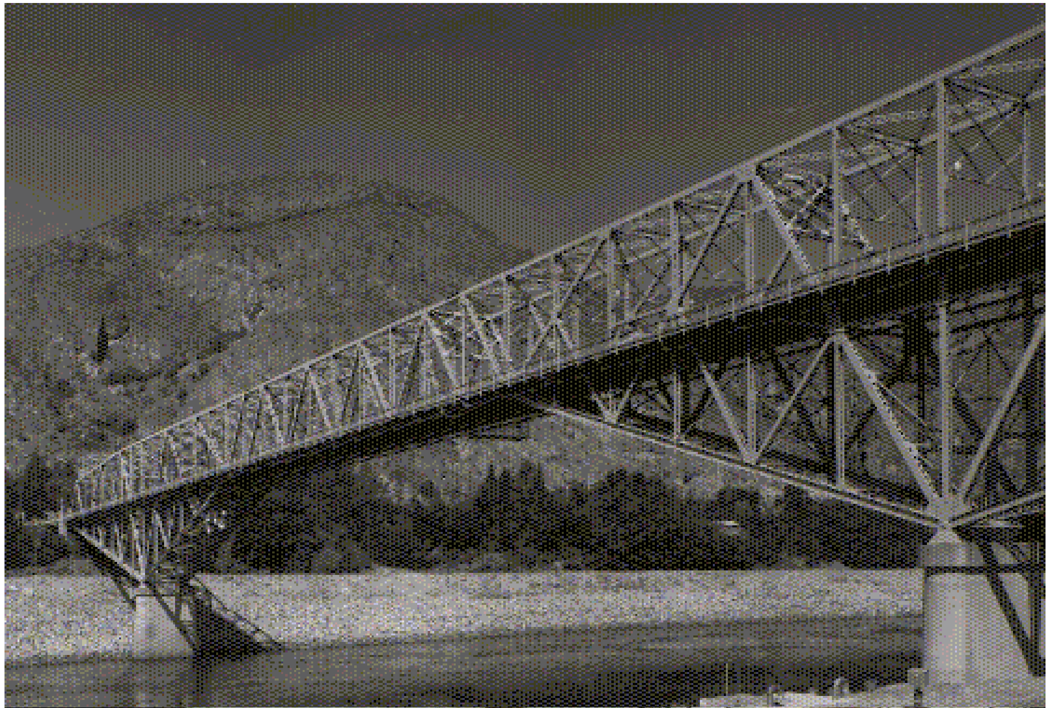
***Spokesman-Review,*** **December 20th 1934**

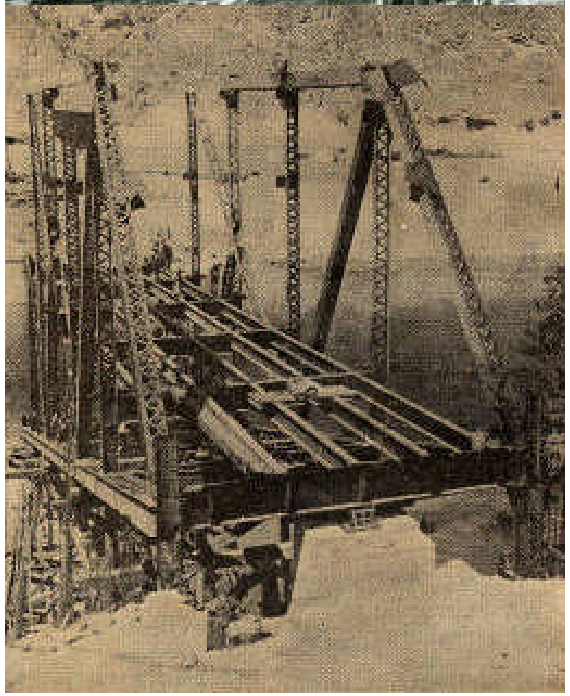





***"…The steel bridge will be built because the new state highway bridge will not be ready in time. Representatives of steel companies are here to take the order this week, and first shipments will arrive about three weeks later. It will take six weeks to build the structure. It will carry two-way automobile traffic until the new Grand Coulee railroad is completed. After that, rails and highway will run side by side. Mason said they will not build a ferry, but will use the present Tuttle Bros. Boat until the bridge is ready…"***

***Spokesman-Review*, December 1934**





***"…But the method of controlling the river flow and maintaining steady progress in pouring the various blocks, or sections, is not quite so simple as a matter of capacity and speed of machinery. That has already been indicated by the shifting and sinking out of line of one of the caisson piers sunk for a railroad and highway bridge which was to have been completed last summer. This is about the only defeat the engineers have suffered so far, and they have re-doubled their precautions as the major job progressed…"***

***Popular Science,* February 1936**

**Top: caption: "Construction of the two highway bridge piers - looking west, December 2, 1934"**

**Bottom: caption: "Superstructure of the state highway bridge, about 25% complete, under J.H. Pomeroy & Co., Inc." (July 1935)**

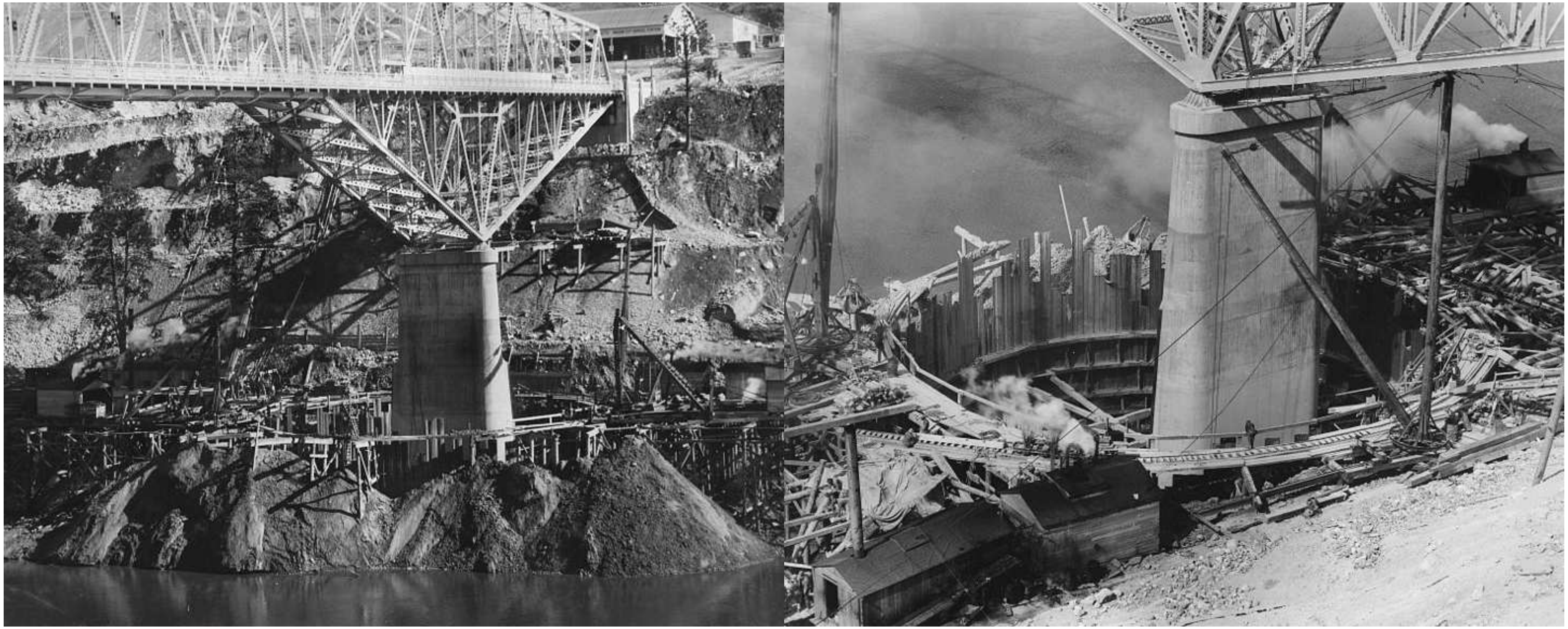
***"Two of the large I-beam circles that will strengthen the 100-foot circular cofferdam being built around the east side 'leaning pier' of the state highway bridge have been completed and more are in process of construction. The rings are made of huge steel I-beams, cut into about 10-foot lengths, with the ends mitered, to form a polygon that is virtually a circle. Guide piling has been driven completely around the pier and the two rings of steel welded, bolted and riveted into position. Later, steel piling will be driven around the outside of the circle to keep out the water and earth. Piling is being trucked to the site and stacked in readiness for driving. In contrast to the 70-foot lengths used by MWAK in building their west shore cofferdam, this piling is but 30, 35 and 40-feet long. All of the earth inside the 100-foot circle must be removed, down to bedrock, when the pier will be pulled back into position…"***
***Spokesman-Review,*** **December 28th 1935**
**Above L&R: caption: "Driving wood piling for working platform in enlarging highway bridge Pier 2, November 1935"**

***“Preparations were being made today by J.H. Pomeroy Company, Inc., for the start of work on a smaller inner coffer-dam, inside the main ring of steel on the bridge pier, to facilitate the driving of the pilings to bedrock. The pilings on the main ring have been driven down about 40-feet, but a stratum of adamantine hardpan was struck about 38 or 40-feet down. The densities of the stratum made it impossible for the company to tell whether the pilings were going down straight and the pressure required to drive them was enormous…”***

***Spokesman-Review,*** **February 25th 1936**

***"…On the MWAK cofferdam, a limit was set on the driving, and when it took 80 blows of the hammer to drive a piling one inch, the seal was regarded as good enough. On the last few feet on the bridge cofferdam, more than 100 blows sometimes failed to move the piling a quarter-inch, engineers said…"***

***Spokesman-Review,* February 25th 1936**

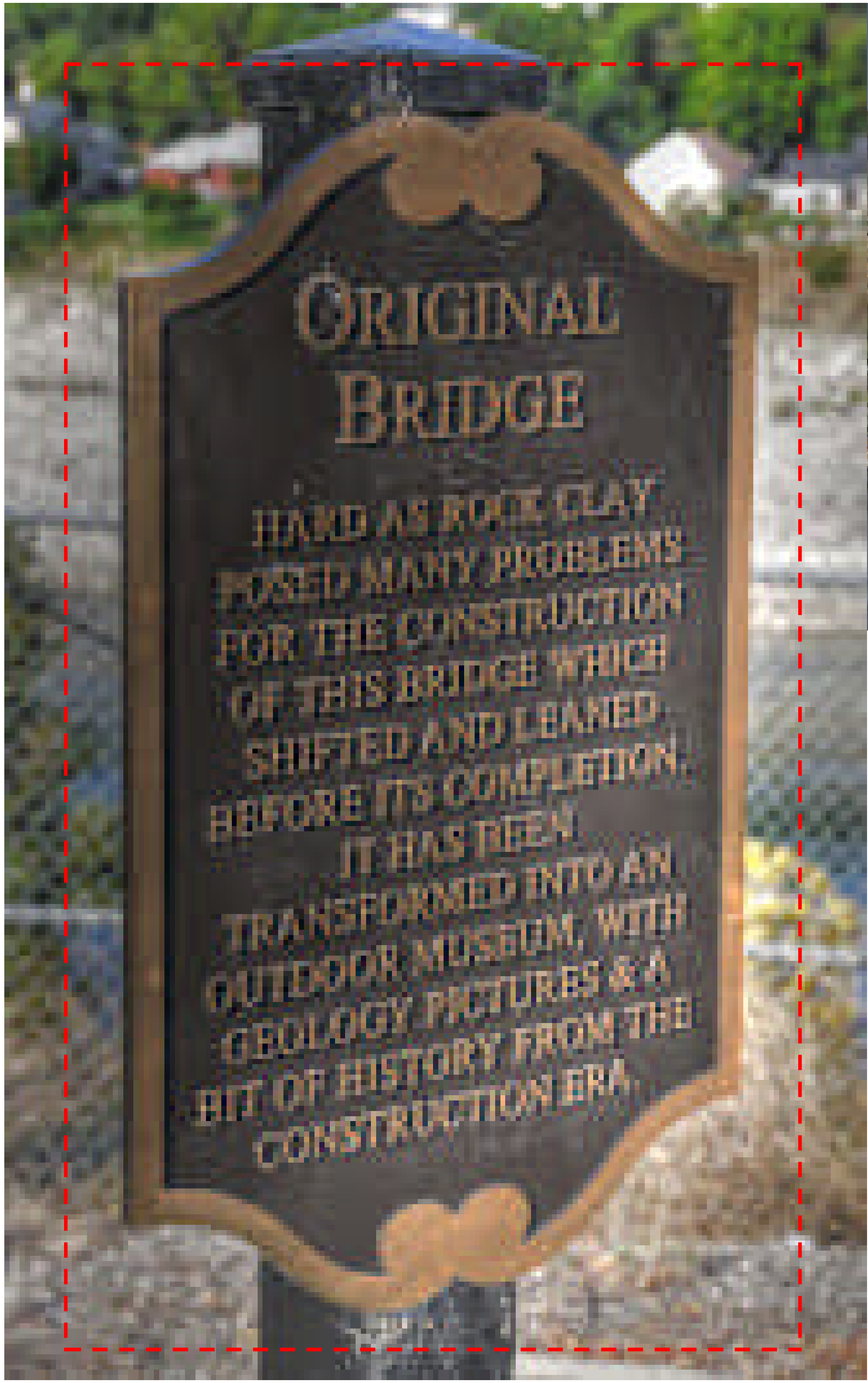


***"…The new cofferdam, engineers explained, is merely a smaller extension of the larger one, and will be a duplicate except for size. The friction of 40-feet of earth of various kinds pressing against both sides of the piling was too great, but with the new setup that pressure will not be attained again until the ends of the piling have pierced the remaining 35-feet and reached bedrock Huge steel I-beams mitered to form virtually a circle will be used on the new cofferdam, as they were on the upper section, to prevent the earth from pressing in and breaking the sides after the dirt around the pier is removed…"***

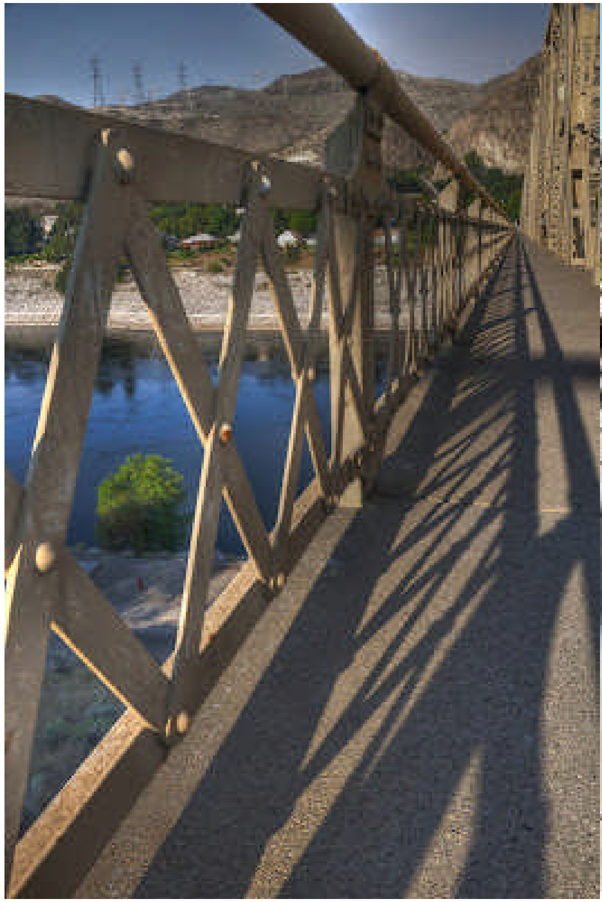
***Spokesman-Review,* February 25th 1936**

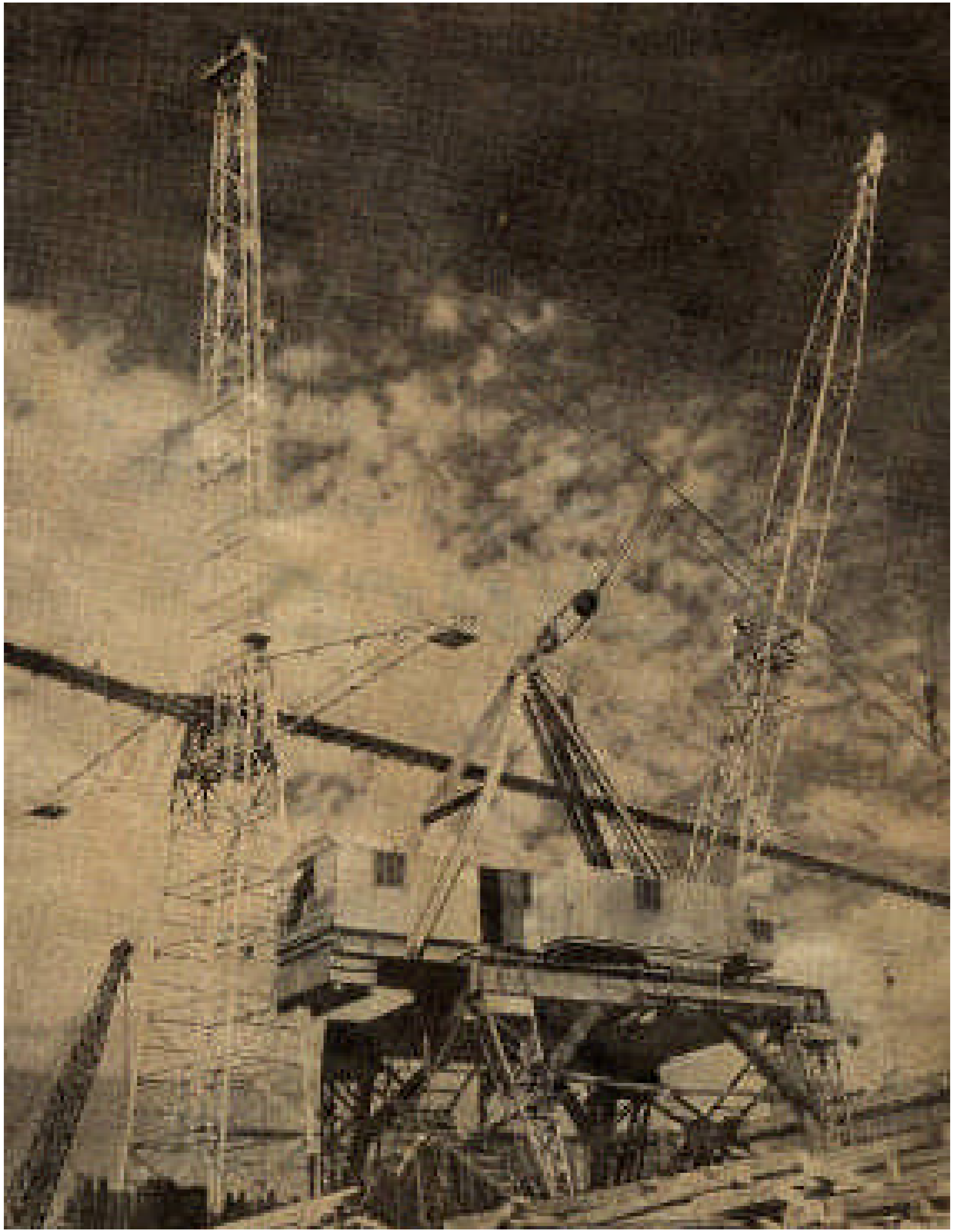
**<u>Above L&R</u>: caption: "Highway bridge pier No. 2 showing sheet pile caisson constructed for pier enlargement, March 1936"**

# A Bit of History




**<u>Inscription (left)</u>: "ORIGINAL BRIDGE – Hard as rock clay posed many problems for the construction of this bridge which shifted and leaned before its completion. It has been transformed into an outdoor museum, with geology pictures and a bit of history from the construction era."**





***"When the workmen of the MWAK Company completed the joining of the sections of the sky-high suspension bri-dge, on which gravel and sand will be transported, it was the tenth time the Columbia had been spanned within one-third of a mile…"***

***Spokane Chronicle,*** **September 20th 1935**

**Left: caption: "Here is an industrial study of un-usual merit showing one of the giant Clyde whirleys of the MWAK Company at work on the sus-pension bridge that will carry sand and gravel on a moving belt for use in the Grand Coulee dam. The whirleys are used in driving pilings and other crane and derrick work. Beside it is the 325-foot steel tower of the span." (*Spokesman-Review,* October 27th 1935)**

***"Supporting cables and the mighty 325-foot central tower of the suspension bridge spanning the Columbia river at the Grand Coulee dam site in the state of Washington appear like a vast spider web of steel. Sand and gravel used in the concrete for the dam are to be carried across the river on this bridge by a belt conveyor system. One of the features of the bridge is a long rocker arm at the bridge level which assists in bracing the tower."***

***Popular Mechanics,*** **January 1936**

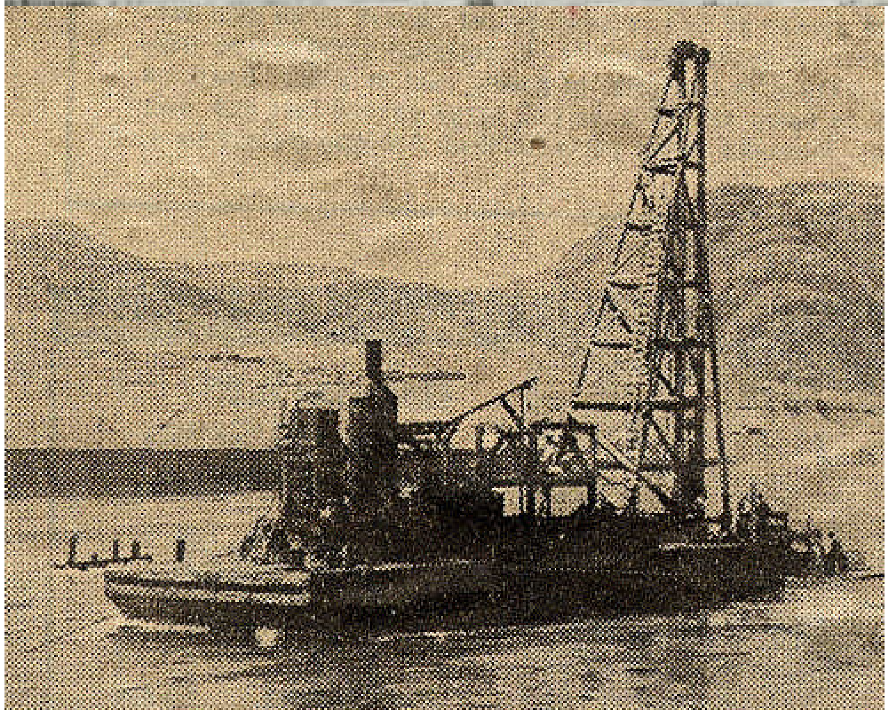
**<u>Left</u>: caption: "Cables and tower of bridge at Grand Coulee dam site over which concrete will be carried by a belt conveyor system"**


***"…The bridge will have three towers, one on the rock below the dam site highway, and protruding just above it in height, one on the downstream cell-block of the west shore cofferdam, 330-feet high from inside the cells, and one in front of the machine-shop on the east shore, rising up the same distance in the air. The floor of the span will be 144-feet above low water and supported from four 2¼-inch cables weighing 66 tons. The floor will be about 10-feet wide, carrying in addition to the corrugated-iron covered 36-inch conveyor, a walk on each side and an 11-inch pipeline to blow cement from the west to the east shore…"***

***The Wenatchee Daily World,*** **June 25th 1935**

**Left: caption: "View of suspension bridge from west shore"**

**Right: caption: "Suspension bridge tower and conveyor system"**



***"Two barges, 70-feet long, with a 30-foot beam, and a load capacity of 300 tons each, are being constructed to be used in the river operations of the MWAK company"***

***Spokane Press,*** **November 15th 1934**

**Top Left: caption: "Photograph of construction of barges used for a variety of purposes at the Grand Coulee Dam construction complex"**

**Top Right: caption: Finished barge being floated in the Columbia River"**

**Left: caption: "MWAK pile-driver, mounted on barge, building trestle bridge"**

# The Rattlesnake Express

***"The method of depositing the overburden which must be removed for the foundation for the Grand Coulee dam, in Rattlesnake canyon, is an interesting one. A.M. Croxson, assistant construction superintendent, yesterday explained how the earth will be taken care of once it reaches the big canyon…"***

***Spokane Chronicle,* November 28th 1934**

***"…The overburden will be hauled over to the edge of the big gulch by the well-known conveyor system, which is to be finished by December 8 or 10. A five-foot wide belt will carry the material to a point over the edge of the canyon where it will drop some 200 or more feet. For the first six weeks only a bulldozer will be necessary to handle the dirt. The big dirt-pusher will keep the spoilbank in the bottom leveled off until it reaches the 1300 elevation. After that a machine known as a 'stacker' will be used. This bit of apparatus should prove to be one of the most interesting during the lifetime of the project…"***

***Spokane Chronicle,*** **November 28th 1934**

<u>Above L&R</u>: caption: "A unique feature of the construction of Grand Coulee Dam was the use of conveyor belts in removal of the material overlaying bedrock at the site. In thirteen months, approximately ten million cubic yards of earth and clay were removed to Rattlesnake Canyon 1¼ miles away from and 500-feet above the excavations on the west and east banks of the river. The principal conveyor had a belt 60-inches wide. It was fed by a network of smaller belt systems, one of which extended across the river. At top speed 1.30 tons of material was dumped each second in the spoil pile in Rattlesnake canyon. The conveyor proved so successful that a similar system now brings the sand and gravel to the mixing plant."

***“…It is built much like other sections of the conveyor belt, only it is movable. Mounted on caterpillars it moves in a semi-circle on top of the fill depositing the earth at various locations. It is constructed in elbow fashion and can be tele-scoped over a 150-feet radius. The machine will be moving constantly while the earth is being dumped into it by the conveyor. In this manner, MWAK will be able to keep the fill at the same elevation. Once the 150-foot radius is leveled off, the machine may be moves to other locations and the pro-cess repeated…”***

***Spokane Chronicle,* November 28th 1934**

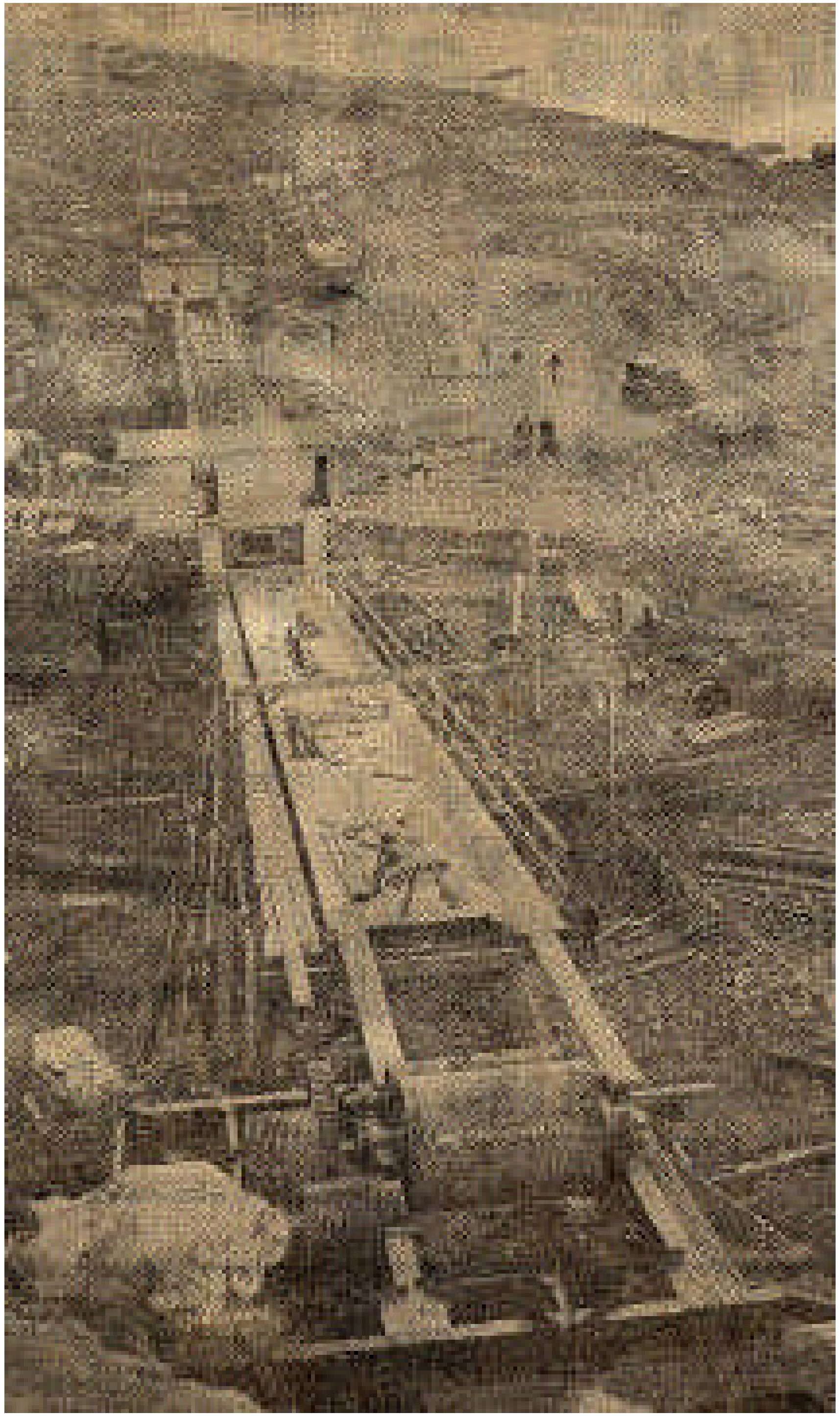
***“Sand and gravel for making of concrete for the Grand Coulee dam will be carried by conveyor belt system from pits to dam site, it was announced today by officials of the MWAK company. Purchase from the Jeffrey company, an Ohio concern, of a $200,000 48-inch conveyor system, for shipment within three weeks, was announced. It follows award to the same company of a $300,000 contract two weeks ago for furnishing a mile-long 60-inch conveyor belt system. The 48-inch system purchased today will be located on the east side of the river. It will be used first in removing excavated materials from the dam to a point high above the river, out of the way, and when excavation is completed, it will be moved to provide a direct means of conveying the ‘aggregate,’ or sand and gravel mixed, for the concrete work in the dam proper.”***

***Spokane Chronicle*, October 24th 1934**

***"…In addition to the west shore belt, another 4,500-foot system is to be constructed on the east shore. The twin setups will have a maximum capacity of 50,000 cubic yards per day."***

***Spokane Chronicle,*** **Jan. 11th 1935**

**<u>Left</u>: caption: "Machining a gear at the Jeffrey Manufacturing Co. that would be sent to Washington state to be used in the construction of the Grand Coulee Dam on the Columbia River, ca. 1934"**



***"…Even scrap iron finds its place in the work at the dam. Huge weights, built of concrete, with small pieces of scrap iron in place of aggregates, are being used to stretch the heavy belts on the conveyor. The huge roller, about two feet in diameter at the ends of the belt sections, are connected by pulleys to the string of weights, which will keep an even tension on the belting. Weights are varied according to the lengths of the sections…"***

***Spokesman-Review*, December 14th 1934**

**Left: caption: "Thousands of tons of earth will roll into Rattlesnake gulch over this huge conveyor system being constructed at Grand Coulee dam site by the MWAK Company. The belt will carry dirt from the overburden where bedrock will be barred for the foundation of the dam. The conveyor is built in sections and huge tractors have been used in hauling them into place." (*Spokane Chronicle*, December 5th 1934)**

***"It takes twenty-four men to oil the hundreds of rollers of the conveyor system. One man has been stationed between each two houses which contain the motor which propels the giant belt layout. There are sixteen of these houses. Thus it takes eight men per shift and twenty-four during the 24-hour day…"***

***Spokane Chronicle,* December 22nd 1934**

***"…Practically all of the more than 11,000,000 cubic yards of earth to be excavated for the dam will be dumped in Rattlesnake gulch by belt conveyors, Mr. Slocum said. Cables will carry the belts suspended above the water to the east bank. Shovels will load the conveyors at their lower ends. The gulch, which enters the Columbia gorge just above the dam site on the west, is large enough to hold the entire amount, he said…"***

***Spokesman-Review,*** **June 16th 1936**

**Left: caption: "MWAK built the world's largest conveyor to remove all the rocks and rubble from the excavation site.**[1134] **It's more than a mile long!"**

***"…The huge rocks found in the overburden have caused the MWAK excavators considerable trouble. The big boulders have a tendency to stick in the mesh which separates them from the earth flowing down into the feeder units above the big belt, thus plugging up the open spaces through which the earth must go. Several times during the day the machines had to be removed. Alterations are expected to be made to remedy this troublesome situation."***

***Spokane Chronicle,*** **December 22nd 1934**

***“The thousands of rollers over which ‘flows’ the five-foot wide belt on the west bank of the Columbia will all be covered with an individual rubber mat, officials of the United States Rubber Company said here yesterday. The change is the first indication that MWAK is not quite satisfied with the present setup of moving dirt out of the excavation areas. The reason for the alteration is explained in that the large size rocks, the largest of which are kept from the belt by a strong steel grid, bounce nearly the entire 3,000-feet of their journey up the hillside to Rattlesnake canyon…”***

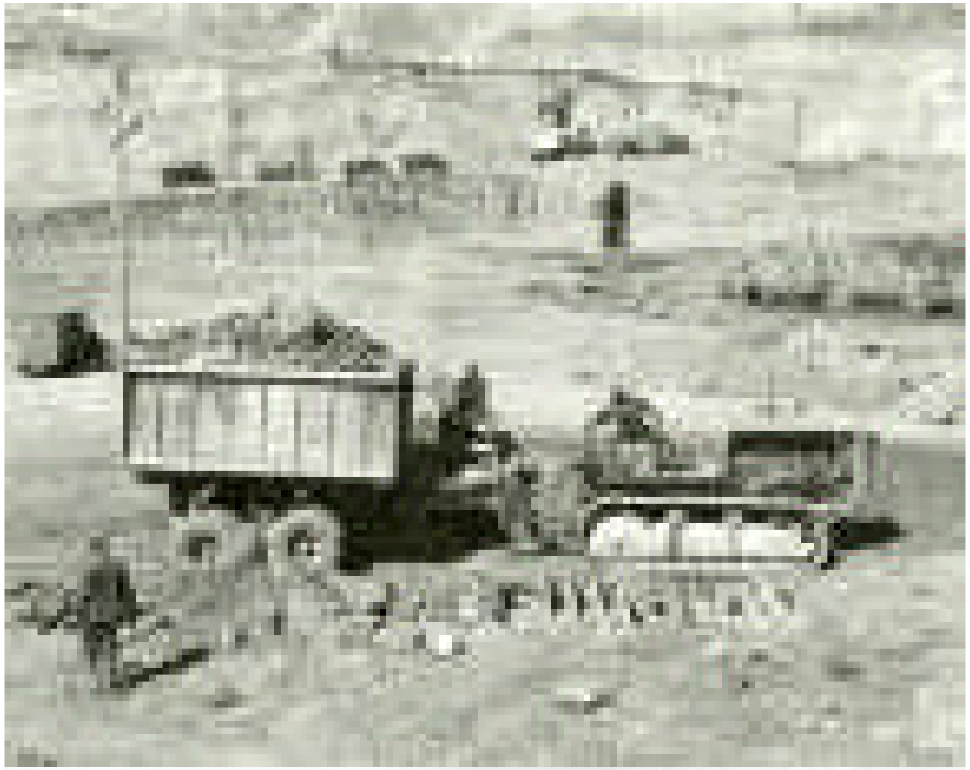
***Spokane Chronicle,*** **January 11th 1935**

***"…This bouncing of the rock against the rubber mat and in turn against the hard steel rollers over which the belt runs has proven hard on the belt and has pierced it in no small number of places. In order to prevent this from continuing, it is felt that by winding rubber around the roller; the shock of the rock hitting against the belt will be lessened by the additional rubber. The alteration will cost MWAK thousands of dollars. The contract between the general contracting firm and the U.S. Rubber Company will amount to about $600,000, the officials said…"***

***Spokane Chronicle,* January 11th 1935**

***"Some of the rollers on the giant conveyor system carrying thousands of yards of overburden daily from the lower excavation areas to Rattlesnake canyon are being moved closer together to save wear and tear on the belt, Silas B. Mason, Chairman of the Board of MWAK, who personally inspected the system yesterday, said. The movement of rollers nearer to one another will do away with the shock the rubber belt must take when large rocks are being carried to the top. By having the rollers closer together, there will be less chance for bouncing of these rocks on the belt and the rollers being so spaced will have a tendency to tighten the belt. It is doubtful if rubber mats will have to be put around the thousands of rollers, as reported yesterday, Mason said…"***

***Spokane Chronicle,*** **January 12th 1935**



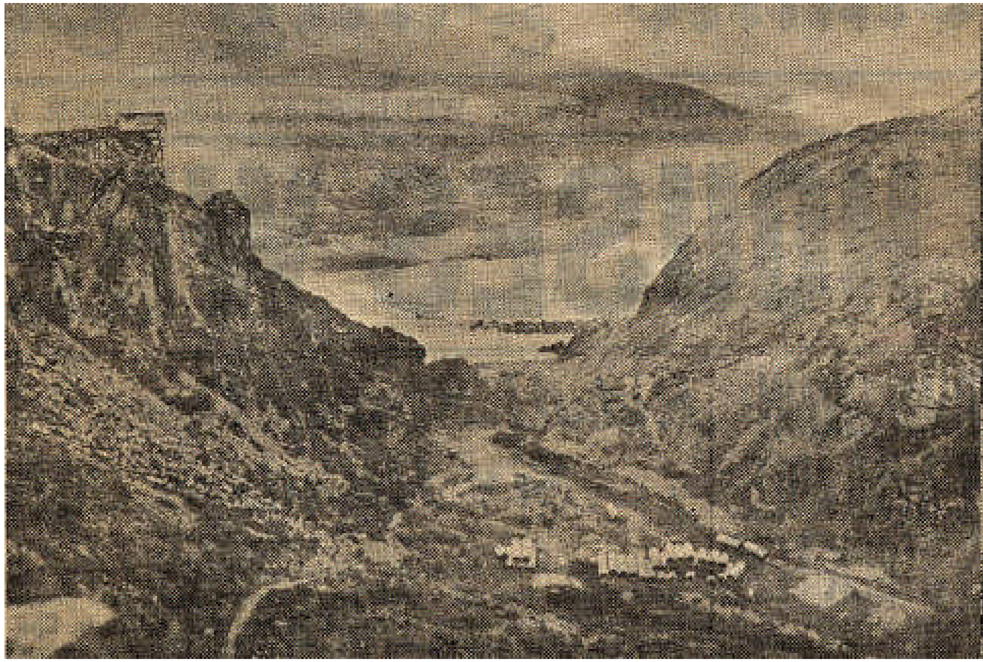
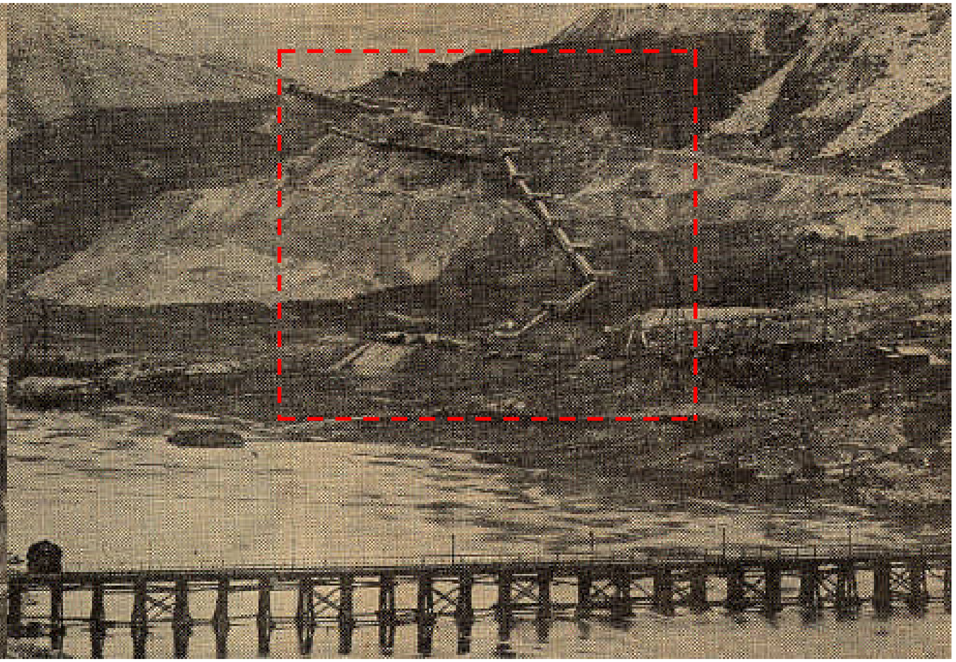
***"…He explained that a new system of keeping the rocks from the belt itself was being perfected. Up to the present larger size rocks were removed from the feeder system by means of a strong grid. In the future the rocks will be kept entirely out of the system by removing them as the shovels pick them up. The tractor-drawn wagons, both Athey's and Wooldridges's, will be pulled under a steel construction, which will be so built as to send rocks into one compartment and the earth into the wagons. Trucks will haul the rocks away, Mason said. MWAK is satisfied with the belt conveyor, Mason declared. He said that naturally some experimentation was necessary in order to bring it up to maximum standard."***



***Spokane Chronicle*, Jan. 12th 1935**

***"…With the exception of rock, practically all material was transported to spoil banks by the MWAK Co. on belt conveyors. Material, dug by large electric shovels, was hauled by 8-yard to 10-yard trucks and in 12-yard to 20-yard buggies drawn by caterpillar tractors to grizzlies grate-like structures on the ground, where boulders over 13-inches in diameter were pushed off and other material broken up and forced through the grizzlies by bulldozers. Feeders under as many as four grizzlies delivered the material over 60-inch belt conveyors to the surge feeder and the 60-inch main-line conveyor, which carried more than 13 million cubic yards of it a mile away into Rattlesnake Canyon, and dumped it at an elevation of 500 to 600-feet above the point of origin. A part of the material excavated on the east side was carried by belts 4,000-feet across the river and thence into Rattlesnake Canyon. After excavating was completed on the west side, the conveyor system was moved to the east side of the river. The main-line conveyor was made up in sections, long or short, depending on the grade at any point, each section driven by a 200-horsepower motor. In excess of 5,000 horsepower was at one time required to drive the conveyor system. The average daily capacity was 40,000 yards and the maximum daily output 50,839 yards in a 21-hour day. More than a million yards were moved in a month…"***

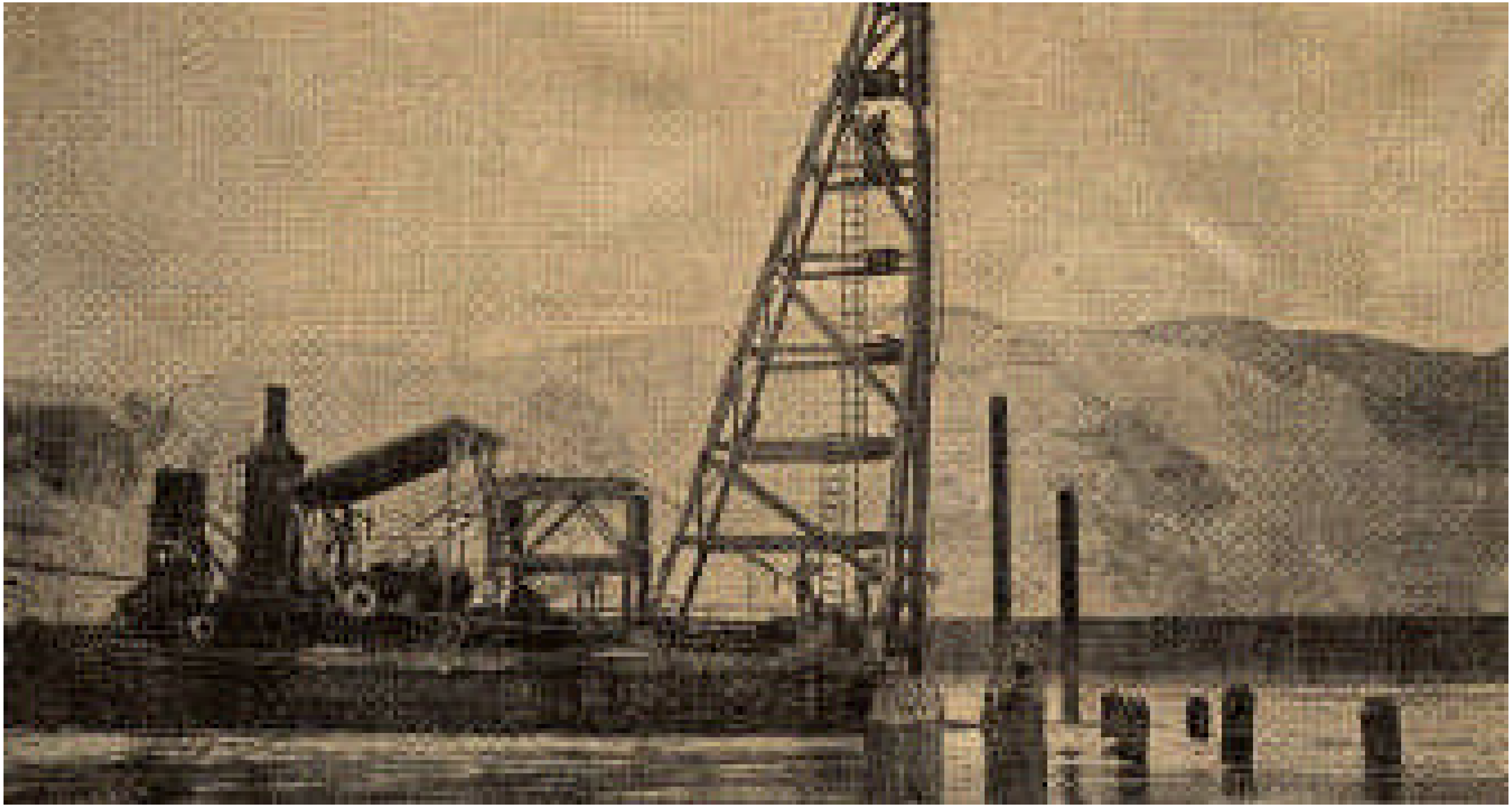
***U.S. Bureau of Reclamation*** **(ca. 1937)**

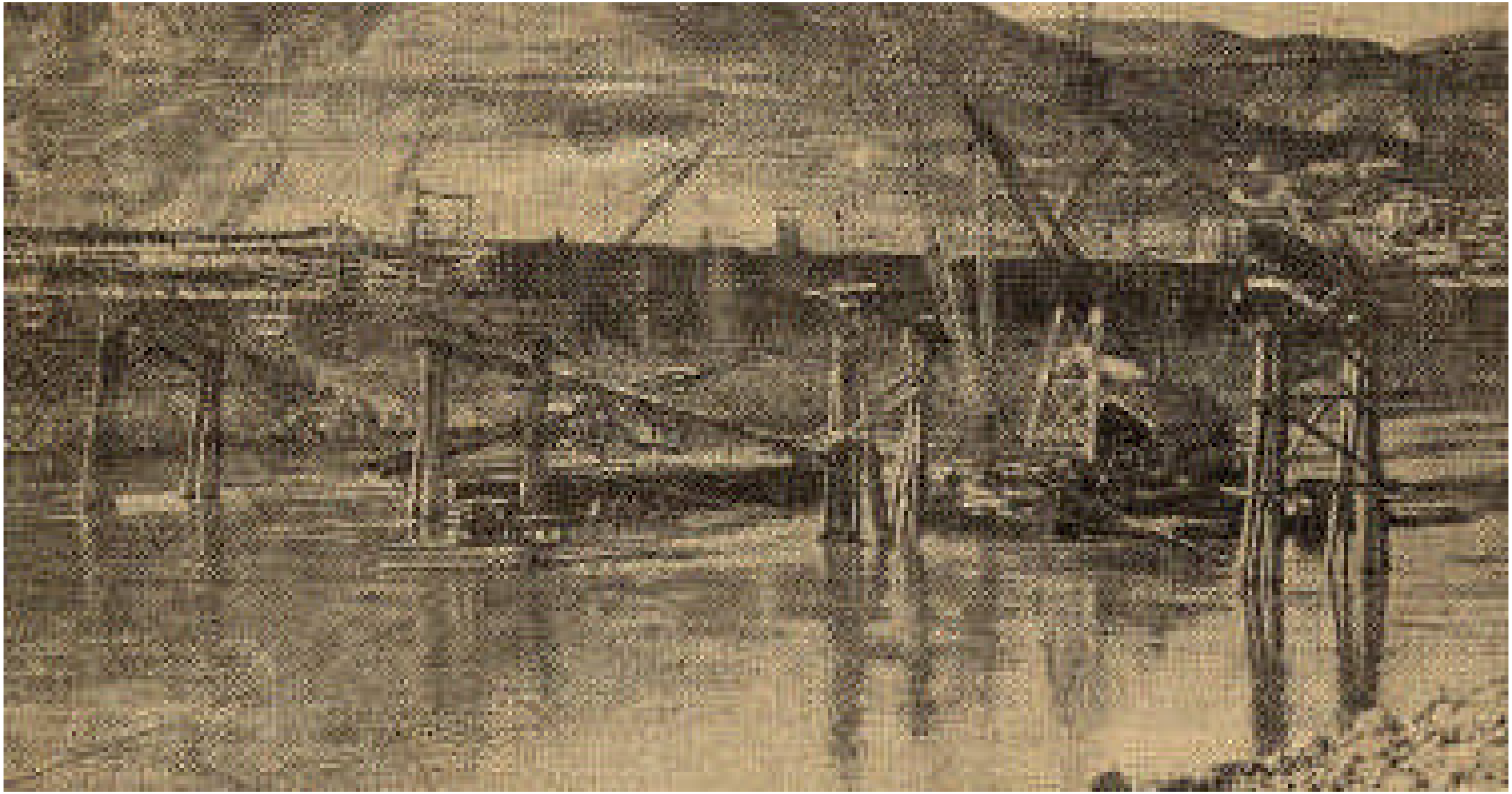
**<u>Left</u>: caption: "Rattlesnake gulch, on the banks of the Columbia, will not be a gulch when MWAK conveyors complete their task of dumping materials from the river level into what now is a deep valley. To get dam abutments down to bedrock requires removal of many hundreds of thousands of yards of sand, dirt, gravel and rock; the gulch provided the disposal area. In the foreground, near the center, is a pile of huge pipe, to be used in the gulch for drainage purposes, while the river shows at the lower end of the earth cut." (*Spokane Chronicle,* December 12th 1934)**

**<u>Right</u>: caption: "Winding up the hill, in the background, like a huge serpent, is the 60-inch conveyor which carries the excavated materials at Grand Coulee dam from the river level to Rattlesnake gulch, far back out of the way. The MWAK Company, contractors, out in the mile-long system to avoid loading and hauling and it will save much time, labor and other equipment. The bridge in the foreground is the private MWAK construction bridge. One Saturday morning, executives of the MWAK Company decided upon the location of the bridge. 'We want it ready to use next Saturday,' directed the chief executive and instructions were met, with time to spare." (*Spokane Chronicle,* December 13th 1934)**

# Old Man River



**<u>Above</u>: caption: "MWAK engineers accomplished a difficult feat in building a conveyor belt across the Columbia river at the Grand Coulee dam. The work is almost completed. The picture shows the pile-driver mounted on a barge, in operation over a portion of the river 60-feet deep. The current was so strong that 16-inch fir piling snapped off. The engineers then tested driving steel I-beams, but the current twisted them into spirals. MWAK then ordered from the coast the longest piling available, 130 to 140-foot lengths cut off the slender ends, lashed the pilings together in groups of three, and drove them successfully. The dock is being built on the trestle, which will soon be in use conveying dirt from the east bank excavation to the conveyor on the west bank, which will dump it in Rattlesnake canyon." (*Spokesman-Review,* August 17th 1935)**



<u>Above</u>**: caption: "Old Man River couldn't fool engineers of the MWAK Company during the recent ice break-up in the Columbia river above the temporary bridge on which travels the endless belt conveyor. The engineers knew the bridge was frail, so they removed the expensive conveyor equipment, and sure enough the ice took out a small part of the bridge. Engineers are now engaged in repairing the bridge over which will again travel the conveyor system that will carry dirt to be used in connection with the west shore cofferdam. The big derrick is swinging the piling back into position." (*Spokane Chronicle,* March 17th 1936)**

***"Last week the 11,000,000th yard of earth passed over the great belt conveyor of the MWAK company, the general contractors at Grand Coulee dam. They must yet move more than 3,000,000 yards of overburden from the east bank, across a conveyor belt spanning the Columbia, which unloads on the main belt and is carried into Rattlesnake gulch. About 500,000 yards are yet to be moved from the deep excavation on the west side from behind the cofferdam and about 70-feet below the river. The contract specifies that one dollar a yard is to be paid for this class of work, which means that the MWAK company has earned $11,000,000 in a little over one year."***

***Grand Coulee Journal,*** **September 17th 1935**

***"…During the first year, with 3,500 men employed in the earlier stages, and a labor and technical staff running close to 7,000 at the peak, the work has involved such marvels as moving 60,000 cubic yards of earth and overburden from the dam site, railroad grades and other excavations, every day. This called for the largest belt conveyor system ever built, running on sets of triple rollers, and forming a moving trough five feet wide. A similar giant conveyor system several miles in length, integrated with a great gravel-pit installation at the top of a hill near the dam site, will haul sand and gravel to the largest sorting, washing, and distributing plant in history. The concrete-mixing plants have a capacity of 14,000 cubic yards a day…"***

***Popular Science,* February 1936**

***"…For several months the MWAK Company has been using more than three miles of conveyor belt in the removal of the overburden from the dam site to Rattlesnake canyon, which today holds more than 12,000,000 yards of gravel and clay. Rattlesnake canyon, once a gorge several hundred feet deep, now is filled practically level with the surrounding country…"***

***Spokane Chronicle,*** **November 2nd 1935**

**<u>Above L&R</u>: caption: "The conveyor system at Grand Coulee Dam was the largest ever put into service. In these pictures the earth can be followed from pit to pile. At the right are seen tractors dumping material into a feeder hopper. It was strained through a grill and stones more than 13-inches in diameter were removed, to be hauled away by truck. A pile of such rock is in the foreground. A belt loaded with clay is seen next. A single belt carried the material only a small part of its journey, each segment lifting it to a hopper a few feet higher than the hopper at which it received its load. Electricity was used to propel the belts. In the center is a view of the entire system, which can be traced from the feeders in the east excavation, across the river and up the canyon back to Rattlesnake Canyon in the distance.**

**At the extreme left is the stacker shooting the material onto the spoil bank in Rattlesnake Canyon."**

***"The 3,000,000 cubic yard spoilbank in Rattlesnake canyon is giving MWAK more trouble. Another 300,000 to 400,000 cubic yards slipped away Monday night in the east portion of the big deposit. The stacker unit of the big conveyor system was working on the west portion which prevented a possible repetition of the damaging slide of ten days ago, when the boom unit of the stacker was bent in two. The slippage of about half of the outer edge of the spoilbank was sufficient to prevent the tractor-threads of the movable arm from swinging in its usual arc. Bosses of MWAK predict that the spoilbank will continue to break off at intervals. Careful supervision of the work will prevent a repetition of the slide which stopped work for two full days, it was said…"***

***Spokane Chronicle,* April 10th 1935**

***"…Most of this material has been moved one and a half miles away by con-veyor belts where it filled a convenient ravine. Today the conveyor belts have reversed their direction and are bringing endless streams of materials down out of the hills to the con-crete mixers…"***

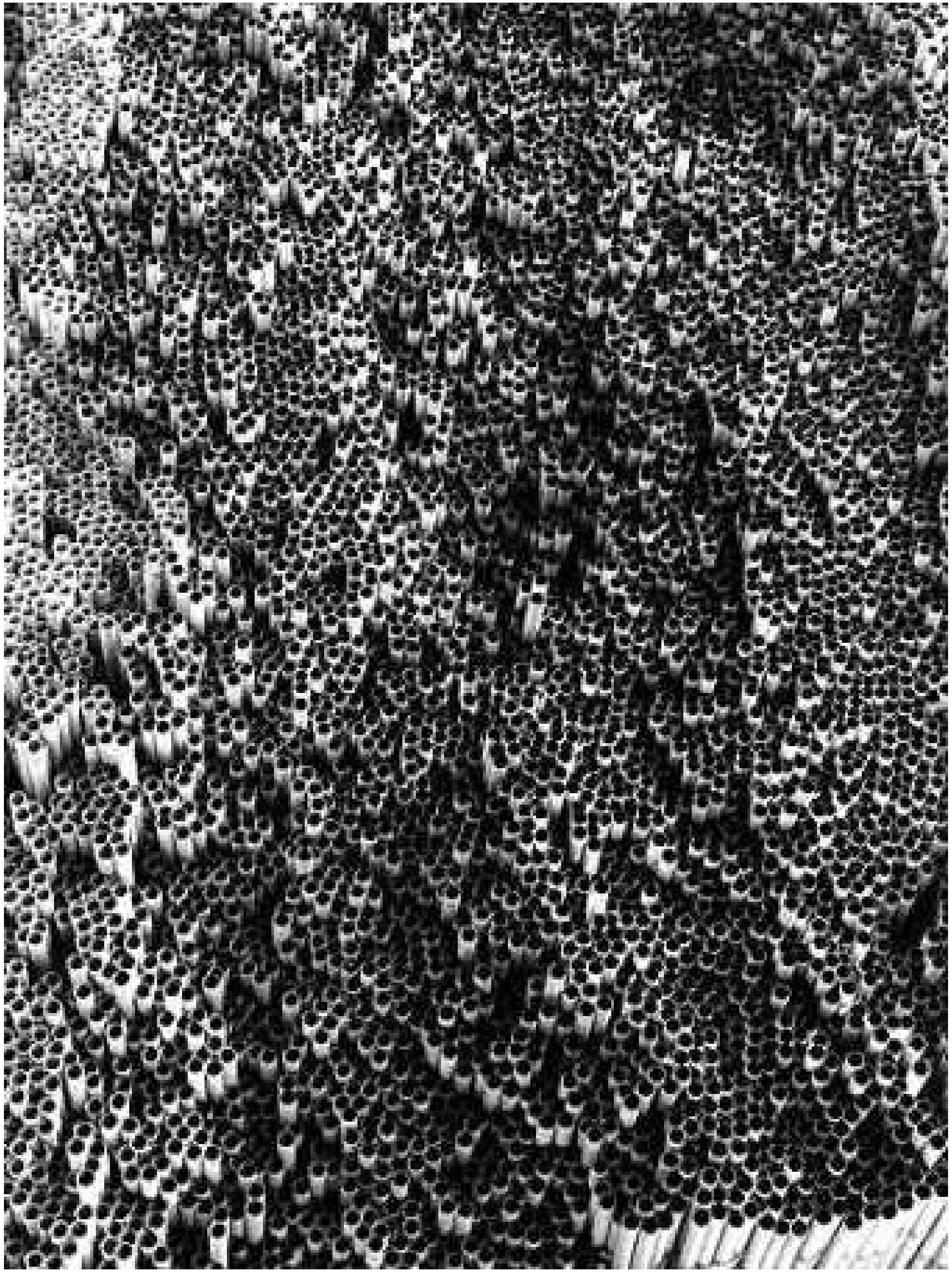
***Popular Mechanics,* April 1938**

**Left: caption: "Removing from the old channel of the diverted river deep beds of clay depo-sited during the last Ice Age"**

<u>Above</u>: caption: “Taken in the early 1930’s, this photograph shows a Bucyrus Erie steam shovel with caterpillar tracks, right, one of the biggest pieces of machinery available at the time, and a smaller tractor on the left. The vehicles are helping to clear the base for the Grand Coulee Dam.”

<u>Top Left</u>: caption: “Thirteen million yards of overburden were carried away from dam site excavations by this system of belt conveyors”

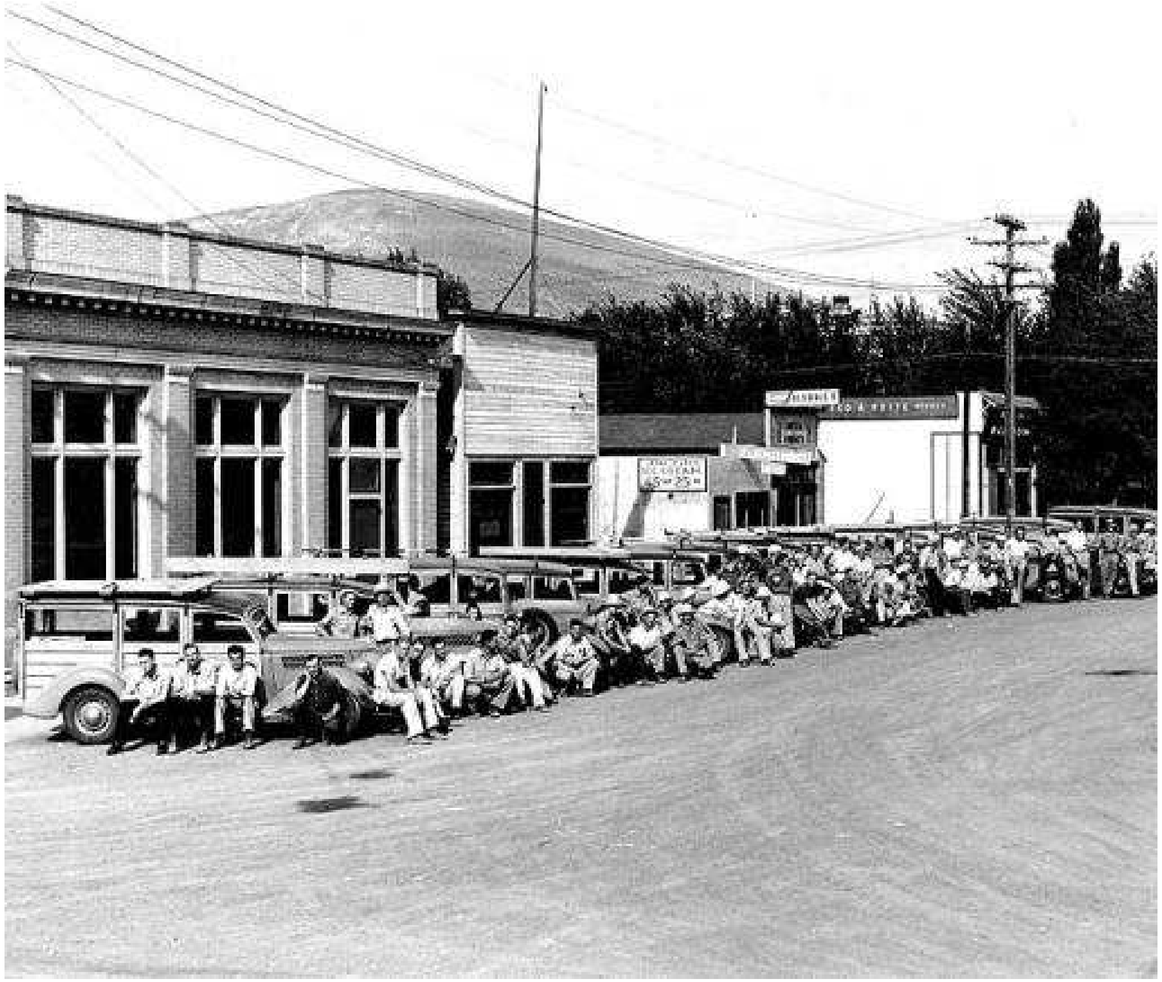
<u>Bottom Left</u>: caption: “At the rate of a million yards a month, a mountain of excavated material was dumped in Rattlesnake Canyon”



*"…All the major equipment to be used on the three-year construction, about $6,000,000 worth, will be bought or ordered by December 1, Mr. Slocum said. Heavy equipment will be moving into the job in about three weeks. One of the first purchases in the next few days will be that of about 40 automobiles and light trucks…"*

***Spokesman-Review,*** **June 16th 1936**

**<u>Left</u>: caption: "Cooling pipe for the construction of the Grand Coulee Dam"**



# Part 17

# Making the Dirt Fly

# A Major Task

***“…One of the major tasks on the project was that of excavation. Under a contract, let in December 1933 for the purpose of providing employment quickly under the emergency relief program, David H. Ryan moved about 2 million yards of overburden, using power shovels, heavy trucks, and large scrapers drawn by caterpillar tractors. Subsequently, the same contractor moved about a million yards of material dislodged in slides on the west side of the river. The MWAK Co. moved more than 15 million cubic yards of common and mare than 1,300,000 yards of rock by January 1, 1938. Excavation on and adjacent to the dam site will exceed 22 million cubic yards. That at the gravel pit, for the completed dam, will be even greater…”***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Before designs for the structure could be completed contract for the removal of two million yards of over-burden was let to *David H. Ryan*. A slide along the left bank increased the amount of material to be handled to three million yards. At left, removal of overburden (December 1933)**

**Above: caption: "Only three families lived in the vicinity of Seaton's Ferry when excavating began at the site of the Grand Coulee Dam late in 1933"**

**Left: caption: "Distance view of the future site of Grand Coulee Dam, January 1933"**

***“A daily average total of 44,000 cubic yards of overburden a day is being set by contractors now at work at the dam site. Although a previous single-day’s record was set up some three weeks ago when nearly 42,000 were hauled away in a 21-hour day, the daily average now being moved is by far the greatest of the two. As far as can be determined no project in the history of the world exceeded the local excavation mark…”***

***The Wenatchee Daily World,* March 8th 1935**

***"…MWAK is now averaging about 28,000 a day, Movement of several of the feeders during the past week has cut down the higher totals of previous weeks. When another unit is added within the next few days, the mark is expected to ascend to 35,000 once again…"***

***The Wenatchee Daily World,* March 8th 1935**

***“…In addition to the earth being moved by the main contractors here, Guy F. Atkinson’s equipment on the east shore, two shovels, one a two-yard Bucyrue-Erie and the other a 1¾ of the same make are doing the digging. Trucks are hauling the overburden away. Guy Atkinson’s average is 8,500 per day…”***

***The Wenatchee Daily World*, March 8th 1935**

***"…On the west shore Goodfellow Brothers of Wenatchee are using a Lima 1¾ yard vehicle for the excavation and this machine is alone making the big average of 4,500 yards per day. Goodfellow is working below David H. Ryan's project on the new dam site highway…"***

***The Wenatchee Daily World,* March 8th 1935**

***"…David H. Ryan with a 1¾ yard Northwest shovel biting into the steep hard clay bank on the relocation of the railroad grade project is making a daily yardage of about 3,000 per day, the latest available figures show…"***

***The Wenatchee Daily World,* March 8th 1935**

***"…MWAK is using two five-yard electric shovels, two four-yard electrics and two two-yard shovels for their 28,000 yardage per day…About two million yards remain to be excavated on the east shore and another 10,000,000 on the west bank before bedrock will be reached."***

***The Wenatchee Daily World,* March 8th 1935**

**<u>Above</u>: caption: "'We get the dirt!' might be an apt slogan for the MWAK Company. Contractors on the Coulee dam job, for they're getting it at the rate of more than 40,000 cubic yards per day from the mammoth hole which they are now gorging far below the normal river bed of the Columbia. Shovels, trucks, tractors and cranes are seen in the foreground, while against the river line looms the steel bulkhead of the 3,000-foot cofferdam. Sections of the conveyor system are also visible at the extreme right." (*Spokane Chronicle,* April 5th 1935)**

# Fire in the Hole!

***“More than 1,000,000 pounds of dynamite has been used to remove rock from the site of the Grand Coulee dam to date, records of the MWAK warehouse show”***

***Walla Walla Daily Bulletin,* April 20th 1937**

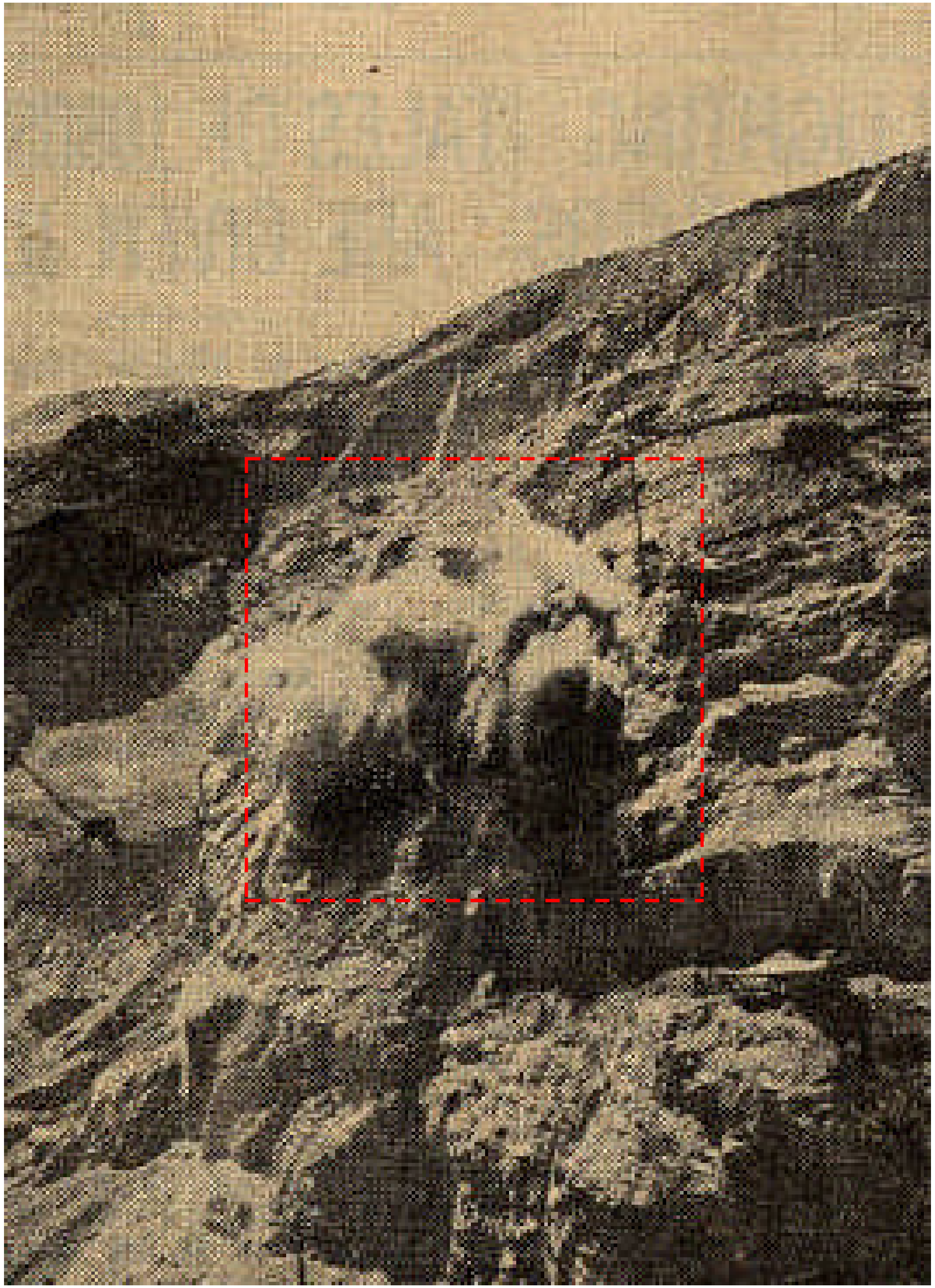
***"…The unit price on rock work is regarded as 'right' for ordinary rock work, but the granite rock at Grand Coulee is exceptionally hard and required unusual skill in the use of dynamite to prevent damage to the rock foundation on which the dam rests…"***

***Spokane Chronicle,*** **December 7th 1937**

**<u>Above L&R</u>: caption: "Blasting at Grand Coulee dam site"**

***"Poured in strips 5 or 6-inches wide between the joists of a ceiling, melted sulphur will anchor plaster firmly that has been loosened because of jars, defective keying, etc. Engineers of the Bureau of Reclamation discovered this method at Grand Coulee dam where plaster in many of the houses had been loosened by blasting. On a test, a plastered surface a yard square that was sagging supported a weight of 240 lbs. per square foot after applying the sulphur…"***

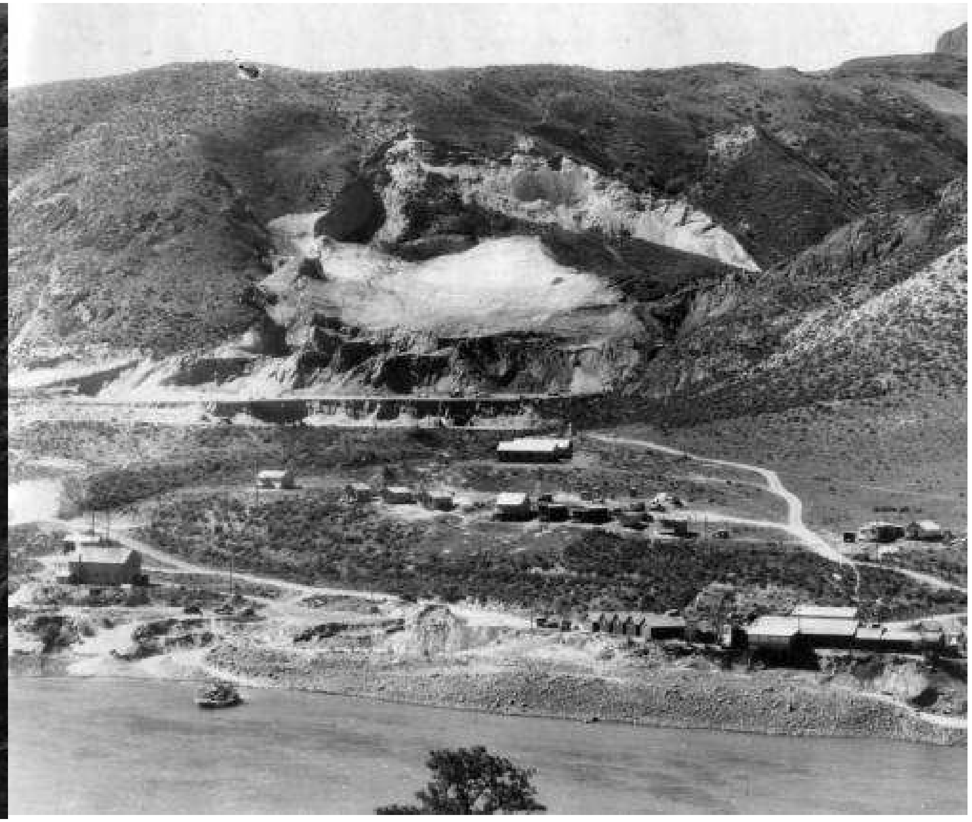
***Popular Mechanics,* April 1939**



***"At the end of the day's work, excavation for the abutments of the Grand Coulee dam will have been half completed, according to figures kept by the MWAK Company, engineering department. The company and its subcontractors are moving nearly 400,000 cubic yards of earth per day."***

***Spokane Chronicle,*** **May 2nd 1935**

**Left: caption: "Blasting the western wall of the river canyon at the place where the dam will join it"**


**<u>Top Left</u>: caption: "View of machinery excavating the bank at the Grand Coulee site, March 1934"**
**<u>Top Right</u>: caption: "View from of excavation taken from across the river. Structures visible in the foreground, April 1934"**
**<u>Left</u>: caption: "Distance view of the future site of Grand Coulee Dam. Excavation equipment may be seen in lower-left."**

**<u>Top Left</u>: caption: "View of the river, and a large section of the bank, which has been excavated, June 1934"**
**<u>Top Right</u>: caption: "Distance view of the future site of Grand Coulee Dam. Excavation operations may be seen in foreground, July 1934"**
**<u>Left</u>: caption: "View of a variety of heavy machines taking part in excavation operations, August 1935"**

***"The MWAK company, general contractors at the Grand Coulee dam, up to March 18, had purchased 520,000 pounds of dynamite, and they keep more than 20,000 pounds on hand…It does not include the explosive used by the other contractors, which would bring the total to about 750,000 pounds…"***

***Spokesman-Review,* March 26th 1936**

**<u>Top Left</u>: caption: "View of the east abutment, with the granite exposed"**

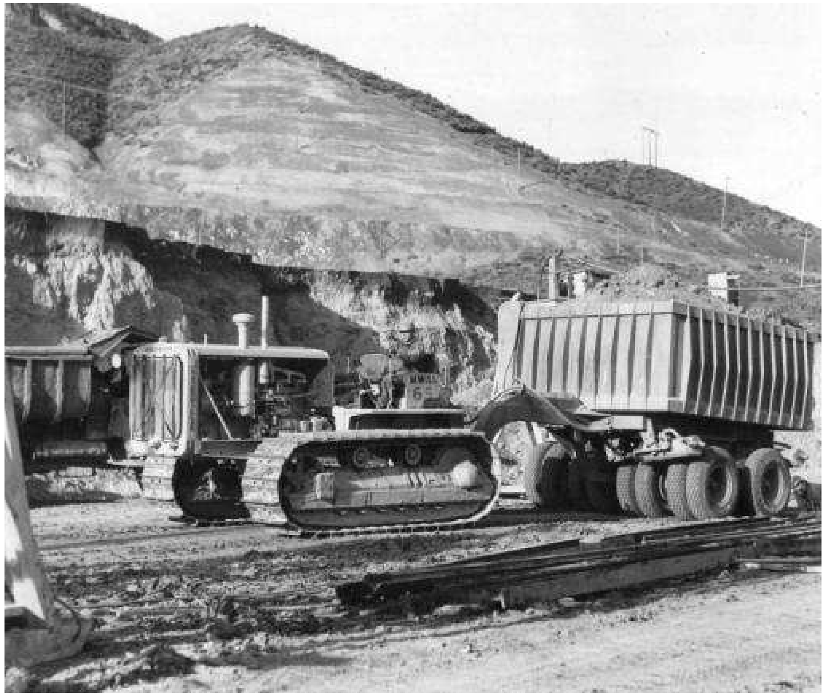
**<u>Top Right</u>: caption: "Crew of jack-hammers at work smoothing the bed-rock of the west excavation for commencement of the pouring of concrete"**

**<u>Left</u>: caption: "Excavation at the Grand Coulee Dam construction site"**

*"…The ruling would force the company to license for maximum loads all its trucks, whether they be operating on the highway or not…Under the ruling, huge trucks, with capacities of from 12 to 14 yards of earth, would require licensing, with high fees because of the tremendous loads the vehicles carry…many of these trucks are not used outside the excavation area, and seldom, if ever, see the open highway. The company uses several small 'pick-up' trucks, and one or two large ones for hauling between the railroad yards at Electric City and the dam site proper. The ruling would require a fee of $300 annually on the huge Spokane-built steel trailer…Other truck licenses would be correspondingly high…"*

***Spokesman-Review,* February 13th 1937**

# Moving Mountains

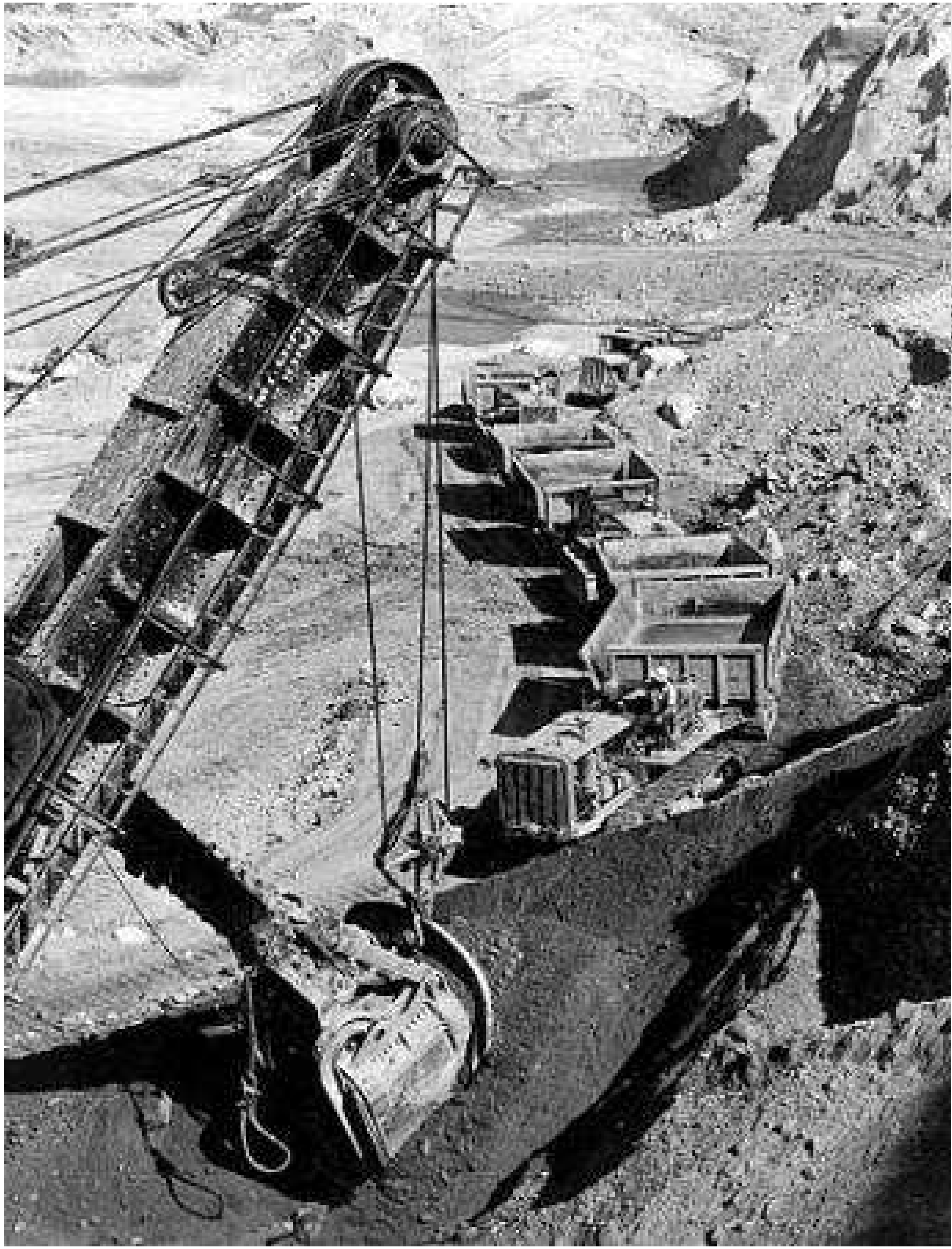


***"Especially built for use at Grand Coulee dam, the biggest dump wagons yet brought to Coulee dam site was tried out yesterday with leading officials of MWAK in attendance. Pulled by an 80-horsepower Diesel Cletrac tractor, the dump wagon, manufactured by the Mack Wooldridge Co., Inc., of Los Angeles, was the eye-focus of attention here yesterday. The huge dump wagon is capable of carrying 30 cubic yards of material per trip, according to its manufacture, Mack Wooldridge. The wagon is of a three-way dump; that is, the overburden can be dumped out on each side and from the back, all according to the machine is set up. It is equipped with 16 pneumatic tires and is hydraulically operated through-out. The Wooldridge product has installed Lockheed pneumatic equalized brakes. Empty, the wagon weighs more than 34,000 pounds…"***

***Spokane Chronicle,*** **November 6th 1934**



**Above: caption: "Tractor-towed three-way dump wagon"**



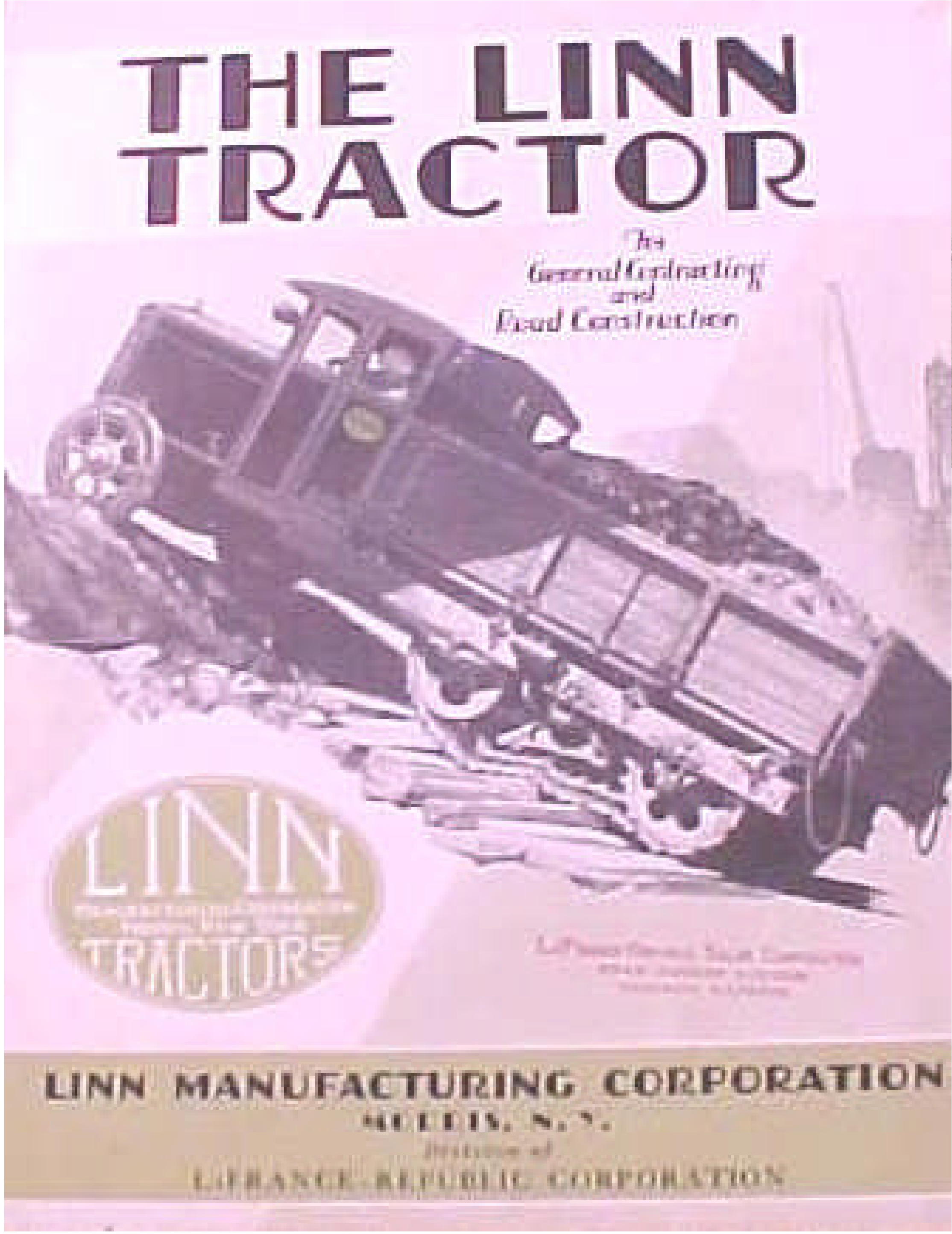

***"…Other types of wagons, needed to haul excavated material, which have been tried out here are the 25-yard Le-Tourneau wagons and the Athey Forged Steel Track Trailers, two per group, each capable of holding 13 yards each…"***

***Spokane Chronicle,*** **November 6th 1934**

**Above: caption: "LeTorneau dump cart filled with gravel, Grand Coulee Dam construction site (ca. 1934)"**

**Left: caption: "Excavation using power shovels and tractors, Grand Coulee Dam construction site (ca. 1934)"**


LeTOURNEAU



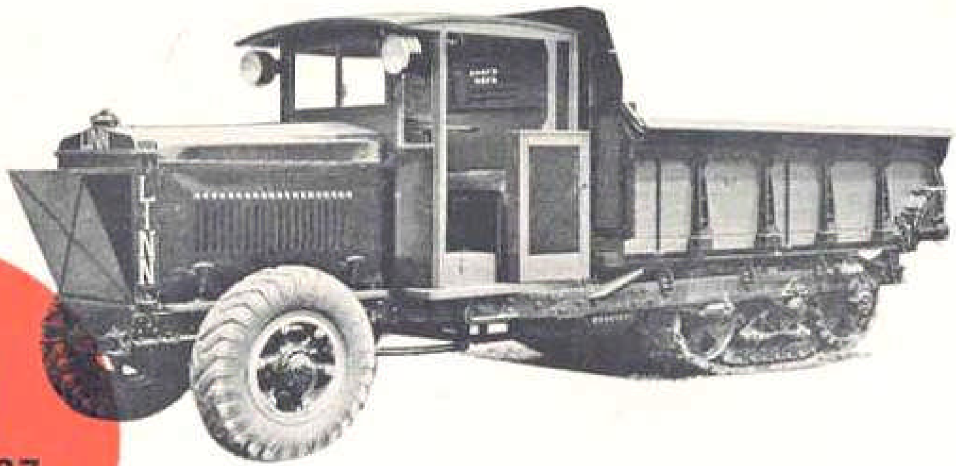

***"…A Linn truck, equipped with tractor thread in the back end instead of wheels, also was loaded up and proceeded to plow its way through the muddy testing grounds in the west slide area."***

***Spokane Chronicle,*** **November 6th 1934**

**<u>Above</u>: caption: "Tracked dump wagons pulled by Caterpillar tractor"**

**<u>Left</u>: Linn "Tractor-Truck" period advertisement**

## . . and for massive power—with extra speed—the LINN SPECIAL "SIX"




# LINN
## model 6H-37

Engine . . . 6 cylinder, 610 ft. lb. torque Hercules gasoline. Tractor speed . . . 11.8 M.P.H. Furnished with closed cab, or open, protected safety-seat with auxiliary seat and clutch controllable by driver facing either direction. Pneumatic tires, electric lights and starter, overdrive transmission, high speed reverse (5 speeds each way). Bodies . . . 8-9 yard rear tipping LINN dump body (dumping angle 50°) with automatic down-fold tail gate. Rave boards and heavy-duty underbody hoist . . . 14 yard dump bodies for culm, ashes and other light materials . . . LINN two-way side tipping bodies . . . and special bodies for snow plowing, industrial requirements, and with standard logging bunks (see pages 14, 16 and 18).

# The LeTorneau Legacy

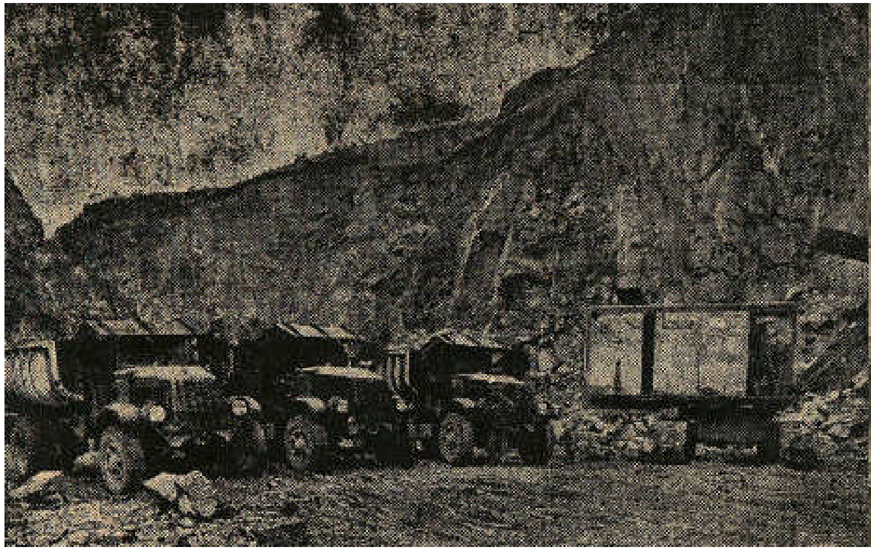
***Robert G. LeTourneau*** **(left) was the leading advocate of high-speed, high-capacity, mobile earth-moving machinery, and his numerous inventions spearheaded the concept. His interest in such equipment stemmed from his own experience as an earthmoving contractor; machines that were available to him in the early 1920s simply did not suffice for the tasks at hand, so he designed and fabricated his own. One of his inn-ovations was the large, wheeled dump wagon. Small dump wagons had been used for decades behind horses and mules, and most were bottom dumps. Larger wheeled bottom-dump wagons for use behind steam traction engines followed, then crawler-mounted dump wagons for use behind crawler tractors.**


Left: caption: “Dump car: Used with the first steam shovels, railroad cars were the first haulers. Narrow- and standard-gauge trains were used in many construction applications until the advent of the truck.”
Right: caption: “Dump wagon. The stock-drawn dump wagon also came into use in the mid to late 1800s where trains were impractical. The bottom opened to dump the load on most wagons. These too were replaced by trucks.”


**Left: caption: “Dump truck: 1936 International C30. As motor vehicles were perfected, it was only natural that dump trucks should replace trains and stock-drawn wagons.”**

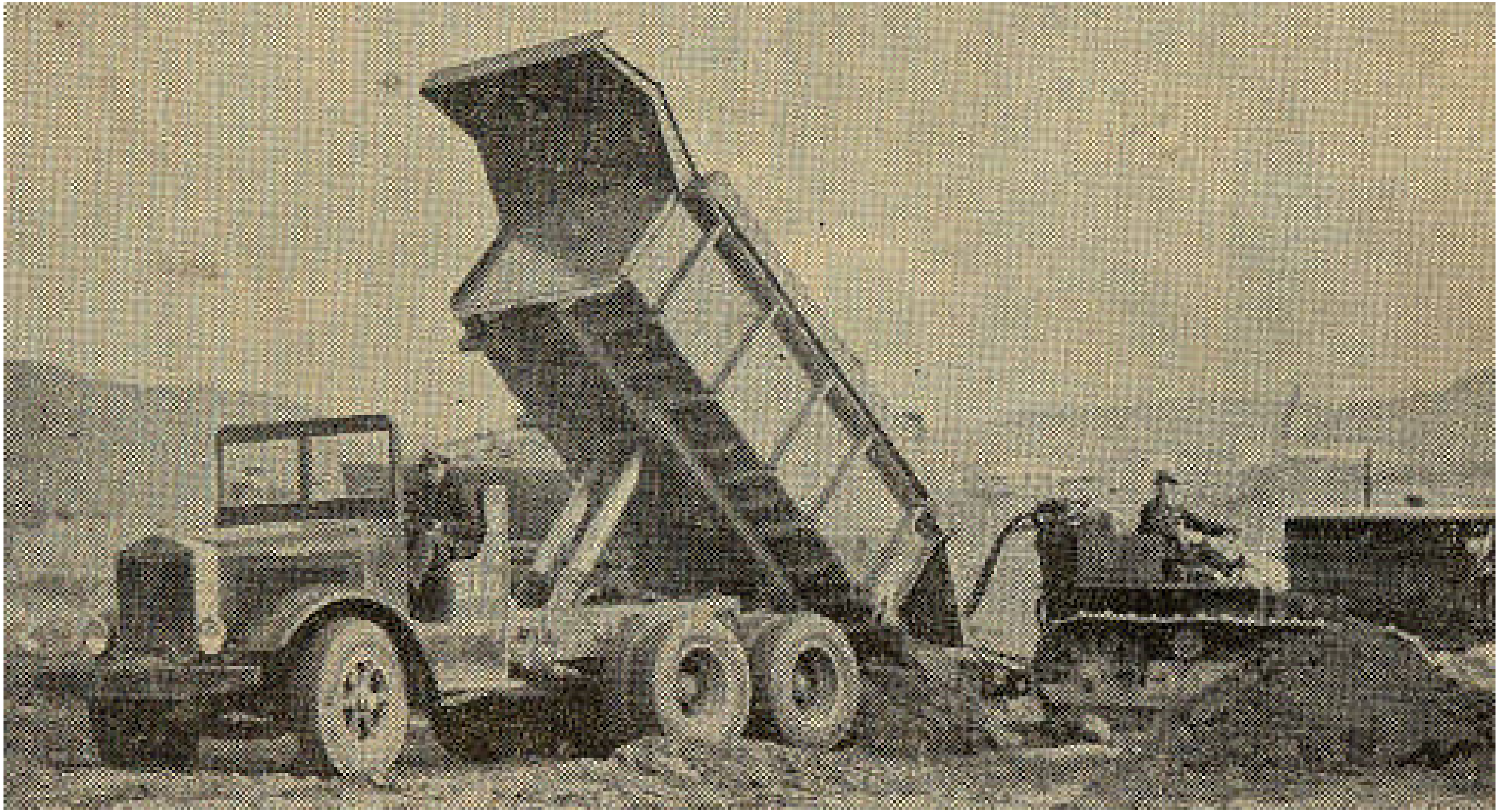
**Right: caption: “Crawler dump wagon: The first mechanized off-highway haulers were wagons that were used behind crawler tractors starting in the early 1930s. They could roughly haul 10 cubic yards each.”**

Left: caption: “Dump truck: 1961 White Super Mustang. Heavier loads require more tires on the ground to carry it. This tandem-axle truck carries up to ten cubic yards.”
Right: caption: “End dump truck: Euclid 46TD. Purpose-built off-highway end dumps were invented in 1935. This 1950s model carried 22 tons; trucks for construction and quarrying are usually rated under 100 tons.”




**<u>Left</u>: caption: "Trucks played, and still are playing, an important part in the building of the dam. Trucks were used entirely in excavating 3,000,000 cubic yards of dirt under the David H. Ryan contract. While MWAK Company relied on their conveyor system, trucks were, and still are, being used to excavate dirt where it is not feasible to run the 'feeders' for the big conveyor." (*Grand Coulee News*, November 15th 1935)**

**<u>Right</u>: caption: "Paul Bunyan himself might have designed the equipment which is being used to build the mighty Grand Coulee dam, for everything used on this big league job is built on a mammoth scale. One of these twelve cubic yard trucks, filled with coal, would be very welcome in anyone's driveway along about next November. Till then, and then some, they'll be busy moving dirt for the MWAK contracting concern." (*Spokane Chronicle*, May 1st 1935)**



<u>**Above**</u>**: caption: "Among the latest deliveries of large trucking units is a fleet of six whites with specially built bodies to carry 12 cubic yards of material, to MWAK. One of the fleet is shown in the picture. The body was built by the Union Iron Works here, chassis being furnished through the White factory agency. The job has six wheels with two tires on each of the four rear wheels. There are two drive axles, making possible pulling through soft material much as a caterpillar tractor pulls through mud and soft spots. The picture shows one of the units unloading material on the 'grizzly' which screens out the rocks, preventing injury to the machinery handling the dirt. Gross load of the unit in operation is 60,000 pounds."** 1185
**(*Spokane Chronicle,* March 20th 1935)**


**Left: caption: "Bottom dump truck: c. 1941 Euclid FDT. Invented in 1935, the off-highway bottom dump truck was much larger and faster than horse-drawn or crawler wagons. Capacity ran from 13 to 100+ cubic yards."**
**Right: caption: "Bottom dump trailer: After World War II, the bottom dump concept was adapted for use over the road behind truck tractors. Typical capacity was 12 to 24 cubic yards."**

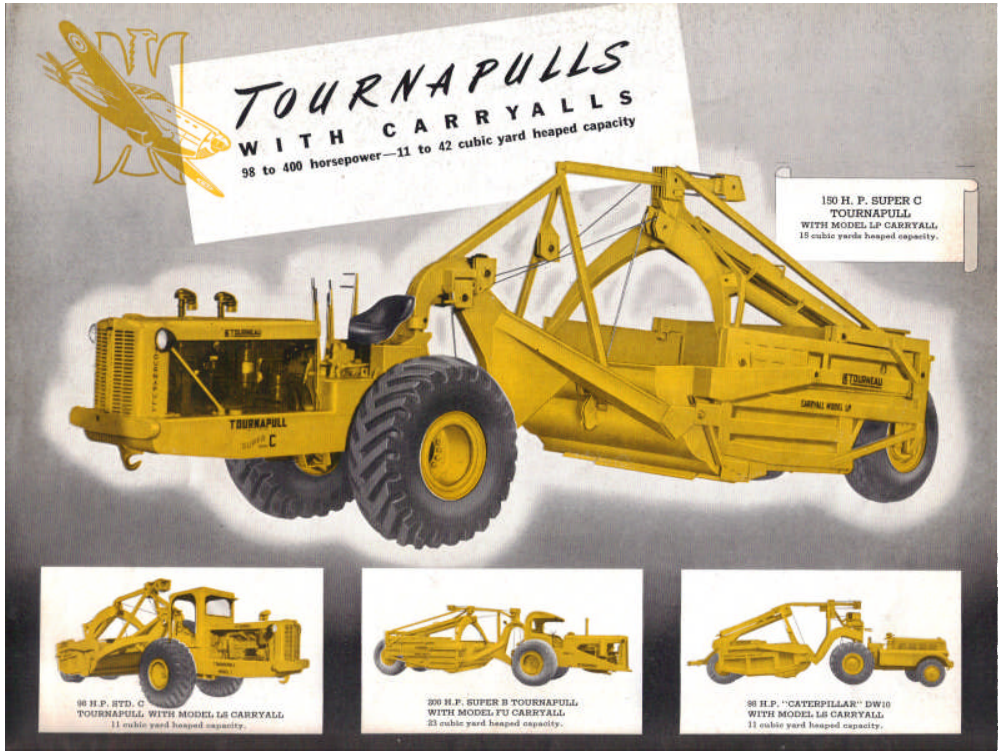
**<u>Left</u>: caption: “End dump trailer. Dump trailers were first used behind truck tractors in the 1930s. They work the same as dump trucks, but can carry larger payloads; indeed, a dump truck can pull one too.”**
**<u>Right</u>: caption: “Rock wagon: c. 1960 LeTourneau-Westinghouse D Rocker. From the 1940s through 1960s, the prime movers that pulled scrapers were often hitched to rear dump wagons instead to haul and dump rock.”**


**<u>Left</u>: caption: "Articulated dump truck: DJB D350. The articulated dump truck resembles a prime mover and rock wagon, but it's built as a complete unit and all wheels are powered. The largest carries 55 tons."**

**<u>Right</u>: caption: "End dump truck: c. 1997 Cat 797B. End dumps used in mining are quite large. The Cat 797B, for example, had a working weight of 687.5 tons and was rated at 3,550 horsepower and 380 tons capacity."**

LeTourneau developed and used his first dump wagon design; the *Hopper Wagon*, in 1928. Traveling on oversized steel wheels and carrying sixteen cubic-yards, it was (like many other LeTourneau designs) a departure from any comparable machine. The body sloped down to the rear, so that it dumped by gravity merely by raising the tailgate with a rope pull. The tailgate could set to a preset position for controlled dumping, and closed itself when the wagon was empty. A crawler-mounted version for use on softer ground soon followed. In 1929, LeTourneau was awarded the contract to grade the Benicia approach to the *Carquinez Strait Bridge* in northern California. For this job, he designed and built the twelve cubic-yard *Chariot*. The Chariot rode on the same wheels as the Hopper Wagon (it was the precursor of the rock wagon attachment for rubber-tired prime movers) but unlike the Hopper Wagon, it dumped by tipping the body back as the rear of the wagon was drawn forward by a cable from the towing tractor.

**The first rubber-tired dump wagons were built around 1933. These were 25 cubic-yard behemoths called *Slide-Out Buggies*. They traveled on sixteen 11.25 x 20 Firestone tires that gave the wagon good flotation in poor conditions. Rather than a true end-dump design, the Buggy was the first known positive ejection wagon; operated like the Chariot from a cable control unit on the towing tractor, it dumped by drawing its bottom-less body backwards from the Buggy's solid frame, so the load simply fell out (left). The design proved to be sturdy, economical and simple to maintain.**



**Several derivatives of the Buggy were produced. Not only were there different capacities and configurations, such as a trailer behind a truck tractor or a dump body on a truck, but the Buggy's chassis was offered as a transport trailer for everything from construction equipment to custom heavy hauling. *Robert LeTourneau* went on to revolutionize earth-moving with his single-axle *Tournapull* prime mover and he developed various end, bottom and positive ejection-dump wagons for use with it. The configuration of a rubber-tired off-highway prime mover and end dump trailer is now considered to be the predecessor of today's articulated dump truck.**

**<u>Left</u>: LeTorneau "Tournapull" period advertisement**

**<u>Right</u>: caption: "The Model C Tournapull was the second of RG LeTourneau's Tournapull range to appear (the first was the Model A)"**


JGV 776

# Great Balls of Rattlesnakes!

***"…Three huge balls of rattlesnakes, totaling several score, have been tumbled unceremoniously from their dens the last two days by excavating equipment eating into the hill in the vicinity of the slide area. Two writhing masses were discovered yesterday and sent over the five-foot belt leading to Rattlesnake canyon. The third bunch, exposed today, were disposed of immediately by the excavating crew. There has been insufficient warm weather as yet to bring them out of their winter hiding places. Several previous 'catches' have been unconfirmed…"***

***Spokesman-Review,*** **April 10th 1935**

# Foundation Exploration


***"…Diamond drill holes to the extent of about 33,000-feet were put down into the granite foundation on which the dam rests. Occasional holes were drilled to depths varying from 660 to 880 feet. In all instances there was found light-colored, dense granite, suitable, according to the board of consulting engineers, to bear any load that might be put upon it…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**<u>Left</u>: caption: "Close-up view of three diamond core drill bits"**

***"…After uncovering bedrock, additional exploratory work was done with Calyx drills, extracting rock cores 36-inches in diameter, which permits a detailed examination to be made of both the core and the hole from which it was taken. Eighteen such holes were drilled to depths varying from 29 to 68-feet. Bedrock is quite uniform in character, and in general was prepared for foundations by the removal of weathered surface rock to a depth of 6 to 10-feet…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Grout Curtain

***“…To seal the cracks and crevices in the granite bedrock under the dam, formed millions of years ago when the molten rock solidified and shrunk, grout of cement and water is forced down through holes drilled into the rock. Of such holes, 30-feet deep and 20-feet apart, five rows were drilled under the upstream edge of the dam and entirely across the river canyon. The rows were spaced 20-feet apart, and the holes in each row are staggered with respect to those in the next row. The 30-foot holes were grouted under pressures up to 250 pounds per square inch before any concrete was placed close to them. After considerable concrete was in place on bedrock, a row of holes 75-feet deep and spaced 20-feet apart was drilled diagonally downward into the rook under the dam through the curved fillet of concrete which connects the upstream face of the dam with bedrock. An effectual seal against leakage under the dam will be created by the grouting of these holes and a single row of holes 150-feet to 200-feet deep, to be spaced 10-feet apart and drilled from the drainage gallery in the dam close to bedrock. Grouting pressures in the deep holes may run as high as 1,000 pounds per square inch. As an added pre-caution against the uplifting effect of any leakage under the upstream edge of the dam, there will be one row of uplift pressure relief holes spaced 10-feet apart, permanently open into the drainage gallery at the base of the dam…”***



***U.S. Bureau of Reclamation* (ca. 1937)**

***"…Once the site is selected it must be prepared for the dam. Holes are drilled down into the foundation material and a rich concrete mixture known as grout is forced down into the holes under pressure. The grout will flow into and seal off any cracks in the subsurface rock. Later on, as the weight of the dam begins to grow, other holes are drilled from galleries inside the dam to depths as great as several hundred feet and again grout is forced down into the holes, at pressures up to 500 pounds per square inch. Even the finest fissures in the natural rock are sealed by this method…"***

***Popular Mechanics,* August 1942**

***“So that there will be no leakage of water through the bedrock on which the big dam will rest, cement will be forced for hundreds of feet down into every crevice of the granite bedrock, no matter how tiny. This operation, known as ‘grouting,’ was started here this week…”***

***The Wenatchee Daily World,*** **November 16th 1936**

***"…Aided by a grouting pump, supplying about 100 pounds pressure. The first of the 30 foot holes took 502 sacks of cement according to the MWAK Columbian showing how much cement the terrific pressure shoots into crevices as small as one-hundredth of an inch, and about 50-feet deep. The 502 sacks of cement used on the first of the holes is now lodged in the tiny fissures of the granite rock and is serving its purpose, that of reinforcing the rock on which the dam will eventually sit…"***

***The Wenatchee Daily World,* November 16th 1936**

***"Almost 12,000 sacks of cement have been forced into the fissures in the close-grained granite under the west shore end of the dam. Engineers believe the grouting has penetrated even the tiniest fissures. An average of seventy sacks of cement has been forced into each of the 30-foot grout holes. The holes are three inches in diameter at the top and taper to two inches at the bottom. About 5,000-feet of holes have been drilled thus far."***

***Spokane Chronicle,* December 26th 1936**

***“…In drilling down to bedrock to insure firm foundations for the dam the drillers wore away nearly forty-nine miles of hardened drill steel. To make sure that the foundation granite itself is as strong as possible, ten miles of grout holes were drilled into it and 12,500 tons of cement ‘grout’ were forced down the holes under pressure to fill every crack and seam…”***

***Popular Mechanics,* April 1938**

***"…When the entire dam is completed, a complete 'curtain' of cement will have been pressed into the rock. The low pressure grouting, now taking place, will be run in five parallel rows. Just prior to river diversion over the concrete another two rows, much deeper, will be bored (eventually from abutment to abutment) and when the concrete for the entire structure has been placed, a single row, bringing the cement curtain down to several hundred feet, will finish this important task..."***

***The Wenatchee Daily World*, November 16th 1936**

***"Bureau of Reclamation engineers are using magnets to remove metals from drainage and grouting pipes in the bottom of Grand Coulee dam foundation. Under the next contract, diamond drills will bore 200,000 lineal feet of holes into bedrock. Some will be sunk 500-feet. Later a grouting machine will force a mixture of cement and water into bedrock to make it a solid mass. When this work is completed, the pipes will serve to drain away water seeping through the rock which might easily exert pressure under the dam. Special gutters in the lowest gallery will carry the water away…"***

***Spokesman-Review,* January 16th 1938**

# Slip ‘n Slide

***“Twenty diamond drillers, surveyors and laborers had a narrow escape today when about a million cubic yards of earth tumbled down the west bank of the Columbia river at Grand Coulee dam site. A great shoulder of granite stopped the slide after it moved 100-feet down the mountainside. It was estimated it will cost the government  about $250,000 to have the slide removed from the area, where Goodfellow brothers were excavating. The power line of Three Engineers, Inc., and telephone service to the dam site were disrupted. A steam shovel at the foot of the slide was hurled 20-feet into the air.”***

***Spokane Press,*** **March 27th 1934**

***"…Although the loss in dollars and cents cannot be determined, one of the most damaging of accidents was the 1,000,000-yard slide of March 1934. Much earth that would not have had to be moved slid into the excavation area and the slide also pulled down the railroad grade. The relocation of the grade was necessary, costing the U.S. Bureau of Reclamation from $200,000 to $300,000. An extra contract amounting to about $110,000 had to be let to make a deeper cut in the slide area…"***

***Spokane Chronicle,* April 12th 1935**

***"MWAK officials are 'well satisfied' with progress in what was once regarded as an extremely dangerous part of the job here, the slide area. Drainage of surplus water, by means of churn drills, has eliminated some of the dangers and lessened the possibility of further slides. Careful placing of shovels and working them in terraces has enabled the contractors to get out considerable dirt. The area underneath the slide was avoided some time because it was felt that work there would 'pull the plug' and let the dirt cascade. The excavation area proper may or may not cause some trouble. At places water has seeped from the hillside and wet muck is more difficult to move than dry dirt. It sticks to the trucks and wagons and 'gums up' the otherwise efficient conveyor belt. To avoid the danger of continuous tie-ups that would be caused by wet excavation, drainage ditches and sumps may be installed, and excess water pumped away, officials said. However, the installation of the tunnel network through the granite under the slide area may carry off sufficient water to make that unnecessary…"***

***Spokesman-Review,*** **April 10th 1935**

***“…Even before this huge slide, cracking of the hillside, caused by the weight of the gargantuan spoilbank, held up traffic on the highway…The 750,000 cubic-yard slide of the Rattlesnake canyon spoilbank caused the company a two-day lay-off, when the stacker unit of the conveyor system was bent…”***

***Spokane Chronicle,*** **April 12th 1935**

***“A huge slide, estimated at around 300,000 yards, cascaded down the slide area yesterday, moving as much as 15-feet in places, and taking out several hundred feet of road. Trucks and shovels were working full speed today to clear the highway. Cracks in the earth appeared about 200-feet down the hill, although the worst place in the slide was just below and across the highway grade, below the David H. Ryan contract. The slide was anticipated by bureau officials, who reported a small crack several days ago. They had planned to blast a portion of roadway across a granite cut, to provide a detour, but the slide came too soon…”***

***Spokesman-Review,*** **April 29th 1935**

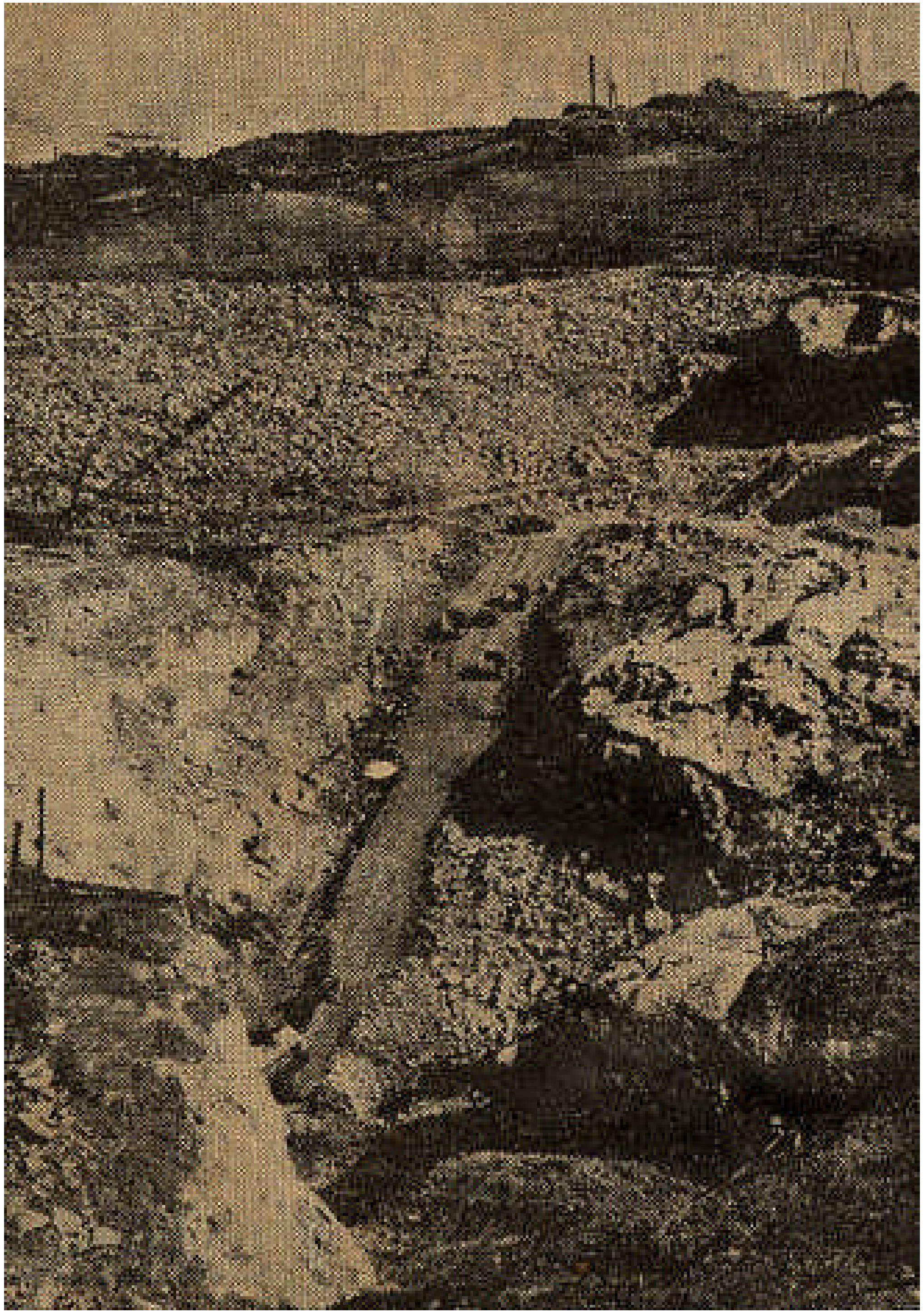
***"A trench is being excavated under the supervision of the Bureau of Reclamation on the slope above the east side excavation pit, where a small slide of 30,000to 40,000 yards occurred last week. Officials believe the slide was caused by the seepage of some water down a crevice until it 'greased' some of the clay substrate and caused the slippage. The trench will be dug horizontally across the area above the slide to bedrock in an effort to discover the flow of water. Once the fluid is located it can be carried off in pipes or flumes to prevent the occurrence of further earth movements…"***

***Spokesman-Review,*** **September 25th 1935**

***"…The earth movement in the 'east side slide area' (what is known here as the east forebay area) has allowed construction work in the deep crevasse between the cofferdam and the east abutment. Quiet a month, engineers believed the area might stop moving, but today additional movement was noted and some earth caved into the deep hole on the east side bedrock. Two options are open to the engineers: They may decide to build stronger and more extensive bulkheads, to stem the flow of earth, or they may find it necessary to remove perhaps 200,000 more yards of earth, in a re-sloping process. The bulkheads probably will be installed. Work on that section of the excavation must proceed swiftly in the next few weeks, it was said, if the USBR sees concrete poured in the bottom of the huge gash before high water floods the east side pit…"***

***Spokesman-Review,*** **March 12th 1936**

# The Great Menace



***"…In excavating at the east end of the dam they had encountered a crevasse which had to be cleaned to the bottom to find a rock foundation for the dam. This left a hole 100-feet deep and an acre in area at the top, and above the hole a fan-shaped hill of clay, 200,000 cubic yards of it, which began slipping into the crevasse with high water in the spring…"***

***Popular Mechanics,* December 1936**

**Left: caption: "A declivity in the granite uncovered in the east side excavation at Grand Coulee dam fell away more than 100-feet below the average bedrock surface. This general view of the east excavation shows the great hole, at the bottom of which engineers have found some rock. In the background the east side concrete mixer can be seen under construction."**

***“Moving like an irresistible glacier, a mountain of clay crept down upon the excavations for the Grand Coulee dam in Washington, menacing the great construction project. Steam shovels made futile efforts to clear the sliding clay as fast as it advanced. A concrete wall was thrown up hurriedly, but the slide topped it. Then the engineers hit upon the plan of freezing the toes of the landslide…”***

***Popular Mechanics,* December 1936**

***“How an expenditure that unofficial reports said would amount to about $82,000 will save earth removal costs that might approximate $1,000,000 on the east shore of the project here was revealed by engineers of the MWAK Company, builders of the dam, tonight, with the concurrence of Reclamation Bureau engineers. The estimate of the $1,000,000 is on the basis of a cost of $1 a cubic yard for the removal of earth to stop the slipping that is interfering with the exposure of the east side bedrock. Instead, the slides will be stopped by creation of a frozen dam at the toe of the slide area above the east side pit, the engineers said…”***

***Spokesman-Review,* July 31st 1936**

***"The far-famed 'ice dam' built by contractors as a slide-prevention measure, last night again proved its worth by holding back a sliding mass of clay on the east shore of the dam. A small slide moved a considerable distance in the area southeast of the ice dam, and kept moving until it struck the nearly flat area directly behind the gig ice barrier. The slide caused little damage, outside of covering one minor construction roadway…"***

***Spokesman-Review,*** **March 2nd 1937**

**<u>Left</u>: caption: "The soil around the dam site is heavy clay - mudslides are an ongoing problem. Winter rains in 1937 loosened a hillside on the east side of the river. MWAK engineers decide to freeze a portion of the hill to keep it in place. Workers drive 100 two-inch pipes into the clay and fill them with super-cooled salt brine."**

Left: caption: “In the east section of Grand Coulee Dam, a 400,000-ton mass of plastic clay repeatedly moved toward and filled a deep crevice in the bedrock, threatening serious delay and great expense for its removal. What did the engineers do? They stopped it cold, literally. They froze it! Six miles of pipe were driven in an arc between the wall of the crevice; brine at zero F. was circulated through the pipes, and from August 1936. to April of 1937 an 80-ton ice plant kept this arch type earth dam frozen. The frozen earth held back the mass of clay and excavation proceeded.”

***"…A huge refrigeration outfit, larger than ever before used in construction work, will be installed to create the frozen dam. Approval of that method was received from the Denver office of the United States bureau today as equipment already was being assembled for it. The huge plant will have a rated refrigeration capacity of 100 tons of ice daily, or enough to serve 4,000 average families. Three-inch pipes, called points, will be sunk at regular intervals in the earth above the present small concrete retaining wall built earlier in the first attempt to halt the slides…"***

***Spokesman-Review*, July 31st 1936**

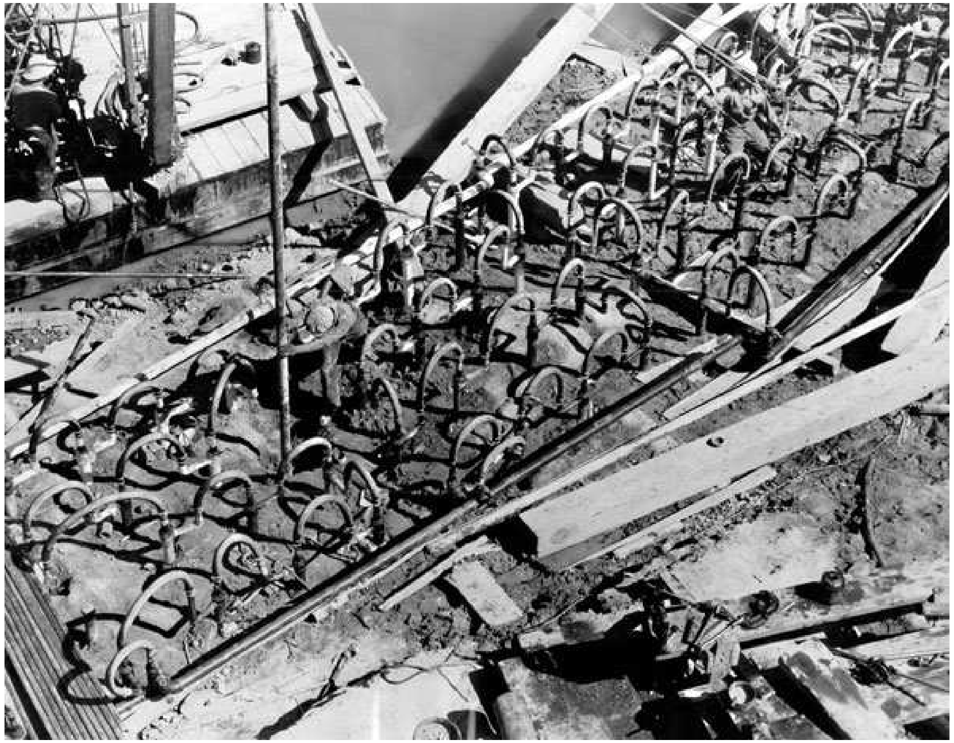
***“Grand Coulee dam’s unusual ice dam was nearing its first real test today…MWAK Company workmen are removing the mud from the crevice the dam is protecting, leaving it the only barrier against thousands of tons of sliding earth on a slope above the excavation. The greatest danger to the frozen dam, which engineers say is the only one of its kind, is that a slight earth movement would break the pipes made brittle by freezing. The bottom of the fissure the dam is protecting is 150-feet below the level of the Columbia river.”***

***Seattle Times,* October 21st 1936**

**Above: caption: “Watching for bedrock movements with aid of instrument combining levels, lenses and Mercoid switch”**

***"…The frozen dam will be about 100-feet long, arched back against the slide area; 25-feet high and 25-feet thick; but the thickness gradually will increase during the period of freez-ing. The slide area is composed of fine, round particles of sand, instead of the hard clay of the west bank, and it has been almost impossible to keep it from moving. Re-sloping to an unusually flat angle failed to keep the earth in position and engineers resorted to freezing as the only solution…"***

***Spokesman-Review,* July 31st 1936**



***"…To freeze the foot of the clay slide and turn it into a solid dam of frozen earth, more than 300 three-inch pipes were driven about forty-seven feet deep in a cluster just above the concrete wall, which was then under water. Spaced thirty inches apart, the pipes had nipples at the top and outlets on the sides near the top. Then pipes of one and one-half inch diameter were inserted through the nipples and extended almost to the bottom of the larger pipes, which were connected in series in groups of sixteen by short hose links, and all connected to a common feeder and common return pipe…"***

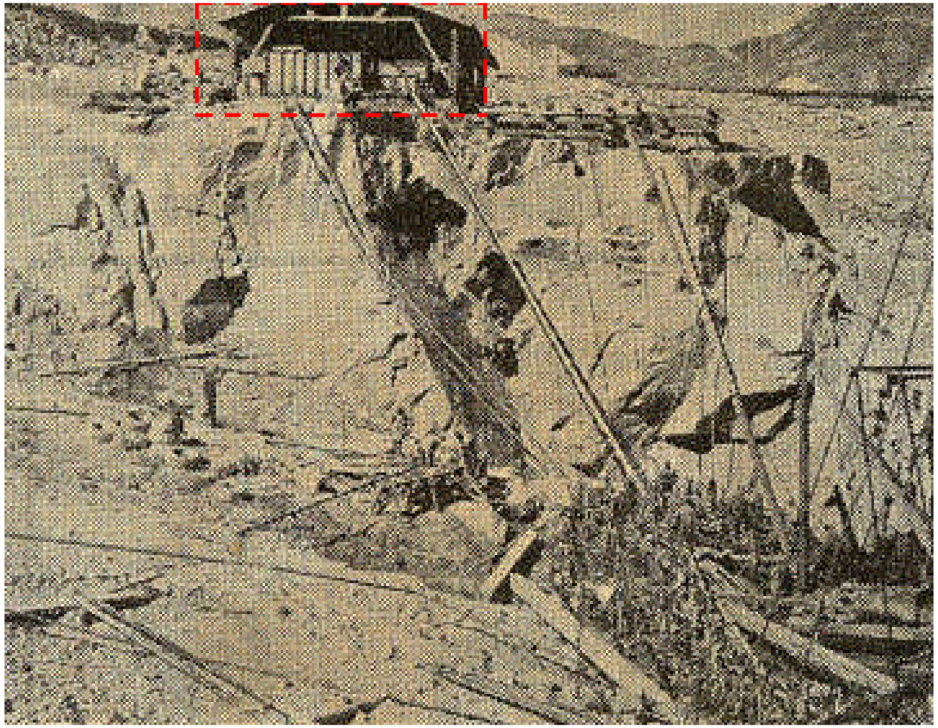
***Popular Mechanics,* December 1936**



**<u>Above</u>: caption: "Close-up of connections on arch area (August 1936)"**

***"…Two ammonia pipes will be run down the points, carrying heat away to a mammoth cooling unit, just as in ordinary refrigerators. The method has been used before in construction work but never on such a large scale. It is usually used where wet, slippery sand or quicksand is found, but never in such quantity. The worst trouble on the east side was encountered in the deep crevice on the east side, far below the river level. There the earth kept sliding into the pit, preventing cleanup work and removal of rock for concrete. Once the concrete is in, the earth will not move. Installation of the huge refrigeration probably will start next week."***

***Spokesman-Review,*** **July 31st 1936**



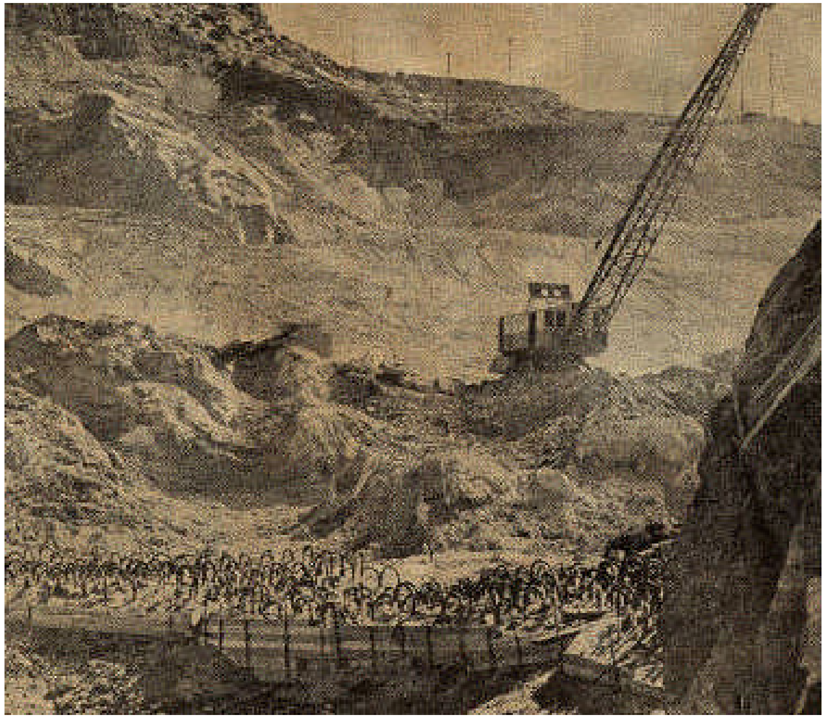
**<u>Above</u>: caption: "The largest actual freezing operation for construction work in history, a unique procedure, is shown in the photograph. The MWAK Company is freezing an arch dam, 100-feet long. 30-feet thick and about 50-feet deep at the 'toe' of the slide area on the east side of the river at the Grand Coulee dam site. The finely ground clay has been sliding into the deep trench in bedrock on the east side. The freezing plant is shown at the top of the photo. Freezing is accomplished by means of liquid ammonia pumped through myriads of pipes driven into the earth. If successful, this freezing operation will save the cost of moving an estimated 1,000,000 yards of earth which may slide into the excavation for the dam." (*Spokesman-Review*, September 19th 1936)**

***"…Finally, brine from a refrigerating plant fifty feet up on a rock cliff was pumped into the smaller pipes and all-owed to rise through the large pipes and spill into the return channel, thus freezing the earth more than forty feet deep. The refrigerating plant comprises two co-mpressors of eighty-ton capacity."***

***Popular Mechanics,*** **December 1936**

**Left: caption: "The completed frozen arch at Grand Coulee Dam (Nov. 1936)"**[1227]

**Unique in the history of dam building was the use at *Grand Coulee Dam* of a temporary frozen earth dam. Threatened with delay and great expense by a body of more than 200K cubic-yards of plastic clay which, in spite of timber cribs and concrete barriers, moved toward and repeatedly filled a deep crevice in the bedrock at the east end of the dam, U.S.B.R. engineers conceived the idea of freezing the toe of the sloping mass of clay to form a dam across the crevice (actually, the idea was inspired by an old miner's trick). Six miles of pipe (three miles of inch-and-a-half pipe inside three miles of three-inch pipe) were driven in an arc between the walls of the crevice. Brine at 0° F circulated through the pipes, freezing a portion of the clay into an arch-type dam; 20-feet thick, 45-feet deep and a span of 110-feet. From August 1936 to April 1937, an 80-ton ice plant kept the ground frozen and the ice dam held back the clay while excavation of the crevice was completed and the base of the dam built up above the toe of the clay slope. As soon as the ice dam was allowed to thaw out, the clay began to move again, proving the +/-$40K expenditure on the ice dam cost-effective in both money and time saved.**



**<u>Above</u>: caption: "Here's a view of the famous 'ice dam' at the Grand Coulee construction job. For it, MWAK engineers borrowed a page from the river tunnelers' book. When slides threatened to delay some of the work, the engineers froze the front face of a 'mud glacier' into the shape and strength of a 100-foot arch dam, to hold back the rest of the 'goo' so it could not slide down into the east side excavation area and impede progress there. The pipes sticking into the ground circulate ammonia brine and freezes the mud. The efficacy of the trick is demonstrated by the frost collars shown where the 30 and 40-foot pipes emerge from the ground. Sawdust is piled deeply over the surface, to serve as insulation. While the dam is holding the tide of earth back, the big dragline shovel above is excavating the material back of the dam, to reduce the pressure on it."** 
**(*Spokane Chronicle*, September 22nd 1936)**

***“With a perfect record established, the dam of frozen earth which has been holding back millions of tons of sliding earth from the dam foundation, will complete its task within three weeks…MWAK, by concentrating its concrete pouring in the deep fissure which the ice dam protects, will have the concrete high enough by mid-April to be clear of sliding mud. Barring a mishap during the three weeks, the dam will have functioned without a flaw during it six months of existence…The ice dam brought the Grand Coulee dam considerable publicity, being featured in many national construction magazines and daily papers, including several in New York.”***

***Spokesman-Review,* March 31st 1937**

**<u>Above</u>: caption: “A frozen-earth dam 100-feet wide protected a deep bedrock excavation for seven months from a flood of plastic clay”**

**<u>Left</u>: caption: “Six miles of refrigerating pipe were drive into the toe of a 200,000 cubic-yard mass moving clay”** 1231

***“…The structure was born of desperation by company engineers. Every time they reached bottom of the excavation area, overburden either tumbled into it, or moved sufficiently to indicate a major slide was imminent…To hasten thawing of the mass, hot water may be pumped through the network of pipes…The original cost of the dam and of operation was about $40,000…One major slide would have cost many times that amount.”***

***Oregonian,* April 1st 1937**

# The Dragon’s Tooth

***"Khaki-clad engineers with their familiar levels and transits and affiliated chains and gadgets can be seen climbing and pondering over the high granite ledges of the 'dragon's tooth.' The preliminary work for the drilling and blasting for the site of the dam's giant pumping station is under way. About 200,000 cubic yards of granite must be dynamited loose from high granite abutment wall, the bottom of which is 200 to 300-feet below. Because of the concrete forms below, the Bureau of Reclamation will permit only light 'powder loads,' which will break loose the rock but will not throw it asunder in various directions…"***

***Spokesman-Review*, May 25th 1936**

**Left: caption: "Workers drilling bedrock at Grand Coulee Dam site, July 1937"**

***“Although many people shook their heads doubtfully at the start of the work, MWAK is gradually completing a road down the inside of the slide area on the west side, building it up as they go with rock blasted from the vicinity of the ‘dragon’s tooth.’ Thousands of tons of rock have been blasted away for the foundation for the proposed pumping plant, and hauled by truck down the highway a short ways. From almost directly over the axis of the dam, the contractors started their road down the steep, curving incline…”***

***Spokesman-Review,*** **July 15th 1936**

***"…Bulkheads, constructed to support part of the road, gave way when earth was dumped on them, so the contractors began dumping their rock down the slope. With the aid of a bulldozer and a fleet of trucks, the road is now almost half way down to the toe of the slope. The slide area, with several hundred feet of tunneling underneath, has stopped moving except for an occasional surface movement, and all danger is believed past. The dumping of the additional rock on the top of the earth surface will help to strengthen the area and eliminate any further possibility of slides, engineers said…"***

***Spokesman-Review*, July 15th 1936**

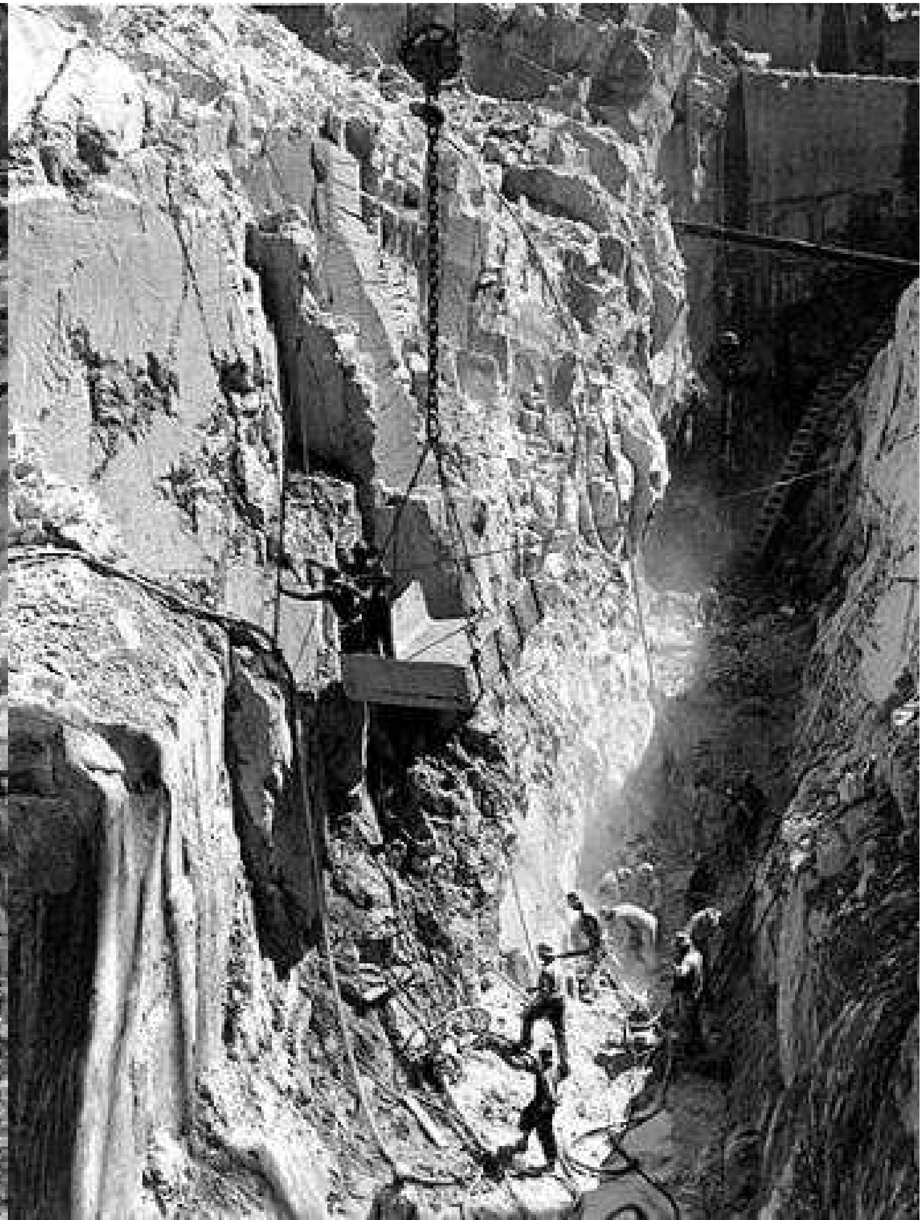
**Above: caption: “Jackhammer crews drilling blasting holes at Grand Coulee Dam, 1938”**
**Left: caption: “Rockmen drilled, blasted, and barred down thousands of tons of weathered and loose rock from abutment areas”**

**<u>Above</u>: caption: “Drilling blasting holes in rock face for Grand Coulee Dam (ca. 1938)”**
**<u>Left</u>: caption: “Jackhammer operators working on steep abutment walls”**

# Certain Death

***"…The drilling of the sheer precipice will be a spectacular sight and similar in operation to the original blasting for the abutment of the dam. The pumping station will be located several hundred feet upstream from the main concrete structure. Jackhammer men were at work today drilling anchor holes for cables which will be strung parallel to the highway bed at that point. From these cables men will hang, ropes fastened to belts around their middles. A fall during this hazardous drill work would mean certain death."***

***Spokesman-Review*, May 25th 1936**



**<u>Above & Left</u>: caption: “Workers drilling bedrock at Grand Coulee Dam site, July 1937”**

<u>Left</u>: caption: “Just making more holes in the rock for some of the million and a quarter pounds of dynamite being used to clear off a firm foundation for the Grand Coulee Dam, first unit under construction on the Columbia Basin Reclamation project.”

**<u>Above</u>: caption: "View of heavy machinery digging tunnel into the bank, July 1938"**

**<u>Left</u>: caption: "View of men working on tunnels cut into the bank, September 1938"**

**<u>Above</u>: caption: ”View of tunnels in the bank, September 1939”**

**<u>Left</u>: caption: “General view of grouting operations on vertical rock face below pumping plant dam, June 1939”**

# Part 18

# The Mighty Task

# Biggest Problem

***"Two noted engineering authorities left Spokane today with officials of the MWAK Company to study the biggest problem in the Grand Coulee dam construction – the building of the giant coffer dam. A.H. Woodward, consulting engineer of New York City, and C.D. Riddle, who becomes job engineer, are the two who went with Silas Mason, Guy F. Atkinson, Francis Donaldson and H.L. Myer of the MWAK Company to the site…"***

***Spokane Chronicle,*** **October 10th 1934**

***"…Coffer dam engineering and construction are the biggest problems in connection with the entire project because the temporary structure will have to retain the water higher than in any dam ever built in the history of the world, according to any engineering records. The party of six…will make several trips to the dam site within the next few weeks as the study proceeds and plans are detailed."***

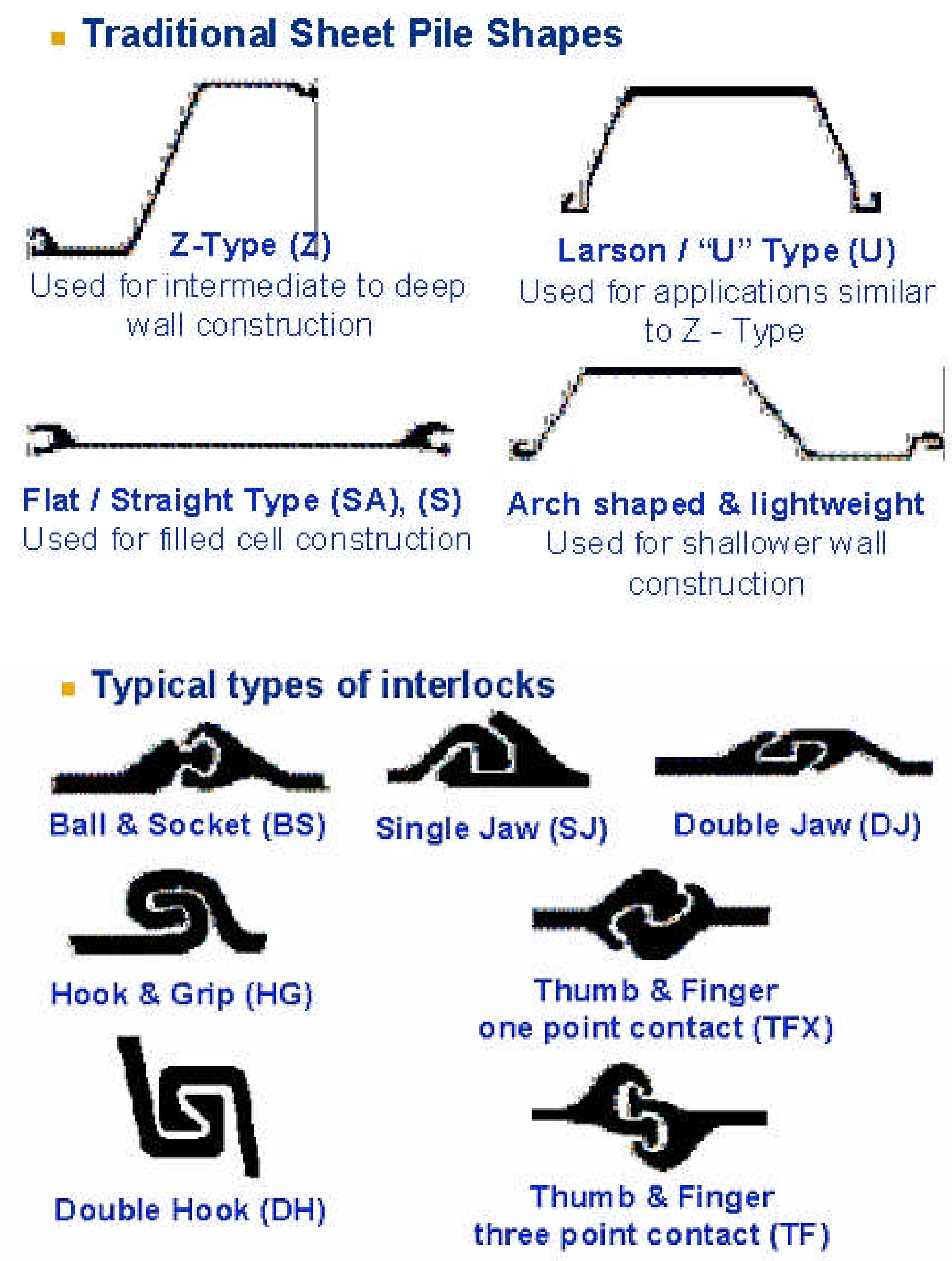
***Spokane Chronicle,*** **October 10th 1934**

***“In order to determine the pressure of the earth of the giant cofferdams for the Grand Coulee dam and powerhouse, workmen for MWAK are engaged in excavating a pit for experimental purposes. Plans call for an eight-foot-square pit surrounded by a trench, which is to be closed in. By placing against the walls various hydraulic jacks and other apparatus, the exact pressure which the earth will have against this proportionate arrangement can be determined. The information thus gathered will be used as data for engineers now engaged in designing the cofferdams.”***

***Spokane Chronicle,*** **October 17th 1934**

***“As on all mammoth projects, models of the various parts of construction must be worked out to determine stresses and strains and other data, and the MWAK group today took the first step in the construction of a ‘miniature’ cofferdam. The model will be located near the west side test pit, sunk by the company several weeks ago. It consists of a pit about eight feet square, and instruments will be installed to obtain figures on pressure and other stresses…”***

***Spokesman-Review*, October 17th 1934**




***"The first of the sheet steel piling with which the MWAK group expects to make tests of coffer-damming methods was driven at noon today. The contractors expect to determine more specifically just what types of 'muck' and rock must be removed, and just what machinery will best do the work. The piling will not be used in the cofferdam, but only in the test pits…"***

***Spokesman-Review,* November 3rd 1934**

***"'Three hundred cars of steel piling will be required for the construction of the cofferdam for the diversion of the Columbia river incident to the construction of the Grand Coulee dam, and we will be ready for it as soon as the Reclamation Bureau can get it in,' Silas Mason, Chairman of the MWAK company, general contractors, said yesterday. 'The Denver Bureau of Reclamation will be ready for bids in about ten days. We are trying to pick up from fifteen to twenty cars of second-hand steel piling in San Francisco for immediate delivery, as this is desired for construction of our railroad bridge…Driving of the cofferdam steel will be carried in places to depths of more than 100-feet and will signal the first big actual step in connection with the harnessing of the Columbia at Grand Coulee…"***

***Spokesman-Review,* November 9th 1934**

***"…A number of engineering details in connection with the river diversion are yet to be decided upon, explained Mr. Mason, although the broad plan of the project has been out-lined. 'We are anxious to get this piling started as early as possible, as it is one of the big jobs in connection with the construction of the dam.'…"***

***Spokesman-Review,*** **November 9th 1934**

***“Awarding of a $1,250,000 contract to the Inland Steel Corporation of Chicago for 20,000 tons of steel sheet piling for the cofferdams to be used in connection with the building of the Grand Coulee dam and powerhouse was announced yesterday by Colonel M.J. Whitson, vice president of MWAK. The award was made by the United States government for the account of the general contractors. The first of the material to be furnished by the Chicago corporation is slated to arrive in ten days, Colonel Whitson said. The 20,000 tons of sheet piling will be sufficient to handle all of the coffer-damming which will be necessary to divert the river here. Part of the material can be used over again, Colonel Whitson said…”***

***Spokane Chronicle,*** **December 6th 1934**

***"…A breakwater has been constructed in the Columbia river on the west bank, but no actual coffer-damming as yet has been started. Structures will first be built on each side of the river. When these are completed, the water will be 'shot' through the sections of concrete while the closure section is being cofferdammed. The closure cofferdam will be the largest ever constructed."***

***Spokane Chronicle,*** **December 6th 1934**

***“The first piling for the giant cofferdam on the west side of the river was driven today by the big ‘whirley’ crane and derrick several hundred feet upriver from the temporary bridge. It will be early summer before the cofferdam is completed…”***

***Spokesman-Review*, December 21st 1934**

# Gang Towers

***“Plans for a series of ‘gang towers’ to speed the driving of piling in the west side cofferdam are being made by officials of the MWAK Company, it was learned today. To permit the use of some of the shovel equipment used in excavating, instead on the cofferdam, where much of it has been converted into cranes and derricks, the ‘gang towers’ will be erected…”***

***Spokesman-Review,* February 21st 1935**

***"…Because of the difference in the size of the cells in some sections of the coffers, two types of towers will be used. In the center section, two towers will be erected on each side of the walls, sitting on trestles built alongside. The water side trestle is under construction. The inshore trestle has been completed. Between the two towers, mounted on wheels to permit them to roll from cell to cell, two heavy beams will be placed. From them, beams will be suspended to provide a runway for the hammers. There will be six hammers to each pair of towers, of which, four are planned. Rollers will permit mobility to any place on the wall…"***

***Spokesman-Review,*** **February 21st 1935**

***"…On the larger cells similar towers will be used, except that, because a boom stretching across the length of the cell would have to be about 100-feet long, the towers will be built inside the cells, then dismantled and moved as they complete their job. On the towers swinging booms, pivoted at one end, will replace the sliding beams and trolleys. Plans, officials said, call for eighteen hammers, although the towers could handle more if all were used at one time. However, some time would be lost in moving the towers from cell to cell, and the dozen and a half hammers all will be put into service immediately. One of the 'gang towers' is nearing completion now, in the center section of the cofferdam, and others will be constructed as soon as the work on the outside trestle progresses far enough…"***

***Spokesman-Review,* February 21st 1935**

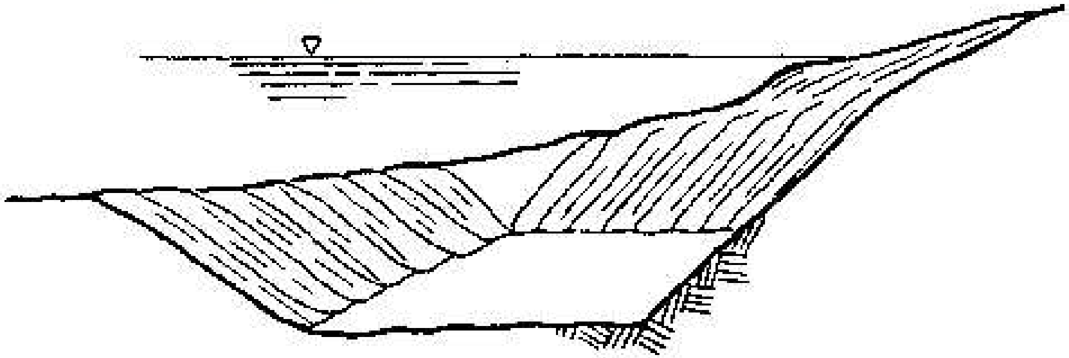
# In the Dry

***"…In constructing a dam, it is necessary to lay bare firm bedrock an which to build the structure, and to divert a stream while the foundation is laid in its bed. In narrow canyons and for smaller rivers, tunnels are sometimes driven around the dam site, and cross-river cofferdams are used to divert the river through them…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

# Typical Cofferdam Construction Sequence (i.e. Bridge Pier)

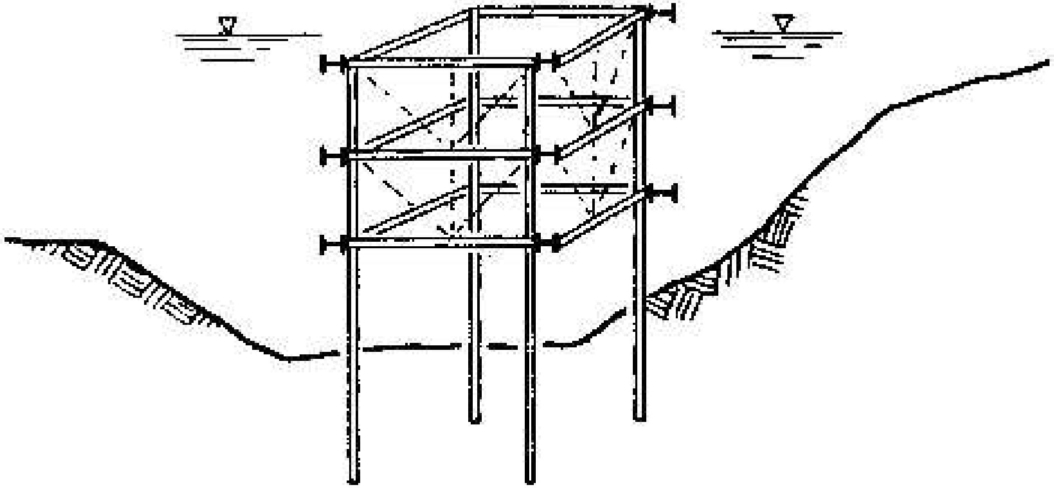
1. Pre-dredge to remove soil or soft sediments and level the area of the cofferdam.



22

2. Drive temporary support piles

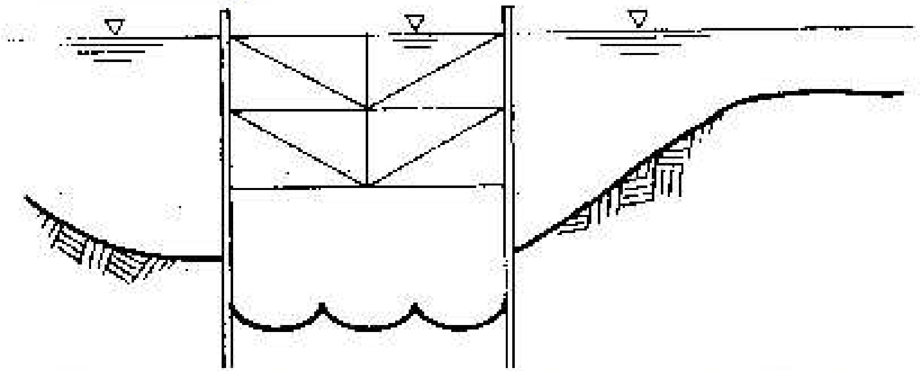
3. Temporarily erect bracing frame on the support piles.



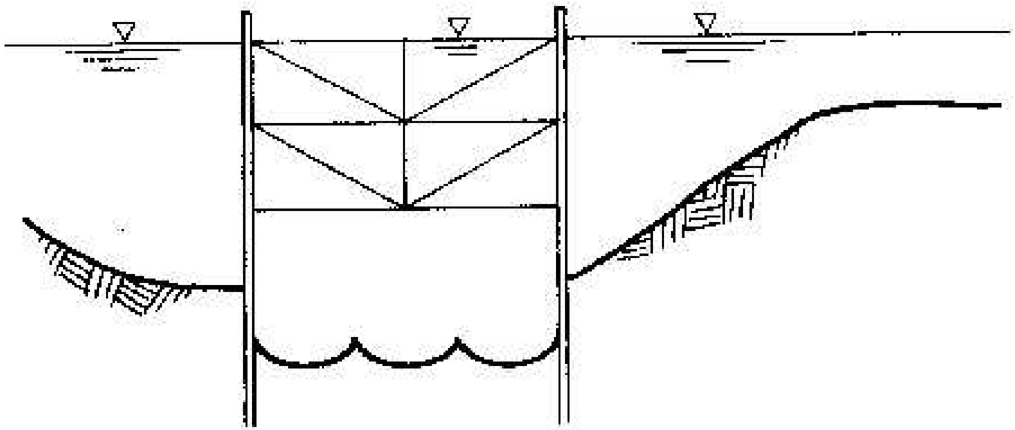
4. Set steel sheet piles, starting at all four corners and meeting at the center of each side

5. Drive sheet piles to grade.

6. Block between bracing frame and sheets, and provide ties for sheet piles at the top as necessary.

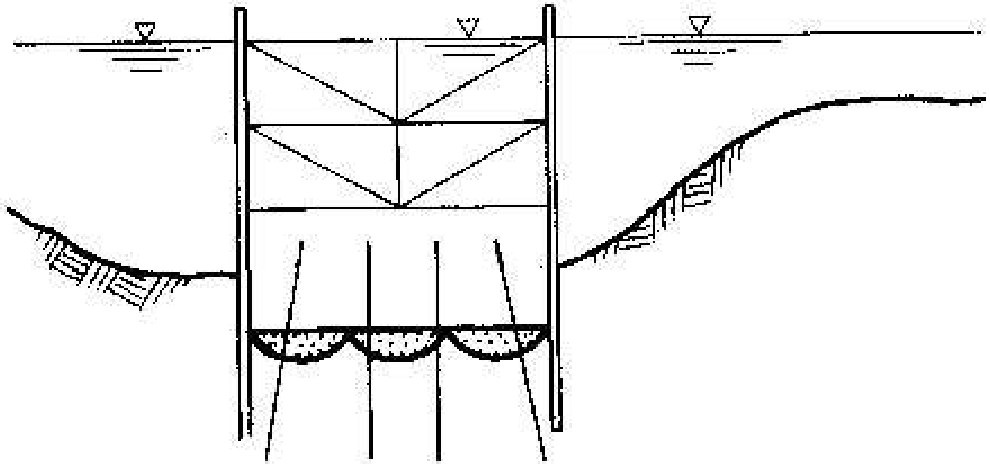


7. Excavate inside the grade or slightly below grade, while leaving the cofferdam full of water.

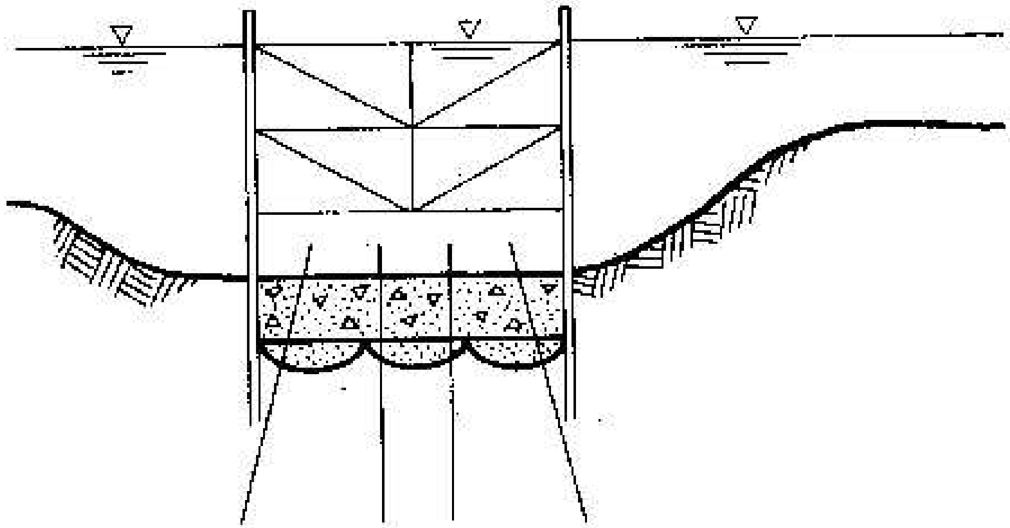


8. Drive bearing piles.

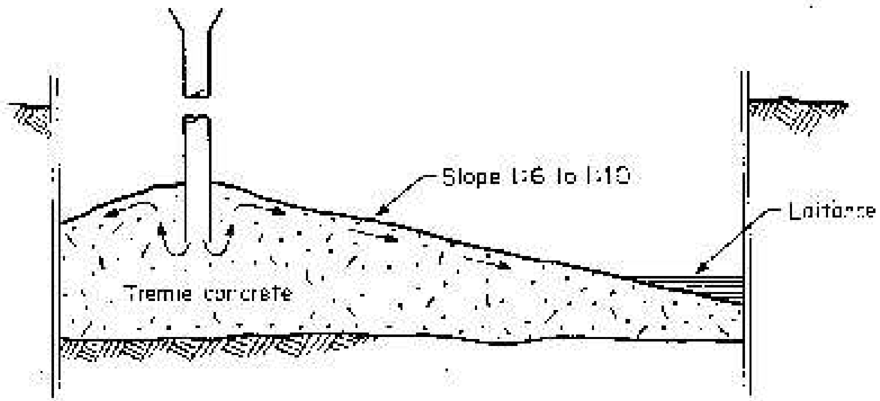
9. Place rock fill as a leveling and support course.



10. Place tremie concrete seal.



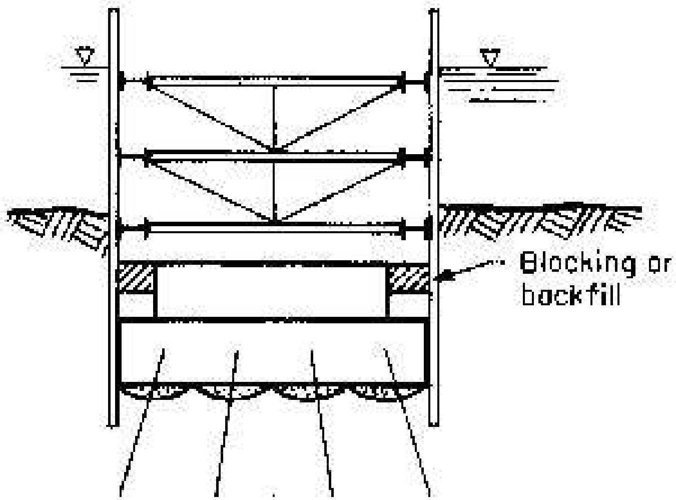
## Tremie concrete seal.



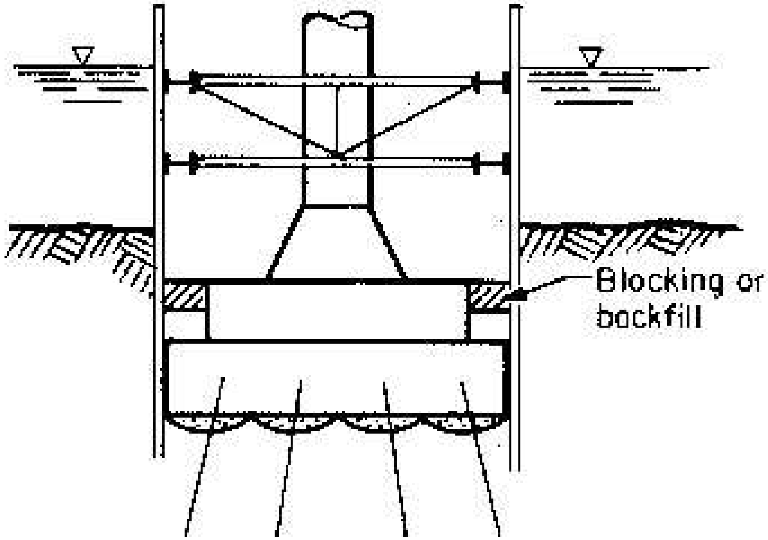

**11. Check blocking between bracing and sheets.**

**12. Dewater.**

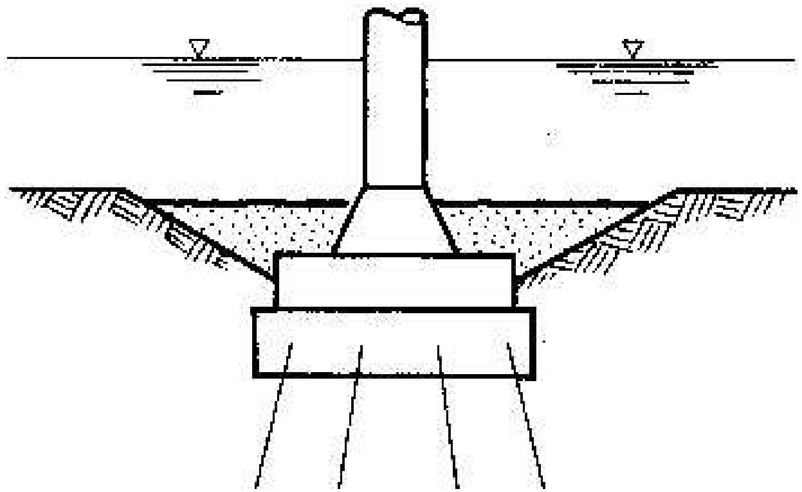
**13. Construct new structure.**

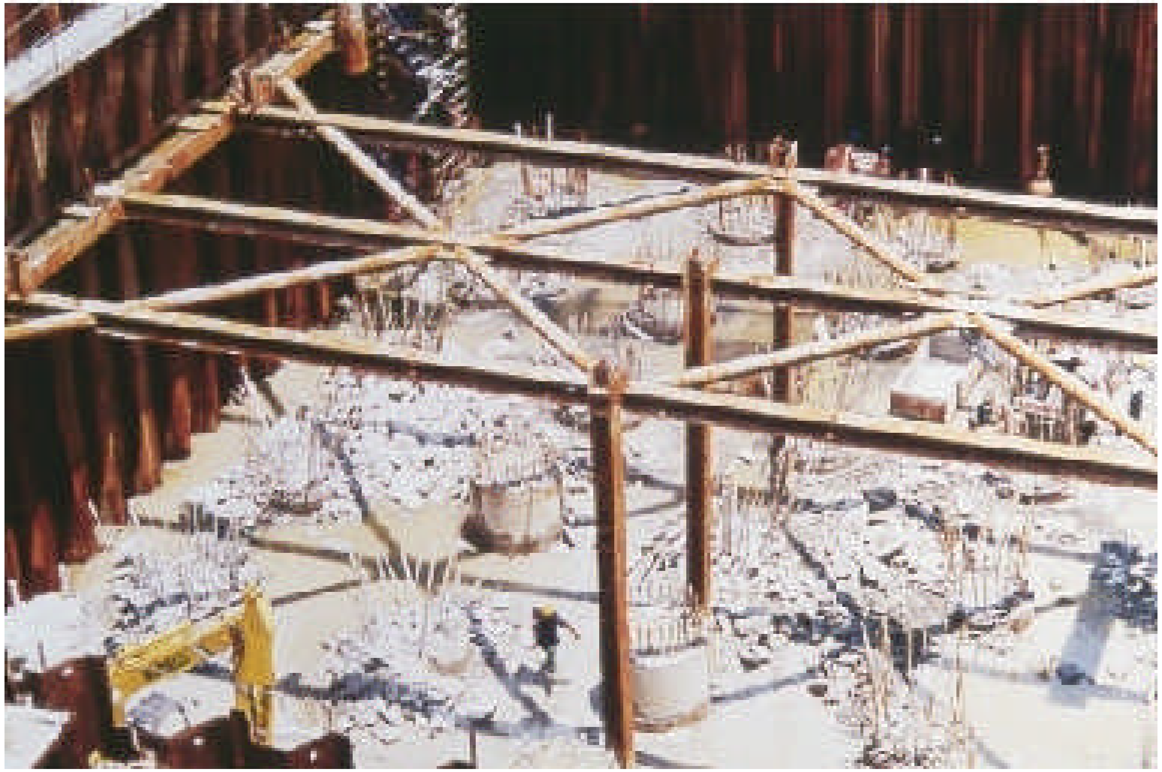


13. Construct new structure.
14. Flood cofferdam.




15. Remove sheet piles.
16. Remove bracing.
17. Backfill.





# Fast & Furious

***“Time and tide wait for no man, neither does MWAK. Fifteen minutes spent in the cofferdam area on the west shore of the Columbia yesterday proved that. Things happen fast and furious, so fast and furious that no human being is capable of writing down all that takes place in a short quarter-hour…”***

***Spokane Chronicle,*** **January 10th 1935**

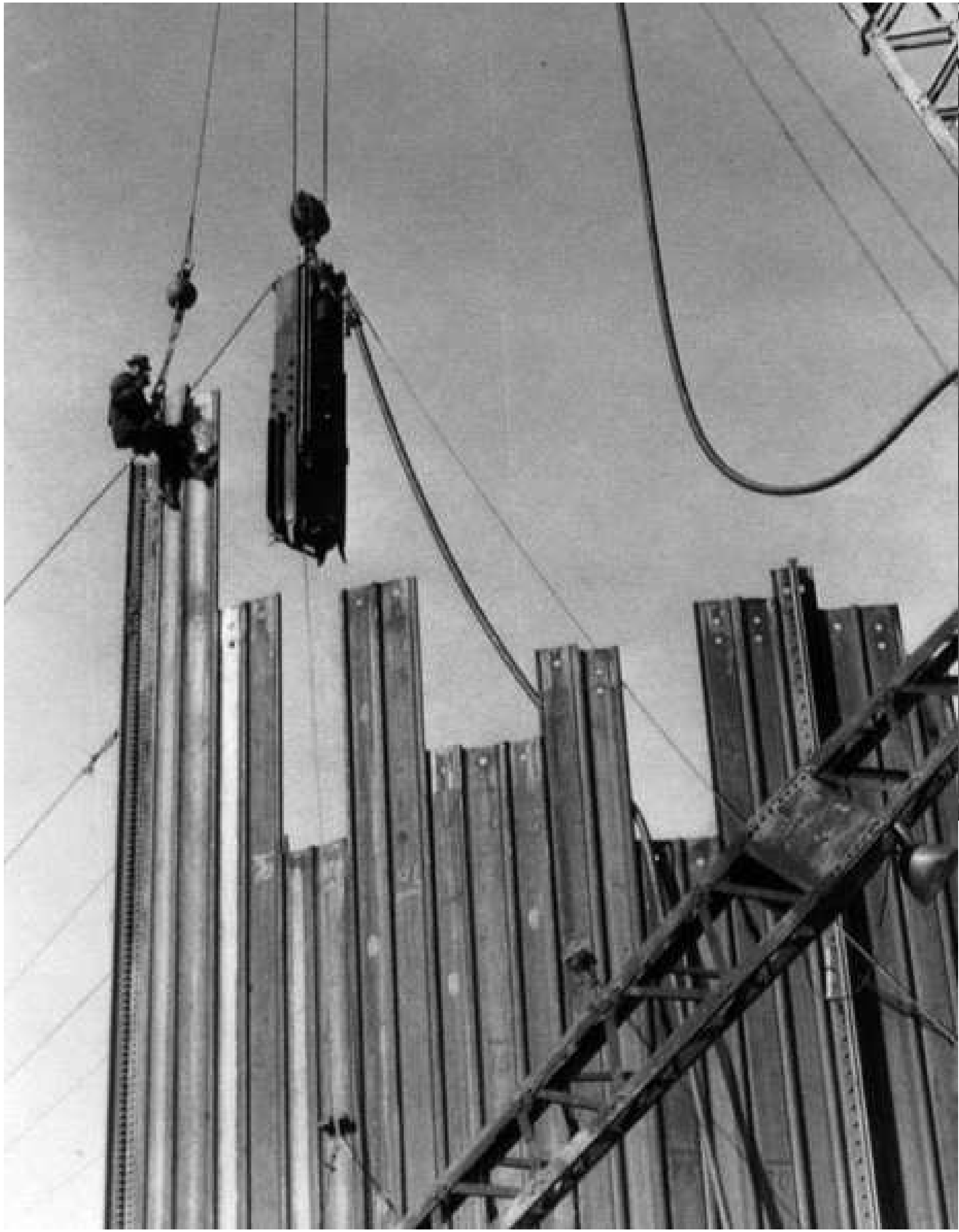
***"…Here are just a few of the items of an average fifteen minutes: Steel sheet piling is being unloaded near the first cells of the coffer. A Thew-Lorain 75-A crane has a load of piling strung from its booms. A cat is pulling a long truck, one of the dozens which bring in the piling daily out of the mud. Another truck has broken its long beam and is being repaired. Workmen with hooks are placing ties in place on the upstream trestle. A crane is blowing off smoke. Whiffs of steam are shooting out from everywhere. A high rigger, precariously seated in a small seat at the end of a long cable running down from a 103-foot high crane boom, is placing the sheet piling in place at the top of the first cells…"***

***Spokane Chronicle,*** **January 10th 1935**

**Left: caption: "Steam Hammer (3-1/2 foot-ton) driving interlocking steel piles in west cofferdam cell."**

***"…A timekeeper is checking off the workmen. Four men with mechanical 'claw hooks' are carrying big beams. Bosses are shouting and signaling here and there. A truck, containing a welding machine, is stuck. Another crane is swinging piling in place at another joint. Engineers are working at the edge of the district. Toward the hillside the click-click of the belt conveyor is heard. The smoke stack of the huge boiler is blowing off steam. Men are piling timbers in the storage section. Some are drilling holes in beams with electric drills. Timber piling for the trestle is being driven. A 75 horsepower 'cat' is coming down the road – bent on doing something…"***

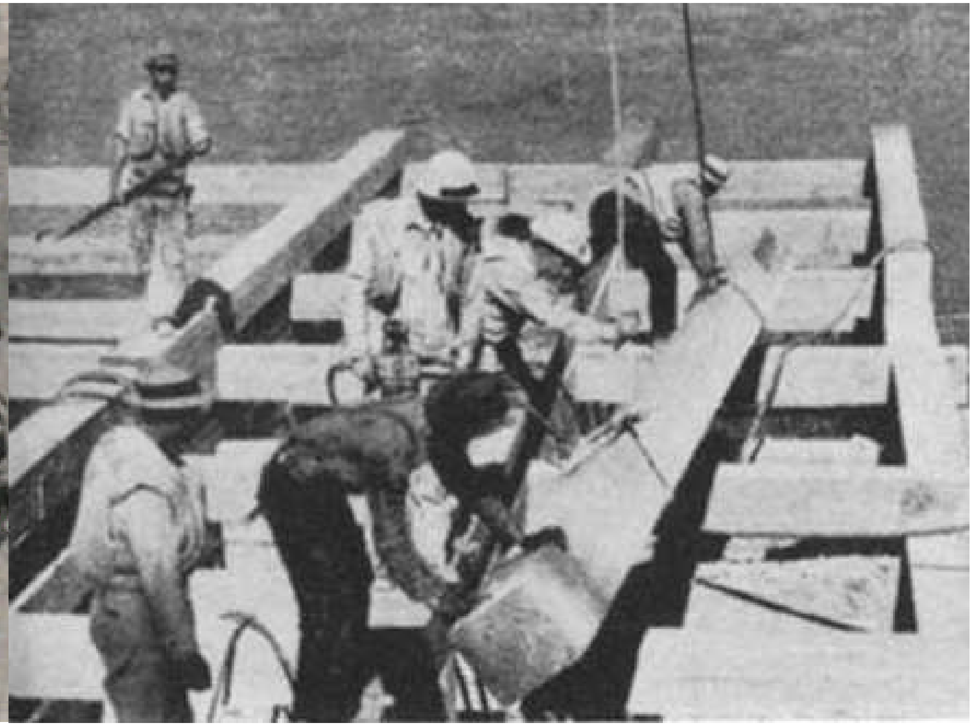
***Spokane Chronicle,* January 10th 1935**



**<u>Above</u>: caption: "Setting a 3&1/2 foot-ton steam hammer for driving piles in cofferdam connecting section 'C' with block 40 (August 1936)"**
**<u>Left</u>: caption: "Placing the McKiernan steam hammer (ca. 1935)"**

***“…All over ropes and cables are swinging. The ground is cluttered everywhere with timbers and machine parts. A couple of men are digging a ditch and a group of carpenters are constructing a foundation for a new warehouse. Down-stream, another ‘whirley’ is driving piling. Clatter of steel against steel, engines, motors, noise and more noise is heard everywhere. A compressor is pounding spasmodically near the riverfront…”***

***Spokane Chronicle,*** **January 10th 1935**

***"A Power-Driven saw used to cut timber during the construction of a huge wood crib at Grand Coulee Dam in Washington features a blade that actually stands still while the cutting process takes place. The 'secret' to the novel saw is that the teeth run on an endless chain around the blade, which merely serves as a guide for the teeth as they cut into the timber. A three-horsepower compressed air motor drives the chain. The saw is so designed that it can also be used under water without impairing its efficiency."***

***Modern Mechanix,*** **February 1938**

**<u>Left</u>: caption: "These workers are using a novel saw featuring a blade that stands still! The cutting teeth run around the blade on an endless chain, which is powered by a compressed air motor."**

**<u>Right</u>: caption: "Ten and a half million board feet of heavy timbers went into the cofferdam cribs"**

***"…At another place, hammers are pounding on a new building. A foreman looks at some blueprints and gives orders. A hundred men are walking hurriedly to and fro, all going somewhere. Everywhere someone is doing something with precision and no waste of time…"***

***Spokane Chronicle,*** **January 10th 1935** 

**Above: caption: "Construction of Grand Coulee Dam, ca. 1935"**

***"A big flood gate, which will act as a safety valve in case the pressure of the mighty Columbia river weakens any part of the 3,000-foot long west-shore cofferdam, was under const-ruction at the extreme downstream end of the steel wall yesterday. The gate will allow MWAK to flood the excavation area in case any section or group of cells in the main structure weakens and imperils the entire bulwark. Rather than allow the whole cofferdam to be demolished by the Columbia the opening of the big gate would save the structure and allow MWAK to repair the silling portion. The gate is merely an open portion of the single steel wall, built up by 12x12 beams laid one on top of the other, so that they can be hurriedly removed."***

***Spokane Chronicle,* April 4th 1935**

***“Dirt pressure early today wrecked one section of the nearly completed cofferdam at the Grand Coulee dam site. The dam, constructed of closely joined steel sheet piling cells, filled with rock and dirt, is intended to hold the water of the Columbia river back while the west end of the $30,000,000 concrete structure is built…”***

***Spokesman-Review,*** **April 7th 1935**

***"…Four hundred thousand cubic yards of dirt and rock had been dumped inside the structure. The pressure caused the sheet piling to act as shears that clipped the huge bolts holding the piling together. The opening made by the break is about 30-feet wide at the top, narrowing at the base…had the accident occurred later during high water, the entire construction area would have been flooded. The water has not reached that section of the dam yet. The section must be rebuilt."***

***Spokesman-Review,*** **April 7th 1935**

***“There will be no repetition of the collapse of one of the cells of the huge west shore cofferdam early Saturday, the chronicle’s special correspondent was assured today. The company, plainly disturbed by the break in the majestic bulwark, issued its first official statement since work was started on the dam site. ‘This was only a minor and does not in any way affect the stability of the cofferdam as a whole,’ Silas B. Mason, Chairman of the Board of MWAK, stated. ‘The faulty joint is being replaced and repairs will be completed within a week. Since the break was far above the present water level, the progress of the work is in no way affected…”***

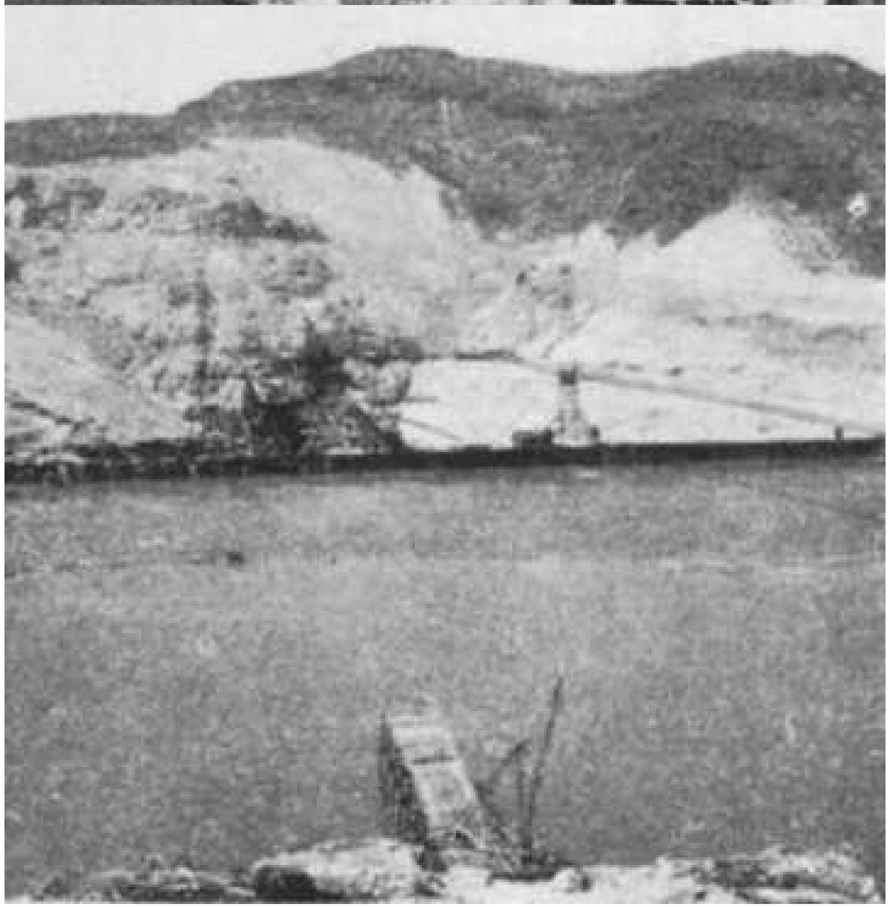
***Spokane Chronicle,* April 8th 1935**

***"…'A thorough investigation shows two similar field connections in the face of the cofferdam, and as a precautionary measure these are being materially strengthened.' When the break occurred about midnight, officials and workmen alike were in a quandary. In the darkness it was hard to determine just what had broken loose. Officials feared one of the interlocking joints had broken. Since there as many joints as there are sheet-piling, the breaking of a joint (a groove in one side of the piling through which the nob of the other is inserted) might mean that any or all of the other 7,000 joints might break. This did prove to be the case."***

***Spokane Chronicle,*** **April 8th 1935**

***“…A solid, sturdy toe of dirt is being built up around the foot of the cofferdam, on the river side, to protect the steel wall and keep high water from tearing out dirt from under the edge of the piling. A steady stream of trucks is dumping over the edge of the cells. The break that occurred several days ago in the well of the coffer has been repaired and is now stronger than the regular joints, MWAK officials believe. The break was caused by insufficient rivets in a ‘lap joint.’…”***

***Spokesman-Review,*** **April 10th 1935**



***"A bulwark is being built on the east bank to prevent the river, the course of which will be changed during high water by the west shore cofferdam, from cutting into the east shore river bank back of the 1020 level on which the field office, machine shop, warehouse and other buildings are located. Engineers of the MWAK figure the Columbia in all its fury during May, June and July, may be so shifted by the cofferdam which extends into the river about 200-feet as to force it to swerve into the bank where the timber breakwater is being constructed…"***

***Spokane Chronicle,*** **April 10th 1935**

**Top: caption: "High water flooded the low east cofferdam in 1935, but the west cofferdam kept a 60-acre working area dry"**

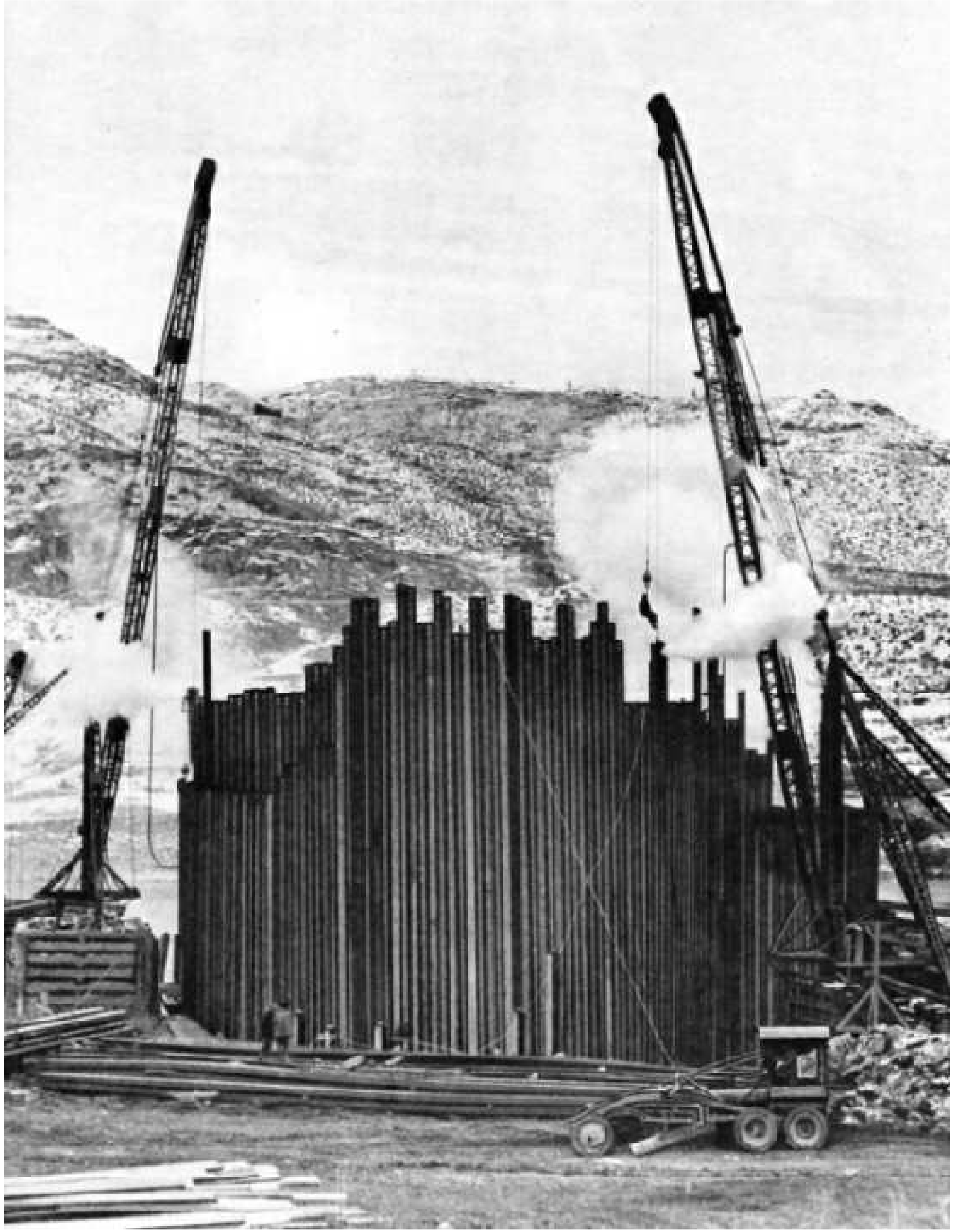
**Bottom: caption: "World's largest cofferdam, 300-feet long, enclosing sixty acres, completed, and the Government camp under construction, 1935"**

# The Big Squeeze

***"…Working against time, so as to be able to 'put the squeeze' on the river for the greatest possible number of days during low water this winter, thirty steam hammers hurled themselves into the fray to build the west cofferdam, and 1,500 men toiled night and day for three and a half months. In this period, as much material was put into the temporary bulwark as went into the entire Wilson Dam at Muscle Shoals, Ala. – 150,000 cubic yards of dirt…"***

***Popular Science,*** **February 1936**

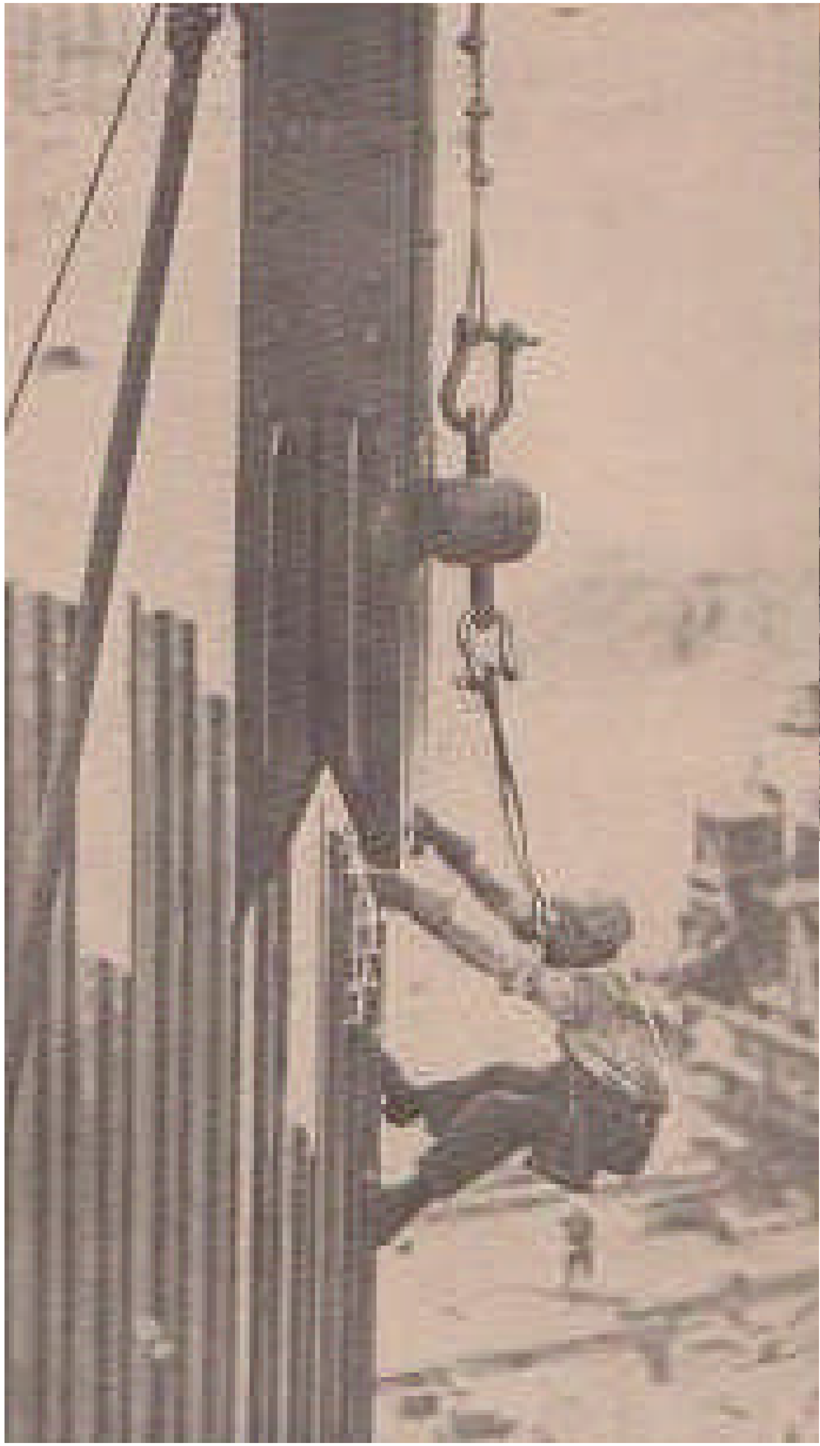
**Left: caption: "Hundreds of cutters and welders cut off haltered ends of cofferdam sheet steel piles and welded on extensions"**

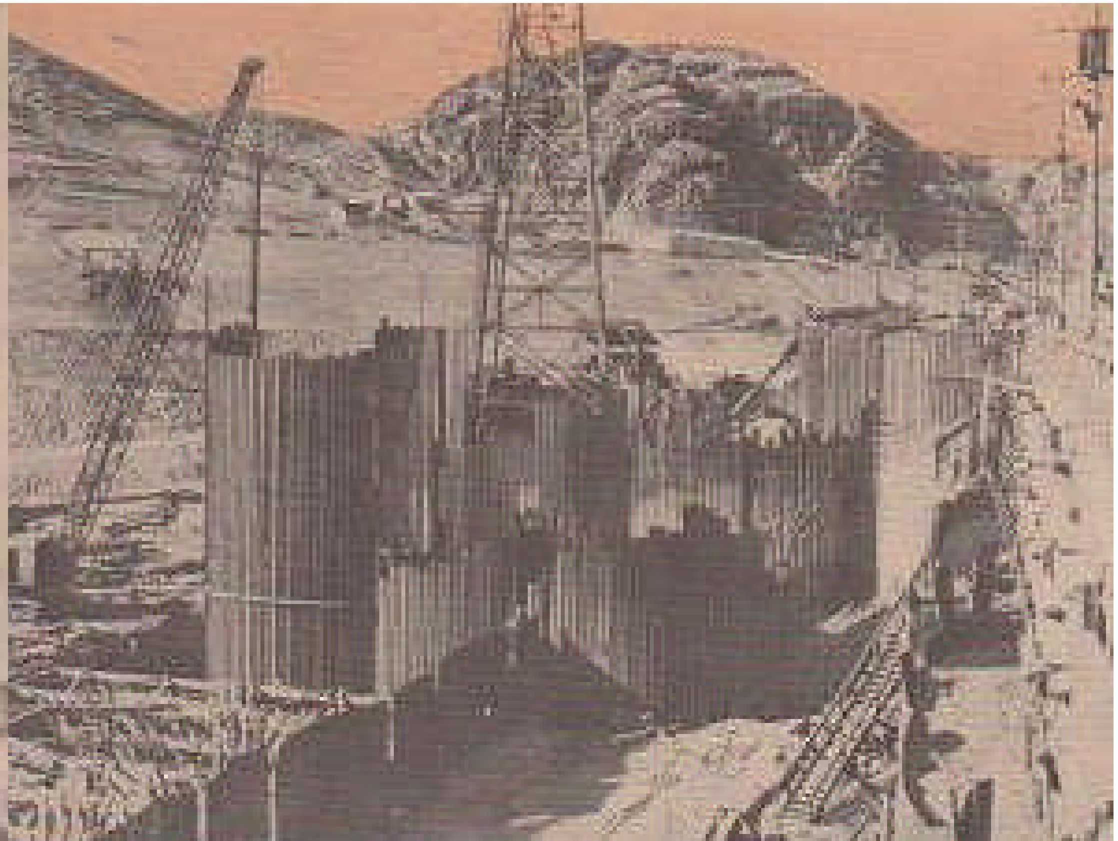


***"…A cofferdam is a temporary dam, built for the purpose of excluding water and water-bearing materials from areas in which construction work is to be carried on. Those at this site were constructed by driving interlocking steel piling into the ground to form a water tight fencelike structure, which is protected against collapse by timber framing or cribs, and filling or embankments of sand and gravel…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

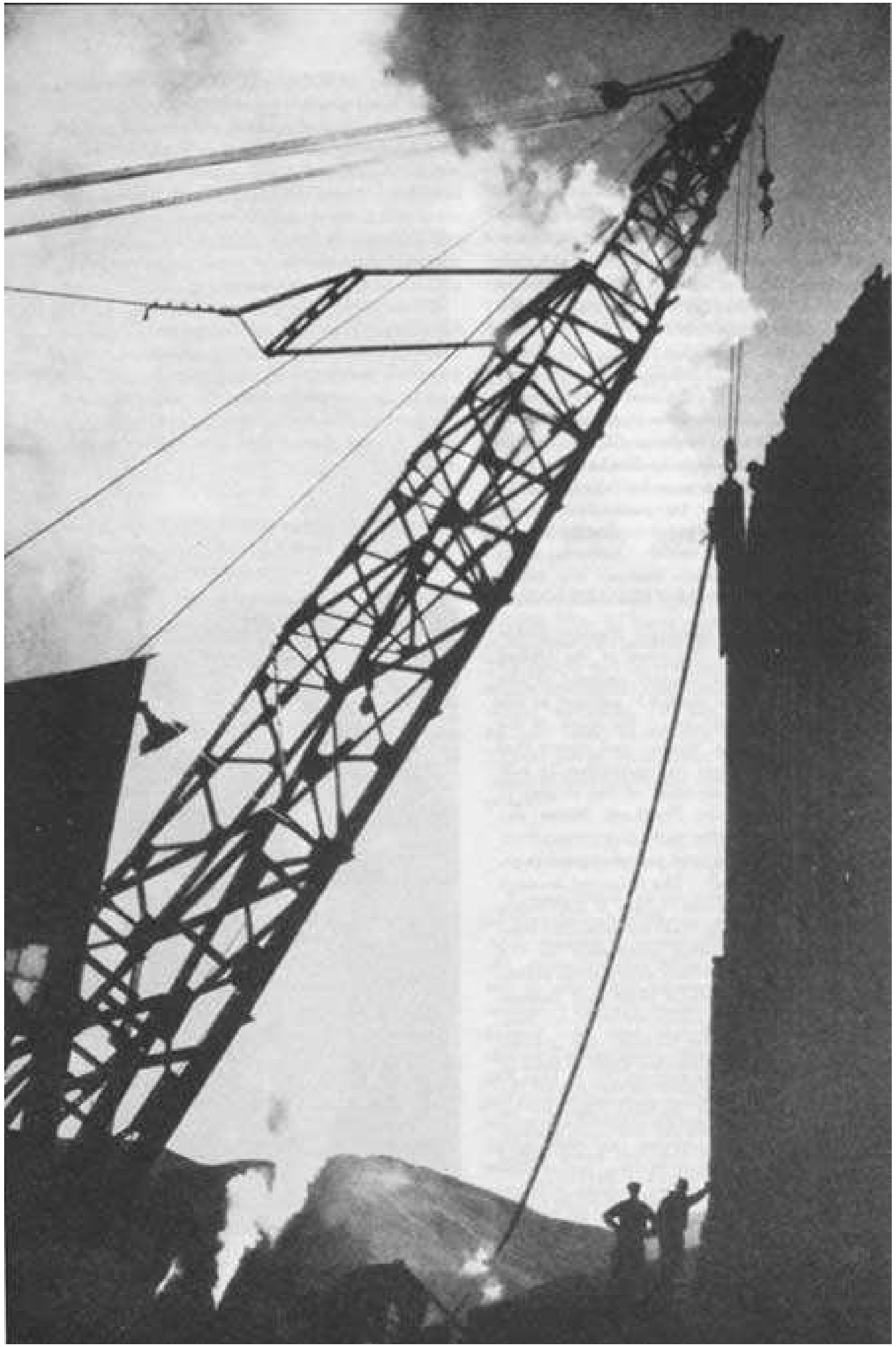
**Left: caption: "Giant Cofferdam of sheet steel piling being built to divert the Columbia River from its bed and allow work to proceed on the foundations of the Grand Coulee Dam, Washington. Three cofferdams in all were built, having a height of 125-feet and a total length of about 5,000-feet."**





<u>Above</u>: caption: "One of the cellular-sheet cofferdams with which the low winter stream of the Columbia is being confined"

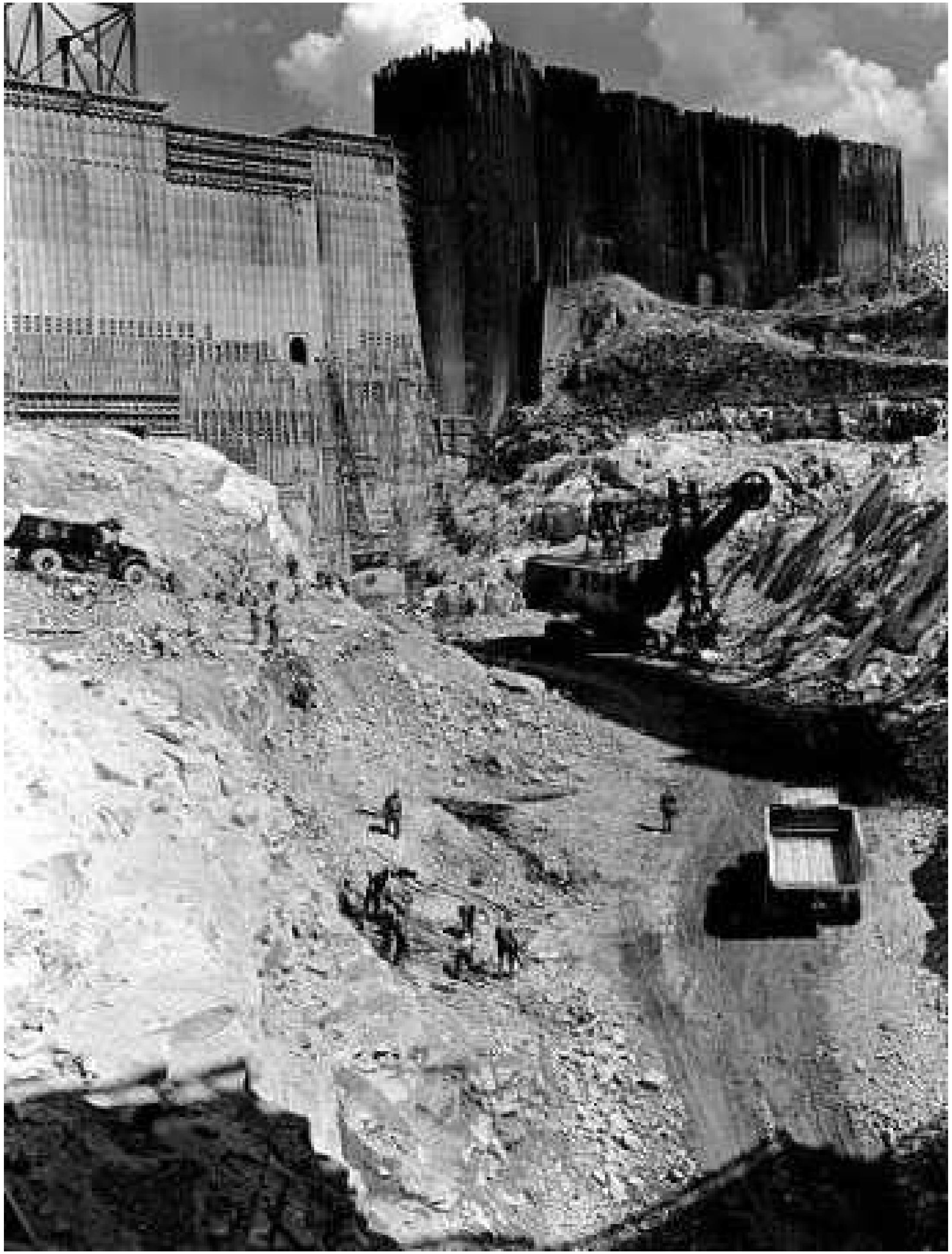
<u>Left</u>: caption: "A worker guiding one of the huge steam hammers into position to drive piles strung for a cell of the huge 2,500-foot cofferdam"



***"…In constructing the west coffer-dam, 15,462 tons, 800,000 lineal feet, 151 miles of inter-locking steel piles 15-inches wide and in lengths of 40 to 80-feet were driven into the hard clay deposits on bedrock by steam hammers handled by long-boom cranes. A chain of joined cells, aver-aging 100-feet in height, approx-imately cylindrical, and about 50-feet in diameter, filled with sand and gra-vel formed the west-side cofferdam along the river. Timber cribs with steel-sheet pile facings formed the shore arms…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "127 miles of heavy steel sheet piling was driven in the west cofferdam by powerful steam hammers"**



*"…During the last year, the contractors have faced the mightiest task in the history of construction and engineering. Diversion tunnels were too costly, and too risky, to handle the tremendous flow. So they have built a cellular-sheet coff-erdam, 2,900-feet long, 50-feet wide, 110-feet high above bed rock – the greatest of its kind ever put in place – on the west bank. On the opposite bank another one, also of interlock-ing sheet piling, and to filled with grout, cement, and earth, will help to pinch the low winter channel…"*

***Popular Science,* February 1936**

**Left: caption: "Bedrock behind west cofferdam (ca. 1937)"** [1292]

# Excavation

***"…From the 60-acre area enclosed, about ten million cubic yards of material were removed, and within it Blocks 40 to 8, inclusive, about a third of the dam foundation, were built from the west bank of the river to the abutting rock wall to the westward…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

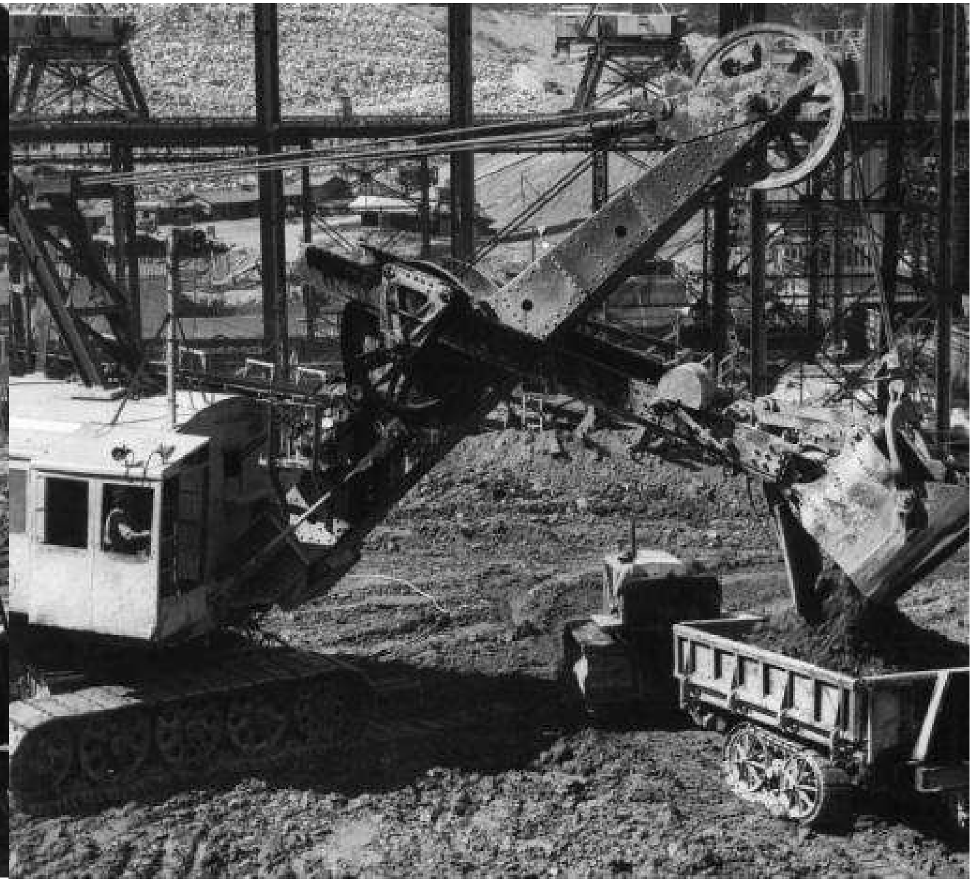
**<u>Top</u>: caption: "Thirteen million yards of overburden were carried away from dam site excavations by this system of belt conveyors"**

**<u>Bottom</u>: caption: "At the rate of a million yards a month, a mountain of excavated material was dumped in Rattlesnake Canyon"**

***"…Most of this material has been moved one and a half miles away by con-veyor belts where it filled a convenient ravine. Today the conveyor belts have reversed their direction and are bringing endless streams of materials down out of the hills to the concrete mixers…"***

***Popular Mechanics,* April 1938**

**Left: caption: "Removing from the old channel of the diverted river deep beds of clay depo-sited during the last Ice Age"**


**Top Left: caption: “A 5-yard electric shovel and 10-yard buggies working in the diversion channel, August 1936”**

**Top Right: caption: “A 5-yard electric shovel, 10-yard dump buggy and 75 H.P. diesel Caterpillar used for excavating in the west side river diversion channel, July 1936”**

**Left: caption: “General view of excavation operations along bank”**

***"With the river rising steadily, workmen of the MWAK Company yesterday were dumping an additional five-yard layer of earth fill back of the steel-walled cofferdam. The Columbia is at approximately the 970-foot level, or about six feet below the peak of last year. The river is about 25-feet below the top edge of the west side cofferdam. Another five feet of steel sheet-piling was added to top off the cofferdam about two weeks ago. Trucks today are dumping earth in back of this additional unit as a further step to preserve the bulwark. Rivermen say the peak of the summer run-off will be reached in about three weeks. Last year's peak was reached on June 2."***

***Spokane Chronicle,*** **June 14th 1935**

**Left: caption: "A 10-million-yard hole on the west bank to make room for dam, forebay and tailbay"**

# The Plan

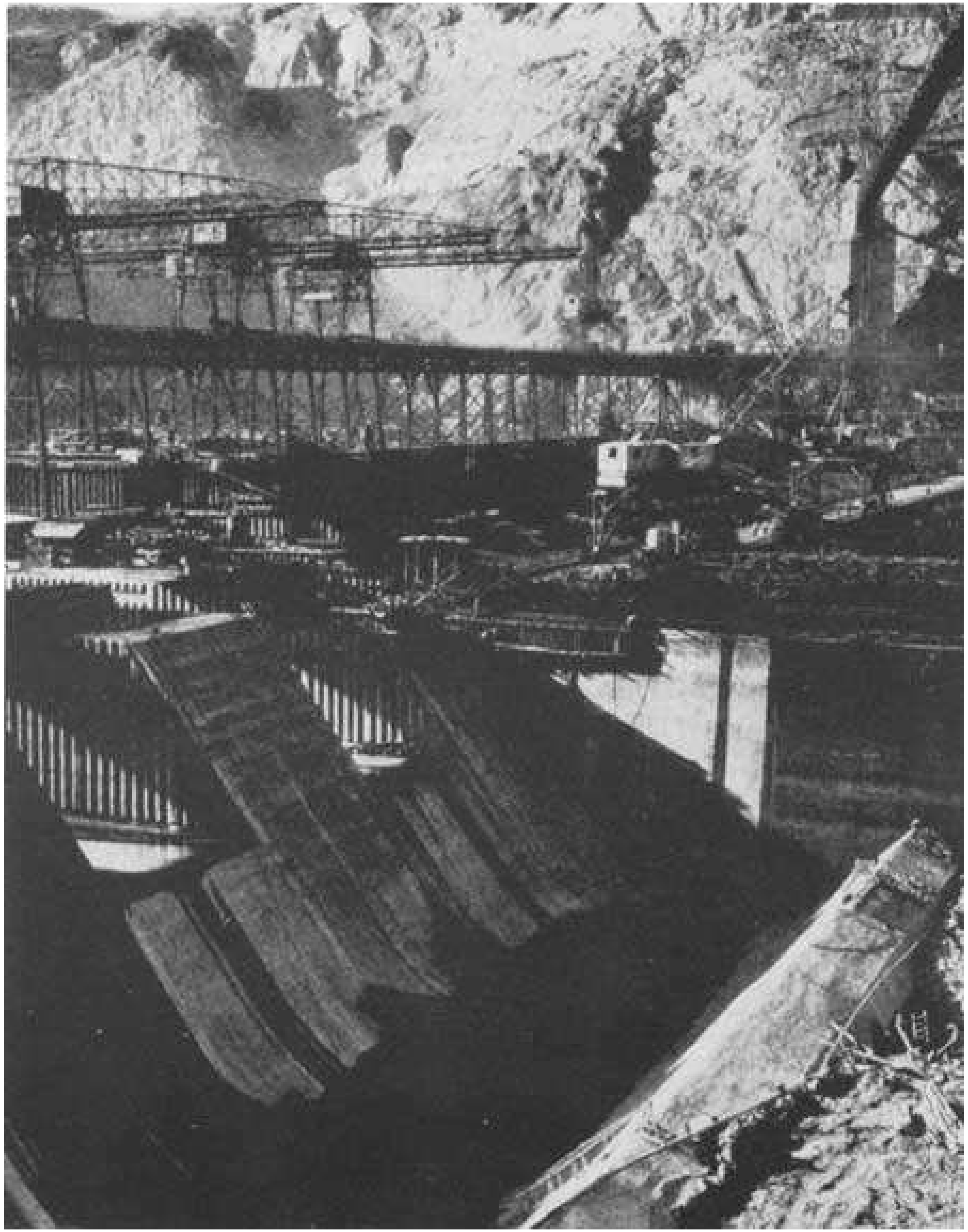
***“The MWAK company has definitely decided against putting in steel cribbing this fall for the center diversion of the Columbia river it was learned yesterday. The company originally planned to put in steel cribs, diagonally across the river this fall. Later logs would be dropped into the slots and the river diverted around over the cured concrete in the west end to allow for excavation of the center section. By installing the cribs this fall it was felt time could be saved next year. Recent sounding of the river bottom have revealed considerable ‘scouring’ or shifting of overburden along the river bottom. The steel cribs, it was believed, would tend to increase this action. The company believes it has plenty of time the coming year for placing the cribs and diverting the river, and can therefore afford to play safe.”***

***Grand Coulee News,*** **September 13th 1935**

***"Three and a half million feet of timber will be used next summer to construct what will be the highest timber cribbing in the world. Inside of the crib, which is a series of square timber cages or cells, there will be dumped about 65,000 yards of sand and gravel filling all of the cribs. This elaborate timber frame-work will be built as part of MWAK's elaborate preparations to divert the river after the river-crossing coffer-dams shut off the Columbia from its regular mid-stream channel next winter. It is an intensely technical layout, difficult to describe, but without it the cofferdams would serve little if any purpose at all…"***

***The Wenatchee Daily World,*** **January 13th 1936**

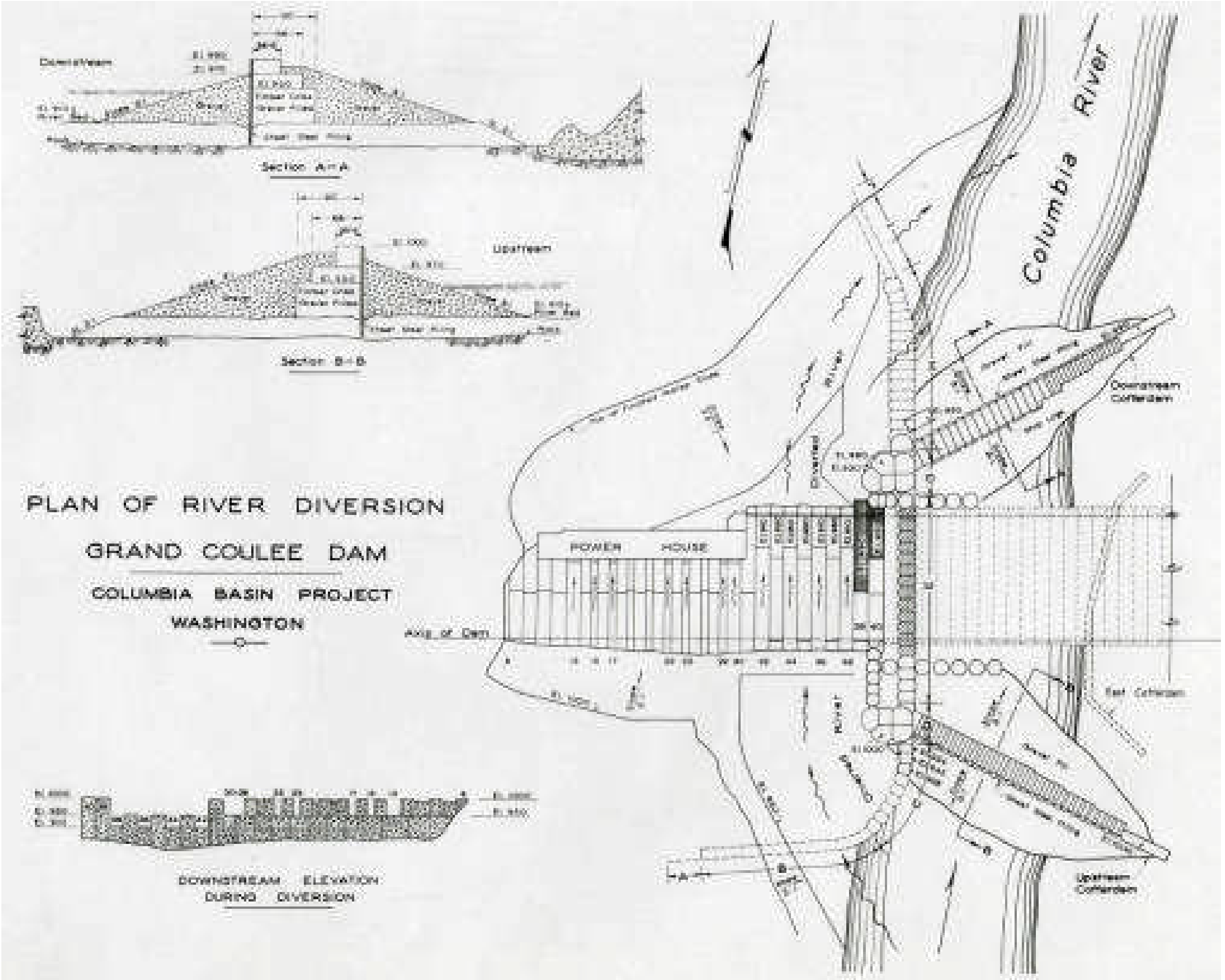
**<u>Left</u>: caption: "Constructing timber crib for cofferdam crossing the Columbia River. Corner of a timber crib for cross river cofferdam - 12 x 12 inch fir. 05/01/1936"**



***"…Their plan is to leave a series of 'low blocks' in the west end of the dam, over which the river will be diverted. During low water, which means in the winter, these openings will gradually be closed and poured, and the dam 'fingered up' to its requisite height…"***

***Popular Science,*** **February 1936**

**<u>Left</u>: caption: "Inside the west cofferdam were built the base of the west powerhouse and part of the spillway section of the dam, with low gaps through which the river was later diverted"**

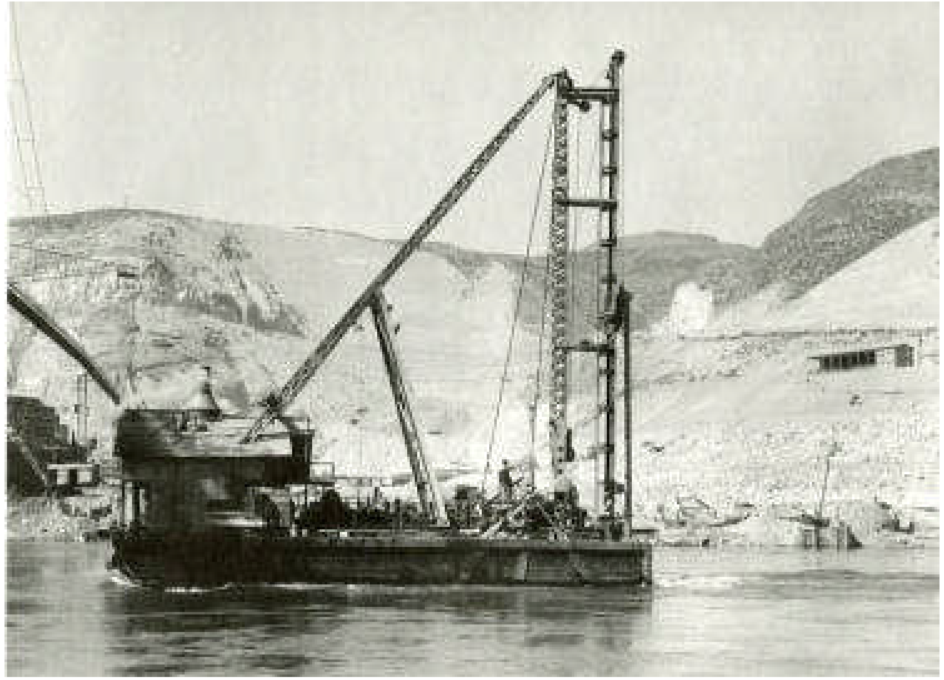


Section A-A
Upstream
Section B-B
PLAN OF RIVER DIVERSION
GRAND COULEE DAM
COLUMBIA BASIN PROJECT
WASHINGTON
POWER HOUSE
Axis of Dam
Columbia River
Diverted River
River Diverted
Downstream Cofferdam
Upstream Cofferdam
DOWNSTREAM ELEVATION DURING DIVERSION

*"…This is what will take place. When Block 40, the concrete panel directly behind the coffer-dam, 50-feet wide, 450-feet long and sloping in height exactly as the final shape of the dam will be, has been poured, the river could come behind it because the concrete will not quite reach to each of the cofferdam cell-blocks. In order to prevent this, other cells have been driven to connect the concrete with the steel. The cribbing and filler will fill in the so called 'dip' in the dam, making the Block 40 sect-ion and also Block 39, next to it, a rectangular block instead of leaving it in its final concrete shape, high at the axis and only a few feet high at the toe (or down-stream end) near bedrock…"*

***The Wenatchee Daily World,*** **January 13th 1936**

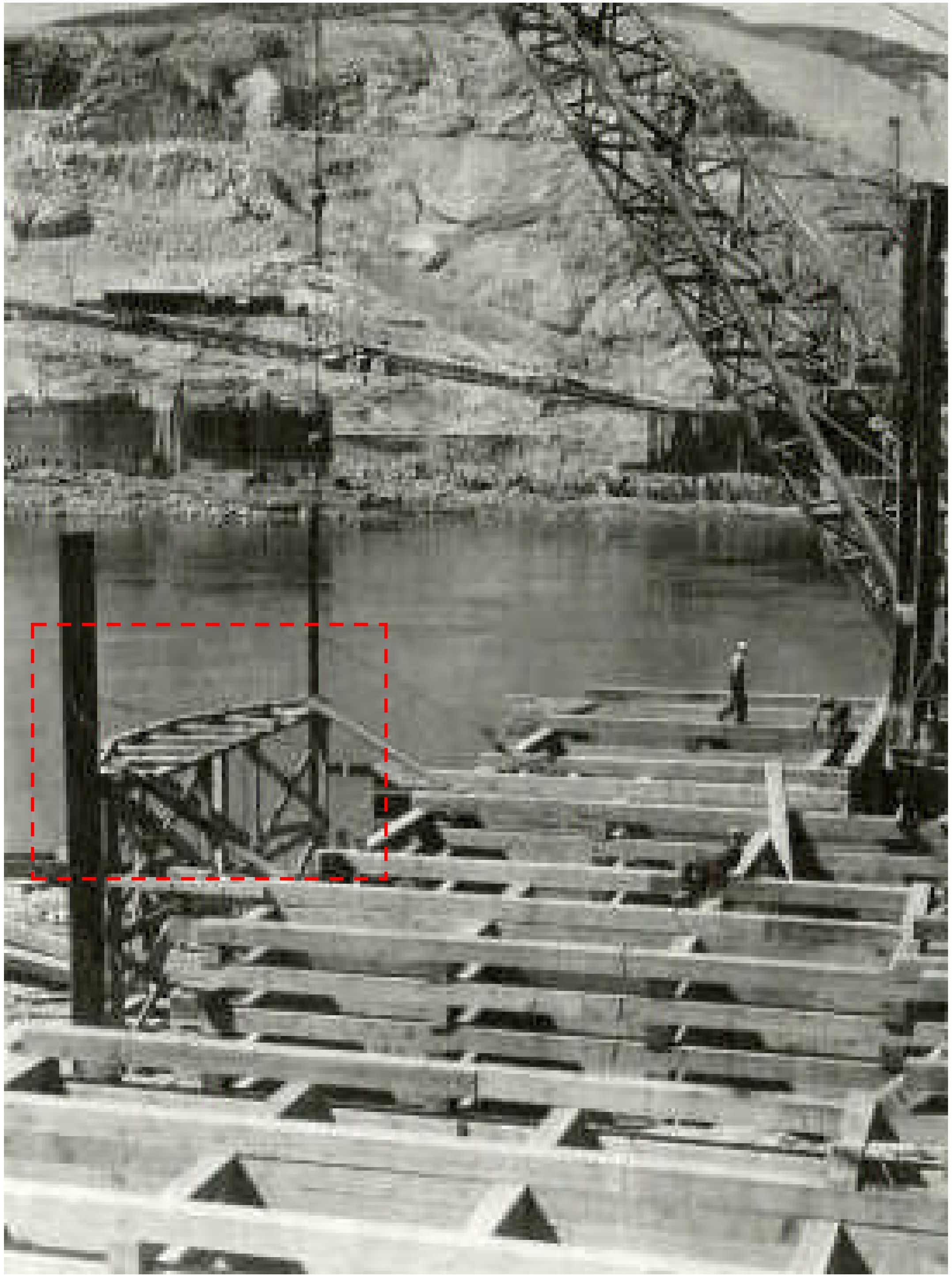
**<u>Left</u>: caption: "Partially completed spillway and energy dissip-ator at Grand Coulee Dam"**



***"…Block 40, at the river's edge, and block 39 next to it, each 50-feet wide, were built immediately inside the west cofferdam to the height specified in the foundation contract. Blocks 32, 34, 36, and 38, each 50-feet wide, were built up only to a point about 23-feet below normal low-water level, and the alt-ernate blocks 33, 35, and 37 were built only 40-feet higher. These and several other low gaps nearer the west end of the dam base were provided to pass the river water while the middle section of the dam was under construction…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**Above: caption: "Determining texture and depth of Columbia River. The sounding barge takes elevations of the river's bottom for fitting timber cofferdam cribs in river channel; 52,000 soundings taken. 07/01/1936"**



***"…The cribbing in the 'dip' is necessary because otherwise the Columbia would run back between the cross-river coffer-dam through the open space in the dip or curvature at the bottom of the spillway. The crib will be about 100-feet wide, 200-feet long and about 120 to 130-feet high. The crib will be com-posed of about two-hundred smaller cribs, 10 by 10-feet in size. Each of these smaller con-tainers will be filled with rock and sand…"***

***The Wenatchee Daily World,* January 13th 1936**

**<u>Left</u>: caption: "Building cribs for upstream cross-river cofferdam. On left is arch form for steel pile facing. 08/01/1936."**

***"Deep sea divers are among the most busy persons around the dam site these days. Divers employed by MWAK have spent more than 200 hours under water here. More than half this time has been in connection with the cross-river cofferdam. Cribs for the cof-fers have been erected to fit the contour of the river floor. After the cribs are sunk into place, divers go down to as-sure a snug fit with the bottom. Cutting of steel piling under water at  the north end of the old west shore cofferdam, and placing of dynamite to remove large rocks from the river floor are other tasks undertaken by divers…"***

***Spokane Chronicle,* Nov. 28th 1936**

**<u>Left</u>: caption: "Diver, Grand Coulee Dam construction"**

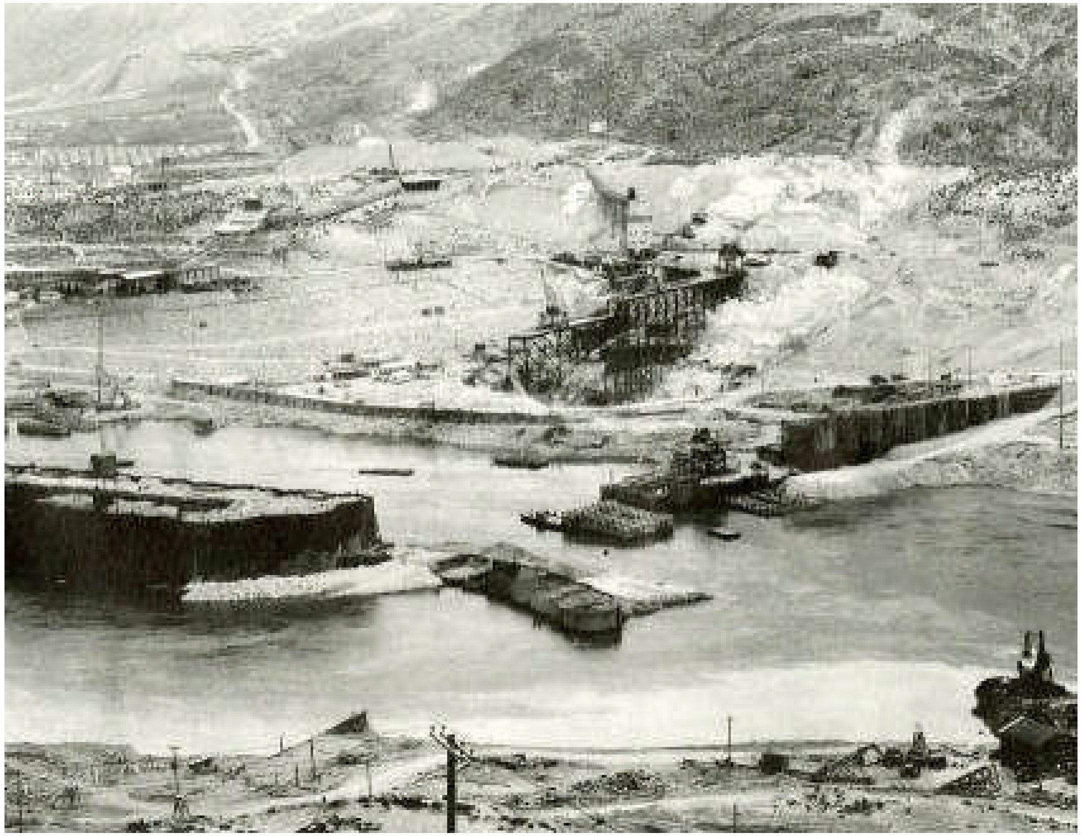
<u>Left</u>**: caption: "Shown here is C.C. Davis, diver for the MWAK Compnay, builders of the Grand Coulee dam foundation, and H.H. Miller, his tender. Davis is getting ready to go under water to retrieve a clam shell dredging bucket that was caught in the bottom of a cell of Block 40 cribbing, as it was technically described. Davis took two tries before hooking a cable on the bucket, down better than 60-feet. The diver said it is impossible to see at that depth and the water is freezing cold. Davis has been diving for MWAK for two years, and, while the work is hazard-ous, it is extremely interest-ing." (*Spokesman-Review*, Jan. 24th 1938)**

***"…'The average diver, ready to settle down in the river, will tip the scales at nearly 500 pounds,' the MWAK Columbian explained this week. 'His helmet equipment weighs 80 pounds, a lead belt, if used, weighs about as much, each shoe 25 pounds and the suit 40 pounds. Whenever he needs it, the diver has a 1,000-candlepower light encased in metal, to radiate heat. This equipment weighs more than his suit. The rays of the encased globe can cut through about 15-feet of water. Unaided, human eyes can distinguish nothing but faint shadows in the river water beyond 15-feet in depth. Shoes of the suit are six inches wide, 18 inched long, with lead soles three-fourths inches thick, and with the eyes of the shoes about three-fourths inch in diameter. The suit itself is made of five layers, three of canvas and two of rubber. The diver keeps in constant communication with the surface by a telephone line."***

***Spokane Chronicle,* November 28th 1936**

***“…The cribbing, when finished, will join with Block 40 and Block 39 in forming a rectangular face against the diverted Columbia. The Block 40 panel (which is simply a slice of the dam) will be the highest of the panels in the dam, the up-stream top reaching elevation 1005, 15-feet above the top of the present west cofferdam. Other panels reach only to about 935. The cribbing will reach elevation 990. or exactly the top of the coffer. The 2,000,000-feet of lumber used in bracing the pit in which Block 40 lays, as protection against the river pushing the coffer in, will be used to form the world’s highest crib. It’s all very complicated to the average layman – but it’s one of the most vital constructions the MWAK will have to build in its work during the next two years.”***

***The Wenatchee Daily World,*** **January 13th 1936**

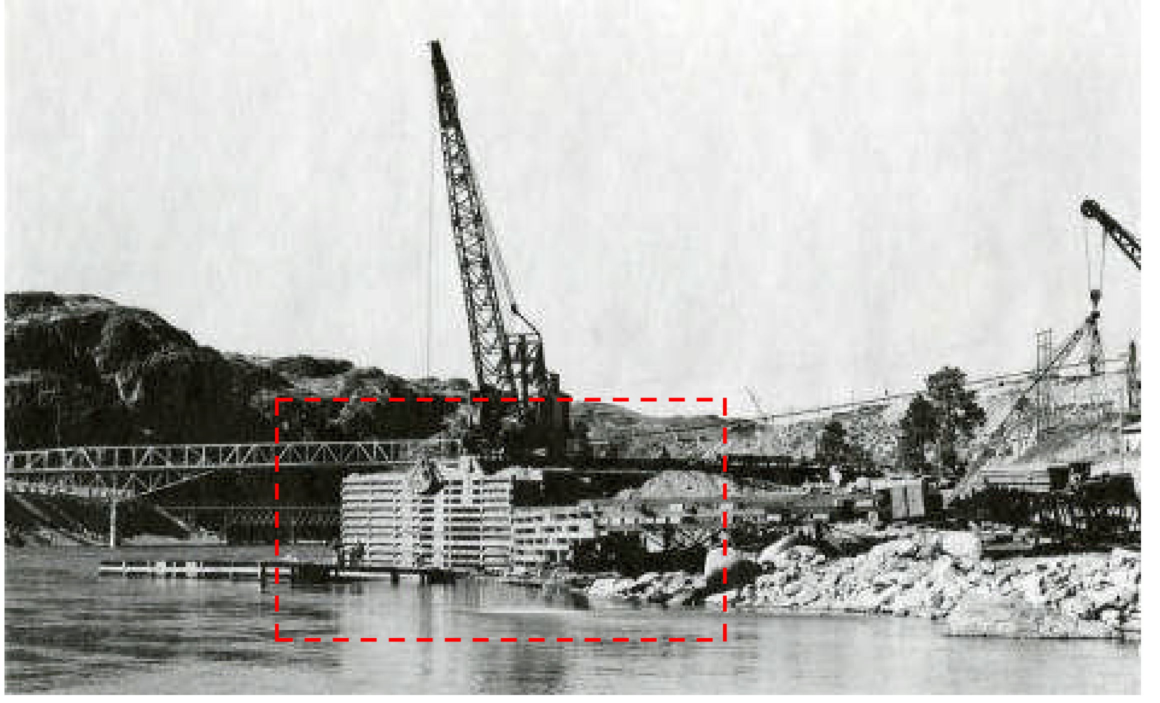


***"Engineers estimate that Block 40, closest to the cofferdam, will have been poured to its contract height sometime in April. After the cross-stream cofferdams are built, the first cofferdam will be removed, and the river diverted around the excavation area over the concrete. Both ends of Block 40 will be tied in securely with the cell clusters from which the cross-stream coffers will be built…"***

***Spokesman-Review,* January 13th 1936**

**<u>Above</u>: caption: "Aerial photograph of diversion channel created by removing selected cells of the west side cofferdam at the Grand Coulee Dam. Looking down diversion channel entrance where part of section 'C' west coffer, has partly been removed. Building upstream cross-river coffer from east side to cluster 'D'; Low east timber coffer and the two concrete placing trestles across the river. 12/02/1936."**

**<u>Above</u>: caption: "MWAK workmen excavating bedrock to permit construction of Block 40 of the Grand Coulee dam. These men are working more than 70-feet below and within 100-feet of the Columbia river. At the south end of the shaft bedrock has been excavated more than 115-feet below the river level. At the north end deep rock excavation has been done in order to pour the 'bucket' or downstream toe of the Grand Coulee dam. It is expected that considerable concrete will be poured on this bedrock within the next month or six weeks." (*Spokesman-Review*, January 19th 1936)**



***"The start of another major undertaking – the building of the world's highest crib, which will help divert the river – is scheduled on the MWAK books for early next week. The huge timber crib, which will need 3,000,000-feet of heavy timbers and braces, built in cells 10-feet square, on top of Block 40 and the adjacent block inshore, No. 39, will serve the purpose of preventing the water turned inside the west cofferdam during the diversion period from backing up behind the completed panel, Block 40. The crib will be about 130-feet high, 100-feet wide and about 500-feet long. The massive network of small cells, each filled with gravel and sand, will be one of the heaviest timber-bracing jobs ever attempted. About 17,000 cubic yards have been poured in Block 40…"***

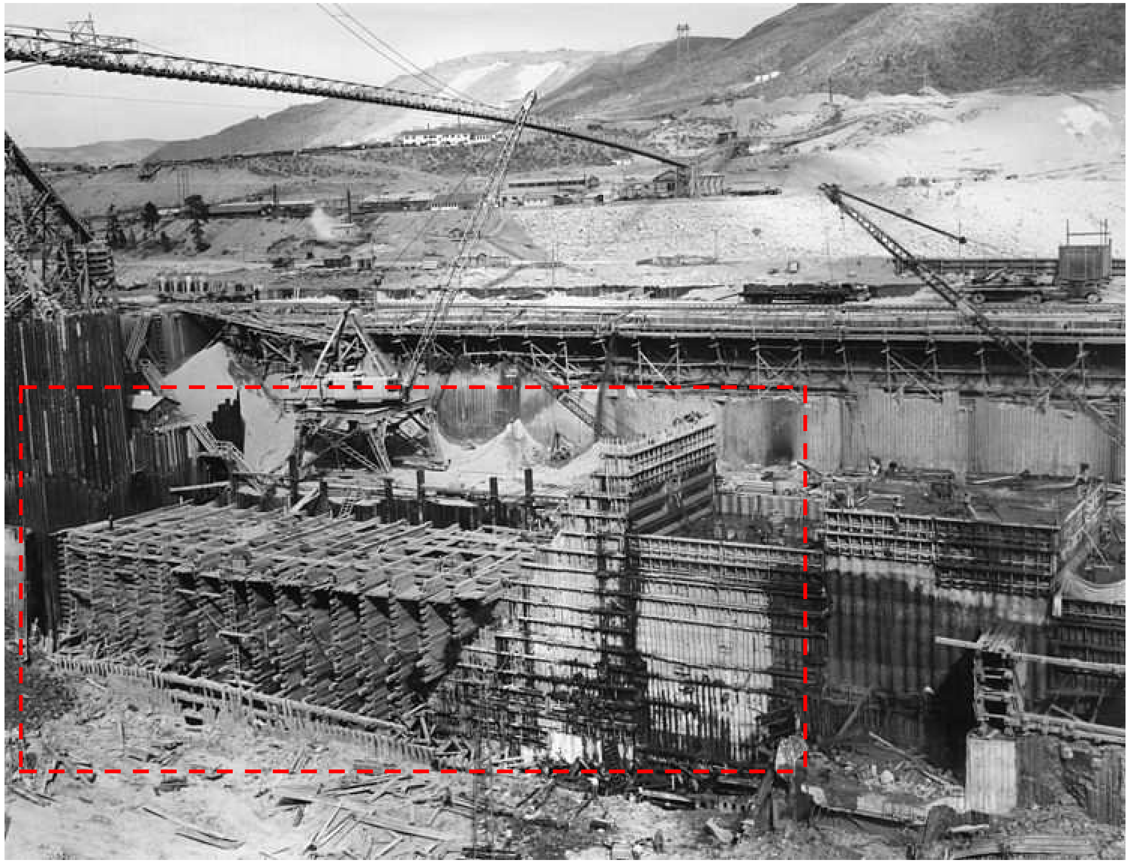
***The Wenatchee Daily World,* February 14th 1936**

**<u>Above</u>: caption: "Shore-end of timber cribs in downstream cross-river coffer-dam. 08/28/1936."**

# Mighty Block 40

***“A trickle from the river of concrete flowing daily at Grand Coulee dam site will be turned into forms inside Block 40 soon, probably within a week, it was learned from MWAK sources today. The blocks will be located upstream from the row of new cells driven inside the main downstream coffer-dam. These are to be filled first for additional support for the cofferdam cluster which gave the company so much trouble for the last month or more…”***

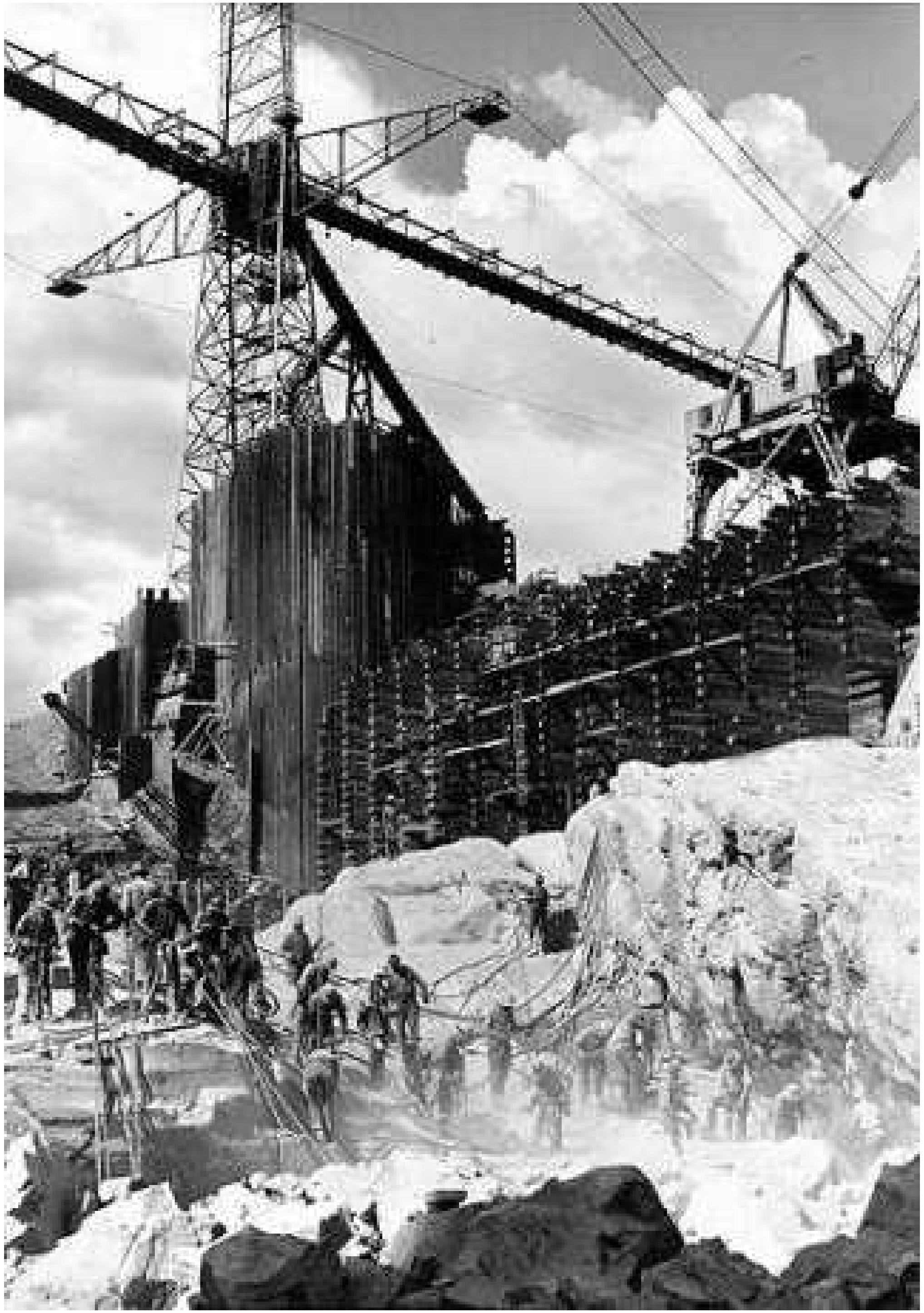
***The Wenatchee Daily World,*** **April 24th 1936**



***"…The blocks will be part of the bucket or dip in the spillway of the dam. With the new cells located over part of where the bucket will be, that portion will not be poured until next fall, when the sheet piling can be removed…"***

***Wenatchee Daily World,* April 24th 1936**

**<u>Above</u>: caption: "View of Block 40, sections E to J, showing the timber crib tie-in structure from the concrete dam to steel cofferdam cells. April 1, 1936."**



***"…Concrete pouring will be a relay-affair in that section of the dam, the company said. The large whirley-crane, located on the trestle above Block 40, will lift the four-yard bucket from the concrete trains, lower it to the bedrock floor, 125-feet below, where another crane will lift it and dump it into the forms. Next week, jackhammer crews will swarm over the bedrock near Block 40 and drill powder holes…"***

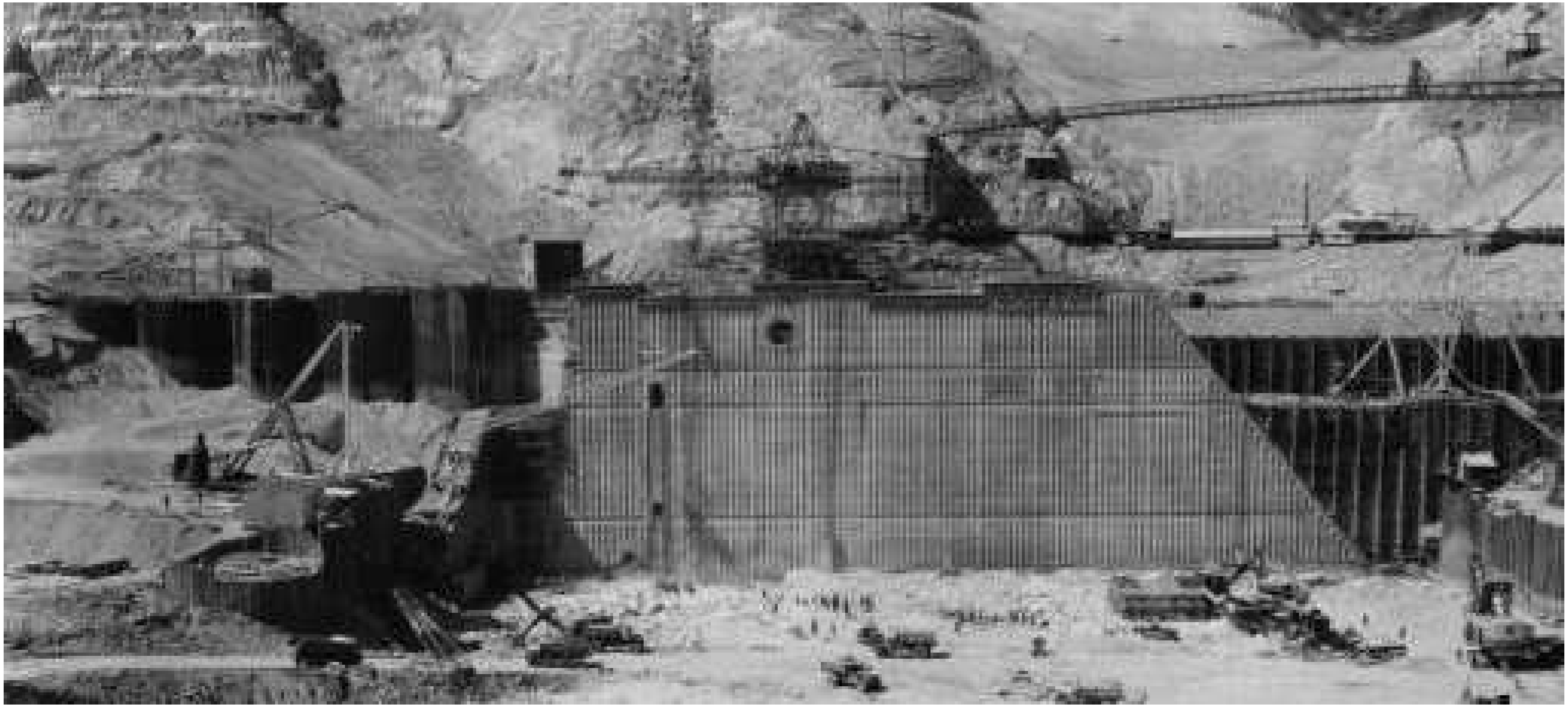
***The Wenatchee Daily World,* April 24th 1936**

**<u>Left</u>: caption: "Jackhammer crew drilling bedrock behind cofferdam, Grand Coulee Dam construction, ca. 1936"**


1887.
1400 37.

***"The sloping concrete spillway of Grand Coulee's mighty dam, over which a torrent greater than Niagara will pour some day, is visible for the first time above the massive wooden forms of Block 40, directly inside the west side cofferdam. The concrete slope and several sections further inward in the highest panel have appeared during the last few days. MWAK is pouring concrete rapidly at this point as it must serve as the support for the cofferdam during the summer high water. The visible portion of Block 40 gives visitors the first tangible idea of how the foundations for the dam will look when completed…"***

***Harrison Searchlight,* May 3rd 1936**



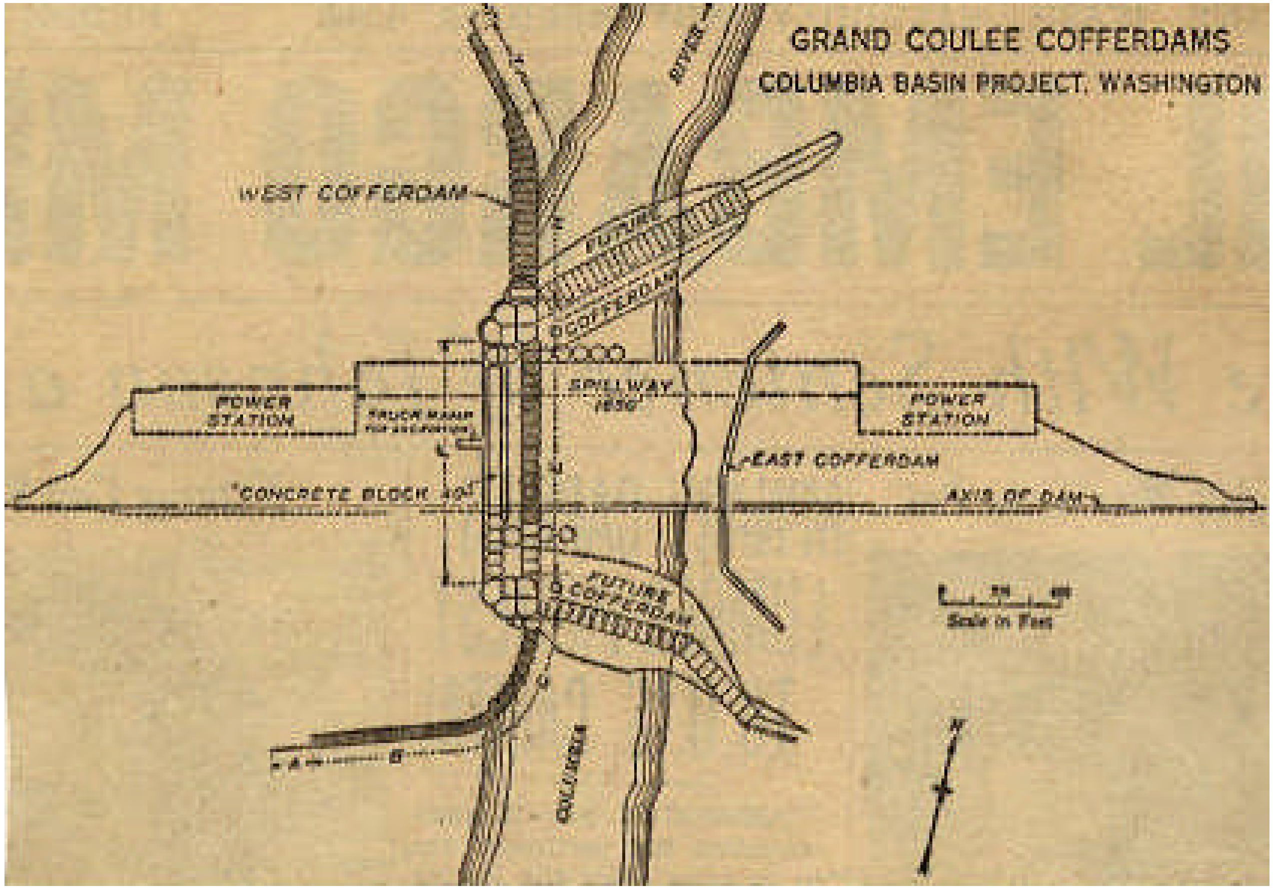
*"Mighty Block 40 of the west side concrete zone – the largest panel of concrete in the foundation dam – this week has reared its head above the high west coffer-dam. The mass, towering toward what will ultimately be the crest of the high dam, is plainly visible above the top parts of the steel sheet-piling. The concrete is to be brought up to elevation 1010, which is about 15-feet higher than the top of the bulwark. Pouring in the blocks is moving along so fast that the end of contract specifications will soon be reached. Block 39, next to Block 40, is also mush-rooming rapidly toward its peak…"*

***The Wenatchee Daily World,*** **October 21st 1936**

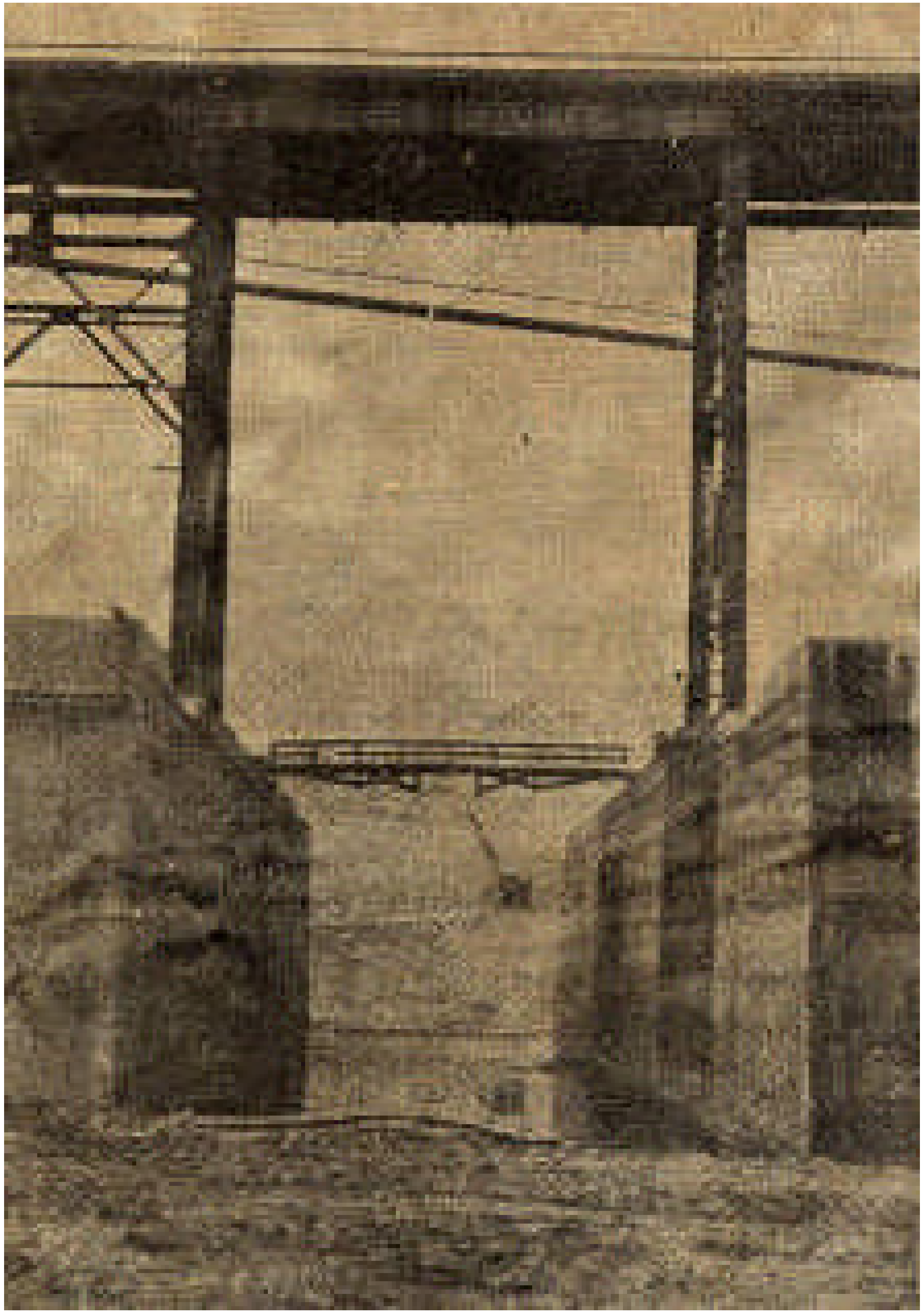


**<u>Above</u>: caption: "Block 40"**

# Diversion




**<u>Above</u>: caption: “Many have asked but few have answered the question of how the MWAK Company is going to control the mighty Columbia river when the time comes to put in the center section of the Grand Coulee high dam foundation. In a recent issue of the Reclamation Era, official publication of the Reclamation Bureau. Bureau engineers have shown by drawings just how it will be done. Shown in the drawing are the west and east cofferdams, already constructed, and behind which work is being carried on toward the pouring of concrete. Pouring of the west shore foundation will start shortly with pouring of the east shore foundation after low water sets in next year. While the pouring of the east shore foundation is going forward two more cofferdams (marked future cofferdams in the drawing) will be constructed across the river, forcing the Columbia to change its course through and over the west shore foundation. The broken line cross-section of the dam shows the location of the power stations on either side of the river, when the project is completed.” (*Spokane Chronicle*, November 23rd 1935)**



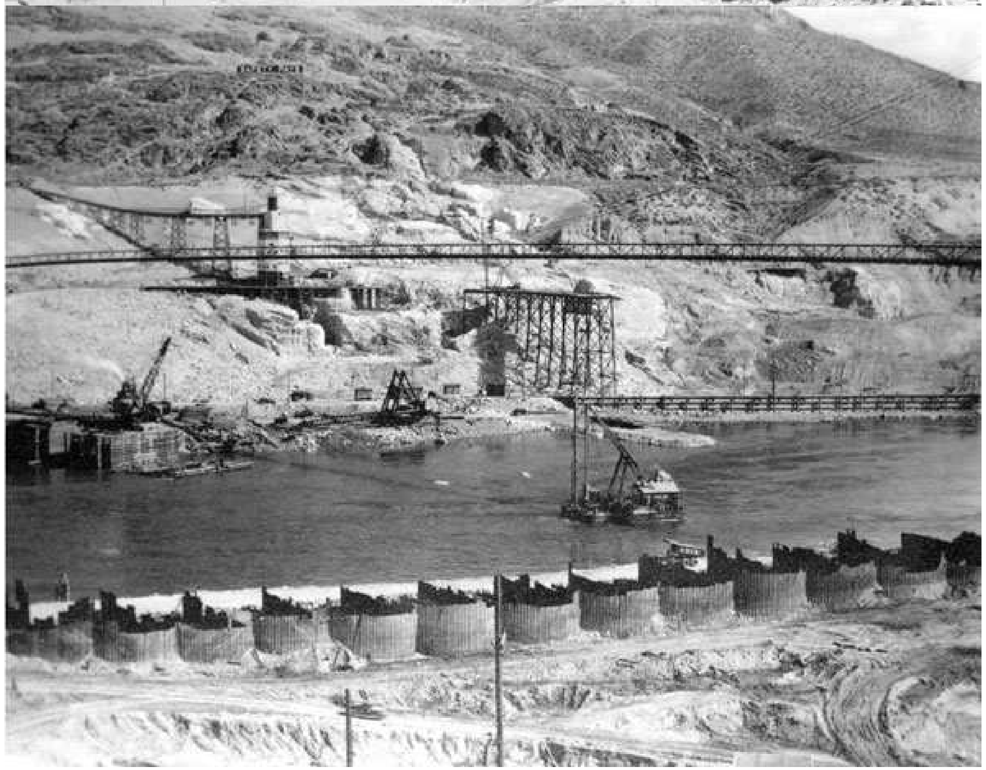
<u>Left</u>: caption: "The climax of more than two years detailed planning and arduous labor on the part of the Reclamation Bureau and the MWAK Company came at 4:10 Thursday afternoon when the first trickle of Columbia river water, shown emerging from the three-foot steel pipes, 'detoured' from the river's original course and started to fill the new 1,800-foot diversion channel behind the west shore cofferdam. The photo shows where water will back up in the openings between the concrete blocks of the west side dam foundations. Before tonight the first flow of water over the low portions of the dam will have started, and the engineers will be ready to tow out the immense timber cribs which have been built in the excavated area above the dam and behind the cofferdam. These sections, anchored and sunk in the main channel, will be units in the diversion dam which will eventually send the whole flow of the Columbia roaring over the low dam foundations while workmen build the center section of the dam itself." (*Spokane Chronicle*, June 11th 1936)

***“The gigantic west shore cofferdam – largest of its kind in the world – will soon be a thing of the past. The end wings of the structure, those portions reaching back into the mountain-side, are fast being removed, as the MWAK Company pushes its activities at that point in preparation for diversion of the Columbia from its present bed. These wings must be re-moved so that the river will flow through the diversion channel and the partially completed west end abutment of the dam. Back of the cofferdam large excavators are busily en-gaged in digging the diversion channel. On one end, feeders are sending dirt out over the big mile-long belt conveyor, while trucks are ‘mucking out’ at the other end.”***

***Kittitas County Leader,*** **June 28th 1936**

***"Interest in Grand Coulee construction was at a new peak today, with officials of the MWAK Company awaiting Reclamation Bureau approval of their orderly and well-designed plans for diversion of the mighty Columbia river during the pouring of the center section of the dam foundation. Engineers throughout the United States have marveled at the cunning with which the MWAK Company has approached control of the Columbia during construction activities…"***

***Spokane Chronicle,* June 30th 1936**



***"An amazing view of the handiwork of man was seen by delegates to the National Reclamation association convention who visited Grand Coulee dam Sunday. Their visit came during one of the most interesting processes of the dam construction – diversion of the waters of the mighty Columbia from the natural channel to the new course devised to enable engineers to build a gigantic block of concrete on the riverbed…"***

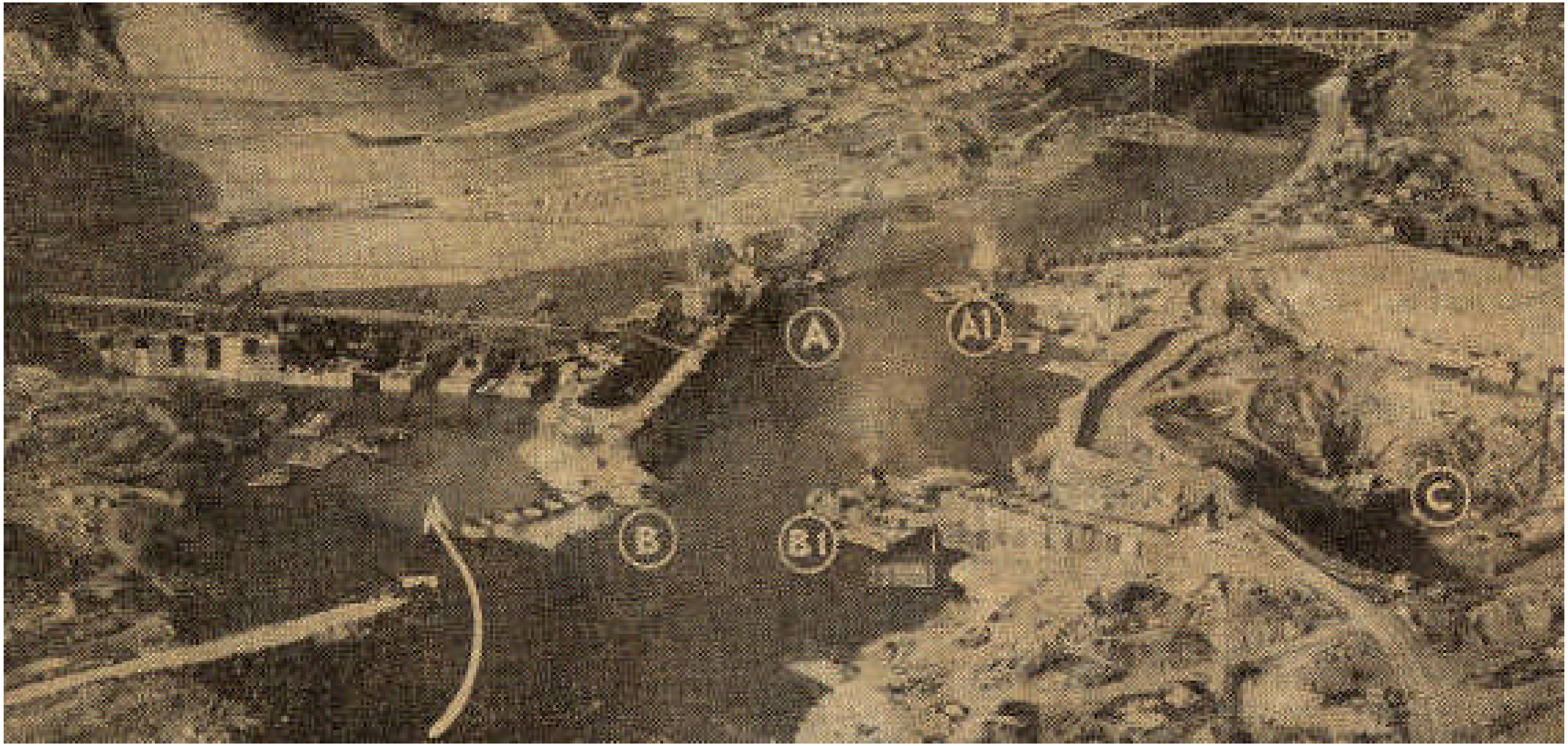
***Spokane Chronicle,* June 1936**

**<u>Top</u>: caption: "West side high and low crane trestles with cantilever cranes at Grand Coulee Dam (July 1936)"**

**<u>Bottom</u>: caption: "Cross river spoils conveyor going to Rattlesnake Canyon center with west mix plant behind. Low Wakefield cofferdam on east side in foreground at Grand Coulee Dam (August 1936)"**

***“…However, the real test of engineering skill is yet to come, in the opinion of the engineers. Pouring of concrete on the east shore of the river is scheduled to start in early fall. At present the river has receded so the entire east shore earth cofferdam is out of water. Eight floating pumps are being installed to pump out the cofferdam. Pumping will start as soon as the river has receded two or three feet more, it is reported…After the east shore cofferdam has been pumped dry, it will be necessary to remove several hundred thousand additional yards of earth and rock before pouring of concrete can be started.”***

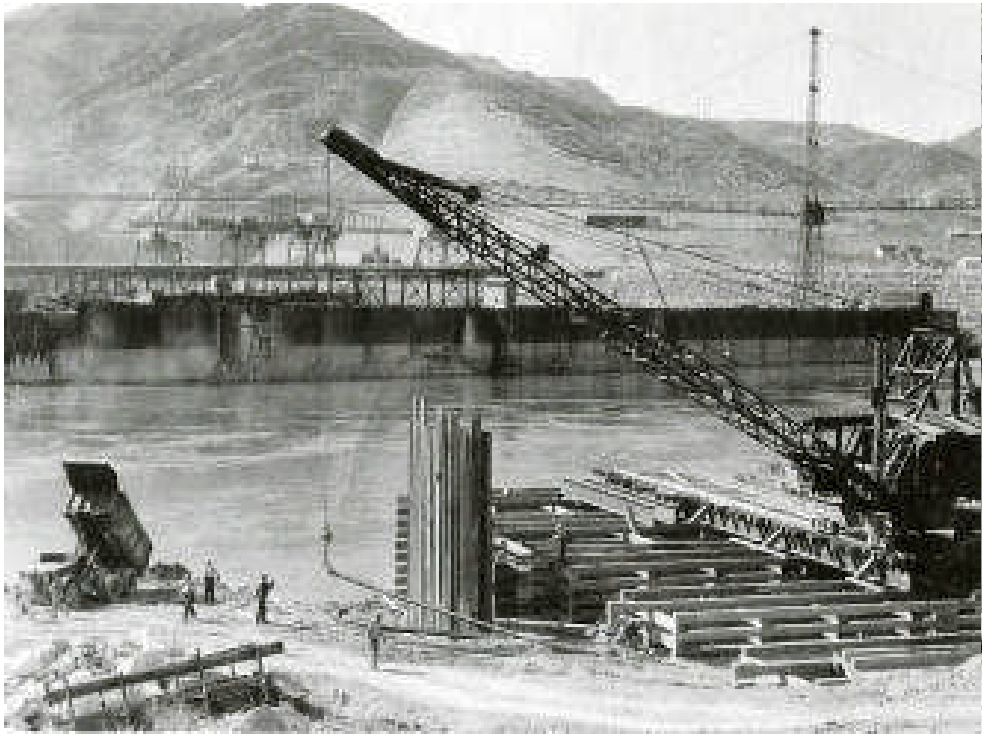
***Spokane Chronicle,* June 30th 1936**




**<u>Above</u>: caption: "The picture shows what the reclamation association delegates saw during their Sunday visit. The aerial picture was taken Saturday, looking downstream. It is the first taken since the diversion was started. The arrow indicates the new course of the river, through openings in the dam foundation. The letters A, A-1, B and B-1 indicate where coffer dams are being constructed across the river channel. Between these coffer dams, the engineers will build the dam proper. The east shore cofferdam is shown on the right, holding the river out from the area marked C, where concrete for the east abutment will soon be poured." (*Spokane Chronicle*, June 1936)**

*“Coordination of equipment for the removal of earth where water will flow in and out of the west excavation area during the diversion period, was begun this morning by MWAK, as the first step in the preparations for the cross-stream and diversion work. Several hundred thousand yards of material will have to be moved, although it will be fall before the water is turned through its new and temporary channel. However, engineers said, the company can remove virtually all of the earth and clay back of the ‘wings’ of the cofferdam, to be in readiness for the diversion. Then, when the cross-stream cofferdams are completed all that will be necessary will be the extraction of the steel pilings driven more than a year ago, to permit the water to flow over the low blocks of concrete…”*

***Spokesman-Review,*** **June 30th 1936**



**Top Left: caption: “East end of upstream cross-river cofferdam for diverting the Columbia River - one arch of steel piling in place. Across river is main sections of west cofferdam. 08/01/1936.”**
**Top Right: caption: “South end of completed west cofferdam being removed by sluicing fill through holes out in the steel walls. West-mix in the distance. 08/08/1936.”**
**Left: caption: “West side cofferdam with fill material partially removed in preparation for river diversion through east side. Cells in section ‘E’ of west cofferdam with filling partly removed - looking downstream. 08/28/1936.”**

***"…The work will start first on the downstream end of the cofferdam, and later shift to the upstream end. A small feeder has been moved from the east side of the river to start the dirt on the conveyor belt. A large electric shovel was being moved into position and another dragline being shifted for the new operations…"***

***Spokesman-Review,* June 30$^{th}$ 1936**

# Step-by-Step

***"…Step by step – and they are large steps – the MWAK Company is coming closer and closer to the time, looked forward to by many when the first part of the Columbia river will be diverted over the west bank…"***

***The Wenatchee Daily World,* September 11th 1936**

***"…The process of diversion is in itself a job of 70 some units of work, as shown by the MWAK schedule of operations, laid-out on a blueprint. However, the present work is confined, in the main, to the following steps:***

***1. Building up of the concrete to a point where the higher block in the diversion-channel area will be high enough to permit continued construction after the water starts flowing through the alternate low blocks. MWAK is concentrating its entire concrete-pouring crew in the river-zone.***

***2. Excavation of the earth inside of and above the former upstream wing of the west coffer. This dirt must be taken out to make a channel for the river to flow through. Shovels, draglines, trucks, caterpillars, bulldozers and other machinery is doing this job, one of the most difficult of the diversion operations.***

***3. Building of more than a dozen large timber-cribs, or bins, in the above area. When the work is completed, and the channel being dug in step 2 is finished, the river will be turned into this area on its way over the west concrete, and the cribs will float. They will then be moved into the river and from there into their final place in the downstream cofferdam…"***

**continued...**

***The Wenatchee Daily World,*** **September 11th 1936**

***"…continued:***

***4. Excavation of the earth inside of and below the former downstream wing of the west coffer. A conveyor belt is carrying away the material inside the coffer and trucks the outer-earth. This area will form the channel to permit the river to re-enter its regular course.***

***5. Construction of the east-shore ends of both the downstream and upstream cross-river coffers. In crib-like formation, the shore ends of the cribs are moving step by step farther into the river. An army of carpenters aided by cranes, derricks, whirleys, trucks and other mechanical devices are pushing this work to its maximum speed.***

***6. Dredging of the river-bottom on the west bank for the west-end of the cross-river downstream cofferdam. The company is removing as much of the gravel river-floor as possible so as to provide a strong base on which to place the coffer cribs…"***

***continued…***

***The Wenatchee Daily World,*** **September 11th 1936**

***"…continued:***

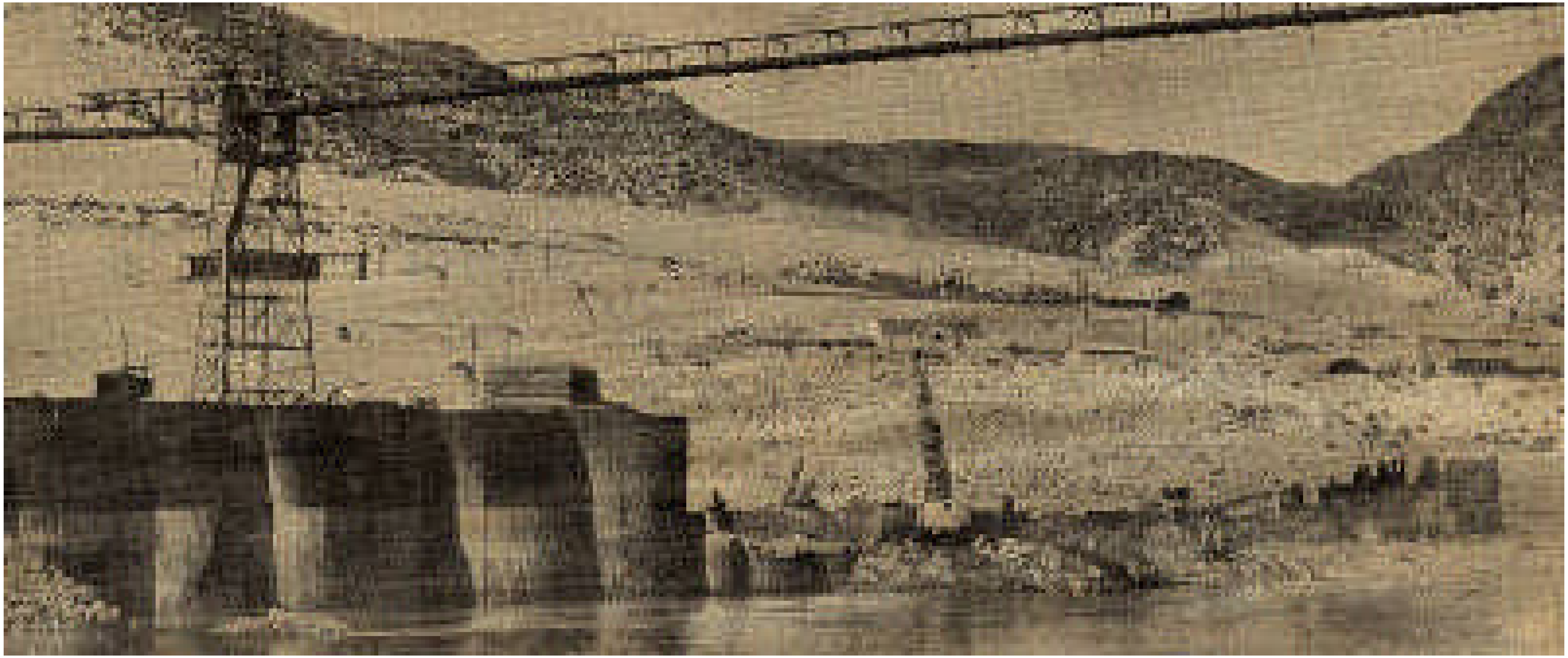
***7. Sounding of the river bottom to determine the exact contour. From a large barge, fastened to cables stretched from shore to shore, the company has taken 20,000 soundings for the downstream coffer. Each crib is to be built to conform to the shape of the river floor. The barge has finished its downstream work, except for a small part of the river near the west bank now being dredged. The barge and accompanying engineers began this week sounding for the upstream bulwark.***

***These are the main phases now in operation. Of course there are a hundred or more smaller jobs taking place daily in addition to the main seven points of interest."***

***The Wenatchee Daily World,* September 11th 1936**

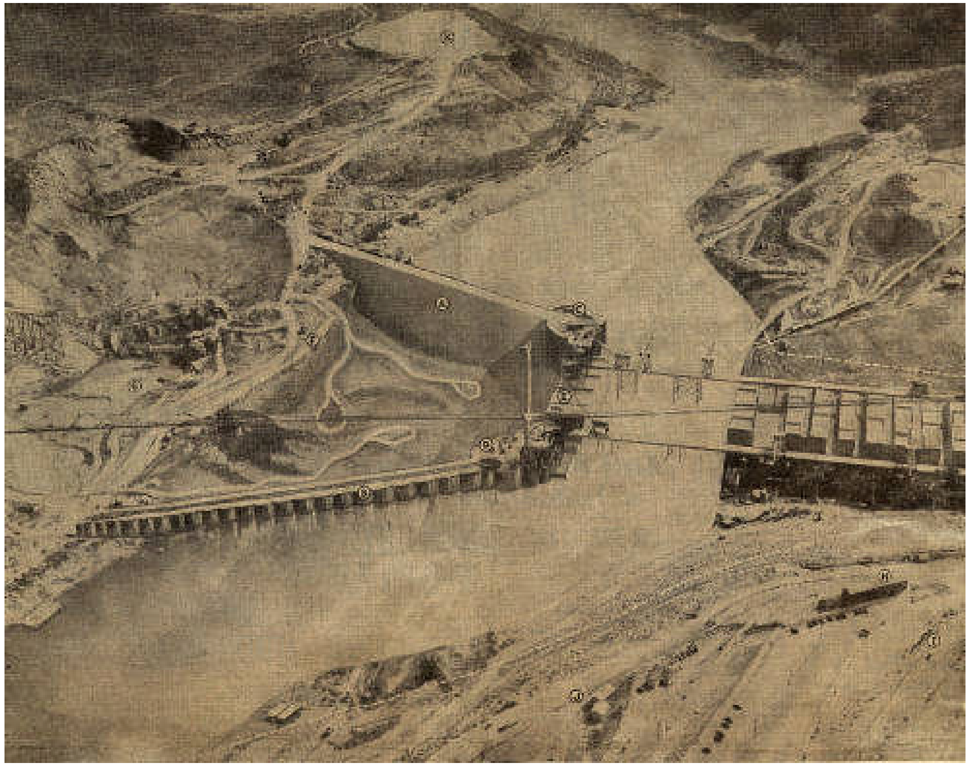
***"…A check of the flow of the Columbia river was made by the U.S. Coast and Geodetic Survey last week. The measuring of the flow is handled from a cart which travels over a shore-to-shore cable. The depth of the bottom of the stream is measured at various intervals to give engineers a cross section. Then a fan-like device is lowered to measure the speed of the stream. Ear-phones are attached to the device, and each time a fin turns it makes a clicking sound in the ear-phones which reveals how fast the river is turning the wheels…"***

***The Wenatchee Daily World*, June 3rd 1937**



<u>Above</u>: caption: "'Make way for the Columbia!' That is what MWAK workmen are doing in west shore operations at the Grand Coulee dam project, where, within six or eight weeks, the mighty Columbia will be diverted about 200-feet from its original channel. In the right portion of the picture, destruction appears to have struck the steel cofferdam. However, such is not the case as the cofferdam is being removed at this point to make a passageway for the river after it flows over the west shore concrete dam foundation. The height at which the Columbia will travel through its new channel is shown by the high water line on the cluster of steel cofferdam in the left of the photograph. The high water line is about 50-feet above the present low water level. The downstream face of the diversion 'crib dam' will tie into the steel cofferdam at the extreme left end where the tall sheet pilings still are standing." (*Spokane Chronicle*, September 23rd 1936)

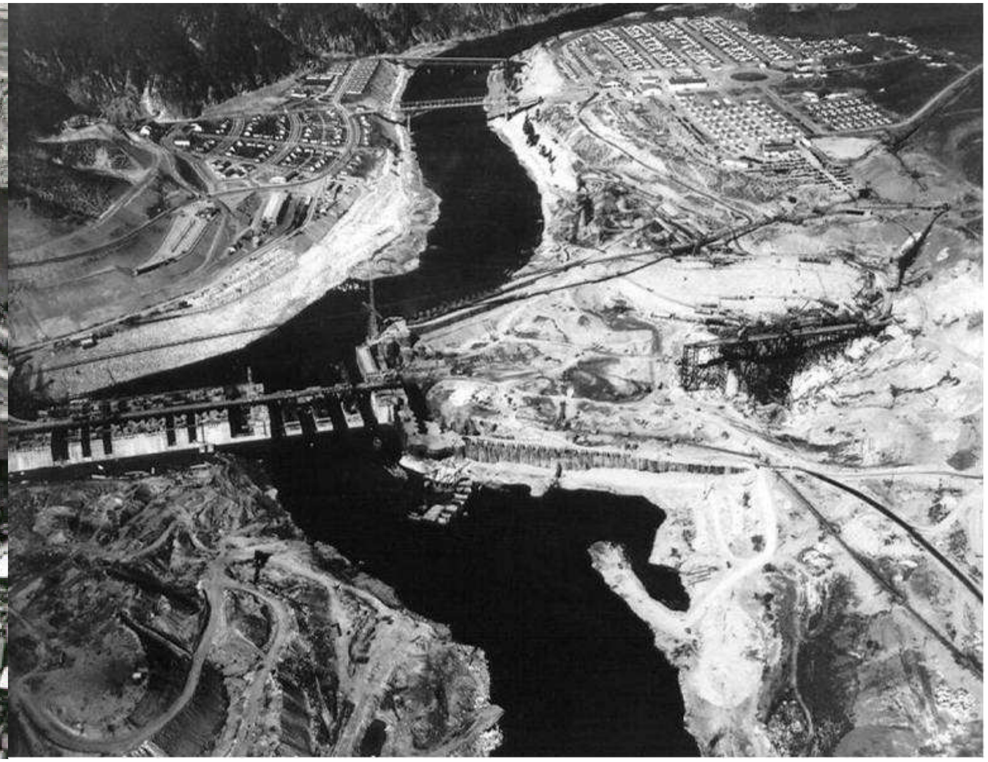
***"…Excavation of the overburden, or clay, will be completed about the end of April; the rock excavation the end of next June. Work will start then on the placing of concrete…"***
***Spokesman Review*, October 21st 1936**



***"…In preparation for the day when a strong current will flow through the west side, MWAK superintendents are directing dumping of rip-rap on the extreme downstream point of the new diversion channel. The heavy granite being dumped on the slope will prevent the Columbia from gnawing part of it away…"***

***The Wenatchee Daily World,* October 21st 1936**

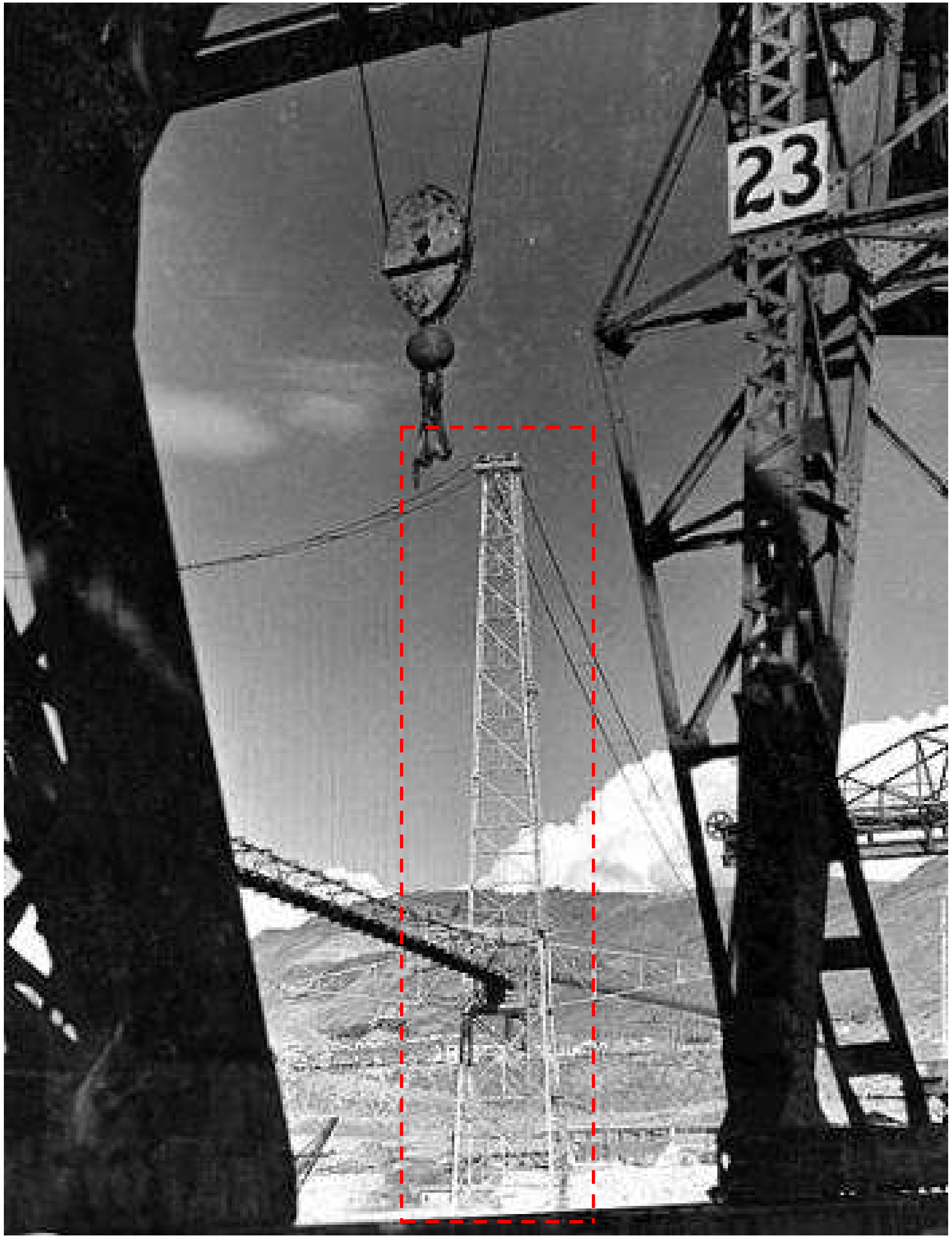
**<u>Left</u>: caption: "How Grand Coulee will look after the diversion of the Columbia to the new channel" (*Spokane Chronicle*, 10/6/1936)**



**Top Left: caption: “You can see how the cofferdam clears a portion of the riverbed for excavation”**

**Top Right: caption: “The east-side cofferdam after the west base was complete”**

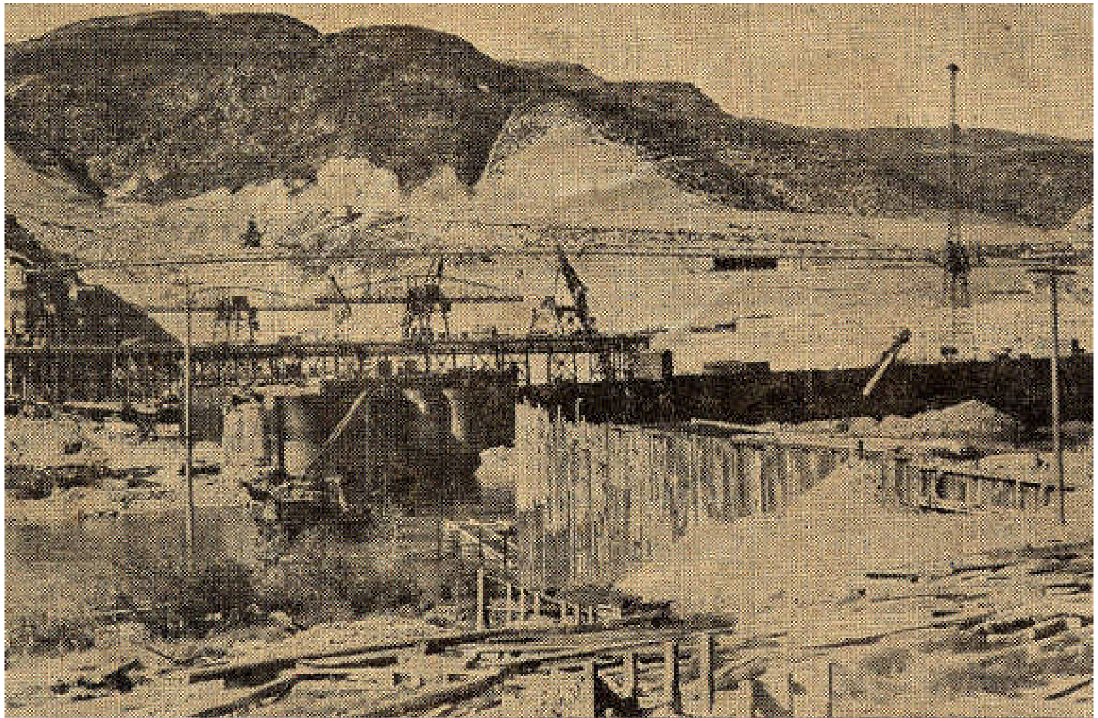
**Left: caption: “East side cofferdam on left with diversion channel center and Grand Coulee Dam foundation taking shape center”**

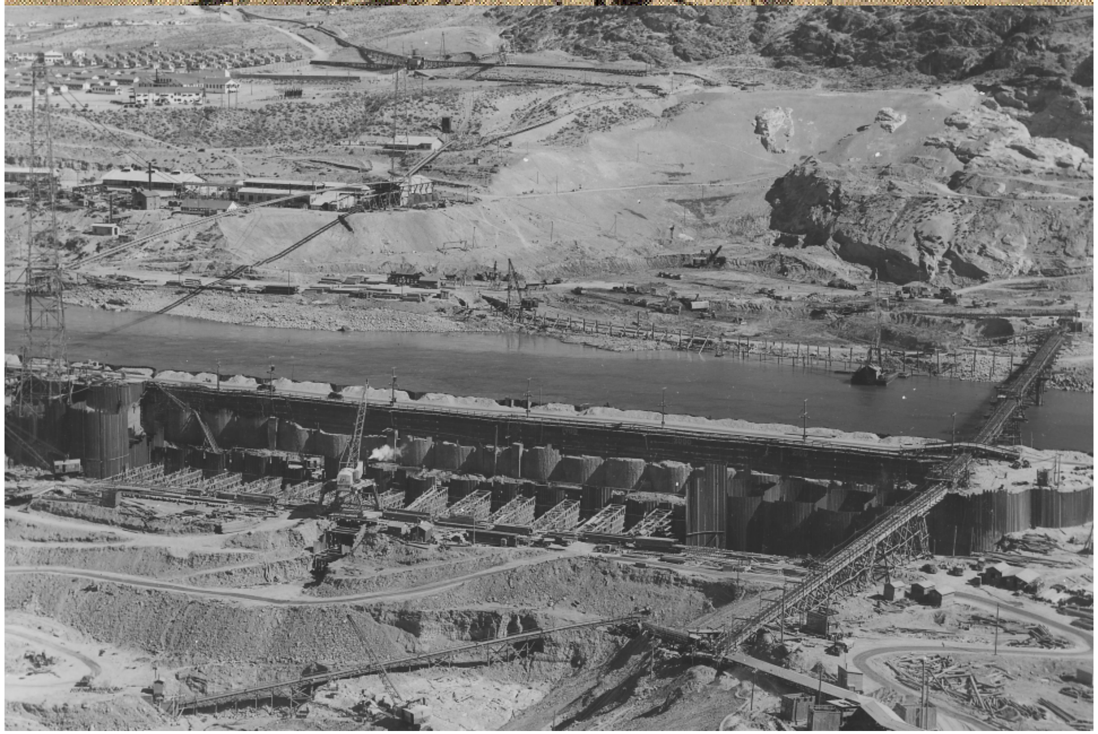



***"…Pumping out of the center section, after the two cofferdams and their fills are completed, will take place about March, it was said. Immediately after the de-watering of the pit, excavation will be started. The contractors expect to have the mammoth conveyor belt, used on the west side up to now and for the next few weeks on the east side by the end of December. It will handle all of the overburden from the center section, as well as some of the common excavation from the east side. Dismantling of the belt has started, although it has not taken out all of the dirt that is being removed for the diversion cha-nnel on the west side…"***

***Spokesman-Review,*** **October 21st 1936**

**<u>Left</u>: caption: "Central tower of the suspension bridge of the sand and gravel conveyor"**





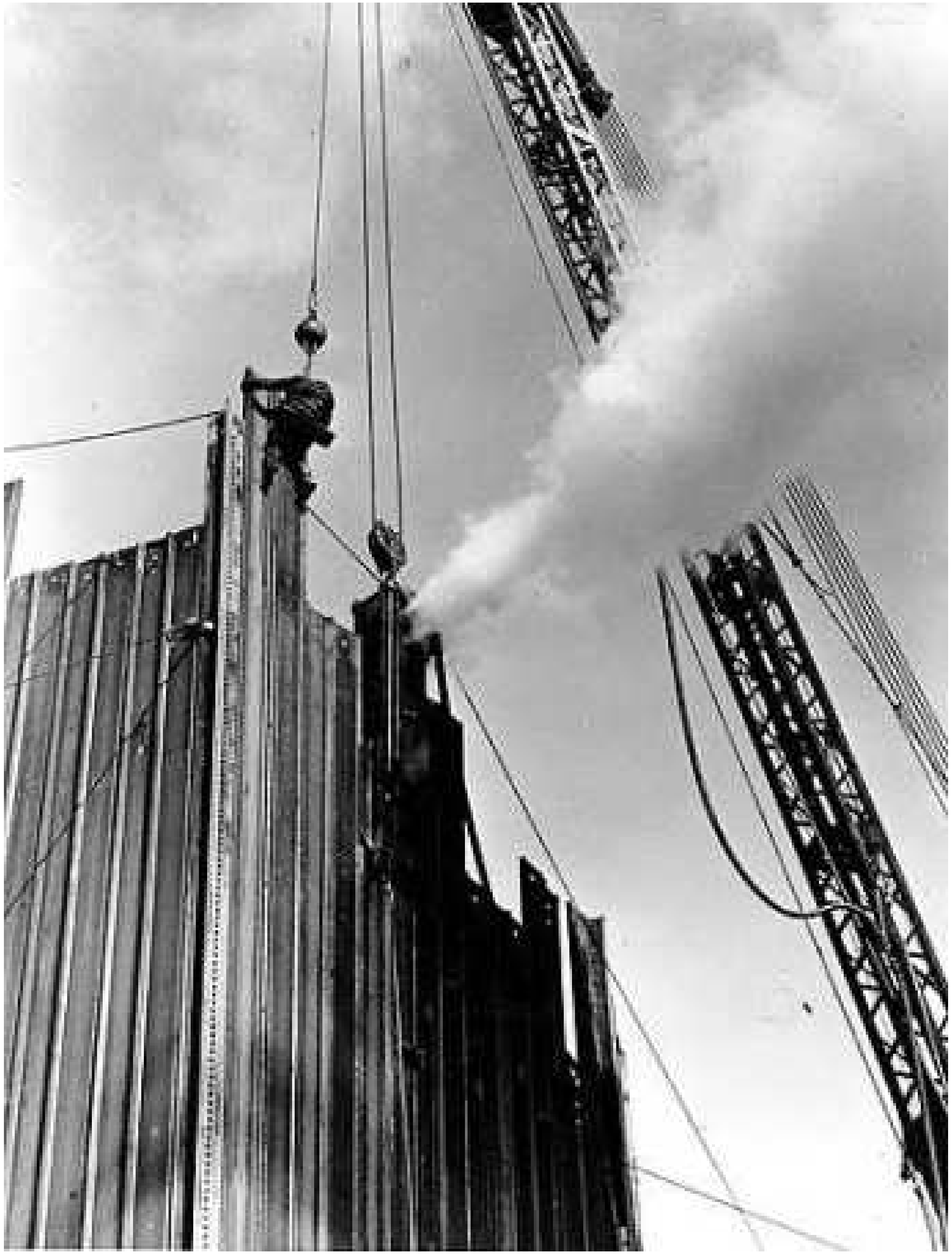
**<u>Top</u>: Caption; "Slowly, but definitely, the Grand Coulee diversion dam is being driven into the Columbia toward a connection with the west shore steel cofferdam for diversion of the river. The wall-like structure in the right foreground of the photograph is a part of the up-stream face of the diversion dam, which is faced with steel piling. The dam is a 'crib' structure. Behind the steel cofferdam across the river can be seen the huge cranes, carrying concrete to be poured into the foundation below (October 1936)."**

**<u>Bottom</u>: caption: "Grand Coulee behind section 'E' of the West Cofferdam – the first concrete in the Grand Coulee Dam, 'Block 40,' will be placed between the two cell-clusters in the area occupied by the timber struts shown** 
**in the photograph"**

***"…Although prophecies regarding the date of the actual starting of the diversion of the river are virtually 'outlawed,' because previous dates have not panned out, it was believed today that next week would see the first water going through the draft tubes into the area back of the dam. Several tasks must be completed before the water can be turned into the temporary channel. More excavation is needed on both the upstream and downstream sides of the dam, although some of it may be done after the water has started over the concrete, by means of draglines and clamshell cranes. At one period, grouting held up the work, but all of that has been completed and the other factors are still to be completed…"***

***Spokesman Review,*** **October 30th 1936**

**Left: caption: "Jackhammers and dynamite moved a million yards of rock to make a firm, clean footing for the dam"**



***"Completion of the cross-stream cofferdams, which will divert the river, is scheduled for the end of next March, it was learned today from U.S.B.R. engineers, with the full diversion to be completed soon after that. The downstream cribs, the engineers said, would all be placed by the end of December. It is the downstream cofferdam that will make the diversion of the river, rather than the upstream barrier. The latter, it was said, will serve merely as a barrier to keep the water out of the center section, to permit excavation and concrete work. By the end of October next year, all of the concreting in the center section, where the river is now flowing, will have been completed, the engineers said…"***

***Spokesman Review,*** **October 21st 1936**

**Left: caption: "Driving steel piling"**

***"Preparations for diversion of the river will go ahead in earnest next week, it was said by engineering officials, who added that the sections of the low concrete-placing trestle between Block 40 and Block 32, would be removed next week to facilitate flow of the water through the diversion channel. Just below, the buildings housing carpenters, time offices and other headquarters were being moved to higher ground. One of the huge hammerhead cranes was moved to the high trestle, with most of the concrete pouring from the low structure completed. Excavation of the diversion channels at both sides of the dam is going on apace and the first water may be turned through the west side in a few days…"***

***Spokesman-Review,*** **October 17th 1936**

**<u>Left T&B</u>: front (top) and rear (bottom) view/s of the west bank cofferdam in-place**

***"…Then, the placing of what are known as 'stop-logs' will effect the complete shutting off of the stream. The stop-logs are huge sections of lumber, which will be laid down along the bottom of the gaps, just as an opening in a wall of a log cabin might be closed. A line of the logs will be laid across the river and a small fill made to hold them in place. Then another layer of logs will be placed, until by the time they reach elevation 950, about 40-feet above the river bottom, the entire flow of the river will have been stopped…The slowness of the gradual diversion was remarked by the engineers. Even with placing of the last of the down-stream cribs, there will still be considerable water going through the gaps left in the cofferdam, although a large amount of the flow also will be diverted at that time…"***

***Spokesman Review,* October 21st 1936**

***"Nature today took a hand in the plans of company and USBR engineers for the diversion of the river, which has been scheduled for today, and caused another delay, which engineers said would bring diversion some time next week. On the south face of the dam, on the edge of the diversion channel being dug by the contractors, a small earth movement has occurred, and MWAK was busy removing it. The slide totaled only a few thousand yards of material, but it is much easier to move it out with the channel dry than it would be by dragline and clamshell after the gates had been opened. USBR engineers said that in all probability it would be some time next week before the actual flooding of the west area would occur…"***

***Spokesman-Review,* November 5th 1936**

***“The cofferdam work in the main stream is of gigantic proportions to provide for safety, in view of the cofferdams resting on unstable slippery clay instead of bedrock. This clay formation has given the engineers more cause for study and thought perhaps than any other factor in connection with the general plans for the dam.”***

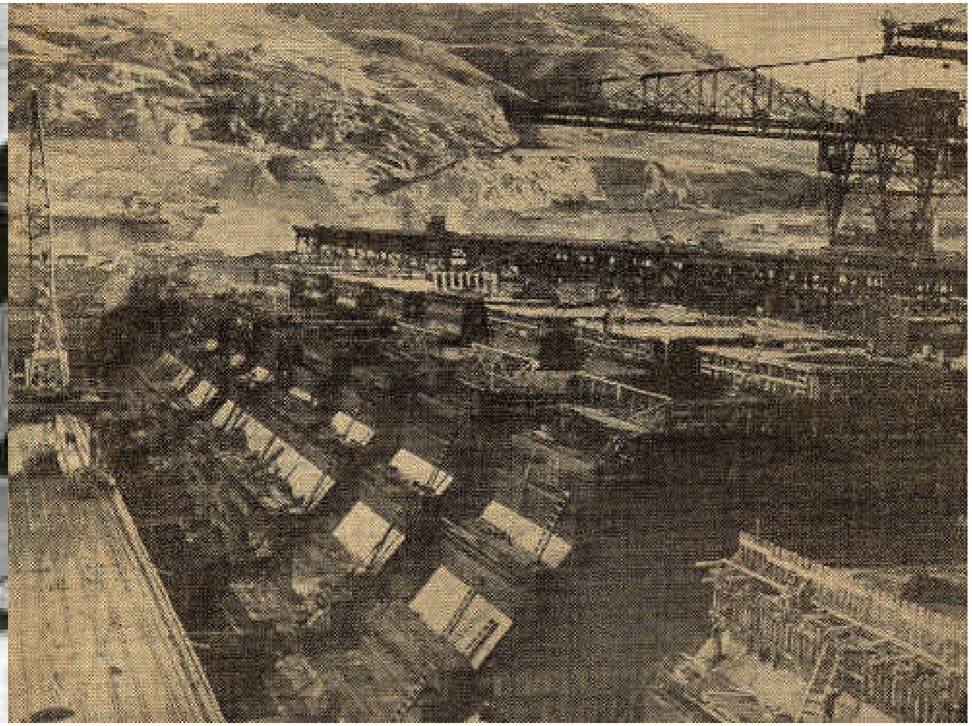
***James O’Sullivan,* Secretary - *Columbia Basin Commission* (November 1936)**

***"Amid a group of swinging booms and clustered equipment, the MWAK Company is getting ready to close the last gap in the downstream cross-river cofferdam, with the placing today of crib No. 7, with only one more, No. 8, to be placed. Wednesday, unless things are delayed by unforeseen happenings, the last crib will be carefully lowered into position, closing the gap between the cofferdam and the big steel wall that is left as the last part of the west shore coffer. The last crib is wedge-shaped, to fit between the slanting cross-stream cofferdam and the steel piling on the west side. Utmost care must be exercised to prevent the crib from breaking away and slamming into place…"***

***Spokesman-Review,*** **December 8th 1936**

***“Exposing a river-bed which has not seen the light of day since a prehistoric sun shone upon it, work of diverting the waters of the mighty Columbia River is now under way as the huge bastions of the Grand Coulee Dam rise under the toil of the swarming workmen…Diversion of the Columbia River was started several weeks ago, so as to leave the river-bed dry for excavation work for the central section of the dam. The water is pouring through four huge slots which were left in the west abutment of the dam to carry the diverted river. It is planned that by March the regular channel of the river will be dry…”***

***Seattle Post-Intelligencer,* December 8th 1936**

**<u>Left</u>: caption: “Individual cells in section ‘C’ in the west side cofferdam cut-down to elevations 954-945 prior to diversion. Shows three valve-controlled river outlets into diversion channel flooding area behind west cofferdam. 11/01/1936.”**
**<u>Right</u>: caption: “Grand Coulee dam will look about as it appears here at the completion of the foundation contract by the MWAK Company. The huge concrete mass in the immediate foreground is the west shore abutment, and will be continued on across the river. Known as a ‘gap’ picture, the photograph shows spacing between the concrete which the Columbia river will flow during the thaw next spring. Smaller gaps, not entirely visible in the photograph, permit the flow of the river at this time.” (*Spokane Chronicle*, December 30th 1936)”**

***"…Heavy cables, from surrounding barges, and from a stationary hoist set up on the east shore of the river, nearly a mile upstream, will ease the huge boxlike structure into place. The increased flow of the water, which is passing through gaps left in the cofferdam, makes the task doubly difficult. Next Monday, the company will start placing the heavy timbers, known as stop-logs, to seal up the gaps through which the water is now flowing. At the same time, the crews that have strung the cribwork across the river will start their 'return trip,' building up, on top of the cribbing already placed. A third trip across the stream will be necessary to complete the cross-stream barrier to its full height."***

***Spokesman-Review,*** **December 8th 1936**

***"In a surprise move that astounded even the government engineers, the MWAK Company announced today that they had completed the placing of the stop-logs, sealing the downstream cofferdam and turning the river off…the company set into place the last of the 35 heavy laminated timbers that closed the gaps in the cofferdam. The company originally scheduled the task of placing the logs for eight days, but completed it in little more than one. The timbers are 34-feet long, 5-feet high and 18-inches thick. They are built up of 12x18-inch timbers, heavily bolted. Thirty-five of them were required to finish the job…"***

***Spokesman-Review,*** **December 16th 1936**

***"…Late today the filling of the cells in front of and in back of the stop-logs was begun. When a small fill is made on both sides of the logs, a crane will start dredging with a clamshell, digging a small underwater trench along the line of the steel piling, on the downstream face of the downstream cofferdam. That is necessary to reach boulders underneath the piling, to make easier and more accurate driving. Driving of the piling will start shortly afterward and more filling is then scheduled, after the walls of steel are up high enough. At the same time, the company will be building up on top of the crib work until the timbers reach the 990 foot elevation…"***

***Spokesman-Review,*** **December 16th 1936**

***"…Water was admitted to the diversion channel November 5, 1936. On December 9 the last crib was placed in the downstream cross-river cofferdam, within 30 hours the openings left in it were closed with stop logs, and by December 12 the entire river was flowing through the diversion channel and through the four 50-foot channels over the low blocks 32, 34, 36, and 38…"***

***U.S. Bureau of Reclamation* (ca. 1937)**

**Above: caption: "Water was admitted to the diversion channel through it, and construction of the cross-river cofferdams started in 1936"**

**Left: caption: "Water that flowed placidly into the wide forebay became a raging torrent in the narrow diversion channels"**

***"With the roar of a cataract, water of the mighty Columbia river started today through three flood tubes in the first diversion of the stream on the project here. The diversion, which engineers expect to complete in about four months, started at 4:10 p.m. The diversion tubes carried the first flow through the gigantic west side cofferdam, which has sheltered the principal construction area since excavation started two years ago. The tubes are three feet in diameter. While the first diversion flow comprised only a dribble beside the river's total volume, it marked the start of what engineers have described as one of the greatest engineering feats ever undertaken. Except for the roar of the gushing water, there was little of the spectacular about the scene…"***

***Spokesman-Review,*** **November 6th 1936**

***"…Water started to rise slowly between the cofferdam and the concrete barrier that has risen behind it. Engineers of the MWAK Company, builder of the $70,000,000 Grand Coulee foundation dam, estimated the big lake behind the cofferdam will rise to river level within 18 to 24 hours. The diverted water then will flow behind the 120-foot high 'Block 40,' highest sector of the concrete barrier, and over lower sections of the concrete foundation. The rising water behind the cofferdam will float 11 large wooden 'cribs,' containing several million board feet of lumber. A channel will be cut for them and one by one they will be taken into the river. Engineers said they would be built larger on the opposite shore and then placed in the river to form the cross-stream barrier for complete diversion of the river."***

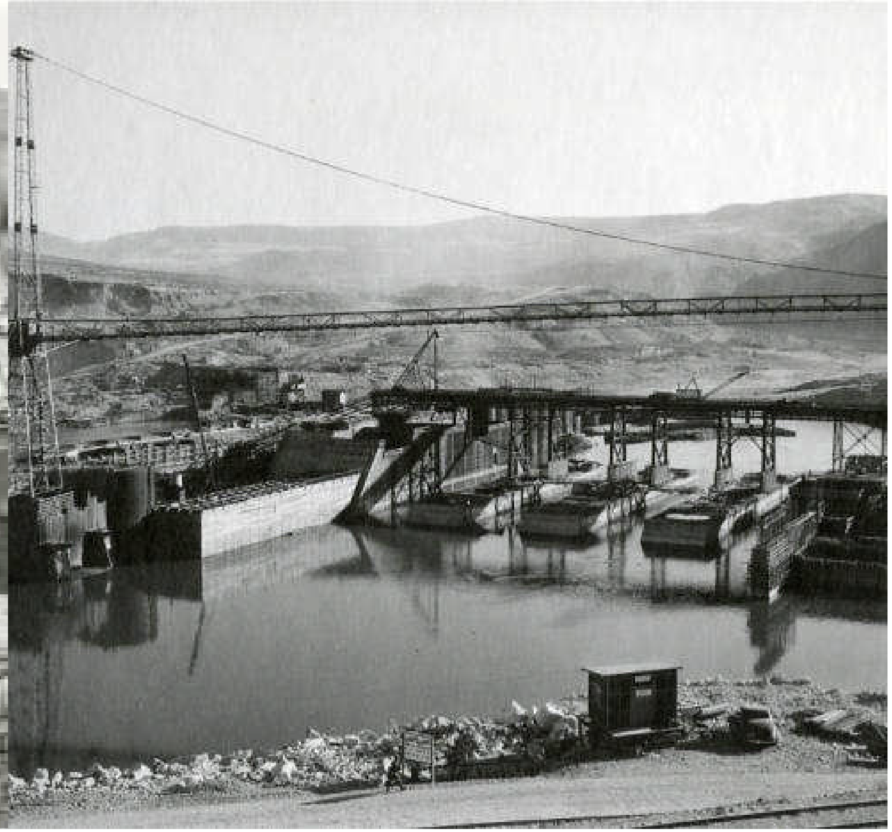
***Spokesman-Review,*** **November 6th 1936**

*“With water on three sides of the west end of the dam, the MWAK Company yesterday opened the dike across the south end of the flooded area to permit the removal of cribs that had been constructed there. The water reached river level Friday night. With the water completely covering the lowest parts of the concrete, the four ‘notches’ adjacent to Block 39, the slightly higher sections yesterday were islands, bridged on top by narrow catwalks to permit travel the length of the concrete. Later, the cribs, built before the area was flooded, will be hauled out into the stream, and lowered down to their positions in the cross-stream cofferdams. A power hoist has already been set up about a half mile upstream to handle the cribs. One of the large cribs, built on the east shore of the river, was placed yesterday on the downstream barrier. From the west cofferdam, the cross-stream dams appear a short distance away, although actually there are perhaps 240-feet separating them from the main west side cofferdam…”*

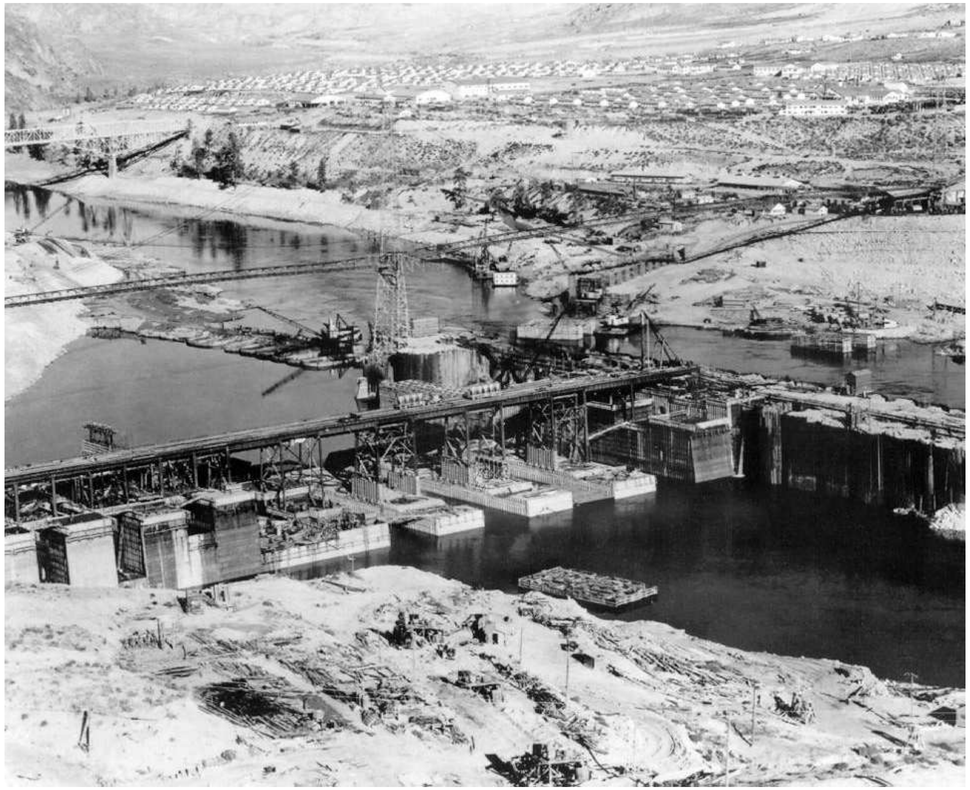
***Spokesman-Review,*** **November 9th 1936**

***"…The diversion is much more easily described now that the pit has been flooded. Only the removal of the remaining portions of the cells on the downstream wing of the coffer-dam, and the completion of the two cofferdams that are gradually pushing their way across the stream, stand be-tween the company and the complete diversion…"***

***Spokesman-Review,* November 9th 1936**



**<u>Top Left</u>: caption: “The two ends of west cofferdam removed and area west of Block 40 flooded for diversion of the Columbia River. 11/20/1936.”**
**<u>Top Right</u>: caption: “Looking south (upstream) after flooding west end of dam foundation - showing the four main diversion slots, the timber plug between Blocks 49 and 50 to cells in section ‘G’ of west cofferdam and to the right the east end of west powerhouse. Center tower of aggregate conveyor suspension bridge rests on foundation in cell 5 of cluster ‘G.’ 11/20/1936.”**



**<u>Left</u>: caption: “Photo taken November 20, 1936 of the construction area behind the west cofferdam. Sections ‘H’ and ‘I’ of the cofferdam have been removed to allow water to flow into the west side diversion channels. Eventually the west cofferdam was removed entirely and the completion of the east cofferdam forced the entire flow of the Columbia through the diversion channels. This allowed work to proceed on the rest of the dam without interrupting the flow of the river. The Contractor’s Camp (Mason City) can be seen in the background.”**

GENERAL VIEW OF CONSTRUCTION AREA SHOWING DIVERSION OF COLUMBIA RIVER.

AT GRAND COULEE DAM, STATE OF WASHINGTON

***"A great feat in engineering history has been quietly accomplished – the Columbia River has been diverted at the site of the Grand Coulee dam. With the placing of 35 heavy timbers in the final gap of the cross-stream cofferdam last week, by the MWAK Company, the mightiest river of the west for the first time was twisted from its ancient course and its huge flow of 1,000,000 gallons of water per second were regulated behind the west bank cofferdam in order that the midstream section of the Grand Coulee dam can be laid. The filling of the cofferdam cells and the work of huge pumps will soon leave the channel exposed and dewatered and work will be begun there to link the gap and join the concrete foundations reaching out from the east and west bank cliffs…"***

***Oakesdale Tribune,*** **December 25th 1936**

***"…In describing the task of this river diversion, a release from the United States Department of the Interior says, in part: 'Approximately 8,000,000 board feet of timber was used in the manufacture of the skeletons of the cofferdams, enough lumber to load five ships. The cofferdams were built in sections on the shore and floated into place in the stream where they were anchored and were sunk by loading them with rock. The most difficult phase of this construction was the placement of the last stop-logs in the downstream cofferdam. When these stop logs were in place the cofferdam received the full force of the main stream of the Columbia River, which it turned aside.'…"***

***Oakesdale Tribune,*** **December 25th 1936**

***"…'In order to dewater the channel, it will be necessary to place additional material in the cofferdams to seal them and to raise their crests to heights sufficient to withstand the spring floods. It is expected that this process be completed early in March and that excavation of the final section of the foundation of Grand Coulee dam can then be begun.'"***

***Oakesdale Tribune*, December 25th 1936**

<u>Top Left</u>: caption: “Removal of plug (north end ofwest cofferdam) for diversion of the Columbia River. 12/02/1936.”

<u>Top Right</u>: caption: “Equipment removing cell section ‘H’ of west cofferdam for diversion of the Columbia River. 12/11/1936.”

<u>Left</u>: caption: “Removing walls of east side cofferdam by burning (Wakefield piling). The flames consumed the walls of the smaller temporary east side cofferdam after the east side had been dewatered. 12/01/1936.”

***"…The upstream cross-river cofferdam was completed, and dewatering of the 55-acre area enclosed was begun January 3, 1937. In six days 80 million gallons of water were pumped out, and on January 9, two months ahead of schedule, actual excavation begun…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

***“With both cross-river wooden-crib cofferdams now in place and being rapidly made watertight with earth, clay and rock, reinforced by steel sheet-piling, the MWAK Company has started construction of two pump trestles to be used to support the large pumps while pumping out the ‘cofferdam lake.’ The two cross-river cofferdams present a scene of great activity, with cranes, barges, steam hammers and a fleet of trucks working steadily, day and night, filling the cofferdams and driving the steel piling. A pump foreman predicted last week that the water would be out of the riverbed section by about January 15.”***

***Latah County Advocate,*** **January 1st 1937**

# For the First Time

***"The sight which hundreds of dam site residents have waited for and thousands of tourists said they would like to see is available today. The bottom of the Columbia is exposed between the cross-river barriers. Where once the turbulent Columbia's treacherous whirlpools and undercurrents flowed there is now a rough-looking bowl with big boulders and small basins. The river floor is moist but not as wet as one might expect. Except for small puddles here and there, MWAK completed pumping operations Saturday. Even before the last of the water had been boosted out through the two-foot wide pipe, the mechanical excavation devices were moving down the gradual shore slopes, each bent on a particular kind of work…Dozens of people drove to the east shore high points to see the river bottom exposed. Those who wish to witness this unusual sight are urged to do so at once as shovels and dozers will soon have the overburden scarred up beyond recognition."***

***Spokane Chronicle,* January 11th 1937**


***"…Engineers said today that when the shovels break through the layer of gravel and get down into the clay a few feet, the formation is dry, although billions of gallons of water once flowed over it…MWAK plans to remove approximately 25,000 cubic yards of clay per day…"***

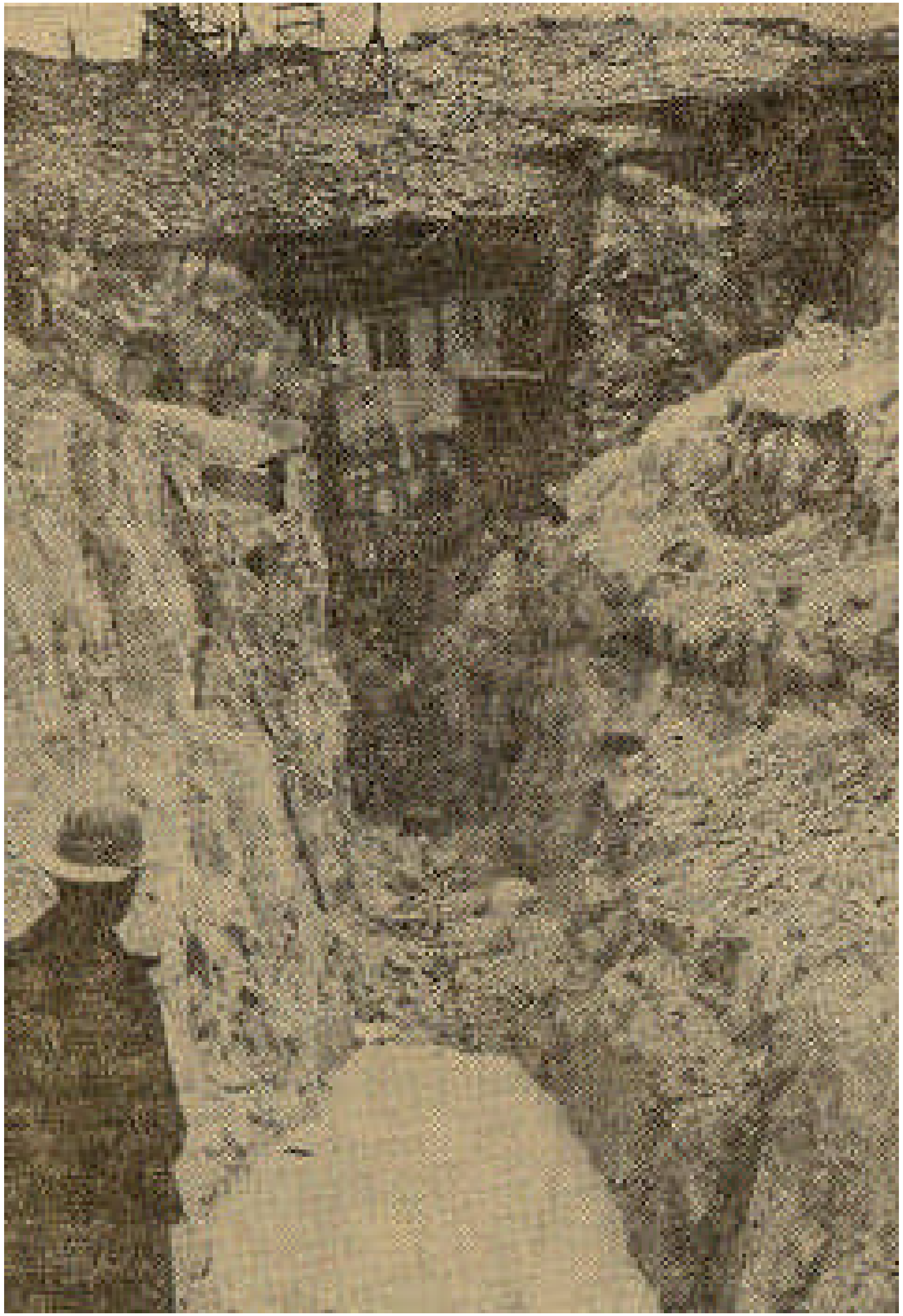
***Spokesman-Review,*** **January 26th 1937**

**Left: caption: "Workers remove weathered and unsound surface rock in the bottom of the Columbia River Channel to provide for a watertight union of granite bedrock and the dam, April 1937"**

**Right: caption: "Site preparation showing workers using sandblasters and removing earth by hand"**

***“Mother Nature must submit to another operation for the removal of a soft spot in the river bed area. The Bureau of Reclamation has directed MWAK to extend the deep crevice in the mid-river granite about 100-feet below the general bedrock level. A fissure on the east shore, which was protected by the famous ice dam, extended from 150 to 175-feet below the surrounding area. Continuation of rock excavation in the deep fissure will further delay completion of the high trestle from which concrete is poured. The total in the area is 1,165,000 cubic yards…”***

***Spokesman-Review,*** **June 20th 1937**



**Left: caption: "The workmen seen here and there in this photograph are 'stooping lower' than any others at Grand Coulee dam site. They are engaged in the lowest work-area of the entire project. The district shown here is that located in the old riverbed area, where the roaring Columbia formerly flowed. It is a deep crevice, the bottom of it 125-feet below the river level, which MWAK company workmen are dynamiting and cleaning to remove faulty granite." (*Spokane Chronicle,* July 1st 1937)**

# Who Threw That Boulder?

***"…Somebody was throwing boulders – and big boulders at that…After pumping the river from the center section of the diversion dam, revealing the river bottom, workmen found many boulders strewn about. But in one location they found an unusually large boulder; so large in fact, drilling crews have been working more than a week cutting into pieces small enough to handle. It is estimated the boulder contains more than 2,000 cubic yards, and may be even heavier as workmen have found the boulder broadens out as they near the bottom. Who threw that boulder?"***

***Spokane Chronicle,*** **January 20th 1937**

# End of an Era

***"An old landmark is passing this week as a crew of MWAK jackhammermen bores into the large basalt boulder on the river bed between the cross-river cofferdams. The rock, as large as a house, was a river-gauge when Sam Seaton used to manipulate his ferry from shore to shore. It protruded above the water during low stages and disappeared in high water. It lay just off the course of the cable ferry which until three years ago was the only means of crossing the Columbia here. There are about two dozen large and small basalt boulders on the river bottom, All have been marked and will be blasted…"***

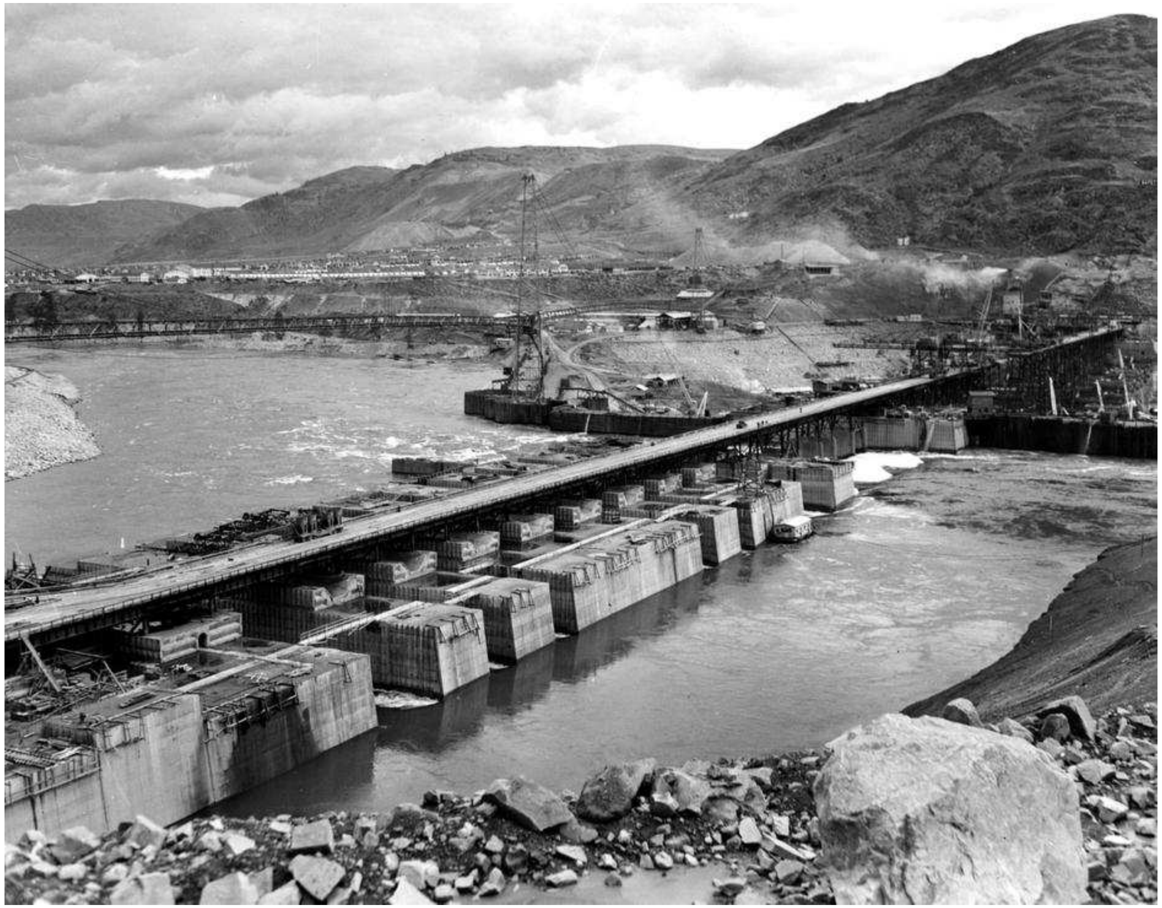
***Spokesman-Review,*** **January 1st 1937**

**<u>Top</u>: caption: "With the diversion of the river accomplished, the excavation of the river channel and east side were carried out in the summer of 1937"**

**<u>Bottom</u>: caption: "Columbia River diverted through base of dam built inside west coffer-dam. Excavation under way in old channel, 1937."**

***"…The river's flow was diverted two months ago as the first cross-stream cofferdam was dropped section by section into the channel. The stream now flows over concrete which has been poured at the west end of the dam, where principal operations have centered for more than two years. Concrete pouring on the east side began a month ago, only to be interrupted by near-zero weather. Engineers expect to complete excavation to bedrock by April 1. The overburden lies 30 to 70-feet deep…"***

***Ellensburg Evening Record,*** **January 13th 1937**



# No Little Trickle

***“With pumps gaining slowly on the water today, the Mason-Walsh-Atkinson-Kier company was winning its battle with the Columbia river to prevent flooding of the entire excavation area at the Grand Coulee dam, engineers said. Hay was being used to help seal the sand seam through which water poured in a torrent. Trucks and power shovels continued to strengthen the coffer cells on the river side.”***

***Spokane Press,*** **March 11th 1937**

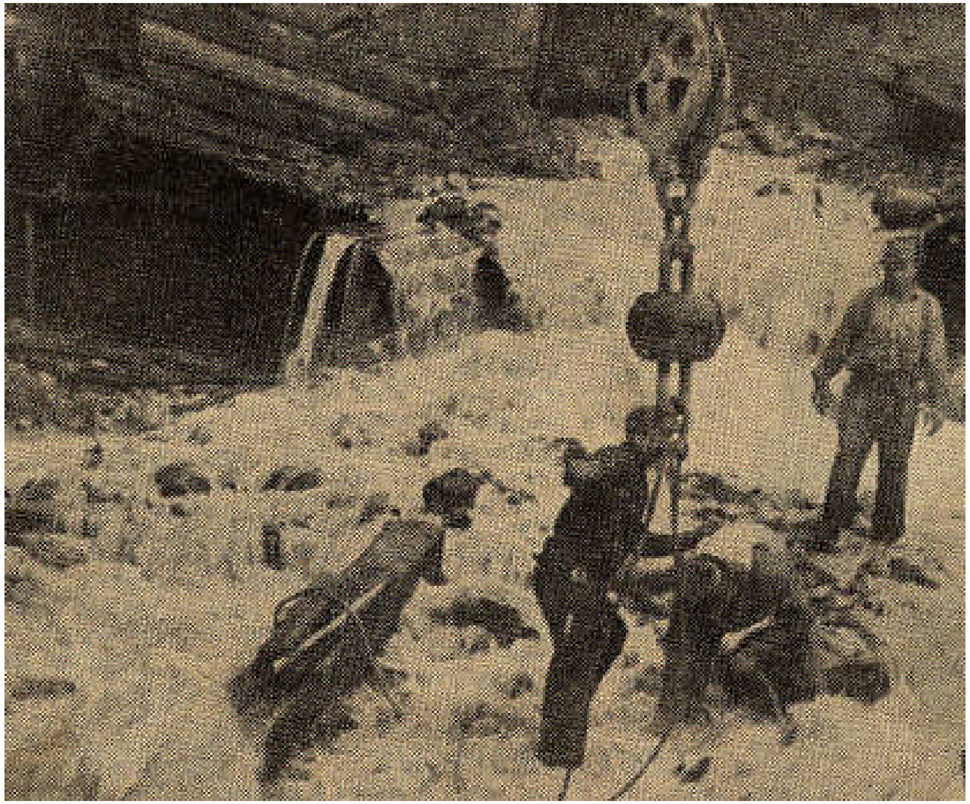
***“A small leak started by a sand seam resulted Wednesday night in the Columbia river breaking through the downstream cofferdam and indirectly causing the death of a worker. The water flooded the east shore excavation pit to a depth of 10-feet. In the excitement of the men to stem the flow, a large tractor passed over a truck spotter, Austin McAfee, 41, injuring him fatally. MWAK engineers noticed the leak at 8 p.m. and made immediate efforts to remedy the break…”***
***Spokane Daily Press,* March 18th 1937**

***"…Several crews were put immediately on the job with pumping equipment to drain the pit. Sand bags were being used and MWAK officials were planning a quick repair of the cofferdam. The water was reported today to be coming through into the pit 15-feet deep. Latest reports by MWAK engineers said the crews had partially controlled the flood-ing waters and pumps were sending the overflow back into the Columbia. Actual loss in money was not believed to have been very much. Time, and the taking of crews from other parts of the project to stem the water tide, will total more than damage."***

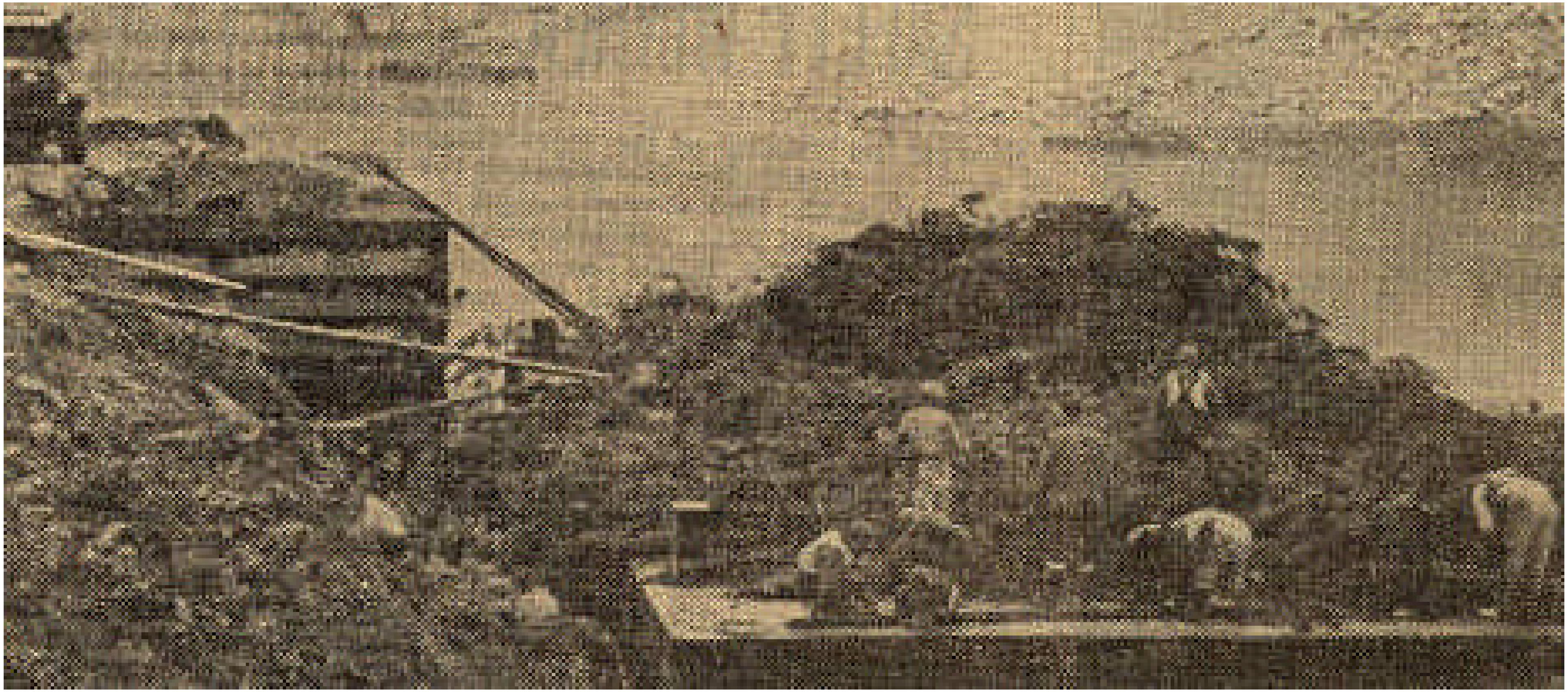
***Spokane Daily Press,* March 18th 1937**

***"A crew of MWAK torch wielders spent today cutting holes about four feet square in the cell of the cofferdam next to that on which the tower stands, letting out dirt and rock and relieving the pressure that has threatened the suspension bridge. Rivets in this cell started to shear off last night and all workmen were ordered away from the area underneath the tower. At first it was intended to hook cables to the piling of the cell and rip it apart. MWAK officials announce that no new leaks had developed and that the water in the pond was no higher…"***

***Spokesman-Review,*** **March 22nd 1937**



<u>Left</u>: **caption: "That the cofferdam seepage is no little trickle is at once apparent from a study of this picture. The big stream can be seen rushing out of the cofferdam cell into the lake in the excavation area. The crane is being used to remove crushed timbers and will help take out sheet piling of the broken cell. The reconstruction program MWAK calls for the placement of six of seven 50-foot cells in the approximate area where the workmen are engaged in this picture." (*Spokane Chronicle,* March 24th 1937)**



**<u>Above</u>: caption: "George Washington and his little hatchet never did as quick a job of cutting down trees as did MWAK workmen in the Nespelem when trees were needed to help seal a hole in the Coulee dam cofferdam. It sprang a bad leak and flooded part of the excavation area. Here, workmen are seen tying the trees to pieces of steel, preparatory to sinking them in the river. Sandbags, hay, tumble-weeds, mattresses, canvas and other material were also used in an effort to seal the sand seam through which water from the Columbia river seeped below the cofferdam." (*Spokane Chronicle,* March 24th 1937)**

***"Grouting of the downstream cofferdam was underway early this week, but meanwhile an inside cell of the upstream cofferdam cluster was split, Monday, by the heavy earth pressure behind it. The partial collapse of the upstream coffer worried the MWAK Company more than the first break, it is rumored, for they fear the pressure of water behind the upriver fill may have developed a 'creep.' No water is leaking through yet, however. The cell, about 50-feet in diameter, broke open at the bottom, the inner wall being pushed out and a portion of the filling inside sliding into the enclosure, caused by the big leak in the lower coffer."***

***Valley Ford Republic,*** **March 26th 1937**

***"'Bentonite,' a volcanic ash found in the Black Hills, is looked to by the MWAK Company, Grand Coulee contractors, to stop the leak in the downstream cofferdam, which has been flowing uninterrupted for two weeks. This slippery, claylike volcanic substance will expand fifteen times its dry bulk when exposed to water. Given a practical application for the first time less than two years ago, it is considered the most efficient absorbent of moisture which nature has devised…"***

***Spokane Chronicle*, March 27th 1937**

***"…Preliminary tests made with a small replica of the cofferdam leak have indicated bentonite will do the trick. A stream from a fire hose was directed through a large box of gravel and sand. The water flowed freely until a mixture of bentonite and sawdust was introduced. The mixture stopped the flow. It is possible bentonite, a carload of which has been received here, will be mixed with cement and sawdust or wood chips when poured into the break in the cofferdam. Bentonite has been used by the TVA in grouting of dam foundations. Cement is used at Grand Coulee. It has been used also to strengthen earthen dams."***

***Spokane Chronicle,* March 27th 1937**

***“Unexpected raising of the Columbia river brought to the MWAK company new worries late last week and made it necessary to rush a large number of men, trucks and power shovels into the mid-river sector, building a new levee to hold back the rapidly rising river from the uncompleted dam foundation. The river rose 2½-feet in less than a week, due, it was reported, to storms in the Canadian Rockies. A 6-inch rise was registered during one night. Reports from up-river said the volume was still increasing in the upper reaches of the river, but was receding in the lower parts.”***

***Spirit Lake Union,*** **April 2nd 1937**

***"The conveyor belt from the east excavation area, silenced when the cofferdam leak began, was started again today on its task of hauling out the remaining few thousand yards of earth that now covers bedrock on the eastern and central sections of the dam foundation. Shovels and draglines were busy excavating during the period while the belt was closed, however, as a considerable amount of dirt was used in constructing dikes or fills across the excavation area to hold back the water, and for the filling on the base of the cells on the river side of the cofferdam. Had not the break come in the cofferdam cells, the company had planned to have virtually all the excavation completed by April 1, but it will be delayed for some time. Resumption of excavating will mean, however, that the bedrock will be bared as swiftly as possible, preparing the way for concrete placing…"***

***Spokesman-Review,*** **April 3rd 1937**

***"Seepage of water through the seam in the clay underneath the cell cluster of the cofferdam, into the east excavation area, has been reduced sufficiently to permit closing of one pipeline from pumps inside the area. Through drilled holes in the clay overburden inside the remaining portions of the cells, MWAK has forced a mixture of 'bentonite' and water, varying from 3 to 7 percent grout to the rest water, deep into the clay. Pressure behind the grouting mixture at present is around 30 to 40 pounds. The material expands greatly, absorbing enormous quantities of water. It has been used successfully on the TVA project, engineers say, where it has been impossible to find perfectly sound granite for foundations. A haul road of clay has been built across the center of the flooded area, cutting it in two parts, and the upstream section requires little pumping…"***

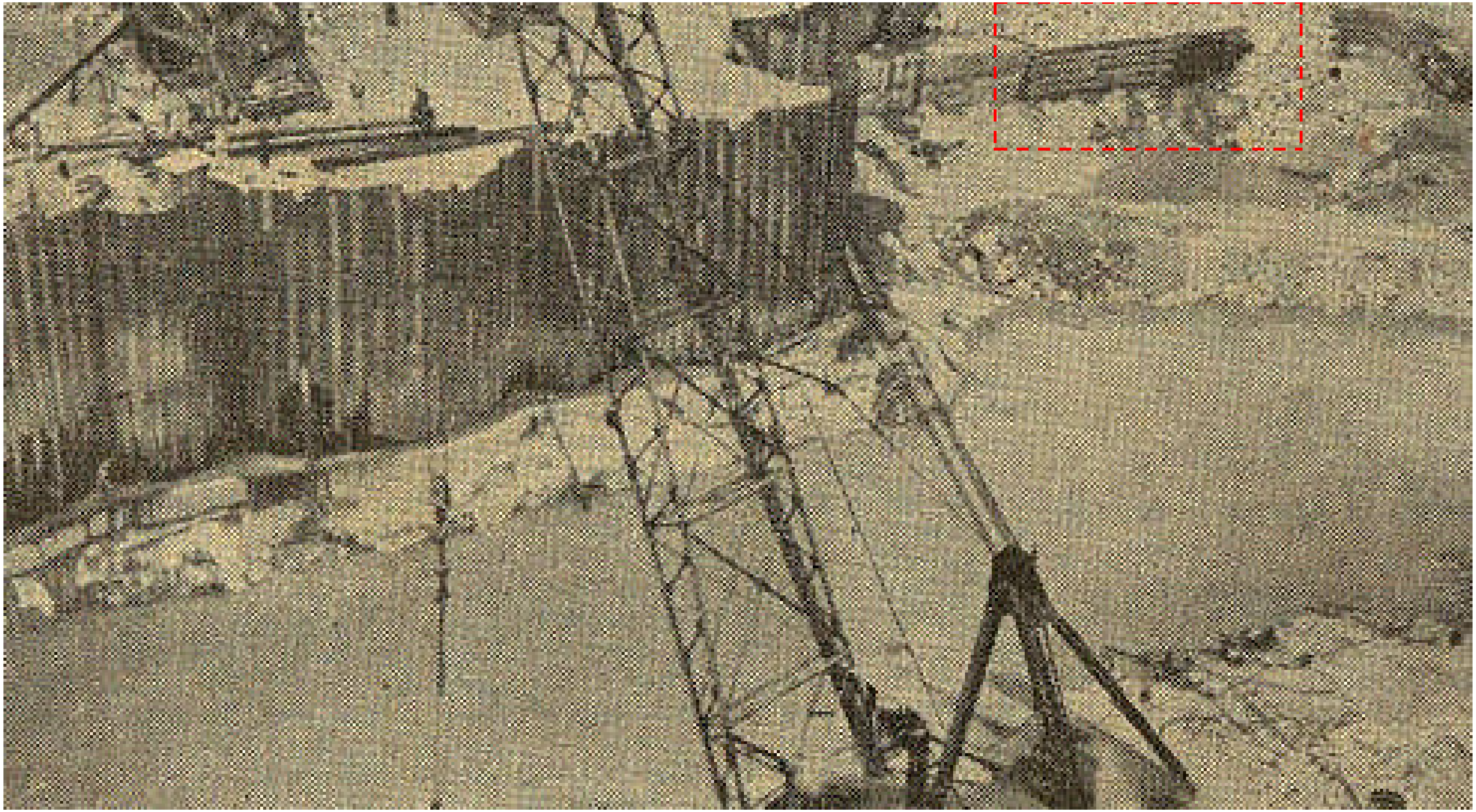
***Spokesman-Review,*** **April 5th 1937**

***“The MWAK company officials can never be accused of having ‘gone to sleep’ on the job while trying to plug the hole in the junction of the west and downstream cofferdam several weeks ago even though they used about 20 mattresses. Instead, superintendents were never more alert than when they threw the twenty mattresses, along with a conglomeration of other material in the fill which was being placed on the river side of the sheet piling. It was hoped that the mattresses, and the hay, and the tumbleweeds, trees, clay sand, gravel, canvas strips, sand bags, cement bags and other items would plug the leak. The hole proved to be too big however and even now is pouring about 5,000 gallons per minute into the flood lake. Engineers said that hay, tumble-weeds, trees, mattresses and also fertilizer, have the unusual tendency of working their way into leaks and clogging the opening. No more earth is being dumped on the river side of the cofferdam now, a big 25-foot wide fill having been created by the thousands of tons of gravel, clay and sand dumped into the river. later when the big cells have been repaired and strengthened, the fill will be brought a few feet higher…”***

***The Wenatchee Daily World,* April 6th 1937**

***"While the battle has not been entirely won, government engineers said today that the flow of water in through the seam under the cofferdam had been 'greatly reduced' in the last few days, and that the outlook was optimistic. The leak at its peak, engineers said, was pouring an estimated 30,000 cubic feet of water per minute into the excavation area, taxing huge pumps to hold it even. Now figures show that the leak has dropped to the neighborhood of 1,000 cubic feet per minute, only a fraction of the former stream. A program of heavier grouting was started this week. The company started the use of sawdust, cement, bentonite and water in a mass that is hoped will seal the influx. Preparations have been under way for several days for this program, while, in the meantime, lighter mixtures of the soluble material were used through grouting pipes…"***

***Spokesman-Review,*** **April 13th 1937**



**<u>Above</u>: caption: “The latest leak in the Grand Coulee dam cofferdam system Friday morning caused the MWAK Company to send its repair crews into hurried action plugging up a new seepage point in the downstream coffer. This photo, taken late Friday afternoon, shows the new seepage lake, about 250 by 70-feet in size, against the new row of steel cells built several months ago to give added support to the main clover-cluster which broke at that time. One of the trucks can be seen building a dike to protect the main area and to try to force the leak to clog itself. The leak, although itself not visible, is located in the right corner of the photograph, at the end of the cofferdam cells row. It is in the shape of a timber cribbing.” (*Spokane Chronicle*, May 29th 1937)**

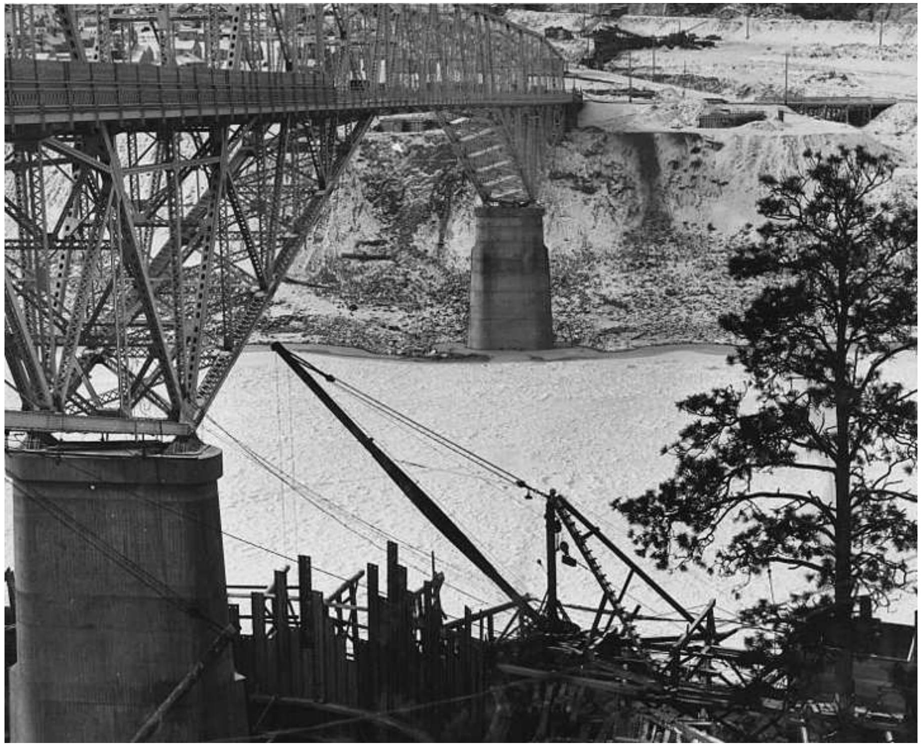
***“MWAK workmen are removing with great care, the supporting cells which stooped the big leak to the cofferdam last spring. Four of these large cells must be taken out to permit concrete placement in the ‘bucket’ of the dam. A concrete bulkhead has been placed against the inside edge of the outer cofferdam to counteract river pressure, and a clamshell crane is removing the earth and rock inside the cells. This leaves the cells’ steel piling intact, resting on the granite bedrock, and should the river start to seep through, the company will be able to fill the cells again and stop it…”***

***Spokesman-Review*, September 13th 1937**

***"…the MWAK company is not making the often mentioned 'financial killing' from its approximate $37,000,000 contract with the federal government for construction of the Grand Coulee dam foundation…MWAK will do well to break 'more than even' on the job which it underbid the Six Companies by approximately $5,000,000…It is estimated the leak in the east shore cofferdam last March, when the Columbia river threatened to submerge the workings, cost the contractors about $500,000. This is regarded as one of the chances a contractor takes in dealing with such a powerful river as the Columbia…"***

***Spokane Chronicle,*** **December 7th 1937**

# Ice Breaking (Paul Bunyan Style)



***"A Paul Bunyan way of breaking up ice barriers in the diversion channel, in case they form, is to be employed by MWAK. Large concrete blocks, six to seven tons in weight, will be attached to the 100-foot booms of two floating cranes and cast, fisherman fashion, onto the ice. It was said the cranes will be able to hurl the blocks up to 300-feet from the center of each barge onto any ice that may form in the channel. Careful manipulation of the booms will permit an operator to cast his immense load onto the ice once every minute. The weight of the concrete blocks, it is believed, will smash any ice barrier that may form."***

***Spokane Chronicle,*** **January 15th 1937**



<u>**Above**</u>**: caption: "Ice conditions in the Columbia River under highway bridge"**

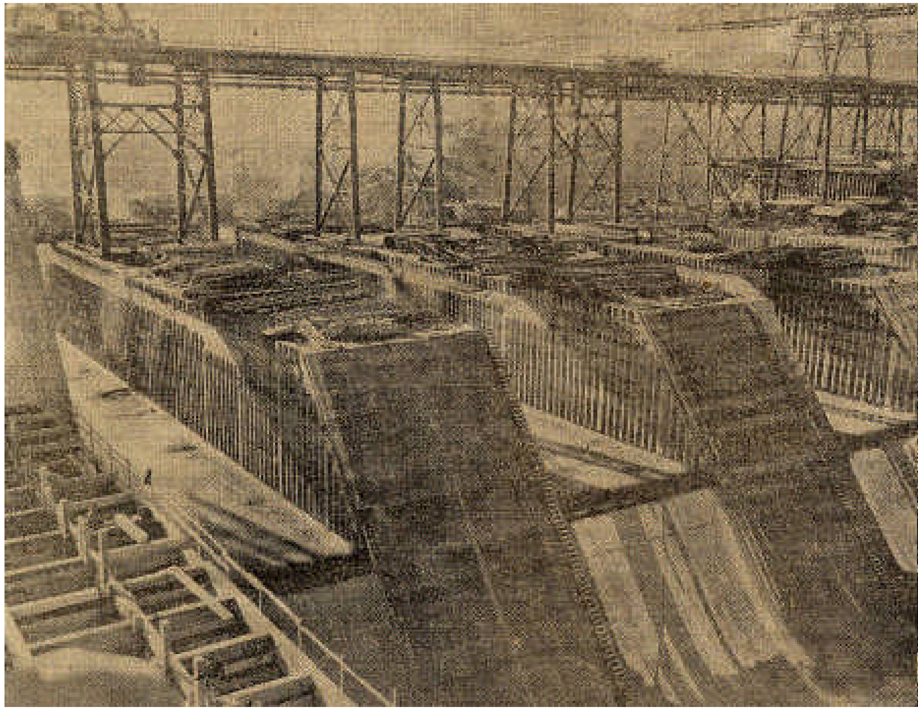
***“The spring break-up of ice in the Columbia river was but a few hours away, it seemed today, as MWAK started smashing the big ice cap just downstream from the slots in the dam. One of the barge-mounted cranes, quipped with a large clamshell bucket, was used to break the jam, as the operators dropped the heavy bucket through the ice. On the upstream side of the dam, the water could be seen around the piers of the railroad bridge today, the first time since the stream froze over. Holes and dark spots in the ice cap were seen all along the swifter parts of the river. Some difficulty may be en-countered later when the ice jams up the river start breaking and floating down through the diversion channel. The com-pany, in that case, probably would use heavy weights they have prepared to break the floes…”***

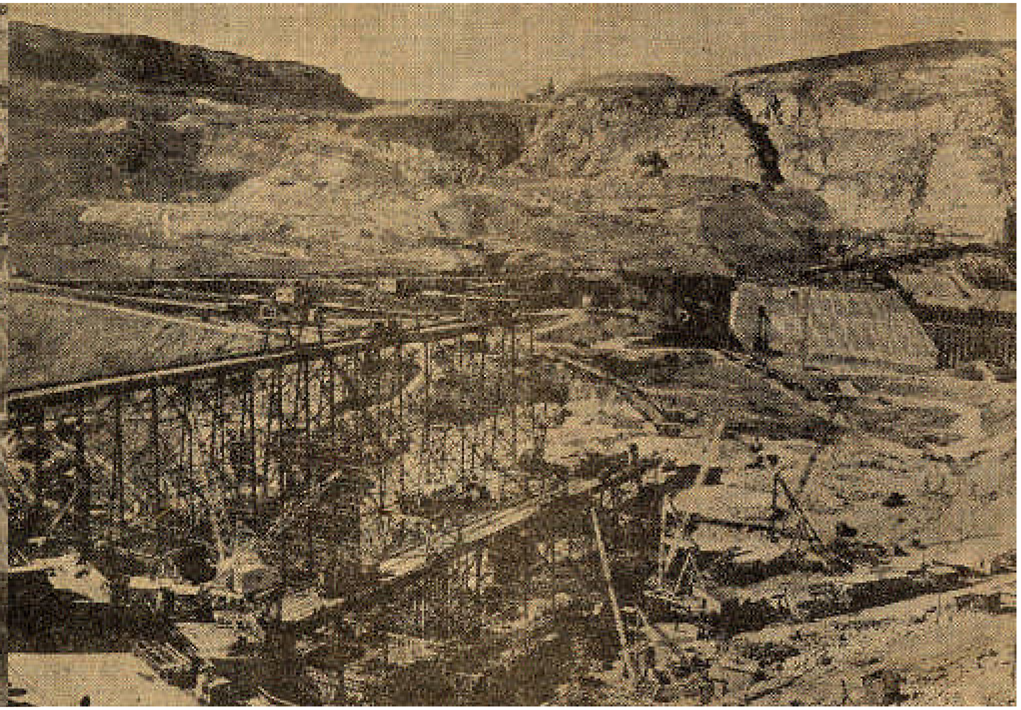
***Spokesman-Review,* February 27th 1937**

# The Turbulent Torrent

***“Although the river is still two months from peak, the stream today was roaring through the slots in the diversion channel and boiling over the ‘bucket’ of the dam at an unprecedented pace. So swiftly does the water strike the upstream ends of the higher center blocks that there is a head of nearly two feet between the level of the stream there and down between the slots. Confining the big stream in the small space has made it almost impossible for small boats to navigate the area around the dam. Only a matter of two or three feet separate the river level and the top of the blocks between 40 and 31 and workmen have cleaned up the other notches in the dam, toward the west abutment, in readiness for the day when the turbulent torrent reaches its crest and forces its way through the additional space provided…”***

***Spokesman-Review,* May 1st 1937**





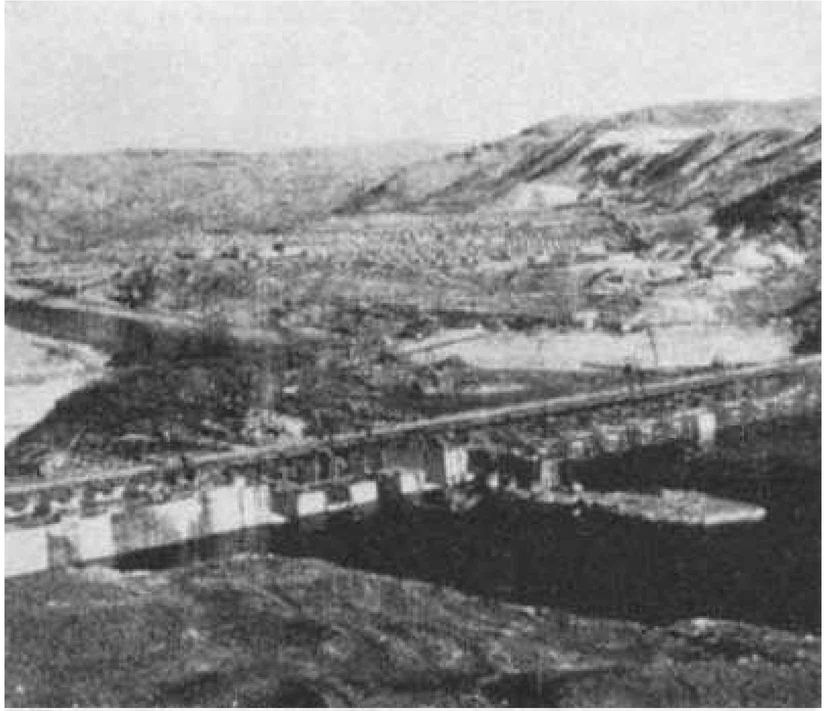
<u>Top</u>: caption: "When you see the water rushing through the flood gates at Coulee Dam, here's what it's running over. The diverted river is flowing through the lower passageways. The tops of the higher blocks are cleaned now, with the rising Columbia roaring below. MWAK officials expect little difficulty from flood waters this spring, they reported." (*The Wenatchee Daily World*, May 10th 1937)

**<u>Bottom</u>: caption: "To join this gap between 'Block 40,' at the right of the picture and the east shore in the foreground is the summer's task of the MWAK Company at Coulee dam. Already the complicated network of steel trestles from the east shore is meeting a similar network which has been projected from the other side. More than 15,000 yards of concrete from both east and west mix are being poured daily during the four months of the dam site's busiest summer." (*The Wenatchee Daily World*, June 5th 1937)**

***“Indications are the MWAK Company has won its final battle with the Columbia river. The river is receding, thereby reducing the pressure on the huge cofferdam system. About 23,000 gallons of water a minute is reported to be seeping through the coffers, but engineers say the amount in not abnormal, considering the size of the barrier walls. Charts show the leakage is reducing as the river level falls. In three years of cofferdam construction and maintenance, the MWAK Company has suffered only one major setback, the cofferdam break which threatened construction operations for several weeks this spring. It has been estimated unofficially the company spent several hundred thousand dollars making repairs and alterations following the break.”***

***Spokane Chronicle,*** **July 9th 1937**

# Mark Down the Date



***"Mark down the date – July 15. the start of another colorful chapter of the construction history of Grand Coulee dam. This time it's the beginning of the destruction of the cofferdams which are now holding the angry Columbia river out of a beehive of building operations, for in three months the big stream must again be turned back into its straight-away path of the ages…"***

***Grand Coulee Journal,* July 30th 1937**

**Top: caption: "The removal of cofferdams late in 1937 allowed the river to flow through low gaps in the completed foundation"**

**Bottom: caption: "The river now flows through low gaps in the dam in many low cascades that will, in time, grow into a 350-foot waterfall"**

***"…The MWAK Company Thursday sent an earth-hungry electric shovel with an appetite of five to seven yards at a gulp into the earth at the east, inshore end of the downstream cofferdam. A fleet of fourteen trucks were busy all day and night carrying away the buckets full. The company superintendent's office said that plans called for the removal of the earth inside the cribbing itself and the steel sheet-piling wall on the river side of the 400-feet thick structure, down to elevation 965. This level would leave the coffer about 6-feet above the present constantly-falling Columbia. As soon as these top strips of the bulwarks are removed, the company will move down for another slice, following the river as it drops down…"***

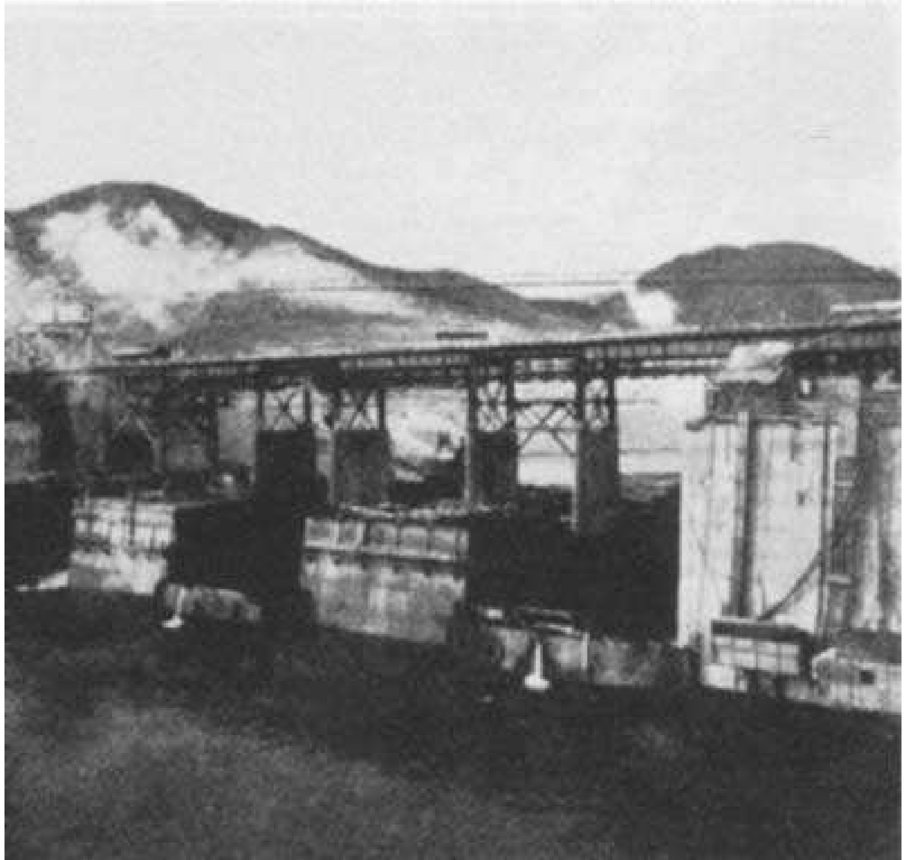
***Grand Coulee Journal,*** **July 30th 1937**

***“Virtually all steel piling, forming the facing for the down-stream cofferdam, has been removed, as the contractors continued the demolition of the structure down to the base of the top tier of cribbing. An electric shovel is working on the earth and gravel that was used to fill the cribwork, while trucks haul it away. Burners cut the steel piling at ground level. Whole sections, with a score of pieces of piling, are cut and tipped over at once, then separated and hauled away. As the stream recedes the cofferdam will be cut down until the entire barrier has been removed…”***

***Spokesman-Review,*** **August 2nd 1937**

***"…Construction schedules call for the re-diversion of the Columbia back into its old channel between October 15 and November 1. Tentative arrangements provide for dynamiting some of the coffer to let the water through. Special dynamite and powder containers have been left in the coffer at various points for this purpose. Once the stream is allowed back into its old course, it will flow partly through outlet tubes and partly through low blocks in the dam, similar to the present diversion passages. While flowing through these holes the present diversion gaps will be brought up with concrete."***

***Grand Coulee Journal,* July 30th 1937**

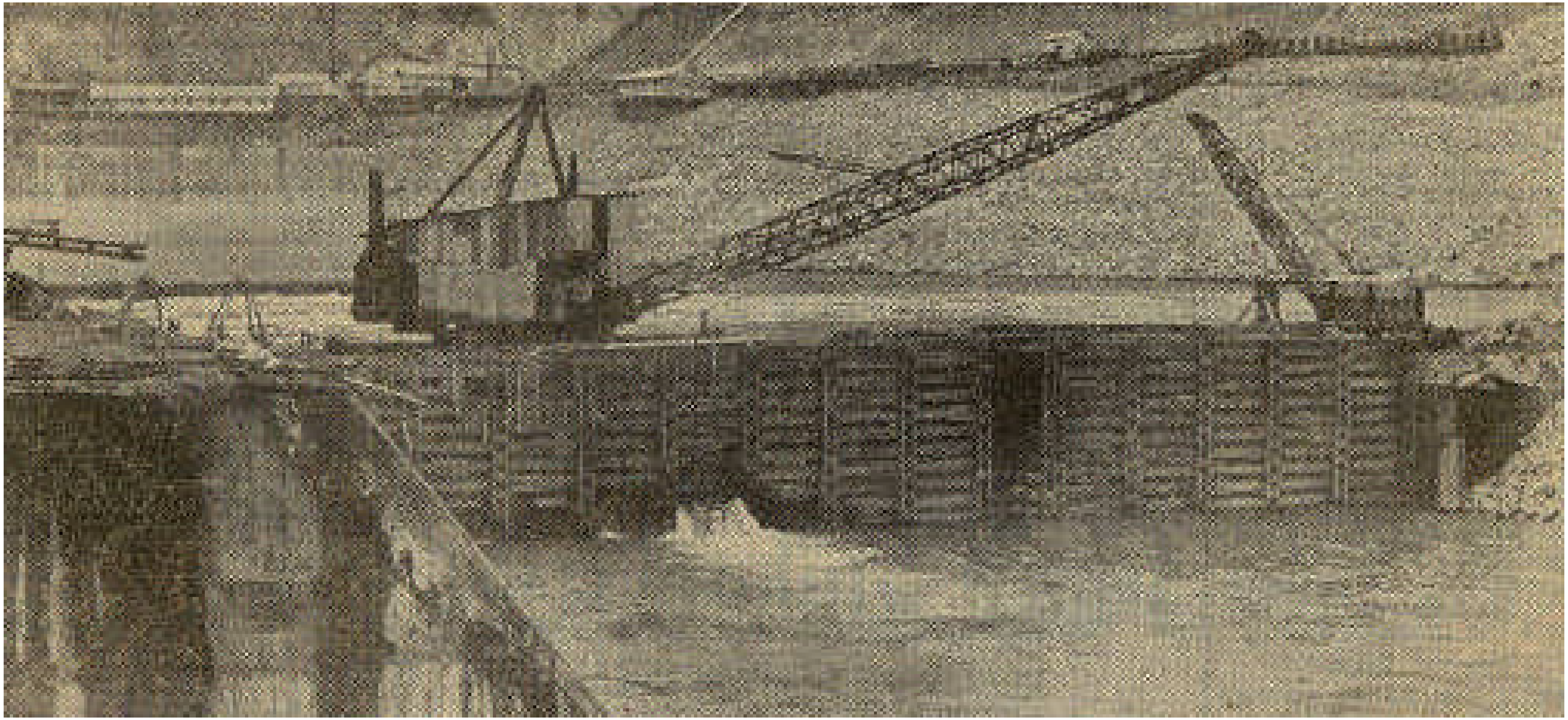


***"The MWAK Company is building huge gates to stop river flow through the four 50-foot gaps west of Block 40. Each will be more than 50-feet wide and high, of heavy timbers in a flat-tened arch shape with reinforced concrete base. Inside will be three large air tanks which will buoy the structures into position. The tanks then will be filled with water, to sink the gate into its slot in still water. Installation of the gates will not take place for a month or more, after con-trol gates have been placed in the spillway section of the dam…"***

***Spokesman-Review,* August 24th 1937**

**Top: caption: "Closed with massive gates 50-feet square, diversion gaps were filled with concrete after the central section of the base was finished"**

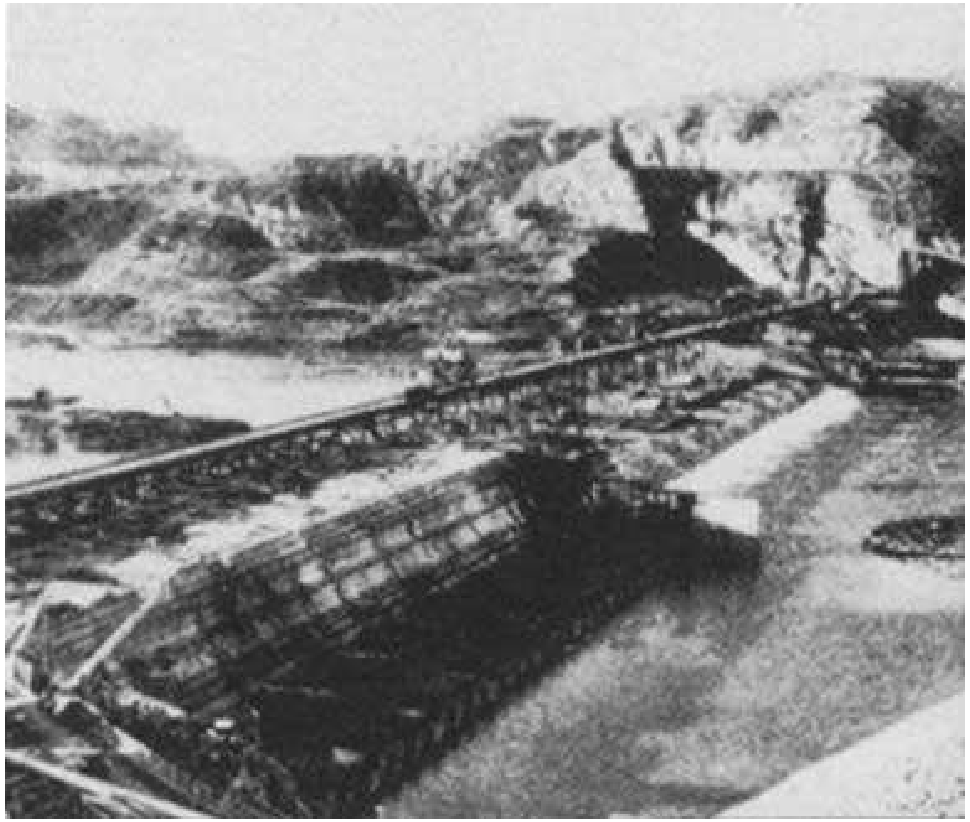
**Bottom: caption: "Two huge steel gates used for closing gaps in river"**



***"Officials announced today that waters of the Columbia were diverted to the east side of the dam at 5:55 p.m. Wednesday. The flow was diverted to the river's original channel while MWAK officials and Reclamation Bureau chiefs assembled to watch the spectacle."***

***Spokane Press,* November 25th 1937**

**<u>Above</u>: caption: "Considered one of the greatest feats of modern times, the Columbia river at Grand Coulee last Wednesday night was allowed to resume its normal course after being diverted to one side while the mighty dam rose from bedrock. MWAK used this huge timber barrier, through which the water is seen seeping, to stem the onrushing tide. When the time came for permitting the river to flood the basin front of the dam foundation, a crane lifted some of the wooden structure, thus allowing a gradual flow into the large 'bucket,' which was filled in 48 hours. In the background is seen the river where it was pushed aside to clear the way." (*Spokesman-Review*, November 28th 1937)**



***"…The construction of the cross-river timber crib cofferdams required 10,500,000 board feet of lumber, enough to build 500 eight-room houses, and the timber cribs on the faces of Blocks 39 and 40, 130 feet high, 200-feet long, and 100-feet wide, required three million board feet. Timbers 12 by 12 to 16 by 24 inches in cross-section and 40 to 60-feet long were used. Nearly a million cubic yards of gravel were used to fill them. Steel sheet piling used to face the water sides of the cofferdams totaled 2,200 tons…"***

***U.S. Bureau of Reclamation*** **(ca. 1937)**

**Left: caption: "Foundation of dam completed, cofferdams removed, and the Columbia River flowing through low gaps in the base of the dam, 1938"**

***“Within a week, Grand Coulee dam’s great cofferdam system, which drew the eyes of the construction world for three years will become history. The two ends of the once formidable cross-stream cofferdams are now only short protrusions from the east slope and only three steel cells of what was once the world’s greatest cofferdam, known as the ‘west coffer,’ remain to be ‘burned’ down to water level. To finish odds and ends may take several weeks, bit for the main the system is nearly gone. In the future, all diversion will be handled by closing low blocks of the center of spillway section, pouring concrete in these, while the river flows through others…***

***Spokane Chronicle,* December 23rd 1937**

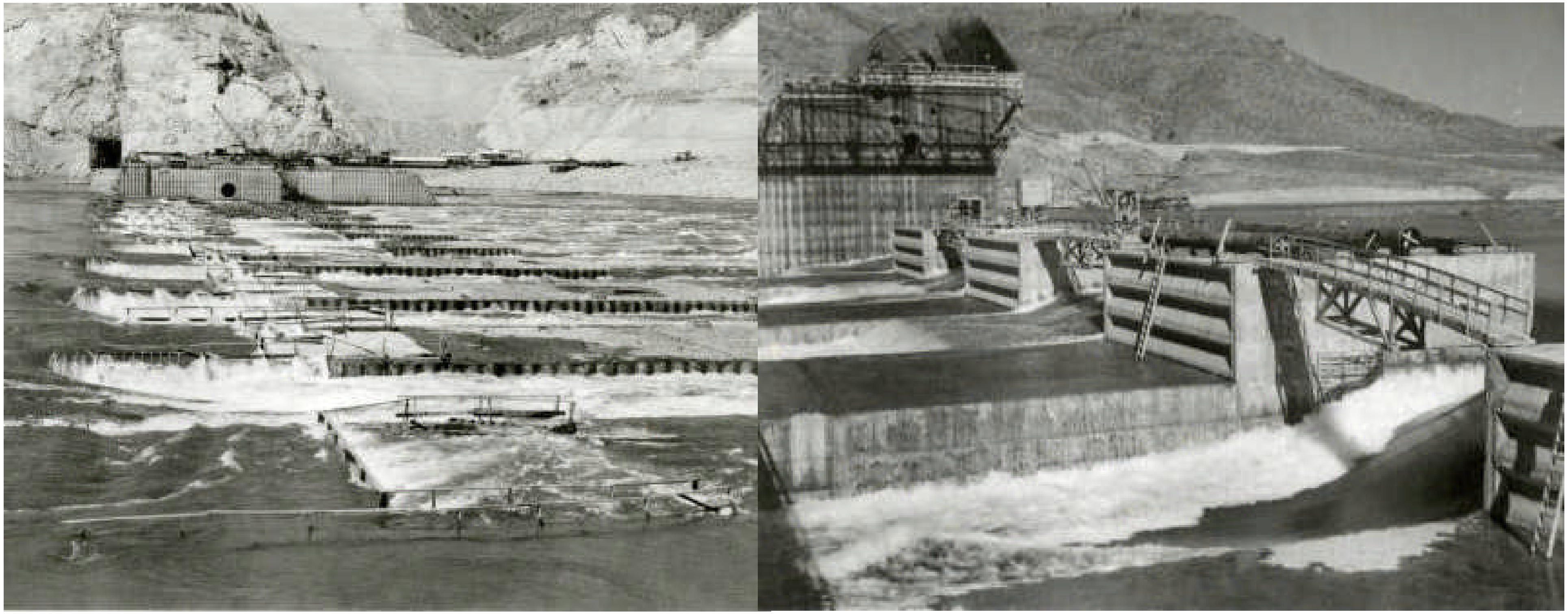
***"…Engineers say that never has the construction world seen anything that even closely resembles the giant system built here. The west shore coffer was erected first, being 115-feet high and 3,600-feet long, made of 19,000 tons of steel, in cellular shapes, to give added strength and filled with earth. This structure kept water out of the west shore. The tables were then turned and the water allowed to go through the coffer and out again, as two cross-stream coffers were built. Water was then pumped out of the old river bed…"***

***Spokane Chronicle,* December 23rd 1937**

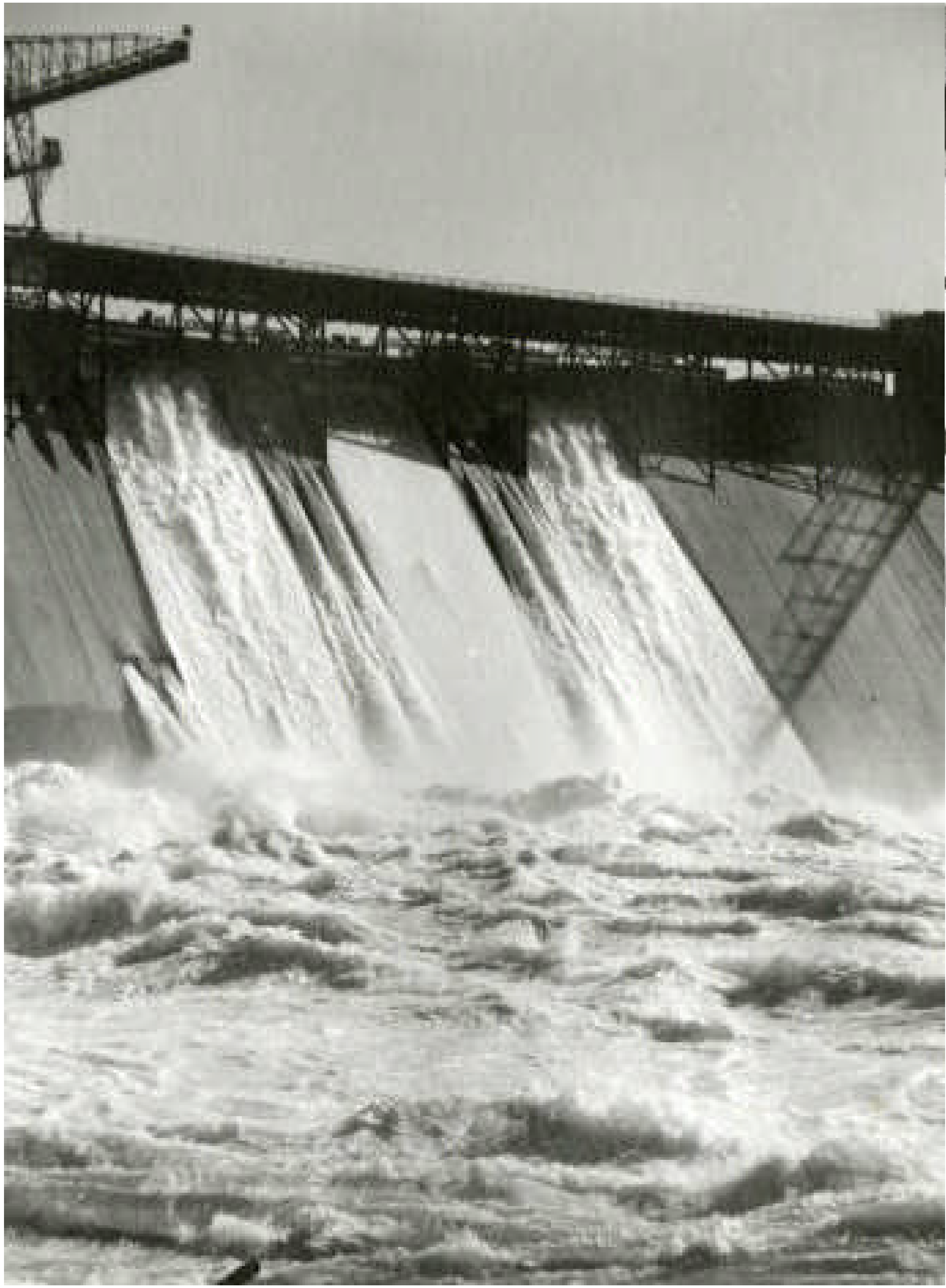
***"…Nine million board feet of lumber was used to build the cross-river barriers and more than a million yards of earth. These coffers were 800-feet long and 90-feet high. When the concrete had been brought sufficiently high in the middle section of the dam, water was allowed to pour into the area and the destruction of the two coffers, now ending, was then started. A plug connecting these two links of the system, with the old west bulwark, requiring two and a half million board feet of lumber, was also dismantled. The MWAK Company bid $3,000,000 in its original contract to divert the Columbia, a task now completed."***

***Spokane Chronicle,* Dec. 23rd 1937**

**Left T&B: caption: "Grand Coulee Dam, ca. 1938"**



**<u>Left</u>: caption: “The 1938 high water of the Columbia River tops the upstream spillway blocks and floods the blockouts left for the outlet works gate installations at el. 934. The maximum flow for 1938 was 361,680 second feet. 05/28/1938.”**
**<u>Right</u>: caption: “The annual flood stage of the Columbia River pours through the spillway diversion area of Grand Coulee Dam. A peak flow of 265,600 second feet was reached in 1940. 06/03/1940.”**



**Above: caption: "Peak flow of the annual flood stage of the Columbia River is discharged over the dam in special diversion channels. 05/29/1940."**

**Left: caption: "Cascading Columbia River flood waters pour through the spillway diversion channels in waterfalls higher than Niagara. 5/27/1940."** 1418


**Left: caption: “Spectacular waterfall at Coulee Dam surpasses Niagara in height. During the 1940 flood stage, the Columbia River was diverted through the outlet works and over a portion of the unfinished spillway section. 06/02/1940.”**
**Right: caption: “The downstream face of the dam, the left powerhouse, the spillway at flood stage, and the Columbia River Reservoir in a general view from the left or west side. The floating debris caught by the log boom will be beached and burned. 6/3/1940.”**

# Part 19

# A Damn Big Dam

# A Panorama of Activity

***"If Coulee dam site were a war front instead of a work front there would be at least 36 vari-colored pins sticking in a map of the area. Standing near the temporary MWAK headquarters one can see, in swinging in a complete circle starting from the north, the entire panorama of activity…"***

***Spokane Chronicle,*** **October 13th 1934**

***"…Pin-points of 'action' were as follows:***

1. ***Pumping out caisson for the west-side state highway bridge pier.***
2. ***Bulldozer and trucks filling in gulch on engineers' town site.***
3. ***Basement work by National Construction company for 30 model houses.***
4. ***Erection of first three houses by carpenters of same firm.***
5. ***Hoe-back shovel filling in water and sewer ditches.***
6. ***Leveling area for two reservoirs for town by Arcorace Company.***
7. ***Field office work of the United States Reclamation Bureau.***
8. ***Filling in of switch-back for the United States construction railway.***
9. ***Pile driver pounding the 11th bent of 41 for temporary bridge.***
10. ***Two Tuttle Brothers' ferries plowing waters constantly.***
11. ***Addison-Miller force boarding and rooming MWAK men.***
12. ***Three Engineers' Company plant generating power and light.***
13. ***Crick & Kuney shovels in slide area building highway-railway bed.***
14. ***Lynch Brothers core-drilling at extreme top of slide site.***
15. ***Tire repair, welding shop and gas and oil plant working.***
16. ***Jackhammer men in granite for highway-tramway bed.***

***continued…***

***Spokane Chronicle,* October 13th 1934**

***"…continued:***

***17. Excavation work, three shovels, 2 trucks for MWAK.***

***18. National re-employment office handling the labor problem.***

***19. Lower end of Crick & Kuney roadbed job near Grand Coulee.***

***20. Engineers cross-sectioning west-side excavation area.***

***21. Building new homes and businesses in private town sites.***

***22. Buildings for excavation bosses in 'pit' being completed.***

***23. On east shore: Activity at MWAK warehouse, buildings arising there.***

***24. United States Reclamation Bureau engineers testing concrete in test plant.***

***25. Cement mixer at work sinking caisson for east bridge pier by Western Construction Company.***

***26. Sewer pipe being laid for 'Mason City.'***

***27. MWAK engineers surveying for hospital site.***

***28. Unloading supplies of all sorts for general contractors.***

***29. Ditch-diggers cutting trenches for water and sewer system.***

***30. Setting foundation blocks for 10 blocks of dormitories.***

***31. Leveling area for reservoir for town site.***

***32. Erection of light poles for electric system of city.***

***33. Digging of foundation for 1,000-man cookhouse.***

***34. Construction of $50,000 two-story MWAK office building.***

***35. Draftsmen, officials and salesmen in temporary office.***

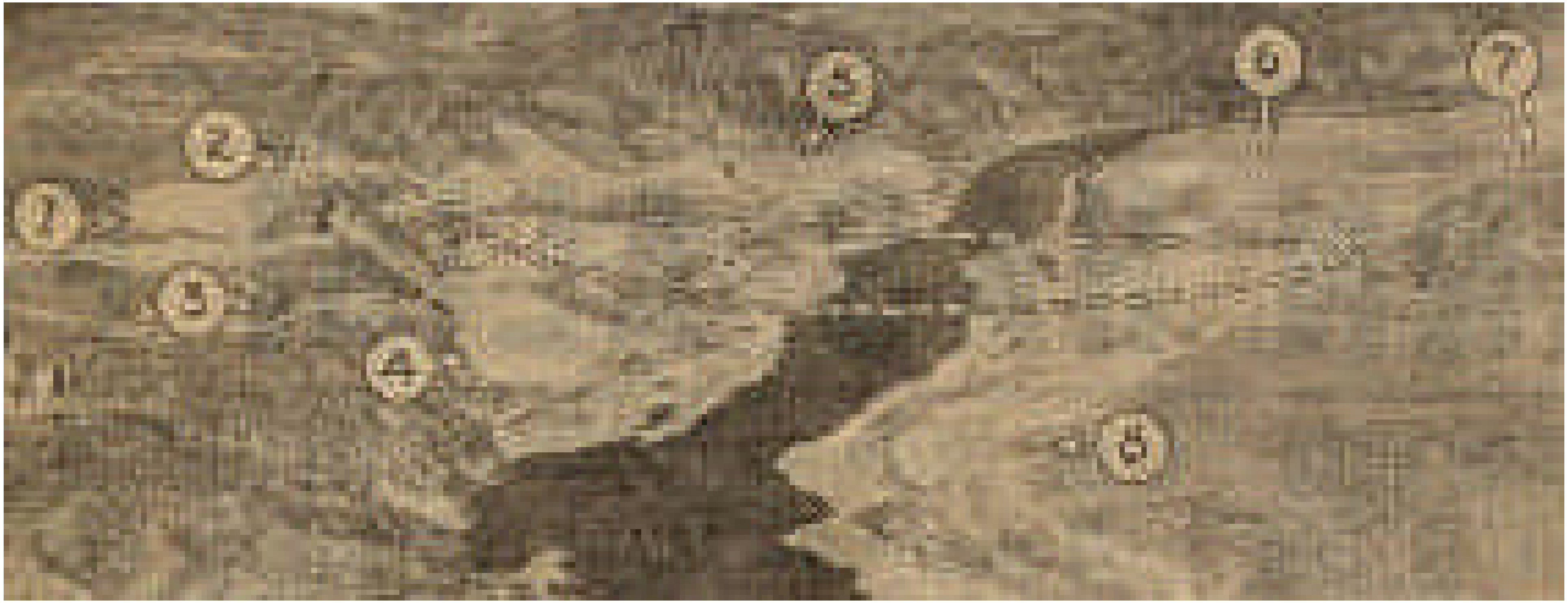
***36. Gravel washer of Western Construction Company.***

***Spokane Chronicle,* October 13th 1934**

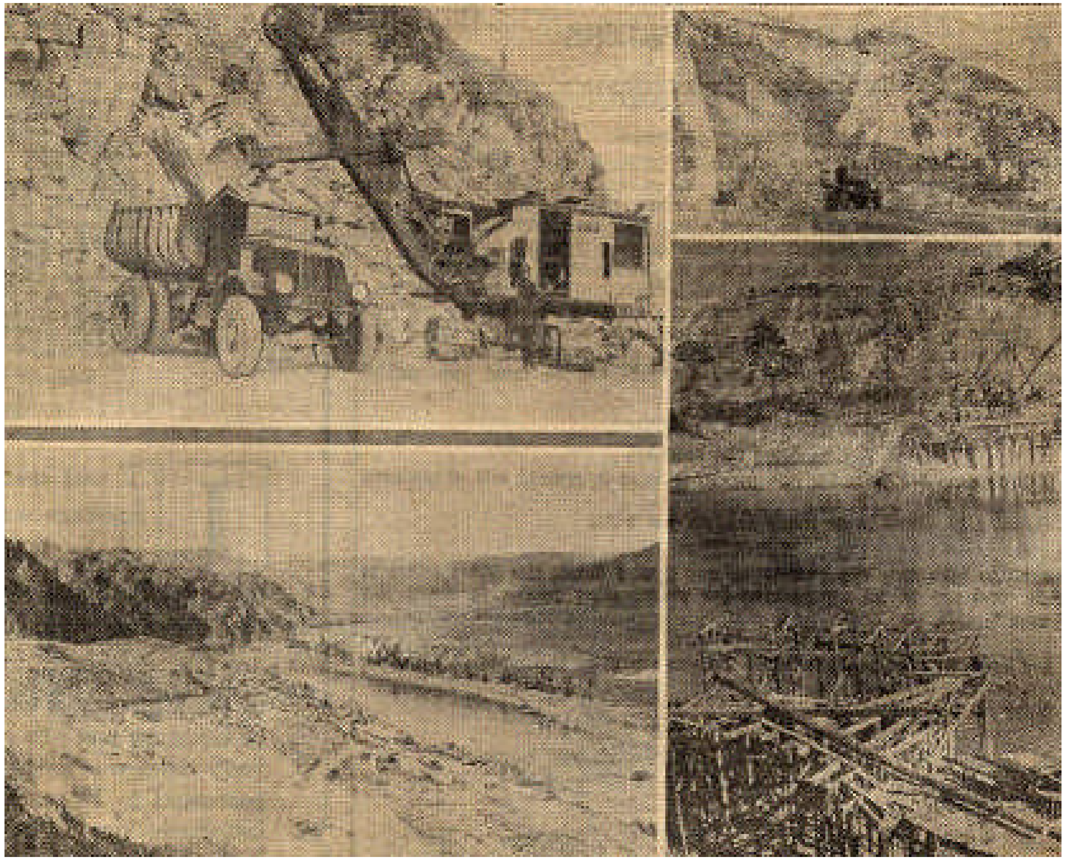
***"...Professional photographers are stumped because if they get too close to the dam they can get only part of it on their film, and if they move off a mile or two to get the whole picture, details are lost…"***

***Popular Mechanics,* April 1938**

**Above: panoramic view of the construction site (ca. 1935)**

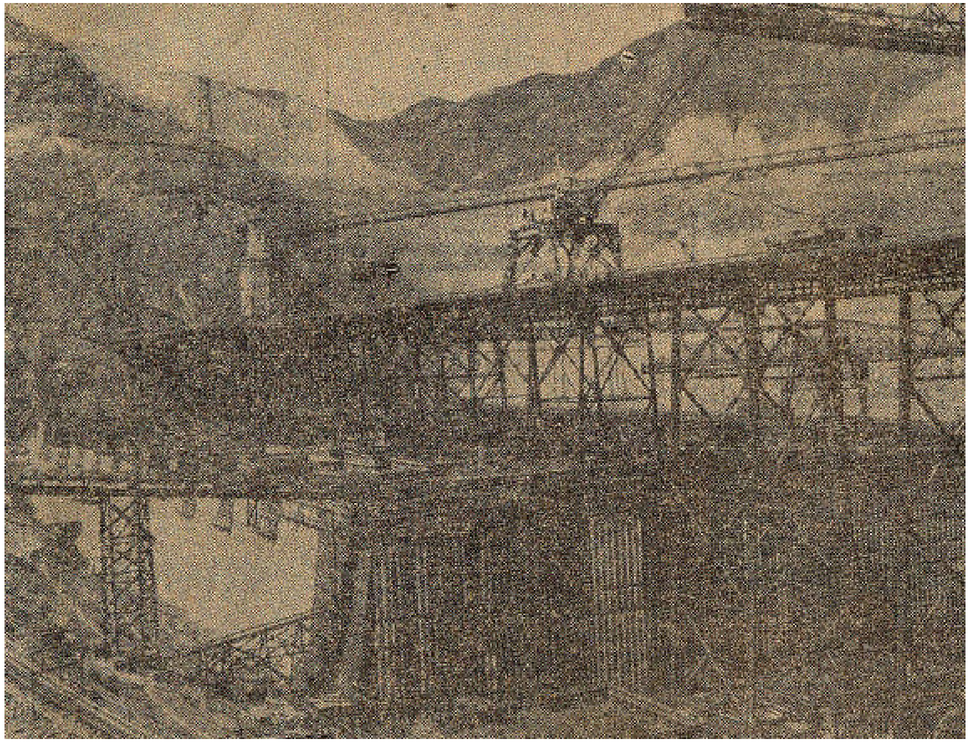


<u>Above</u>: caption: "Here is an up-to-the-minute study of the Grand Coulee dam site and surrounding area, graphically showing work in progress and prospective construction. No. 1 is the new highway grade. The pile of earth immediately under the No. 2 circle will carry the railroad tracks. No. 3 shows the Crick & Kuney camp and the old highway grade. No. 4 indicates spoil pile at the west end of the dam and No. 5 points to the engineers' town site. Mason City, the all-electric town-to-be, is indicated by No. 6. First houses are being put up there this week and they will be heated by electricity in cold weather and cooled through electrical units in the summer. No. 7 marks the location of the new highway to the airport and No. 8 shows the spoil pile on the east side of the river below the dam. The dotted line indicates approximately the dam which will be built, and at the left, within the dam markings, are some of the buildings already constructed on the west side of the river. At this time of year the river is especially low, and it is at this period that much of the work in curbing it will be done, in the next two or three fall seasons. Study of the photograph reveals the rough, rocky type of country in which the dam will be constructed. Barring below-zero temperatures, work will progress all through the winter months, officials of the MWAK Company declare. Two thousand or more men will find employment at the dam, being hired through government bureaus rather than by the contractors." (*Spokane Chronicle*, October 15th 1934)



<u>Above</u>: caption: "Spokane firms and Spokane men and Spokane materials and equipment are playing important roles in work preparatory to the actual building of the Coulee dam. In the upper left panel is a truck sold by the local Mack agency, fitted with a 'Zebra' body by the Union Iron Works, in the service of a Spokane contracting firm, Crick & Kuney, on one of the heavy rock cuts of the rail-highway grade now nearing completion. The upper right panel shows another of the same fleet roaring up the grade with a full load of shattered granite. Lower left is a general view looking north toward the engineers' town site from the curve at the top of the long grade. The white patch in the foreground is the area excavated for the power house, the tiny dots being MWAK trucks and power shovels at work there. The deep right hand panel shows the bridge pier work from the west bank, the east side being nearly completed." (*Spokane Chronicle*, October 15th 1934)

# Form-a-Day



***"Some time in September, less than 90 days away, the first block of concrete on the foundations of the huge dam will be poured by the MWAK Company, placing the world's largest concrete mixing plant in operation…"***

***Spokesman-Review,* June 23rd 1935**

**Left: caption: "This picture shows the start of the Grand Coulee dam being built by the Bureau of Reclamation on the Columbia river in eastern Washington. To make this great block 1,000,000 yards of concrete were poured. The up-stream face of the dam can be seen."**

***"A form-a-day seems to be the slogan of MAWK in the construction of concrete-blocks near the west abutment. Carpenters and other workmen are engaged on the fourth and largest of the forms today. This block is located against the west abutment, the other three forming a line with spaces in between toward the coffer-dam…"***

***The Wenatchee Daily World,* November 30th 1935**

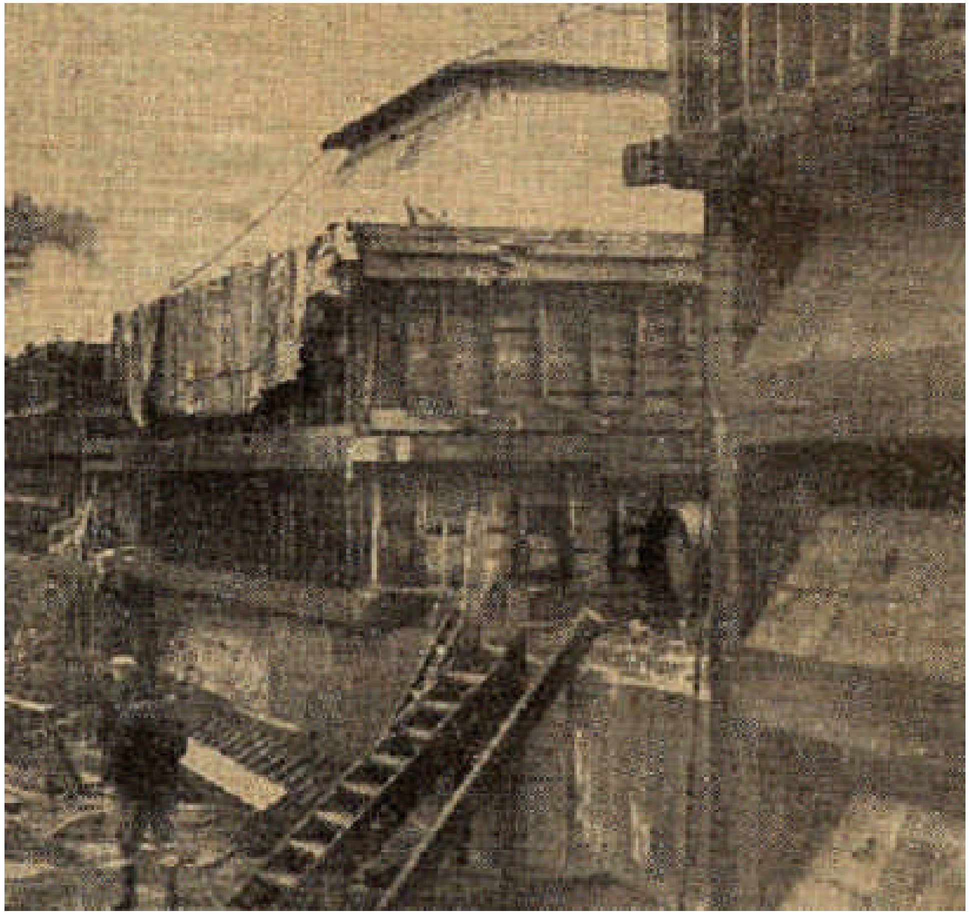
**Left: caption: "Aerial operations at the Grand Coulee dam are becoming increasingly interesting each day as the MWAK Company goes forward with the pouring of concrete. Towering trestle work on which the concrete train and crane operate are shown here. The huge cement bucket is shown being lowered to one of the blocks on the granite floor of the dam site, where concrete pouring is going on constantly." (*Spokane Chronicle*, January 23rd 1936)**

***"Twisting of 1¼-inch steel bars into knots, if necessary, would be a simple task for big machines to be installed in a steel bending plant in the railroad yards near Electric City. The structure, now being erected by MWAK, will be 180-feet long, 80-feet wide and 22-feet high. It will be heavily braced with 36-inch 'I' beams to support six monorail carriers. The plant will bend about 25,000,000 pounds of steel reinforcement bars, varying in size from ½ to 1¾-inches thick, and 40 to 60-feet long. The bars are to be used in supporting and bracing grouting and cooling tunnels which will honeycomb the mass of concrete of the dam. An electric bender, with a turntable device, will bend the steel into desired shapes and an electric cutter will shear bars into proper sizes. A Bureau of Reclamation inspector will oversee the work. The equipment is from the old Pioneer Sand and Gravel Company's bending plant in Spokane."***

***Spokane Chronicle,*** **January 9th 1936**

***"…All blocks of concrete must not be off as much as a six-teenth of an inch and points arte checked and rechecked to assure absolute accuracy. Although the forms may give a tiny bit of leeway one way or the other, the powerhouse site near the west abutment must be perfect. A point on a high granite hillside, more than a mile away, is the point used for measuring the exact locations at the dam site, Engineers with transits and levels tie in points on the slopes. The earth movement, however slight, makes it necessary to tie-in with this far-away but stationary point."***

***The Wenatchee Daily World,* November 30th 1935**



Left: caption: "'How are they going to anchor together the 250 some odd blocks to be poured in the west abutment of the Grand Coulee dam?' The answer is found at the extreme right of the photograph, which shows a series of wood notches. When the wood structure is removed there will be revealed a great mass of concrete, the blocks of which will be 'dovetailed' together by the notches. Even concrete has to go camping under a canvas roof in cold weather as the tent-topping shows. Protection from cold weather is necessary to have the concrete cure properly. This is just one of the thousands of 'little matters' that MWAK engineers have to think about in building Grand Coulee dam." (*Spokane Chronicle*, January 27th 1936)

***"…Now let us review the picture as it stands, and try to imagine some of the transformation needed to create this giant among the world's dams:…"***
***Popular Science,* February 1936**

***“Four hundred carloads of concrete a week, about sixty a day, will roll through the majestic Grand Coulee next summer when MWAK hits top speed in concrete pouring, the Bureau of Reclamation indicated today. The company’s work schedule calls for a production total of 440,000 cubic yards of concrete per month in July, August and September, it was explained. This total, never before equaled in construction history, will be about twice as mush as the peak month of last summer. Two hundred cars of cement a week ordered by the MWAK Company will suffice for the present. About a barrel of cement is used to make a yard of concrete. Both mixing plants will be used next summer in the east shore and mid-stream operations.”***

***Spokesman-Review,*** **March 24th 1936**

***"Spectacular steel-erection work of the building of concrete conveying trestles at the dam site will begin again next week. MWAK's superintendent's office reported that the connection of the large steel beams for the high spans would start from both ends, from the east section and from Block 40, where the new framework will connect to the old…Soon the riveters will start their metallic clattering and 'white-hot' rivets will fly away from the tongs into catch funnels, with the usual surprising accuracy…"***

***The Wenatchee Daily World,*** **April 22nd 1936**

***"The MWAK Company announced today it had passed the 6,000-yard daily mark for concrete pouring from the west shore mixing plant. Tuesday the pour was 6,150 yards, 850 yards short of the theoretical maximum capacity of the plant. The schedule calls for an average pour of 6,000 yards."***

***Spokesman-Review,*** **April 17th 1936**

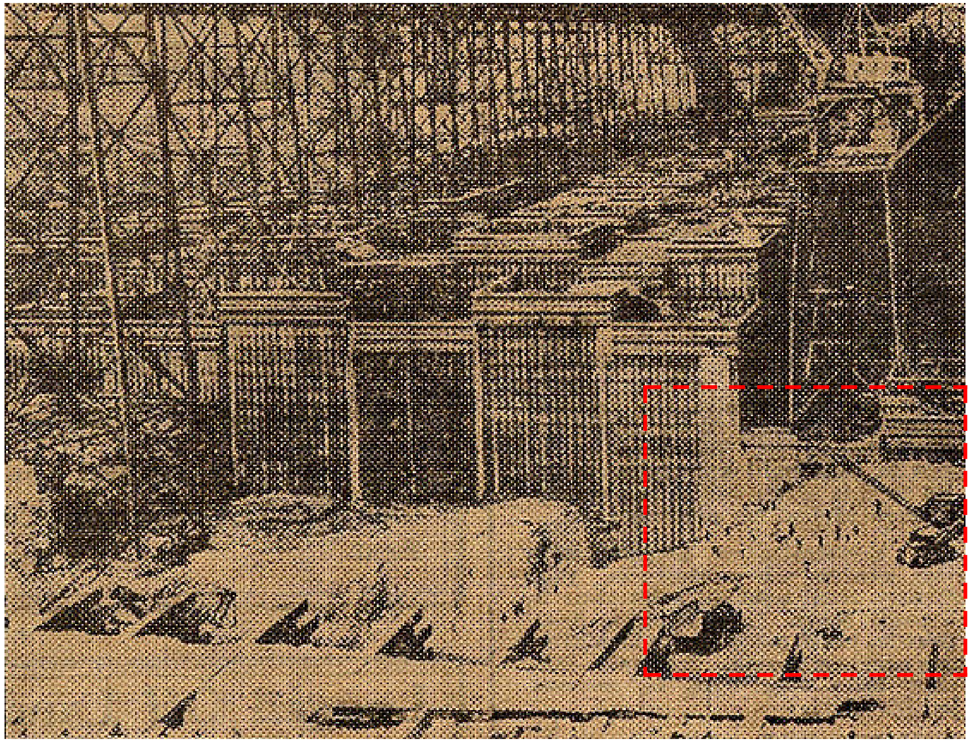
# When the Rain Came

***“Heavy rain, falling here since midnight, caused a shut down of major phases of dam construction this morning. About two-thirds of all operations will be at a standstill most of the day, or until continuous rainfall stops…So exacting must be quantities of various ingredients in the concrete mix that the amount of rainwater falling into buckets and on forms being poured was enough to cause imperfect measures. The company found it uneconomical to cover the blocks which were being poured…About 2,000 men will be laid off if rain continues for three complete shifts.”***

***Spokane Chronicle,*** **June 2nd 1936**

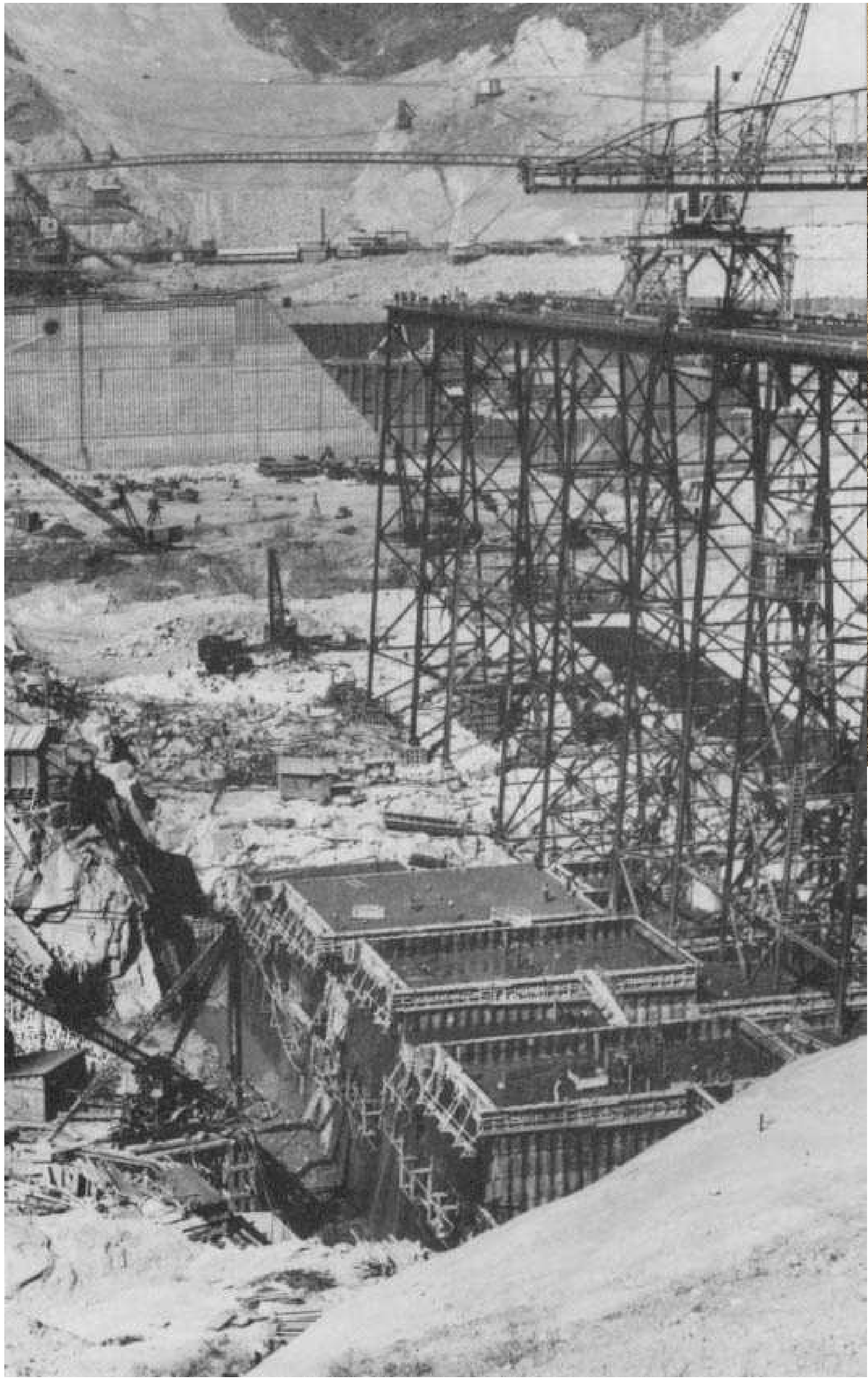
*“Grand Coulee foundation dam has reached its ultimate height in a number of places in the west bank block of concrete, Bureau of Reclamation records show today. ‘Parts of the tiers (or series of blocks) of the dam are up to elevation 1005 and 1010, the height called for in the contract between the MWAK Company and the federal government. This elevation is about 15-feet below the high trestle, from which all pouring is now taking place.’ Most of the blocks will be completed during early January. During the spring and summer, concrete pouring at that point will be at a standstill. Later the eleven diversion gaps, or low blocks on the west shore will be filled up…As soon as the west high trestle has been connected with the east shore end, locomotives will work from both the east and westmix for pouring of concrete on the east bank and in mid-river…”*

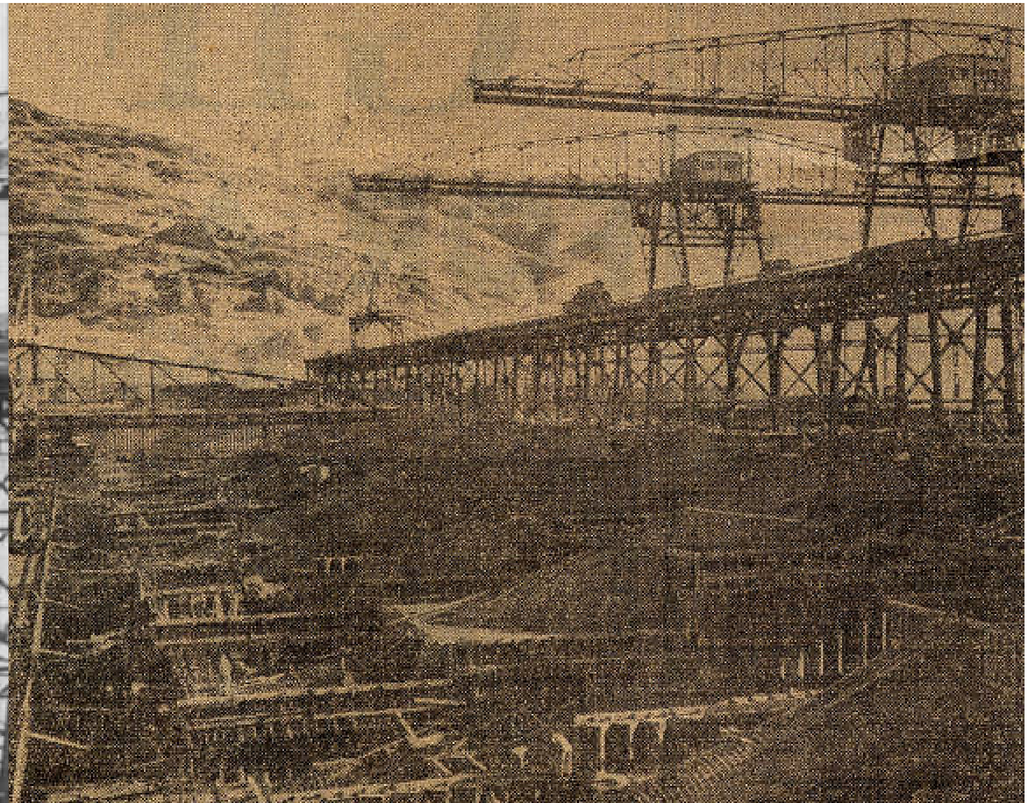
***The Wenatchee Daily World,* December 19th 1936**



***“Out of a complicated maze of construction framework, the mammoth Grand Coulee Dam on the Columbia River begins to take shape. The western abutment of the great dam, shown here, rises more than 90-feet above bedrock. Some idea of the immensity of the structure may be gained by comparison with the truck and crane in the lower right hand corner. Workmen standing near the truck appear too tiny to be seen.”***

***Grange News,* July 11th 1936**





**<u>Above</u>: caption: “Grand Coulee dam continues to rise as 1,720,000 cubic yards of concrete are placed in year since the first concrete pour was made December 6, 1935. In this picture the pen-stock system can be seen taking shape. These great pipes embedded in the dam will carry the water of the turbines at the down-stream tow. A similar set of penstocks in the east abutment, where the first concrete is just now being poured.” (*Oregonian,* Dec. 15th 1936)**

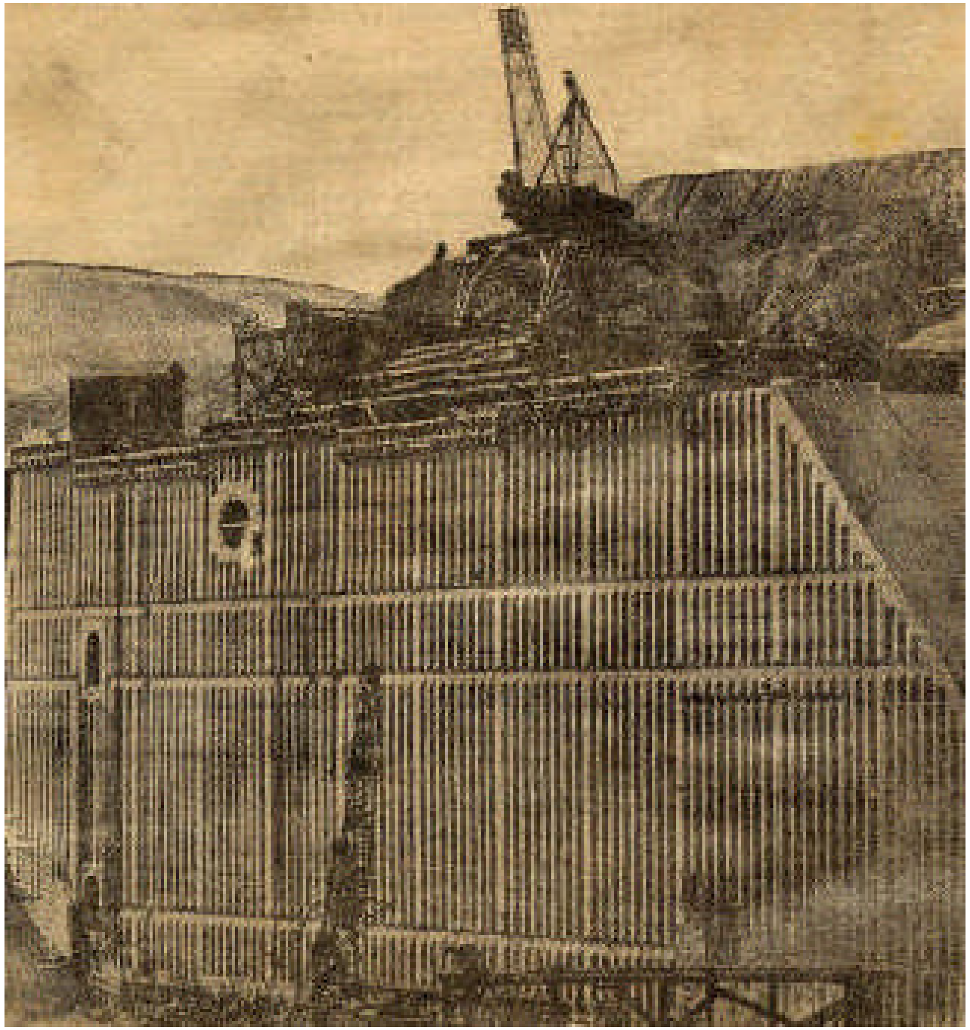
**<u>Left:</u> “Construction activity at Grand Coulee dam site”**

***"A sudden cold snap New Year's day ended concrete pouring operations at Coulee dam until the weather moderates, and threw more than 800 men out of work temporarily. The sudden drop in temperature to 12 degrees froze up MWAK's concrete equipment and created dangerous ice conditions. Company officials said work on the east shore operations would continue, barring a further temperature drop."***
***Spokane County News,* January 8th 1937**

***"Because the steel-work of the highway bridge, although high, will not permit passage of large steel reinforcing bars, 26-feet in diameter, MWAK plans to move a bending-plant to the east shore. The company said that the straight bars would be trucked to the east shore and then bent into the 65-foot long steel arcs which will form support for the penstocks of the dam. All of the bars are now being cut and twisted at the main bending plant in the Electric City freight yards…"***

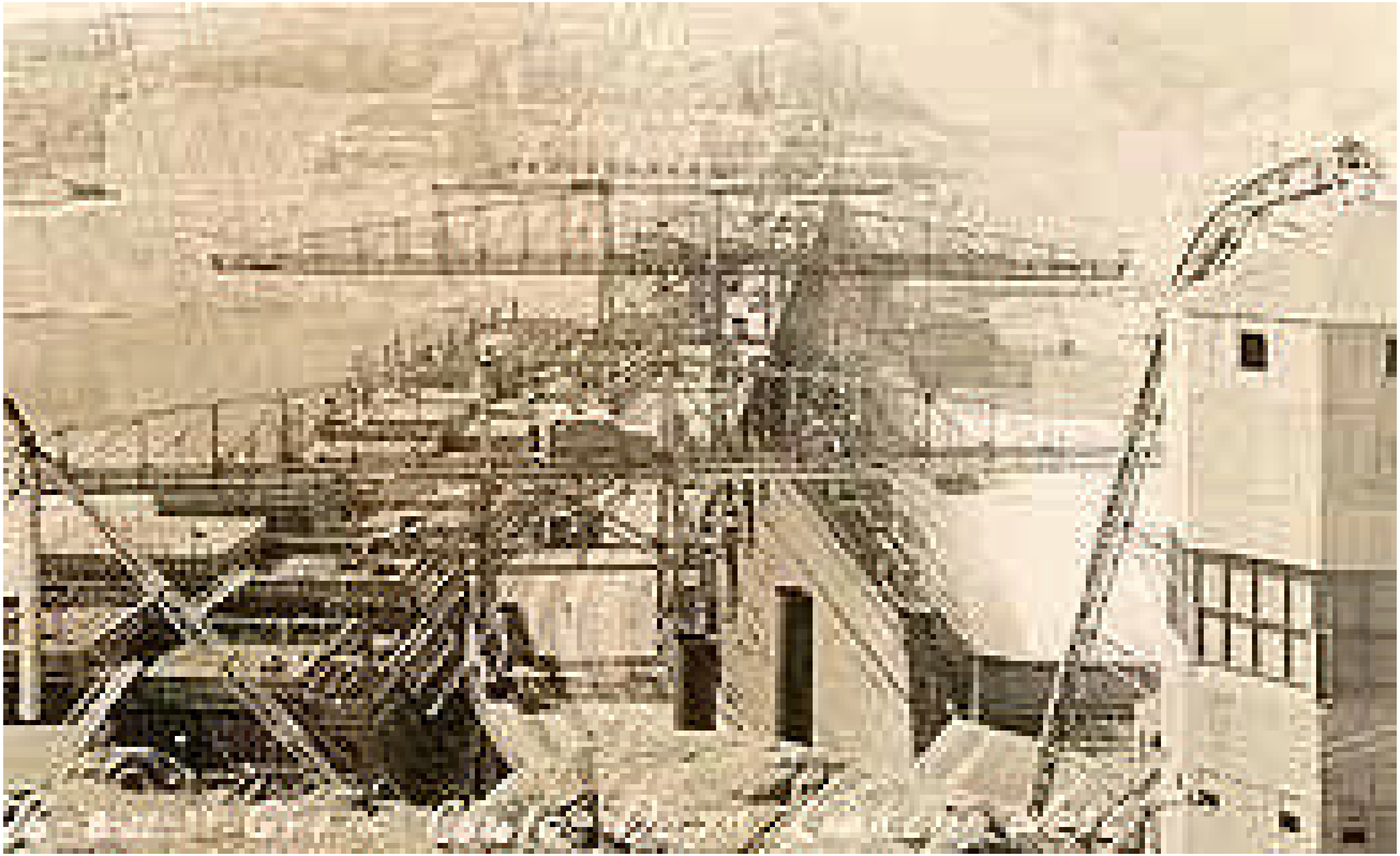
***The Wenatchee Daily World,* February 22nd 1937**

**<u>Top Left</u>: caption: "East mix plant in foreground and overall view of Grand Coulee Dam project (ca. 1936)"**
**<u>Top Right</u>: caption: "Looking northeast over west side high and low crane trestles, note the cantilever cranes, at Grand Coulee Dam (November 1936)"**
**<u>Left</u>: caption: "The construction at the base of the Grand Coulee Dam across the Columbia River channel nears completion in the fall of 1937"**



**<u>Left</u>: caption: "Here is a view of a corrugated concrete wall; the face of one section. The flutings in the face of this section will soon be keyed into the next block which will rise out of the excavation in the foreground. Note the three openings which will be galleries in the completed dam. The slope of the downstream face of the towering barrier can be seen at the right. Pipes protruding from the outer walls of concrete blocks must be painted with lead paint. The paint is to protect them from the water during the flood stages. The men standing on the top of the slab are mere specks when compared to this giant block."**

***The Wenatchee Daily World*, April 15th 1937**



***"The two-million-yard mark in concrete-pouring was passed early this month, MWAK figures disclosed today. A total of 2,072,891 cubic yards has been poured up to and including April 20, 1,840,680 on the west shore and 232,203 on the east bank. About 20,000 cubic yards of 'grout' has been forced into the granite bedrock…"***

***The Wenatchee Daily World,* April 22nd 1937**

***“The Spokane Portland Cement and Lehigh Portland Cement plants and three on the coast must work at capacity to supply cement for Grand Coulee dam construction, according to S.O. Harper of Denver, assistant chief engineer of the Bureau of Reclamation. The government contract calls for 15,000 barrels a day. ‘The program for pouring concrete is so arr-anged it will take all the cement of the five contracting cement manufacturers in the northwest,’ said Mr. Harper. ‘It is possible these plants will not be able to meet the demand. At no time has it been necessary to deliver the capacity de-mand,’ he said. ‘However, the MWAK Company will operate both mixer plants this summer. At this time last year the one mixer plant used 8,000 barrels per day, which is 50 percent of two plants.’”***

***Spokane Chronicle,* May 6th 1937**

***"The 53,000-barrel-a-week cement orders have been increased to 60,000. A barrel is equal to about four sacks of cement. The shipments now amount to about 260 carloads per week – more than 65 cars every week day. Further increases are expected soon…"***

***Tekoa Blade,* May 13th 1937**

***“A new all-time high for concrete production was set at Grand Coulee dam Monday, 8,801 yards of mix being poured, or 400 more than last summer’s high. Workmen placed 8,051 yards on the east shore, 74 on a few high blocks on the west bank and 77 yards of grout, thin mix used for joints. MWAK Company officials plan to pour 300,000 yards of concrete this month, and 440,000 yards for each of the following four months. The best month to date is 225,000 yards. One MWAK official wagered a newspaper man that 17,000 yards would be poured in a single day this summer. This would be about a third more than the world’s record of 10,500 yards.”***

***Seattle Times,* May 13th 1937**

***"The MWAK Company is installing four heavier-duty screens in the gravel screening and washing plant this week. The change will permit increased production of material for the concrete…The new equipment will permit screening of about 1,500 yards of gravel and sand per hour…"***

***Spokesman-Review,*** **May 28th 1937**

***“Improvements on the concrete mixers at the Coulee dam have enabled MWAK to turn out each regular mix of four yards of concrete at a rate of every 2½ minutes, instead of three minutes…The improvements were the result of research that continuously is being made by the contractors in efforts to save costs. They were made by inserting a few extra blades and getting a better adjustment in the mixing machines…”***

***Spokesman-Review,*** **August 2nd 1937**

***“Concrete pourers approached the halfway mark on the Grand Coulee foundation dam today after an almost steady concrete stream for seventeen months. MWAK engineers predicted the midway point on the foundation dam’s 4,518,000 yards of concrete would be reached today or tomorrow. They estimated six to eight months would be required for the second half of the pour. The first half was slower because forms had to be fitted to the uneven bedrock. Off bedrock, the same forms can be used repeatedly.”***

***Seattle Times,* May 15th 1937**

***“Photographers for the MWAK Company, general contractors, must ‘shoot’ every form on the base of the dam where concrete will meet rock. Hundreds of pictures will reveal in detail every formation on the expansive granite base…”***

***The Wenatchee Daily World,*** **October 12th 1936**

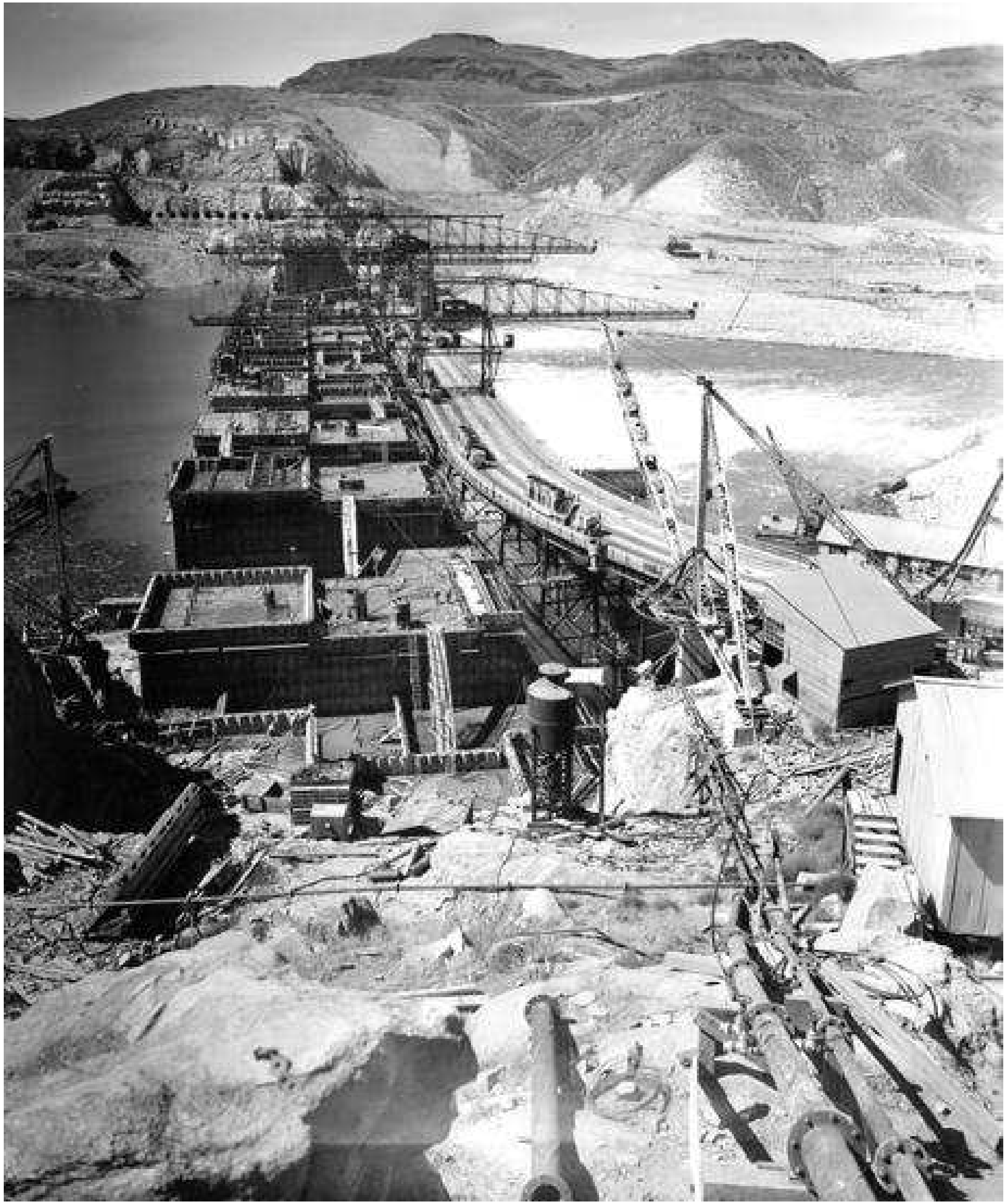
# Of But Thirty-Six

***"…Concrete poured at the Coulee dam now is equal in quantity to that poured for the total work at the Boulder Dam…and yet the Coulee dam, so far, has caused the deaths of but 36 workers, as compared to 89 at Boulder dam. More than 3,000,000 yards of concrete have been poured at the Coulee dam, compared to 3,300,000 at Boulder…"***

***Spokesman-Review,* August 2nd 1937**

***"Only about 75 or 80 blocks of concrete remain before the entire bedrock granite surface under the dam is covered, government engineers said here today, as concrete from both east and west sides gradually narrowed the gap. The MWAK poured more than 1,200,000 cubic yards of concrete on the east side, and passed the 3,000,000 total mark several weeks ago. With the completion of the low trestle, concrete work is expected to speed up, until it gradually approaches the tentative mark of 18,000 yards per day, set by the contractors as their day-to-day goal for high-speed pouring…"***

***Spokesman-Review,*** **August 4th 1937**

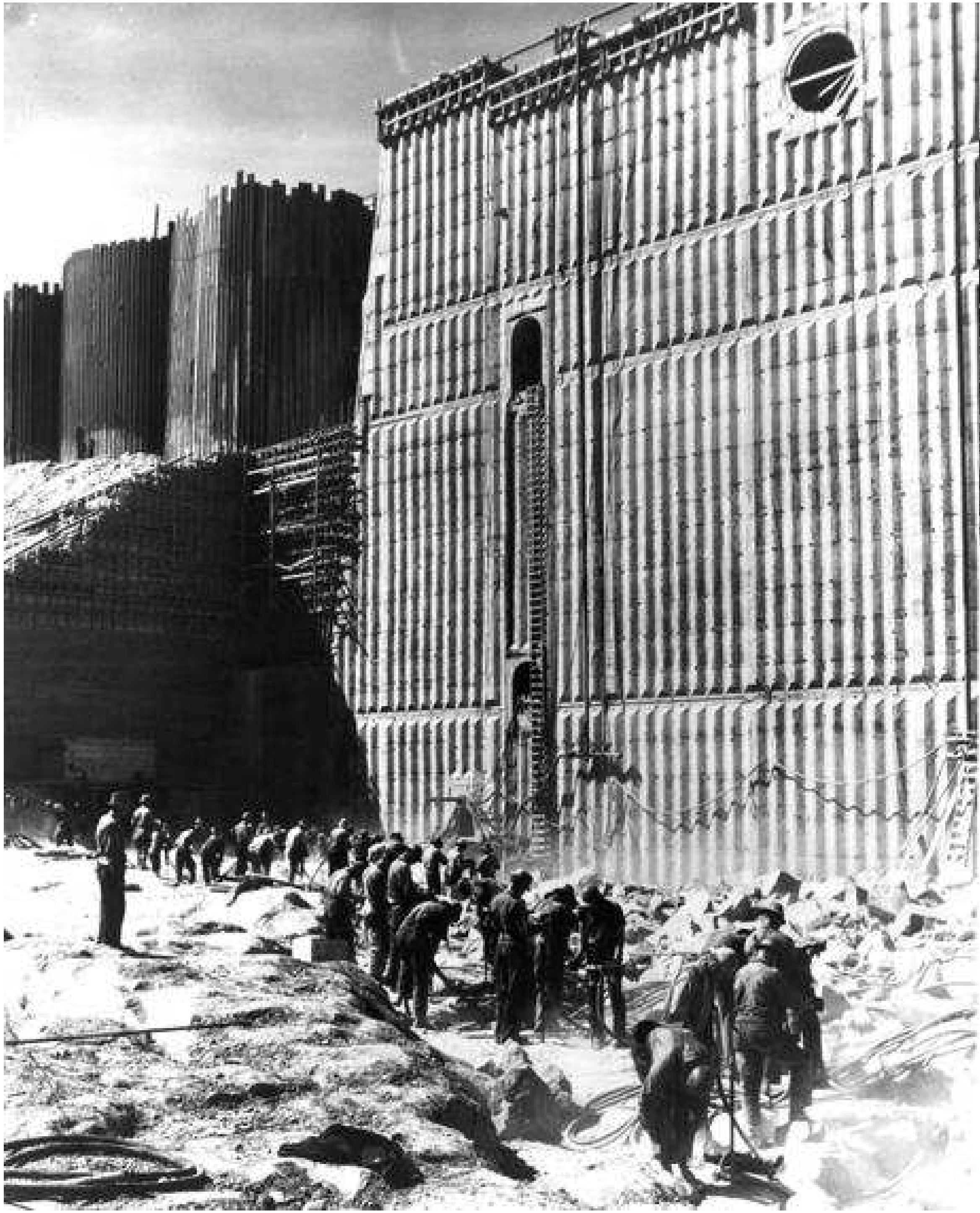


***"Heading down the home stretch, the MWAK Company started on its last million yards of concrete Sunday…It has taken the company almost two years to pour the 3,500,000 yards, or about 1,750,000 a year. It is predicted, with the company having averaged more than 100,000 in a single week, that the remaining 'mud' will be placed in little more than 10 weeks. Even during the pouring of the first 3,500,000, MWAK shattered every type of world record. More than 15,700 yards were placed in a single day, which is 5,000 yards more than recorded in a day at Boulder…"***

***Spokane Chronicle,* September 6th 1937**

***“The Columbia river is now 22-feet below the high point of last June, so the MWAK Company are preparing to close the high blocks in the diversion channel, and expect to start pouring concrete at that point within a few days. Monday forms were being set up on the three blocks separating the four notches through which the entire 71,000 cubic feet per second flow of the river is now being handled. Each block, after receiving 10-feet of concrete will be ready to receive the heavy gates now under construction to block the flow of the river entirely, and force it around the draft tubes left in the dam. The heavy gates, or valves, for the draft tubes have not yet arrived, and, it is reported it will be some time before the 100-ton closures can be placed against the upstream and downstream faces of concrete to shut off the water and permit the placing of concrete there in the low notches.”***

***Latah Citizen*, September 17th 1937**

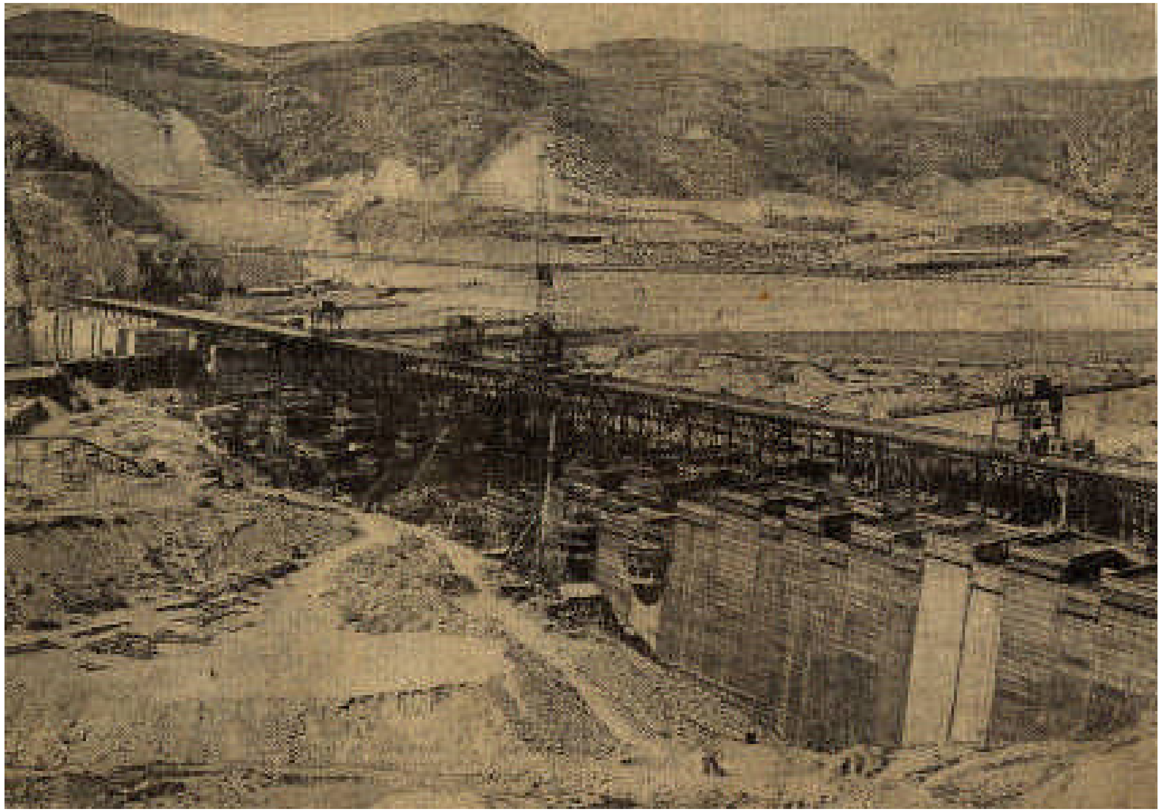


**Above: caption: “Up-stream face of the west bank concreted area”**
**Left: caption: “Const-ruction of the dam showing the upstream face in 1937”**

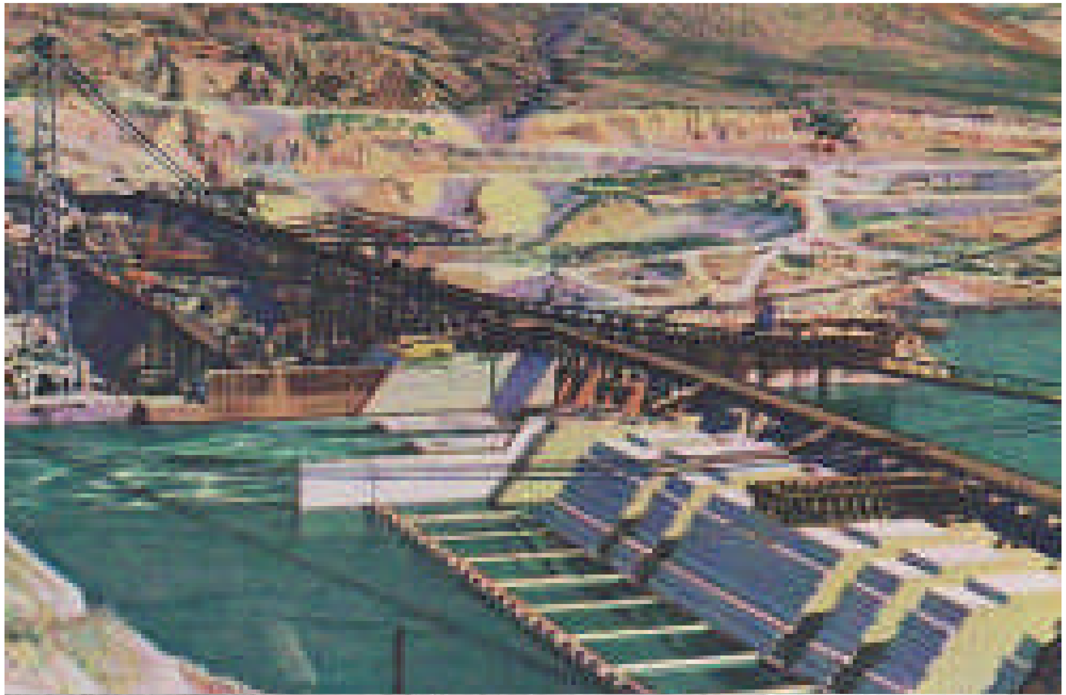
# The Gravel Famine

***“Too much sand in the pits, creating a shortage of suitable gravel, is delaying pouring of concrete in the foundation of Grand Coulee dam. The MWAK Company dismissed several hundred concrete workers yesterday after several 24-hour shutdowns in the last two weeks…The company has installed a side track device to eliminate surplus sand, which is raised by a giant electric shovel in the gravel pit. The demand for gravel has been greater than the supply since record-breaking pouring of concrete began.”***

***Spokesman-Review,* September 27th 1937**



<u>**Above**</u>**: caption: "Already more massive than the completed Boulder dam and now the biggest man-made structure on earth, the first stage in the construction of the Grand Coulee dam is nearing completion. This is what President Roosevelt will see at the dam site next Saturday – virtually all accomplished since his last visit in August 1934, a little more than three years ago. Before spring, 1938, MWAK, General Contractors for the base of the dam, will have their job completed. All the bedrock will have been un-covered in the canyon of the Columbia river and more than 4,000,000 cubic yards of concrete will have been poured into a huge slab, 4,290-feet long, 500-feet wide and nearly 200-feet high in the highest spots. This will represent more than one-third of the total bulk of the finished dam, about 11,500,000 cubic yards. This view was made from the east side of the dam from the upstream side. It shows the high trestle completed the entire length of the dam and the tremendous amount of concrete poured on the east side, in the foreground, during 1937. Virtually all the area has at least one tier of concrete blocks. At the far end of the dam can be seen the west side construction, about 800-feet long, which was poured in 1936. Most of the cofferdams have been removed. The river can be seen at low water in the middle distance." (*Spokesman-Review,* September 26th 1937)**



***"…The pouring of the last million will mean dumping 250,000 bucketfuls. The firm has averaged as high as 3,875 buckets in a single day…"***

***Spokane Chronicle,*** **September 6th 1937**

**Top: caption: "Partly completed base of dam with turbine pits in foreground. Finished dam will be 300-feet higher than concrete shown."**

**Bottom: caption: "President Roosevelt is at the Grand Coulee dam site in Washington on October 2, 1937, during his tour of inspection of federal projects in the North-west. The president is seated in the rear of the car at the left."**

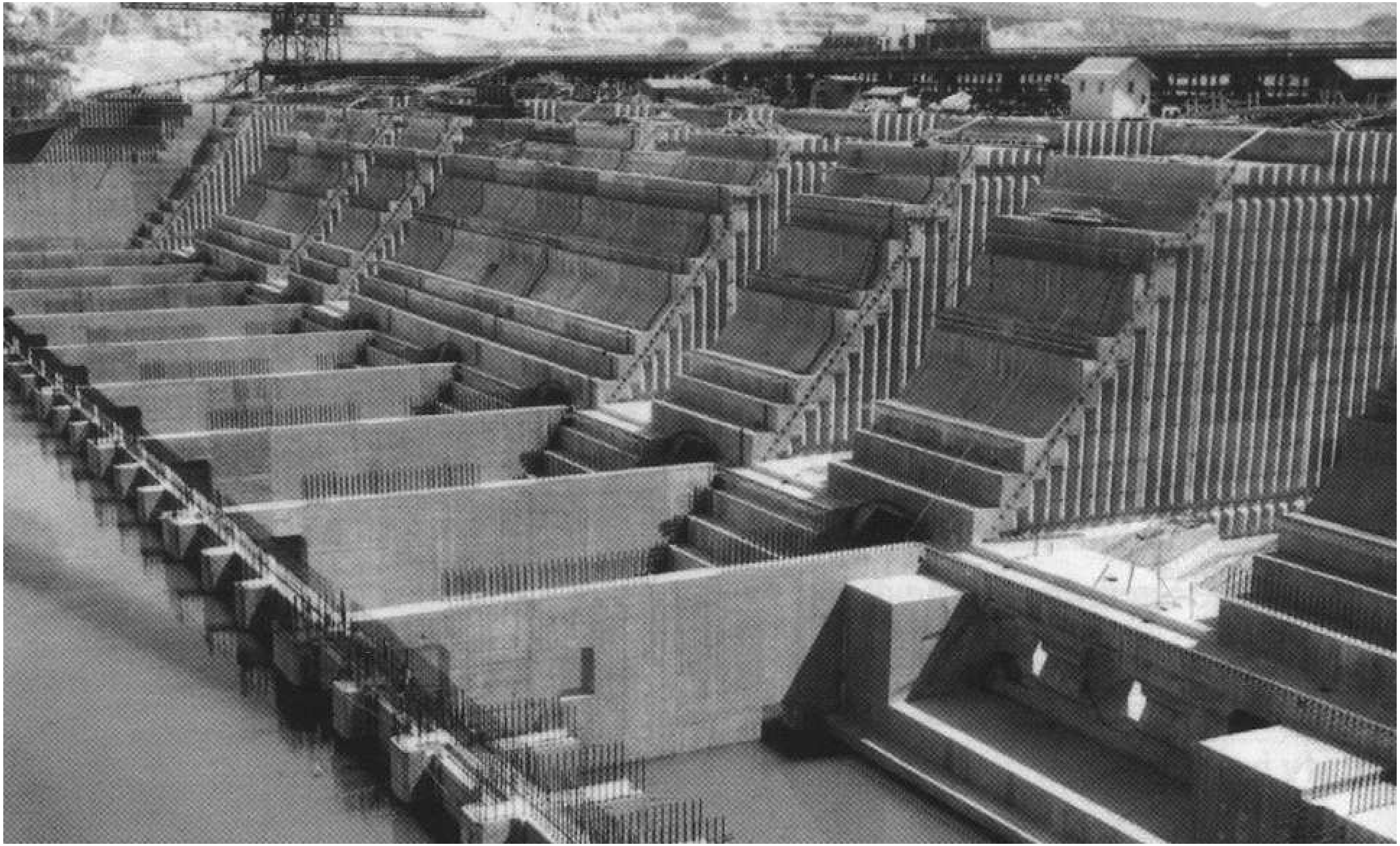
# The Beginning of the End

***“MWAK Company started today on ‘the beginning of the end’ of their contract for construction of the Grand Coulee dam foundation. Only 275,000 yards of concrete remain to be poured in the foundation and officials hope to have this in place well before Christmas. Evidence that the contract is nearing an end was apparent today when workmen started taking out the low trestle over which thousands of yards of concrete have been hauled to be dumped into the giant mass of the foundation far below the river bed…”***

***Spokane Chronicle,*** **November 12th 1937**

***"…Bids will be opened here on December 10 by the Bureau of Reclamation for a contract to complete the dam. The new contract will require more than 7,000,000 barrels of cement which means the placement of 5,800,000 cubic yards of concrete, or more than 1,500,000 cubic yards in excess of the total volume of concrete that went into Boulder dam."***

***Spokane Chronicle,* November 12th 1937**



***“Only 50,000 yards of concrete remain to be poured to complete the MWAK contract for the dam foundation. Within the next two or three days the closure gates will be placed in the diversion channels and the entire operation of diverting the river will be completed.”***

***Spokesman-Review,*** **December 13th 1937**



**<u>Above</u>: caption: “Grand Coulee Dam during construction, 1937”**

# The Last Yard

***"The last yard of concrete under the MWAK Company's contract is scheduled to be lowered into place in the foundation of Grand Coulee dam tonight, bosses said Sunday. About half a dozen pours remained to be made today to fulfill the company's constructual obligations with the federal government. All were to be made in two gaps, formerly known as the diversion passages Work had progressed far enough Sunday to permit installation of parts of the west side fish ladders. Another set has been completed at the east end of the 1,650-foot spillway section. With the completion of the dam, about 4,500,000 of the 11,250,000 yards of concrete will be in place. The structure already is a million and a quarter yards larger than Boulder dam, previously heralded as the largest dam in the world."***

***Spokane Chronicle,*** **January 10th 1938**

***"A silence almost as audible as the two-year long roar of whirling machinery and escaping compressed air prevailed today in Grand Coulee's big 'House of Magic,' marking the end of concrete pouring under the MWAK Company contract. The last yard of the gray mix was dropped Monday evening, ending a job that saw 4,523,000 cubic yards of concrete placed on the granite bedrock spanning the Columbia river from abutment to abutment. MWAK poured its first yard on Thanksgiving day, 1935, although the official first yard was lowered a week later with Governor Martin and a big crowd present. Except for a few day long shut-downs and two interruptions during two winters, the work has moved along continuously. A peak day of 15,500 cubic yards and a month's record of nearly 400,000 were established last summer. The best previous mark set at Boulder dam several years ago was 10,250 yards a day."***

***Spokesman-Review,*** **January 12th 1938**

***"…Word to proceed with the construction will be sent to the Interior Company from the Denver field office of the Reclamation Bureau…Work must start within thirty days after notification…have not advised Reclamation Bureau engineers what their first work will be. It is believed, however, reconditioning of the plant will come first in order to assure continuous operation when actual pouring of concrete is started. Before the work gets underway, it also will be necessary to make realignments in the roadways and railroads. The high tower, which has carried the belt conveyor system for the MWAK Company, also must be removed. Talk among engineers indicates the Interior Company's plan for future work will call for a high steel bridge over which the concrete trains will operate in a manner similar to the MWAK plan of pouring concrete. However, in the absence of the belt conveyor system, it is assumed the west shore concrete mix plant will be relocated beside the plant on the east shore…"***

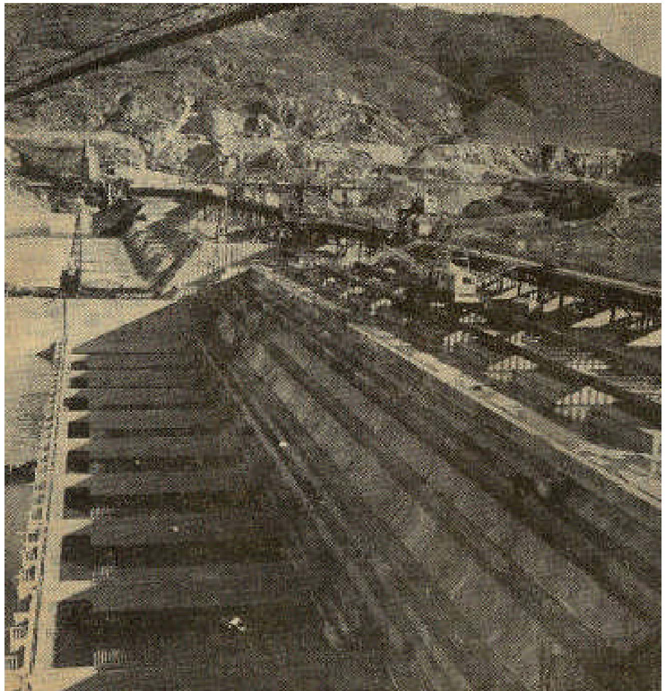
***Spokane Chronicle,*** **January 28th 1938**

***“The Consolidated Builders, Inc. will probably take over the remaining work on the MWAK contract about February 21…It is expected that MWAK will have their work in shape so that the new contractors can start in without any delay in the work. The major clean-up work now to be completed is the removal of the cribs at blocks 39 and 40 and when this is done it is believed that all miscellaneous clean-up work will be completed and the new company can step right in and take charge…the contractors may take over MWAK work even though their bond might not be approved by that time, provided MWAK will assume the responsibility. Following the signing of the contract and the presentation of their bonds the CBI must have the ‘proceed order’ from the Bureau of Reclamation’ before they may formally take over the job and providing MWAK has been released by the bureau from their contract…”***

***Spokesman-Review,* March 12th 1938**

***“Settlement was expected today between the MWAK Company and the Bureau of Reclamation for construction of Grand Coulee dam foundation at a cost of between $35,000,000 and $36,000,000, not including about $5,000,000 in ‘extras’ claimed by the MWAK. Frank A. Banks, bureau engineer in charge of Grand Coulee construction has submitted all necessary papers for the settlement…‘As soon as the settlement has been reached the Consolidated Builders, Inc. will be officially notified to proceed with the new contract,’ explained Mr. Banks. ‘However, this notification is merely a formality, as the new contractor is already at work.’…The approximate $5,000,000 claimed in ‘extras’ by the MWAK Company is a matter to be settled, it is said, in Washington D.C., with Commissioner John C. Page.”***

***Spokesman-Review,*** **March 19th 1938**

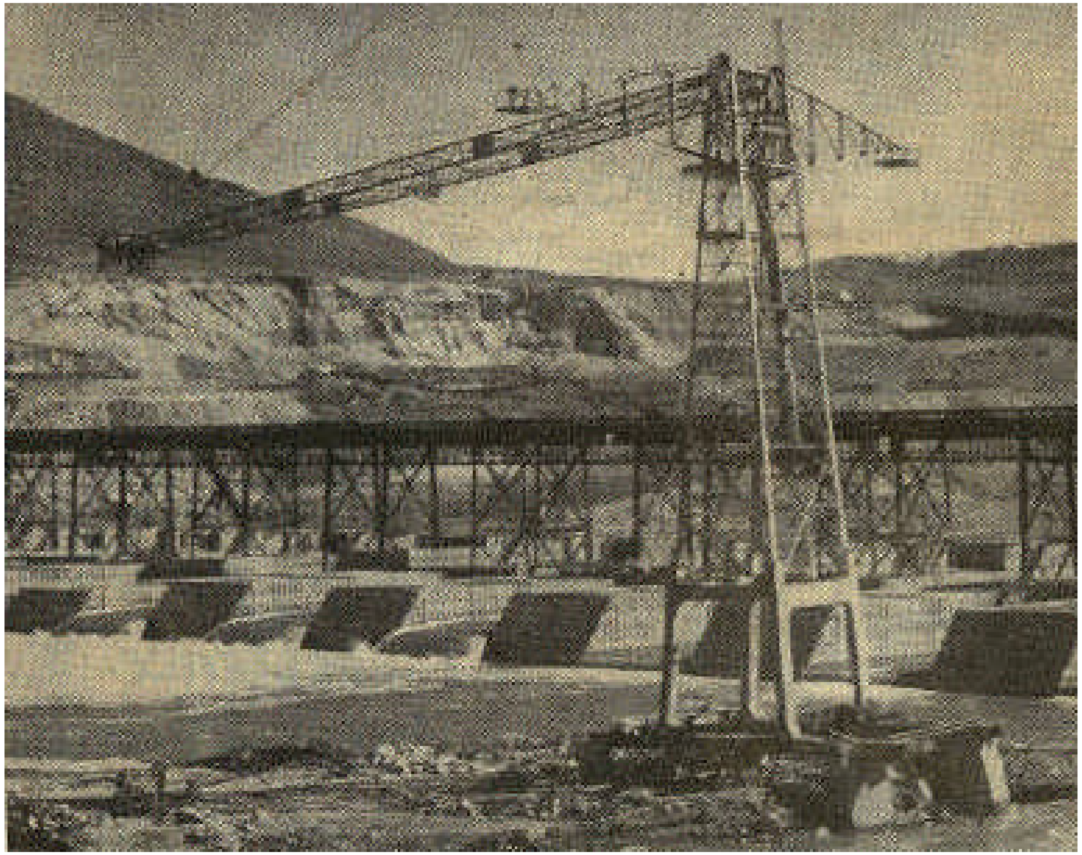


***"The Bureau of Reclamation at 4:30 this afternoon gave the official OK to Consolidated Builders, Inc., to take over the giant task of completing the dam project from MWAK. The latter contractors, released from their part of the contract, erected the foundation of the structure and CBI now takes over. Preliminary arrangements already had been made and the new contractors are ready to start the job immediately."***

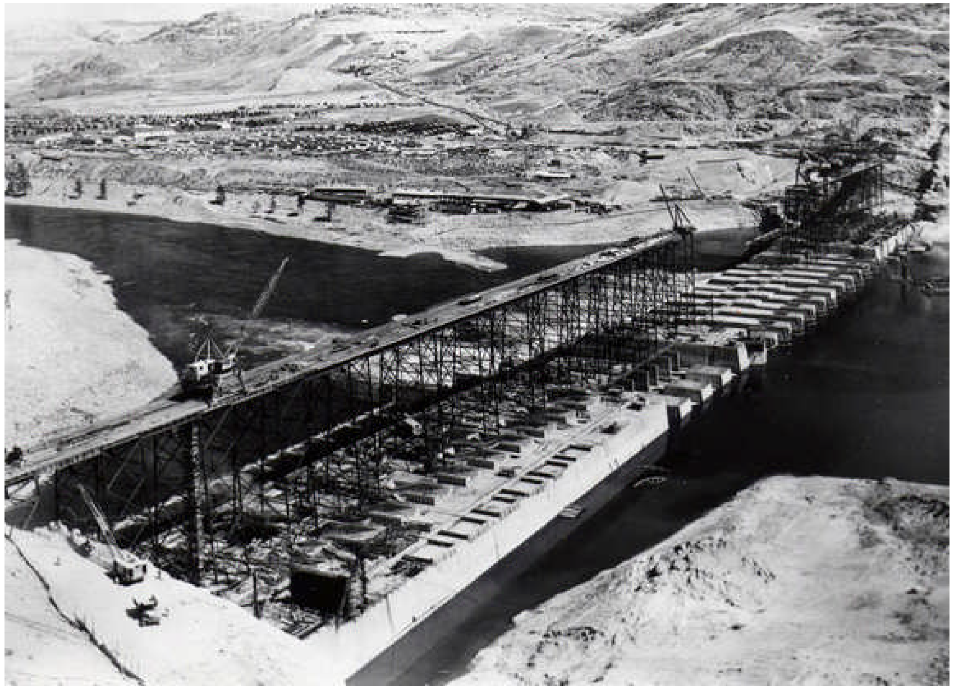
***Spokesman-Review,* March 21st 1938**

**<u>Top</u>: caption: "This photograph by the Reclamation Bureau represents concrete placed by the MWAK Company and the point where CBI, the new contractor, will begin operations. Three hundred feet of concrete will be added to the mass and the east end will occupy the excavated section shown in the upper left hand corner of this picture." (*Spokesman-Review*, March 6th 1938)**

**<u>Bottom</u>: caption: "March 18, 1938. With the foundation complete, work begins on the dam structure. MWAK, the company that built the foundation, joins with several other companies to win the government bid. The new company is called Consolidated Builders Incorporated (CBI)."**

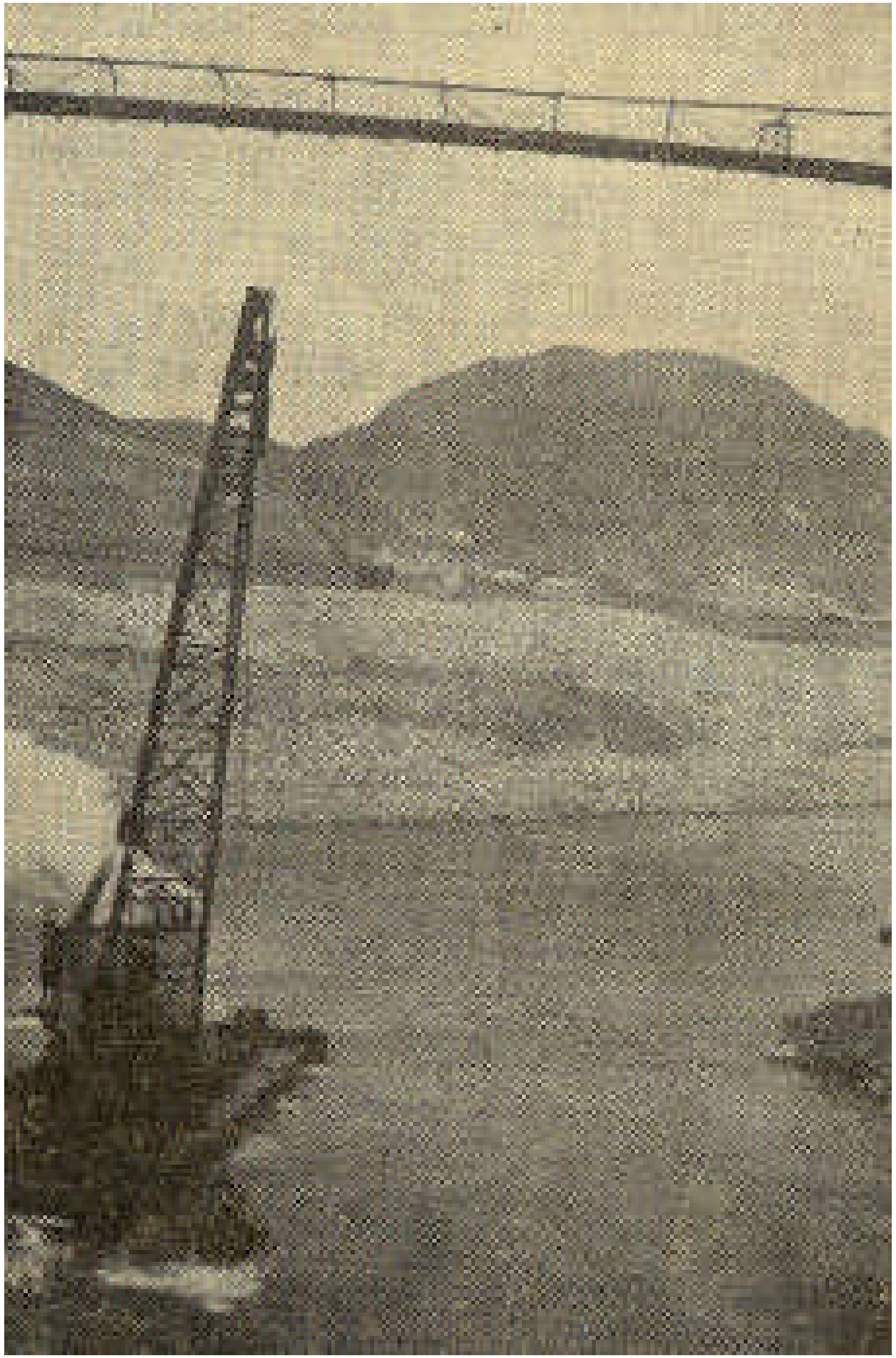


<u>**Above**</u>**: caption: "A tiny acetylene flame Tuesday cut the guy ropes and plunged into the Columbia river a 175-foot section of the central tower of the 3,400-foot suspension bridge which has been one of the spectacular features at the grand Coulee dam. The contract for the completion of the dam provides that Consolidated Builders, Inc., shall remove the bridge before the high-water season of 1938. During its short life of four years, the bridge has carried across the river over 4,000,000 tons of sand and gravel and about 2,000,000 barrels of cement, by means of a belt conveyor and a steel pipe. Now that the base of the dam spans the river, it is no longer necessary to mix concrete on both sides of the river, and the west side concrete mixing plant will be moved to the east shore. The pipe line for the cement will be carried across on the dam, so the suspension bridge has become superfluous." (*Spokane Chronicle,* March 26th 1938)**



***"CBI probably will award a contract to Bethlehem Steel for erection of the high trestle…Negotiations indicate that the contractor may award the contract in the next few days, the contract for the steel has already been awarded to Bethlehem, and it is being made. Approximately 1,000,000 pounds are needed, and delivery is expected soon. The trestle will be at elev. 1180 and will be used for concrete pouring and general utility work. The contract will call for completion late in the fall…"***

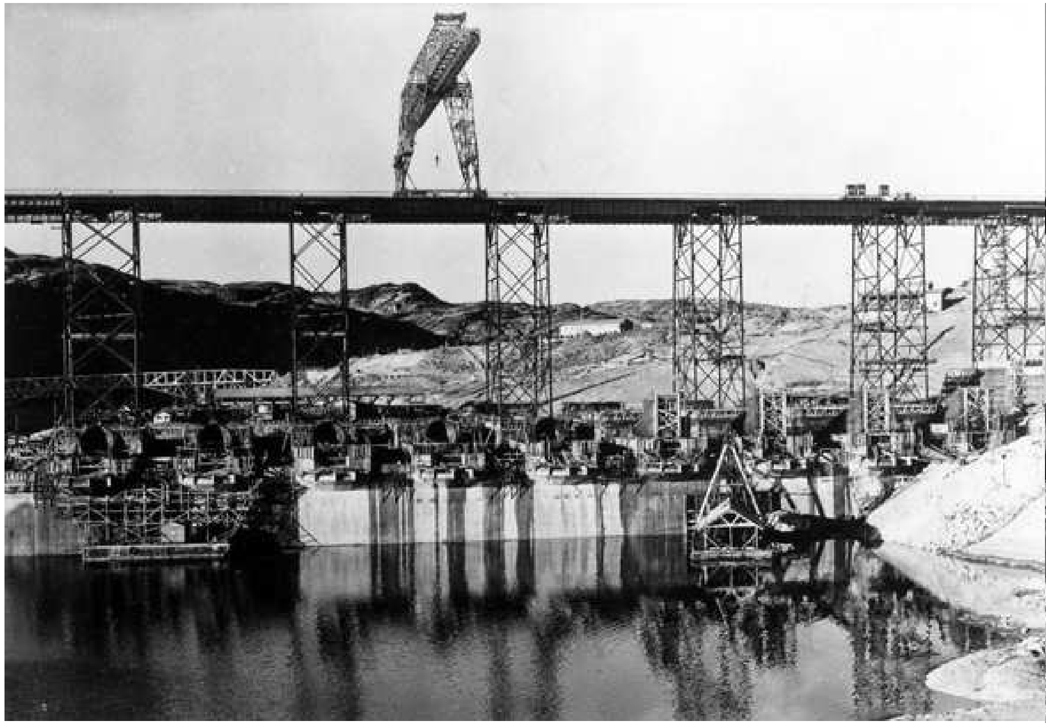
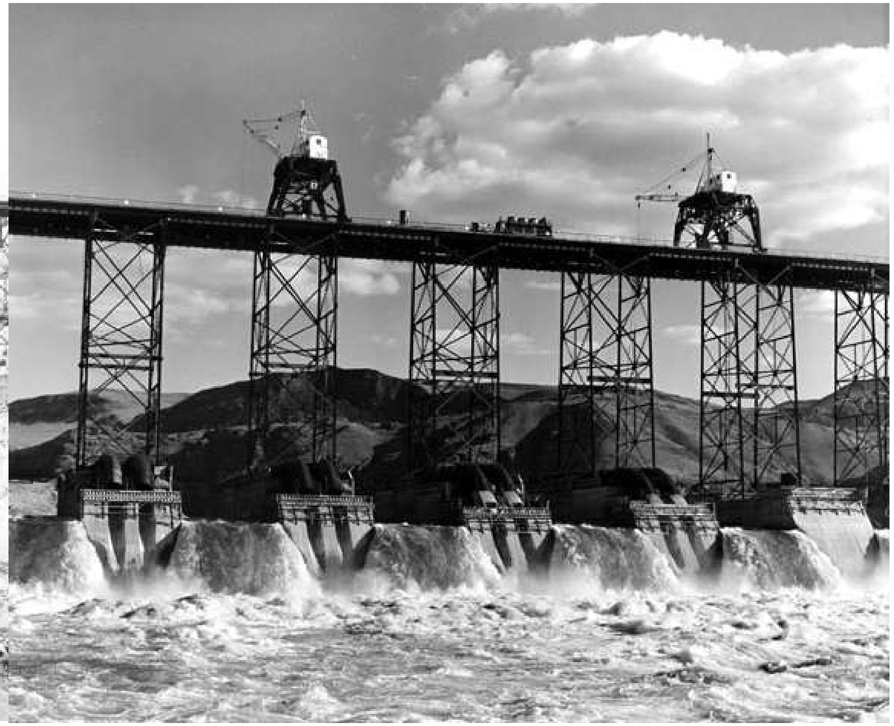
**Left: caption: "The high crane trestle at elevation 1180 at Grand Coulee Dam (August 1938)"**



***"Pouring of concrete was started this morning near the west end of the Grand Coulee dam by Consolidated Builders, Inc., new contractors. Lowering of buckets of 'mud' marked the resumption of actual construction work on the dam. The MWAK Company, the original contractors, started tapering off on concrete placement late in the fall, and completed details of its contract late in March…"***

***Spokane Chronicle,* April 4th 1938**

**Left: caption: "This photograph at the Grand Coulee dam shows the 'clam shell' taking out the last bucketful of muck from the spillway bucket under the contract of the MWAK Company. Consolidated Builders, Inc., the contractors for the completion of the project, now are ready to take over." (*Spokesman-Review,* March 16th 1938)**

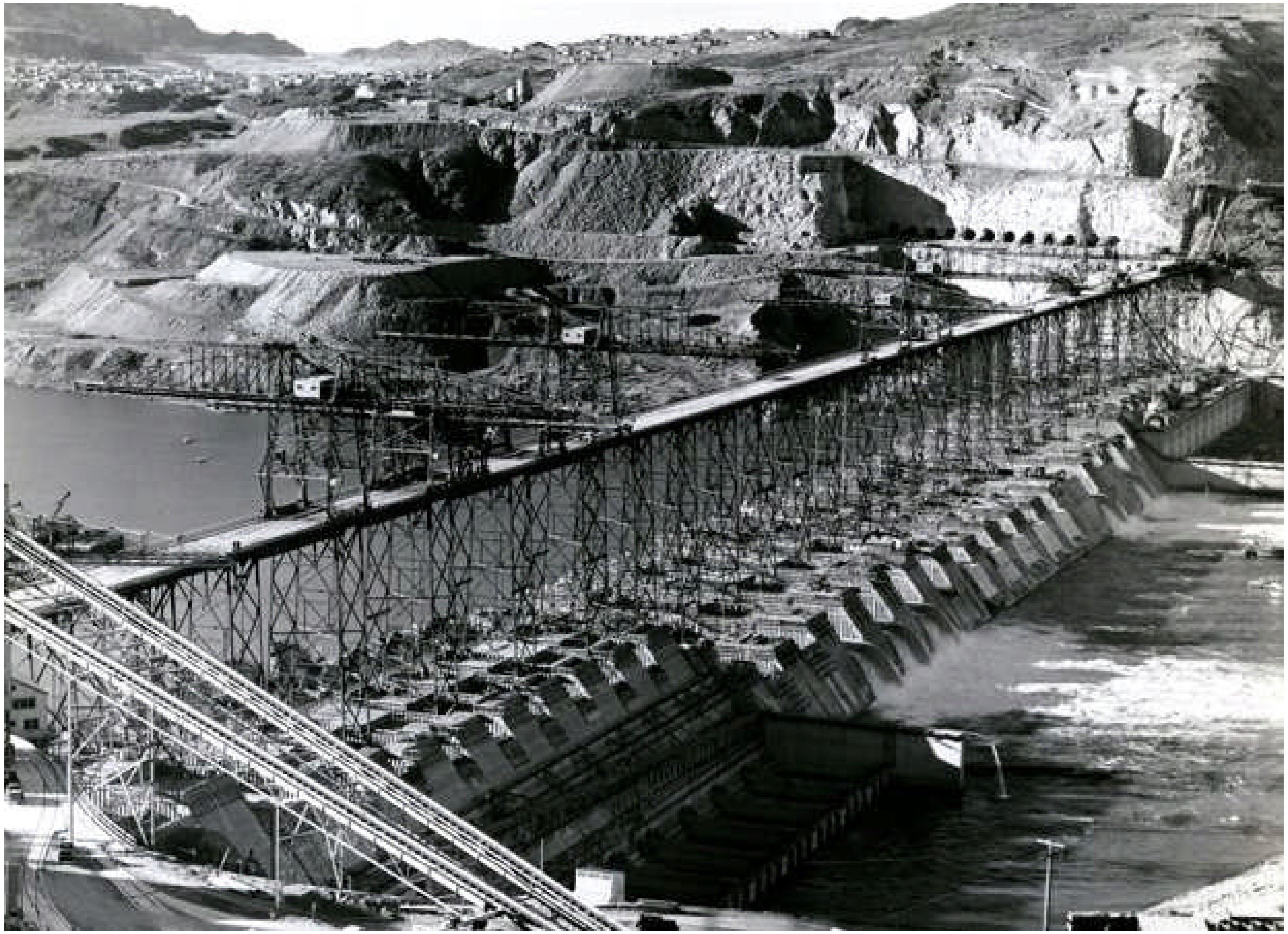
 

***"…The CBI will place about 55,000 cubic yards in the next two months, and will then make extensive changes in equipment. The construction trestle, extending the length of the dam, will be raised about 200-feet and will be nearly doubled in width. The concrete mixing plant will be moved about 180-feet higher on the east bank. Approximately 2,000 men are employed by the Reclamation Bureau, the CBI and subcontractors at the dam site and in the Columbia basin."***

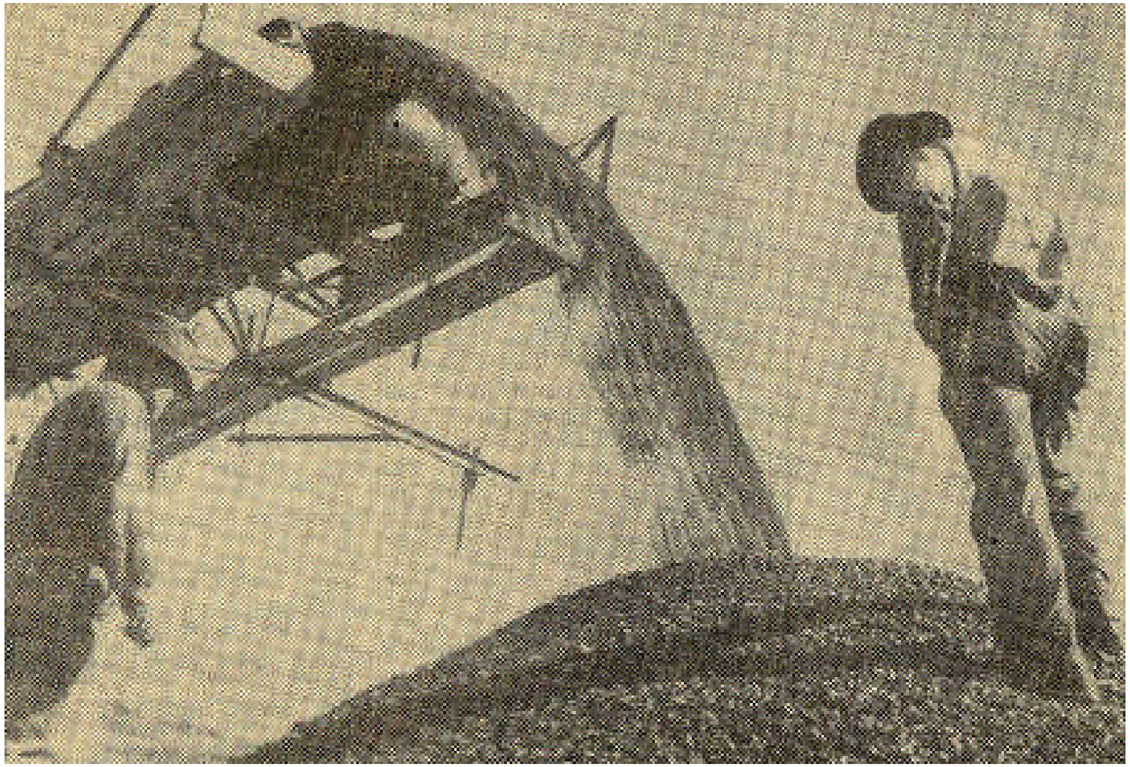
***Spokane Chronicle,*** **April 4th 1938**

**Left: caption: "The high crane trestle at elevation 1180 at Grand Coulee Dam (November 1838)"**

**Right: caption: "High trestle crane work at Grand Coulee Dam (ca. 1938)"**



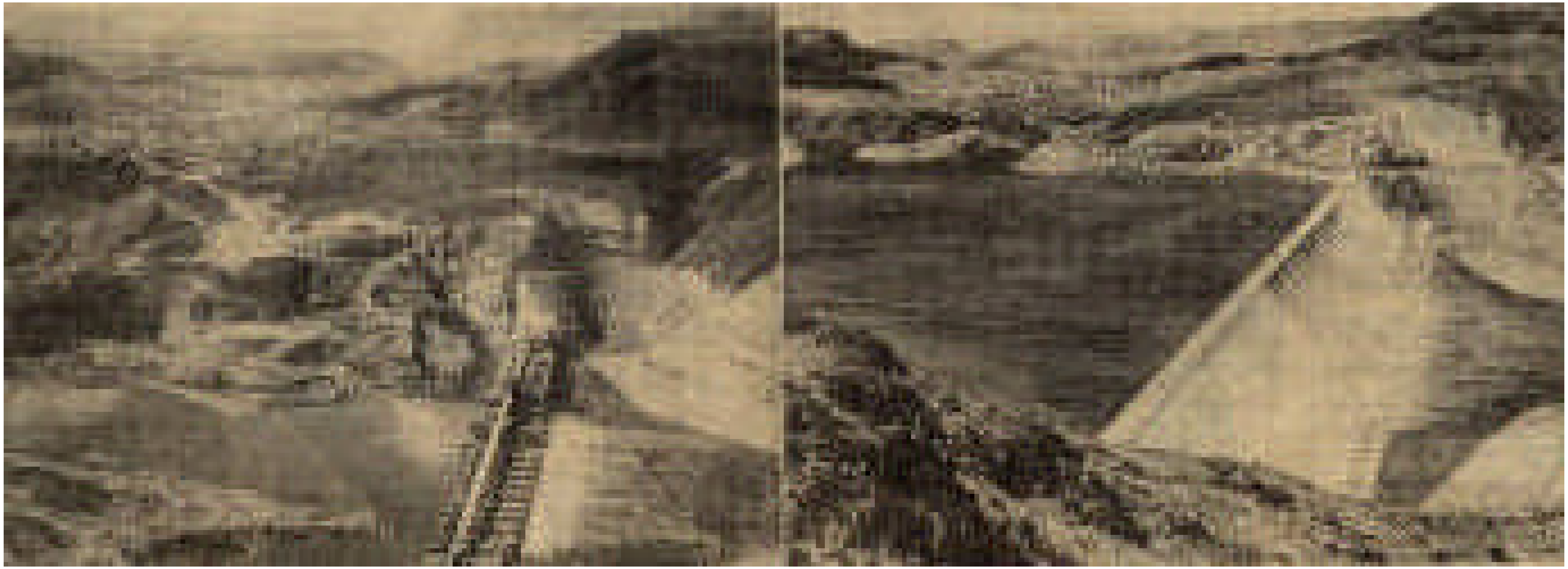
<u>**Above**</u>**: caption: "When Consolidated Builders, Inc. wanted some big poles for raising mixing plant lines at Coulee dam, it was up to B.J. Carney Company, Spokane, to deliver the goods. The picture shows one of their trucks loaded with six 90-foot poles en route to the dam. These overgrown toothpicks presented many problems in handling, as their length of 90-feet and their weight of 22,000 pounds provided man a traffic hazard. A special license to have them on the highways, a pilot, and a police escort to turn corners on their way through the city were just three of the many angles that had to be worked out in advance. The trees were logged and trucked from the Priest River area." (*Spokane Chronicle,* April 16th 1938)**



***“Pouring of 9,000 cubic yards of concrete, to continue until September, will start next month, the CBI announced today. The work will construct a wedge-shaped strip 700-foot long and 40-feet wide in the west power house section of the dam.”***

***Spokane Press,* June 13th 1938**

**<u>Above</u>: caption: “The ring of gravel as it falls from the end of a conveyor belt to a storage pile at Grand Coulee dam site is music to the ears of hundreds of workmen, who have been idle several months pending the start of operations by the Consolidated Builders, Inc., new contractors at the dam. Gravel and sand piles started rising Monday, and actual concrete pouring was scheduled for today.” (*Spokane Chronicle,* April 5th 1938)**

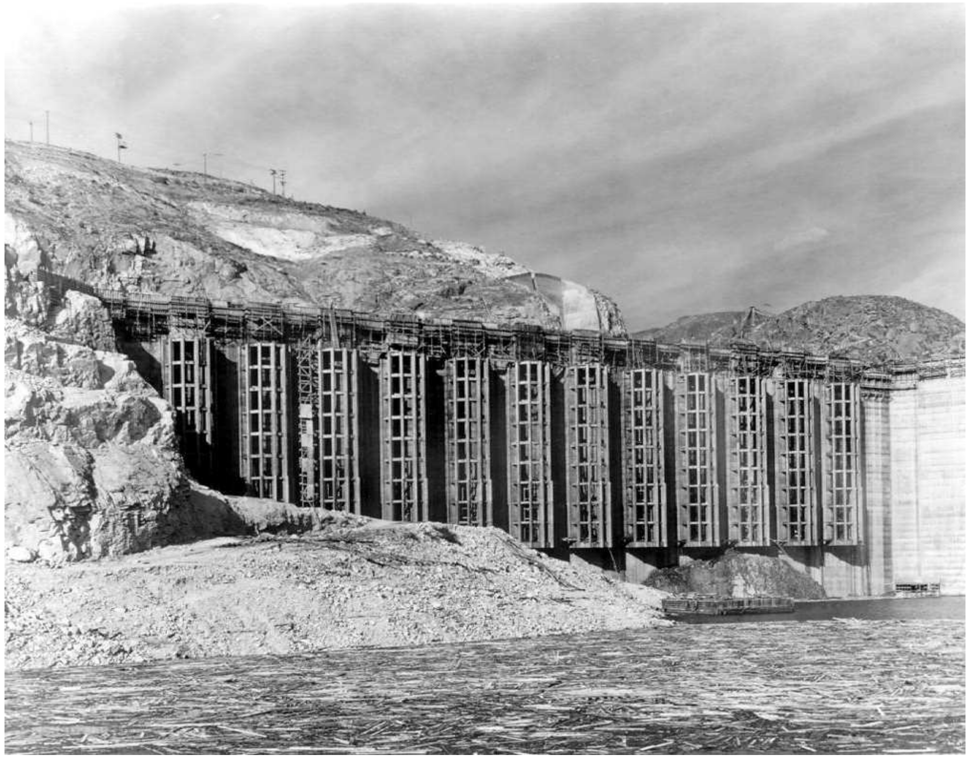


<u>Above</u>: caption: "Grand Coulee dam in the present and future are shown in sharp contrast in these photographs, taken from approximately the same point looking south into Grand Coulee toward Steamboat Rock. The photograph on the left shows the project as it was taken over recently by the Consolidated Builders, Inc., from the MWAK Company. The artist's conception of the completed project is a preparation of the Bureau of Reclamation. Seen in both photographs is the present highway leading down to the project. The town of Grand Coulee is shown in the upper center portion of the pictures. Rattlesnake canyon, where several million yards of earth were dumped, will be entirely under water, as will virtually all of the area behind the dam and below the present highway to the project. At the right in the artist's sketch are the pump house and power plant."
(*Spokane Chronicle*, April 7th 1938)

# Pumping Plant

**<u>Above</u>: caption: "Coulee Dam irrigation pumping plant and discharge pipes – west crane recess, April 1940"**

**<u>Left</u>: caption: "Looking north over pump plant construction, June 1940"**

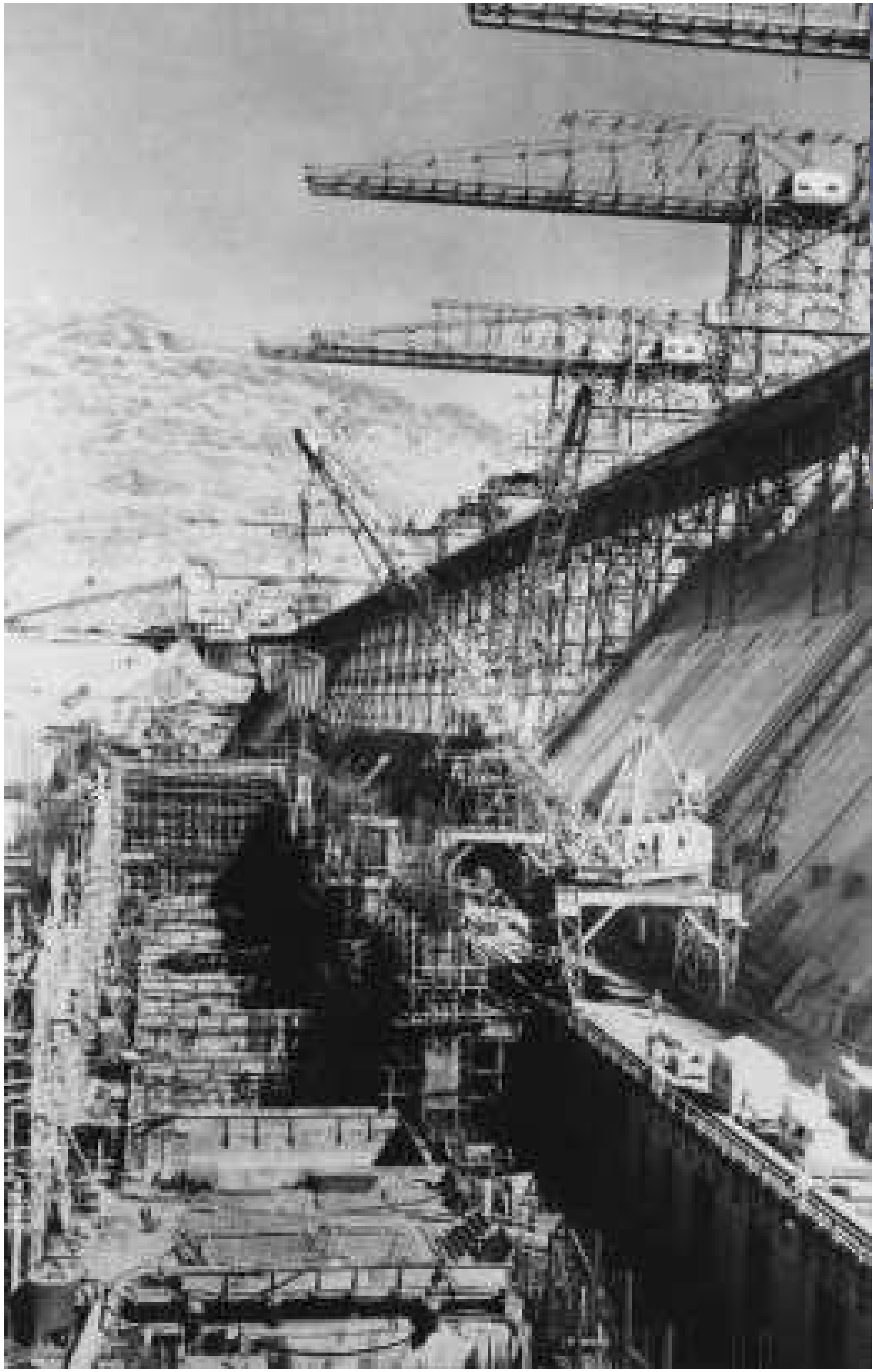


<u>Left</u>: caption: “Photograph of the back side of the pumping plant foundation. Each pump inlet tube is shielded by a vertical column covered by steel grates. These grates, known as trash racks, protect the pumps from sucking up debris from the river. Photo taken on October 23, 1940.”

# Houses of Power

***"…The 'ground' for the east side Grand Coulee dam power house will be laid this week. Eleven thousand feet of cable from 1/2 to 1-1/8-inches in diameter will be laid as a grid over an area 500 by 150-feet. The cables will be 10-feet apart the long way and 45-feet the short way. A similar grid was laid for the west side power house."***

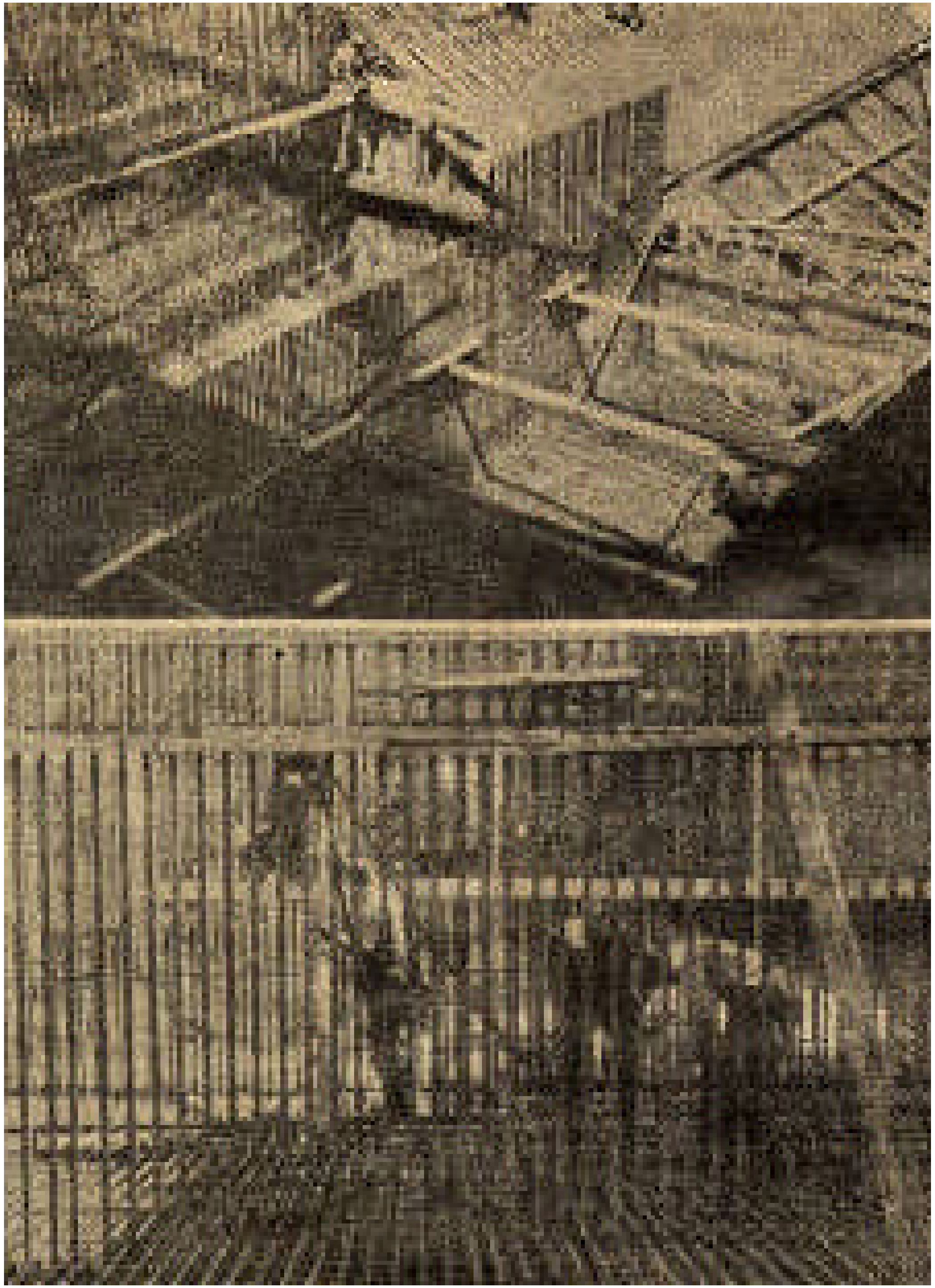
***Spokesman-Review,*** **December 10th 1935**



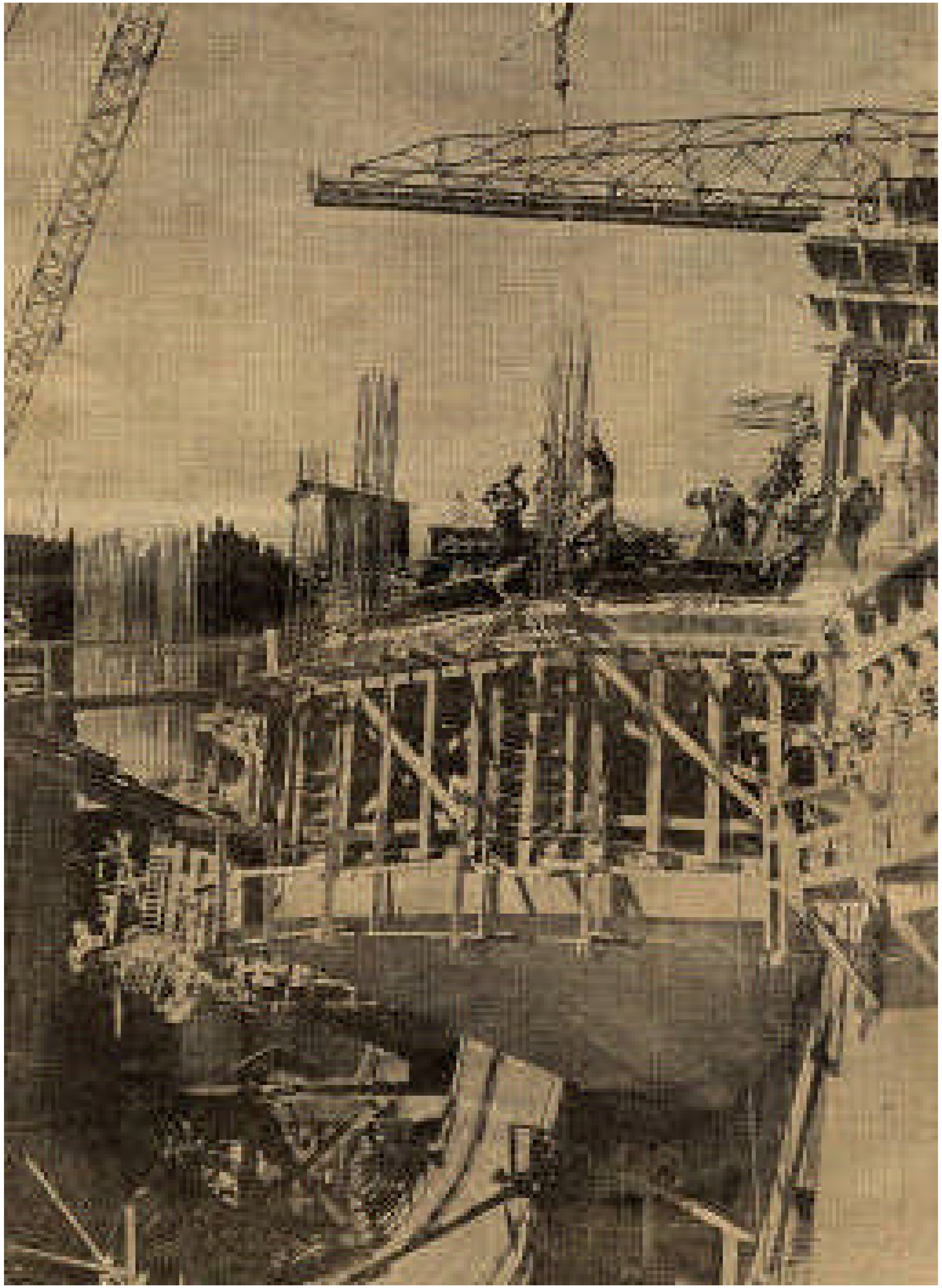
***"…Under construction at the base of the dam is the world's greatest power plant, ultimately to consist of two buildings, each fourteen stories high and two blocks long, each housing nine generators and turbines. The initial installation will consist of one of the two buildings, three main generating units and two stationary service units…"***

**<u>Above</u>: caption (painting): "'The Coulee Dam Produces Energy to Fuel Factories,' by Thornton Oakley"**

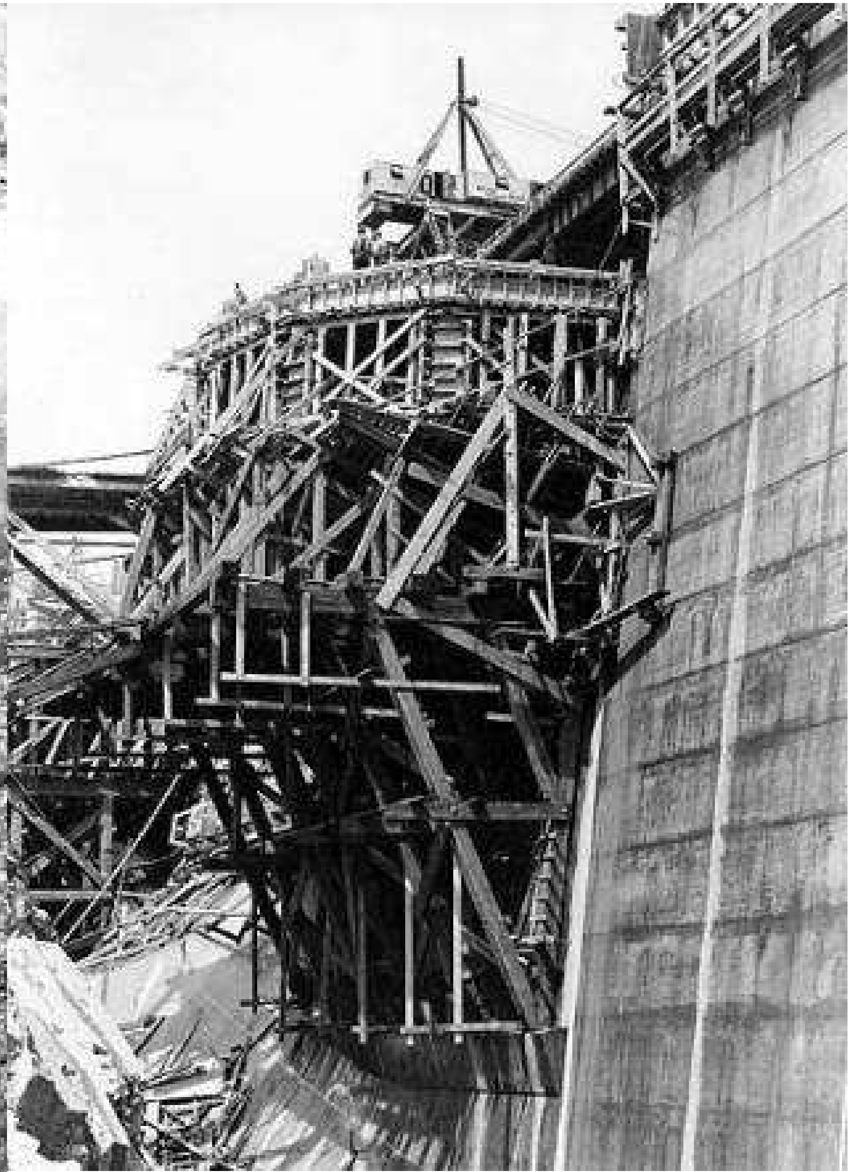
**<u>Left</u>: caption: "Powerhouse under construction – Grand Coulee Dam"**



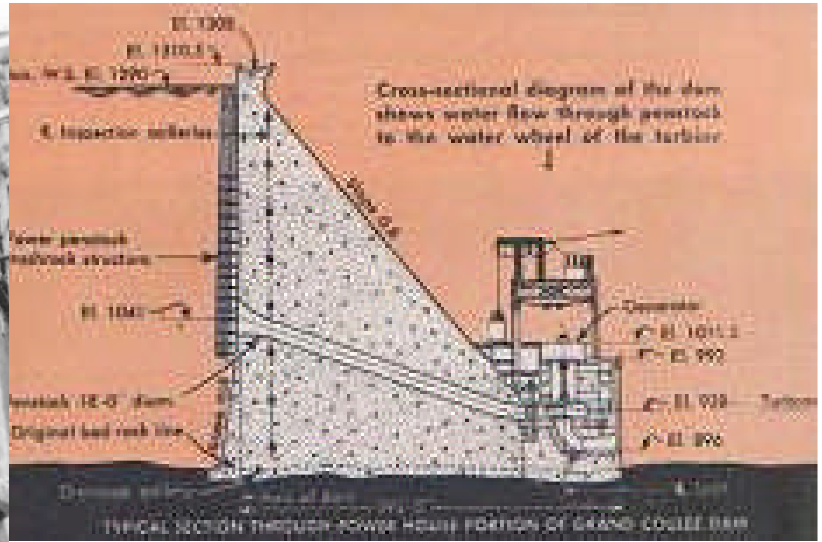
**<u>Left T&B</u>: caption: "'Only a bird in a gilded cage' is the feeling, somewhat, of MWAK workmen whose job it is to erect hundreds of thousands of reinforcing steel in the east powerhouse section of Grand Coulee dam. As the photographs show, the powerhouse, prior to concrete-pouring, is a dense forest of protruding steel bars, placed to strengthen the walls of the structure against vibration. The main dam itself contains no steel. It is this network of interwoven steel bars that concrete is poured in the dam site's tiniest amounts. Plain water pails are used to place the 'mud' in the narrow confines. Workmen move the mix into place with short handled shovels. So narrow are some of the areas that workmen sit down to do their work." (*Spokane Chronicle,* June 14th 1937)**



<u>**Left**</u>**: caption: "A new phase of the construction work on the Grand Coulee dam under the MWAK foundation con-tract is the erection of trash racks on the upriver face of the dam. Workers have dubbed these 'bay windows' be-cause they protrude from the smooth concrete face of the dam. One will be placed at the opening of each of the huge penstocks that carry water to the turbines. Each will be fitted out with metal grill work to catch all trash that may float down the river and might otherwise get into the turbines and put them out of com-mission. Each of the eighteen penstocks will be 18-feet in diameter and the racks will be strong enough to keep out heavy logs. They are so arranged that they can be cleaned if they ever become clogged. The figures of the workmen indicate the size of these trash racks." (*Spokesman-Review,* August 29th 1937)**

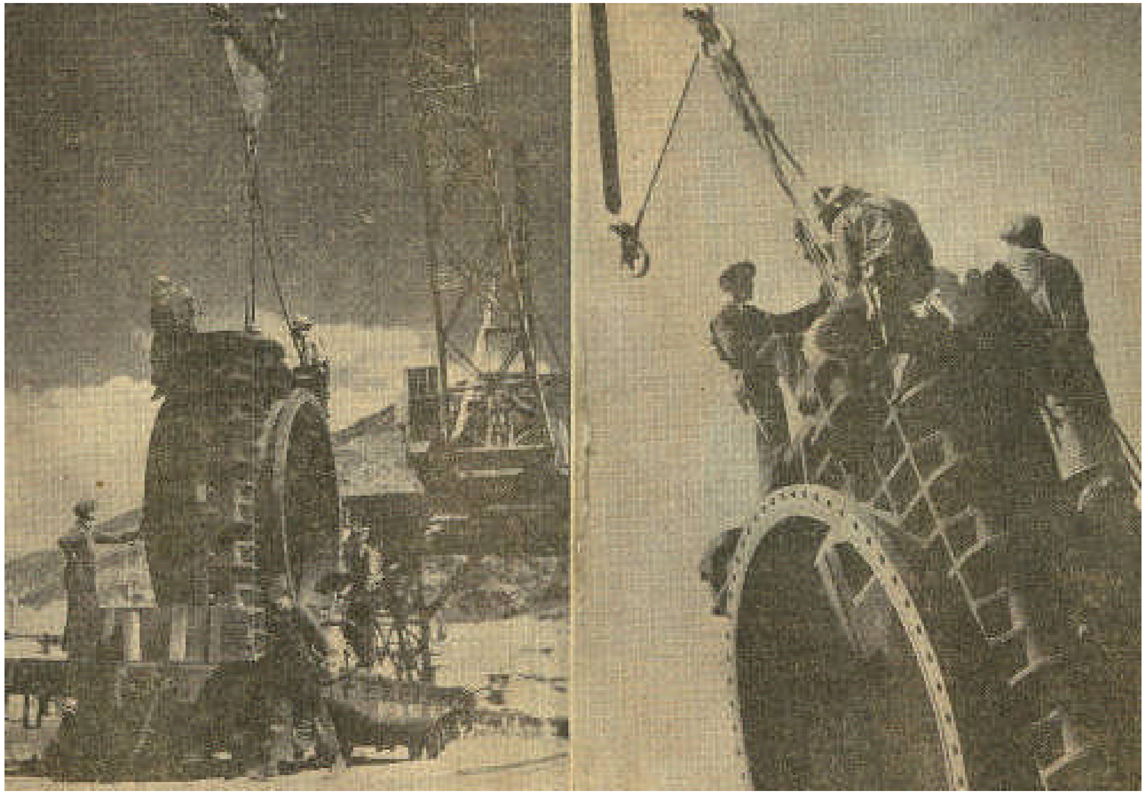


**<u>Above & Left</u>: caption: "Trash racks on the upstream face of the dam built to protect outlet tunnels from debris, Grand Coulee Dam construction, November 1937"**




**<u>Above</u>: caption: "Cross-sectional diagram of the dam shows water flow through penstock to the water wheel of the turbine"**

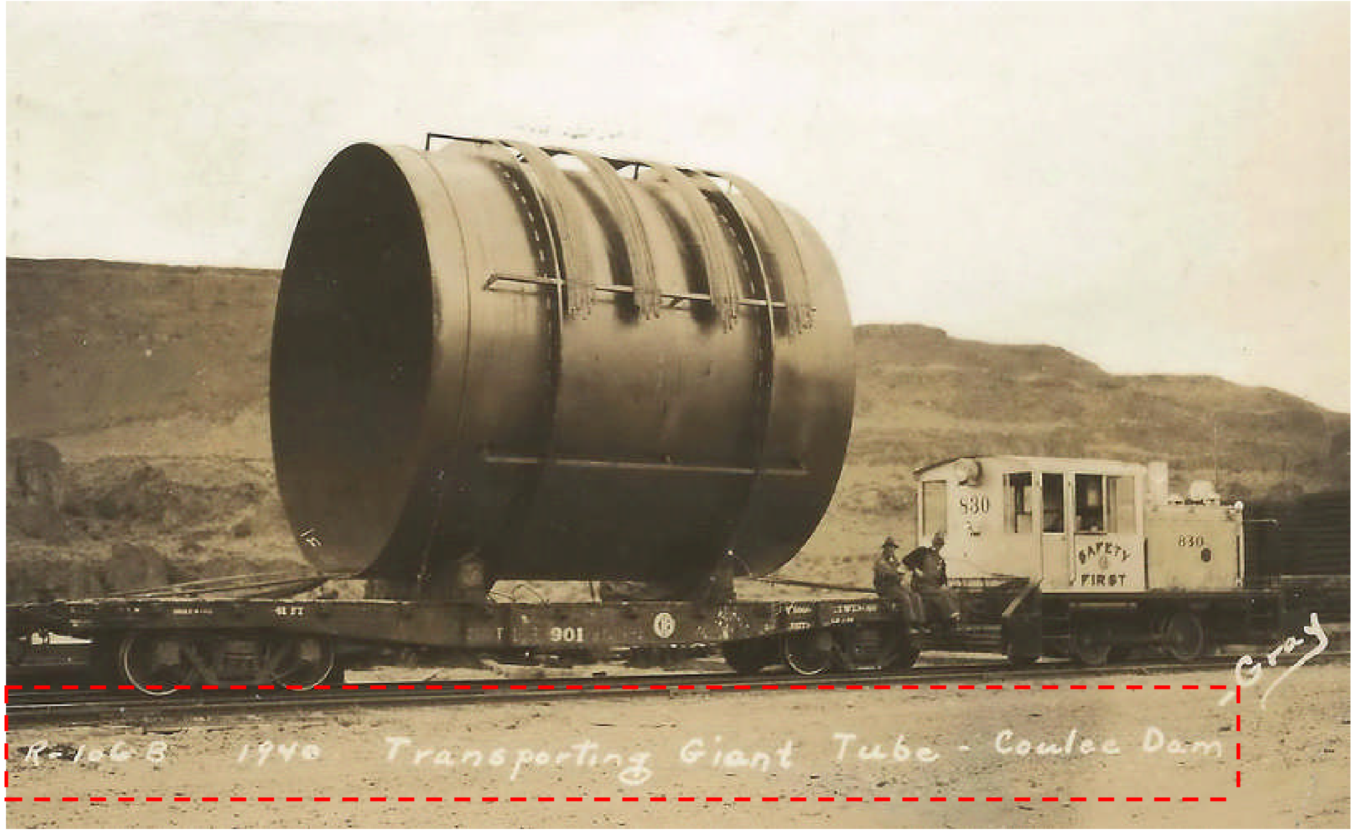
**<u>Left</u>: caption: "Here workmen are seen placing the steel grates (a/k/a "trash racks") into the trash rack assembly of one of the dam's spillway outlet tubes. Photo taken on November 30, 1937."**

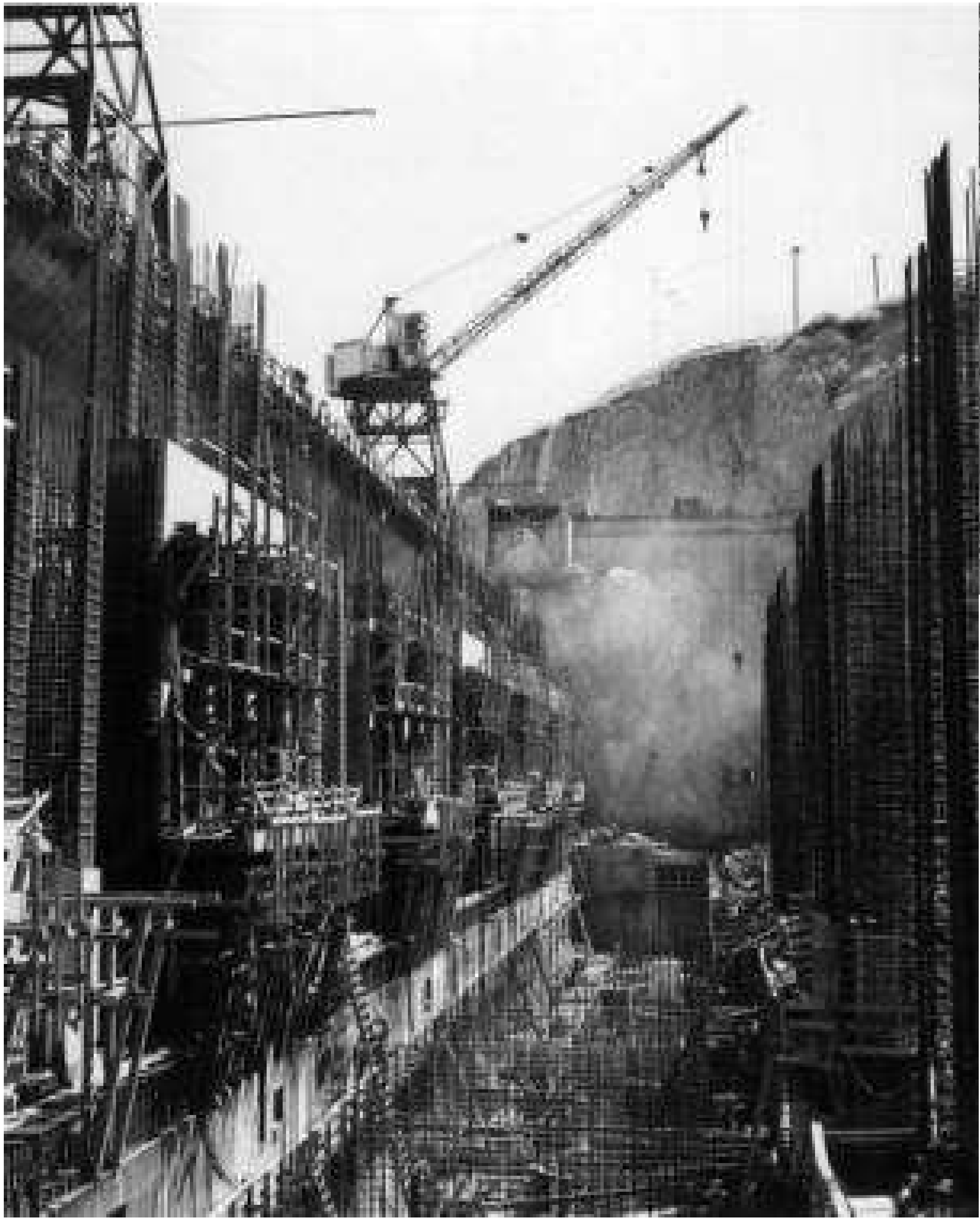


<u>**Above**</u>**: caption: "One of the first major jobs of CBI, new contractor at Grand Coulee dam, is to install the huge outlet valves near the base of the dam. There are 10 pairs of these, each 8½ feet in diameter, inside measure. They will be embedded in the cement. Another series of 10 pairs will be installed 100-feet above the lower tier and another 10 pairs 200-feet above. They will control the flow of the Columbia for all time. They are lowered in three sections to the valve. The section shown above in two views weighs about 16 tons. Huge cranes swing it out over the water and lower it into place. The men ride the load down and 'ride the hook' coming back out of the hole. Railroad flat cars carry the valves out over the construction trestle. This is the first mechanical equipment installed." (*Spokesman-Review,* April 12th 1938)**

***“The penstock factory will be completed on May 15 as scheduled in spite of the delay in receiving material, the Acme Construction Company, contractors, stated today. The west side railroad spur has been completed and the one on the east side is nearing completion. George Williams, field superintendent of the Western Pipe and Steel Company, steel penstocks contractor, will arrive May 15 to supervise install-ation of equipment…”***

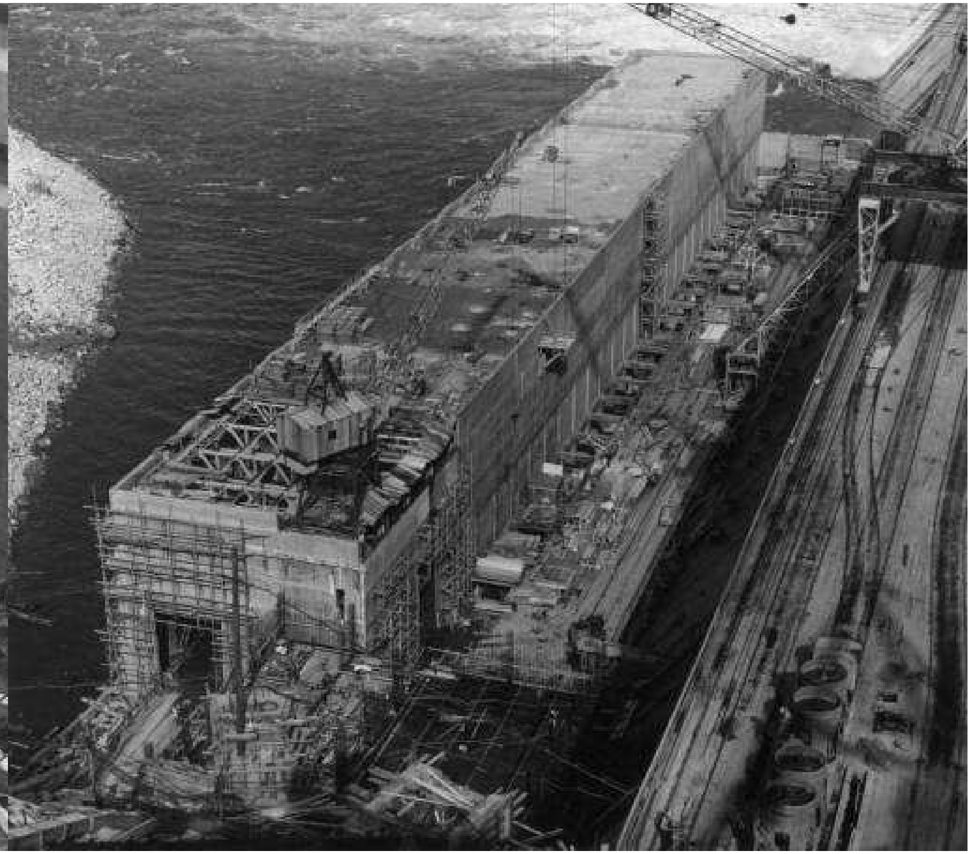
***Spokesman-Review*, May 8th 1938**


R-106 B 1940 Transporting Giant Tube - Coulee Dam
Gray
830
SAFETY FIRST
901



**<u>Above</u>: caption: "General view of reinforcing steel at East Powerhouse base, October 1940"**

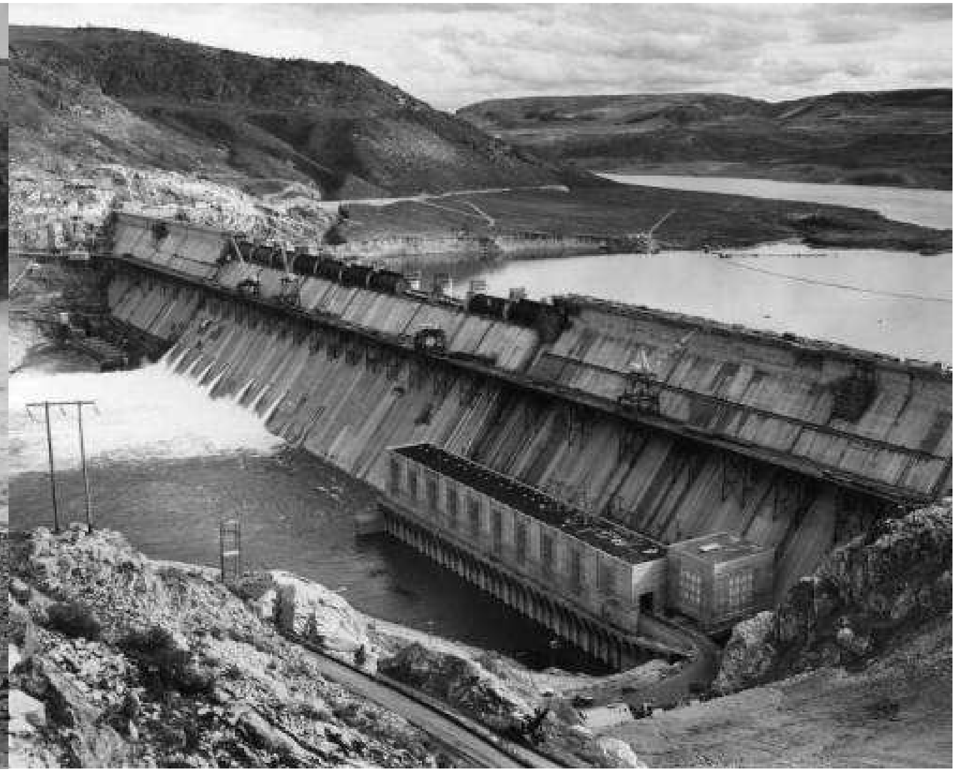
**<u>Left</u>: caption: "installing reinforcing steel during powerhouse construction"**

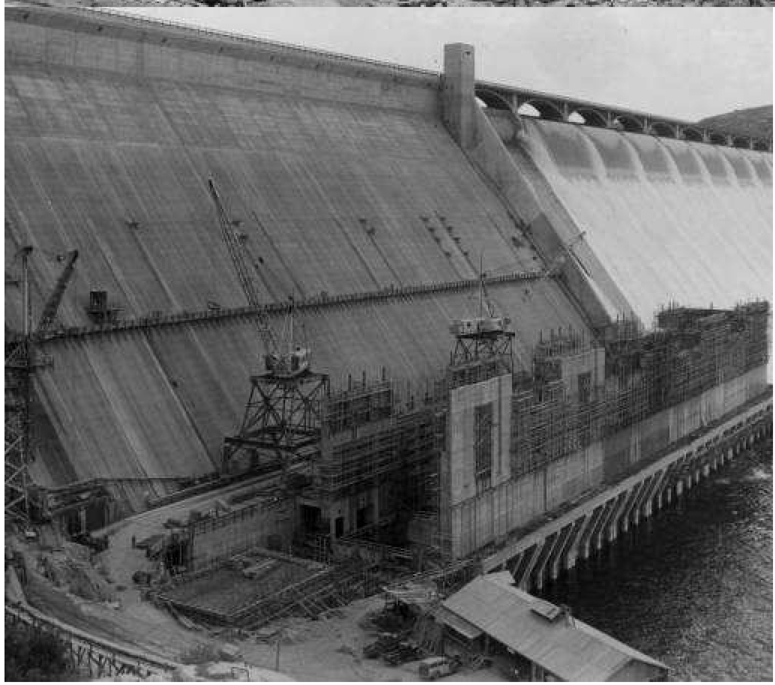


**Top Left: caption: “Men working inside power-house, January 1939”**
**Top Right: caption: “West Powerhouse from Car Skip, April 1940”**
**Left: caption: “Test using a large block and hook attached to a crane in powerhouse, June 1940”**

**<u>Above</u>: caption: “Transformer deck at east powerhouse, December 1941”**

**<u>Left</u>: caption: “Men and machines clean up debris from powerhouse area. Dam is in the background, December 1941.”**

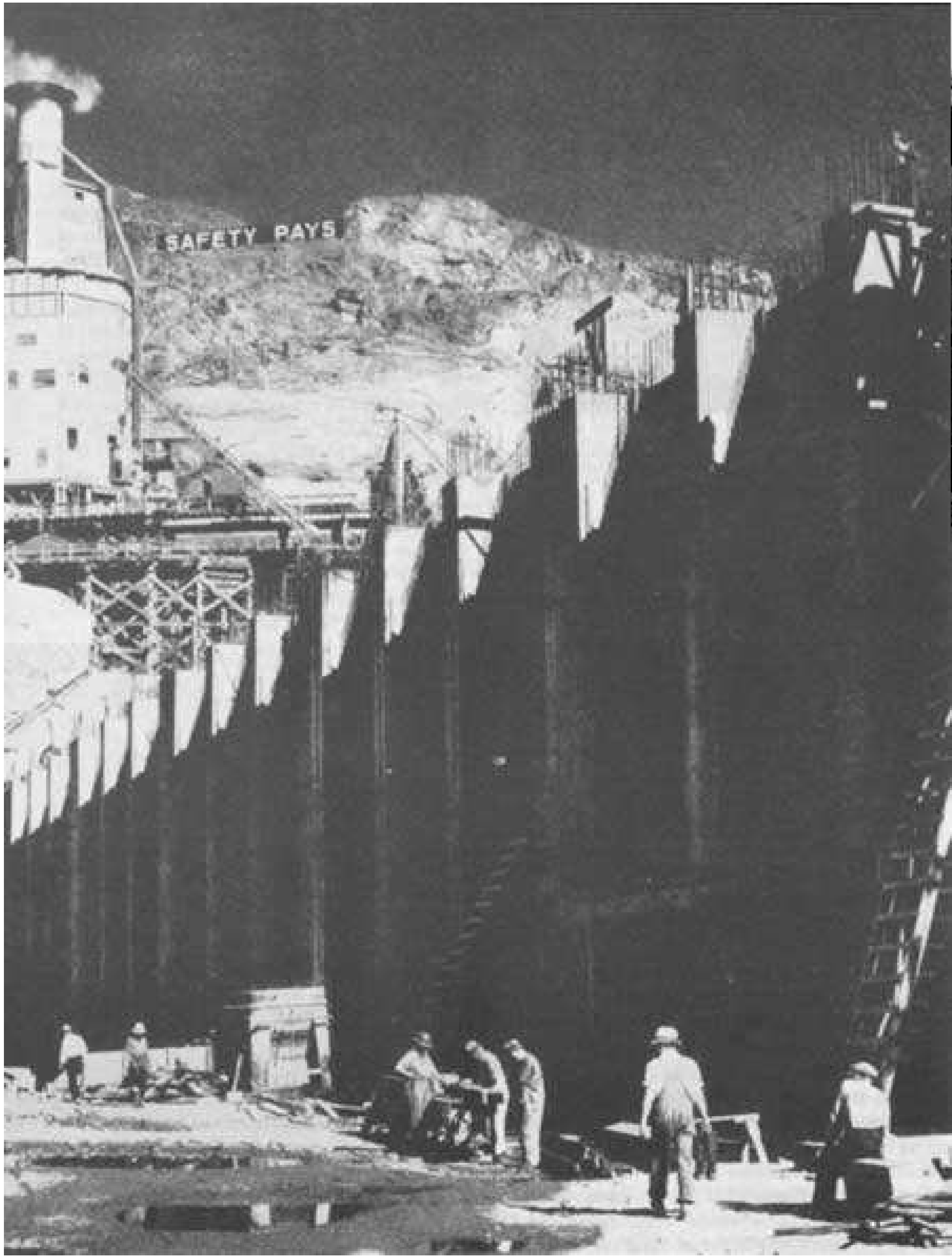




**<u>Top Left</u>: caption: "View of the east power-house foundation with Grand Coulee in the background, January 1941"**
**<u>Top Right</u>: caption: "View of the spillway section from the left bank, March 1941"**
**<u>Left</u>: caption: "East powerhouse, August 1941"**

<u>Above</u>: caption: “View of East Powerhouse and transformer deck with outlet tubes in back-ground, April 1942”

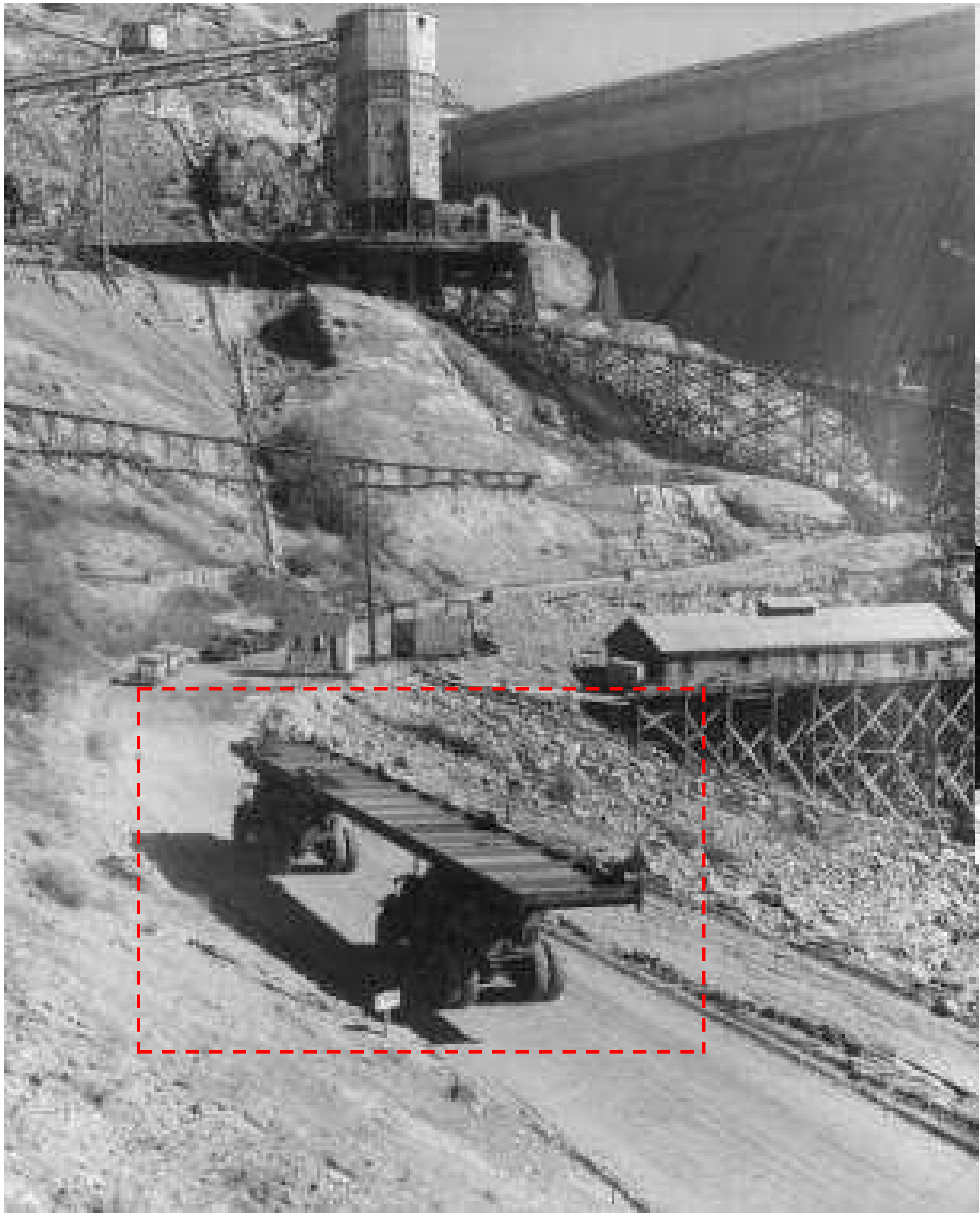
<u>Left</u>: caption: “Bays 1, 2 and 3 in east powerhouse, February 1942”



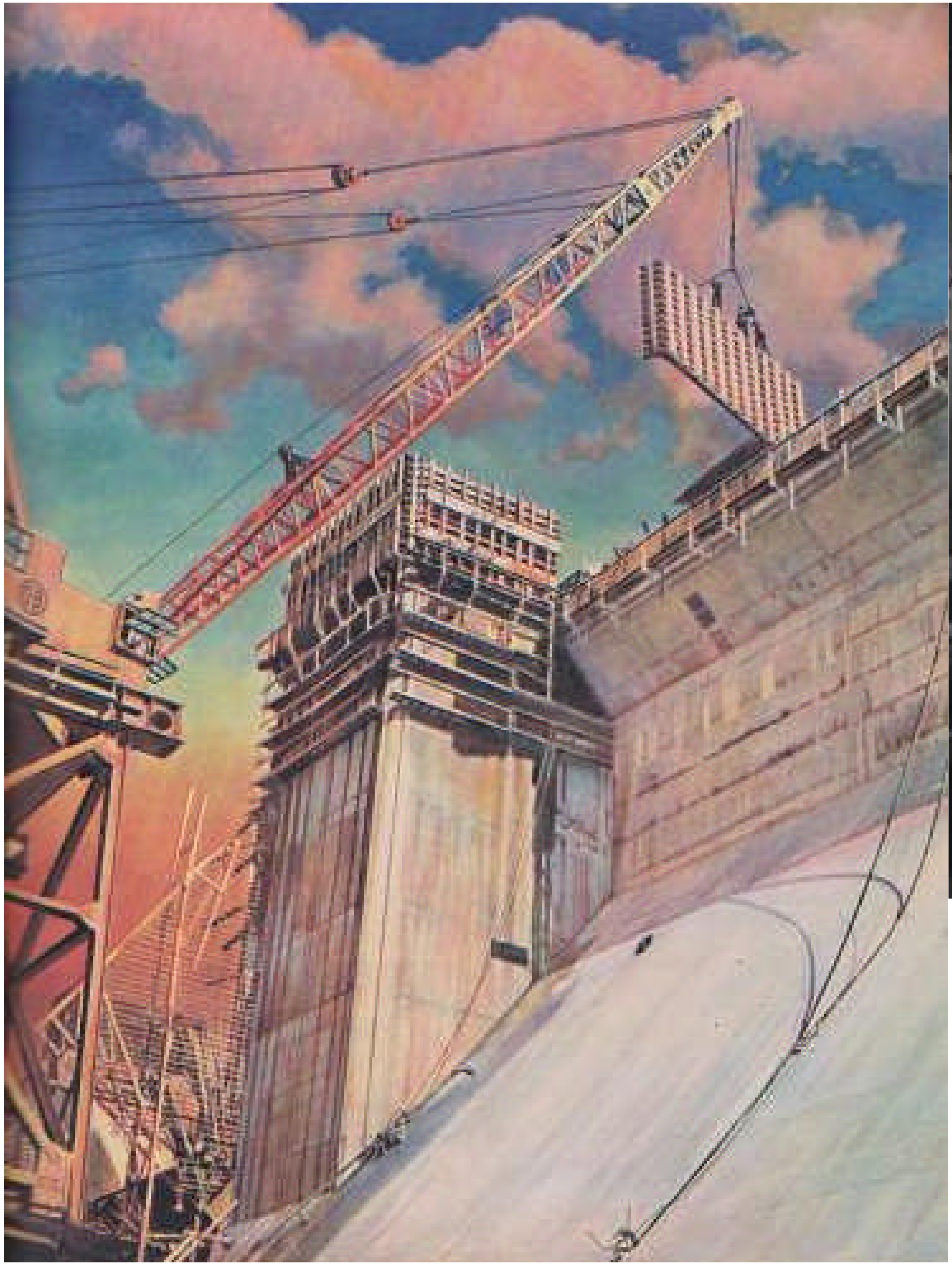


**<u>Above</u>: caption: "East side powerhouse work at Grand Coulee Dam (July 1942)"**

**<u>Left</u>: caption: "The finished dam will tower 300-feet above this massive base for the east powerhouse, now almost completely submerged in the tailbay into which nine huge turbines will some day discharge spent water"**



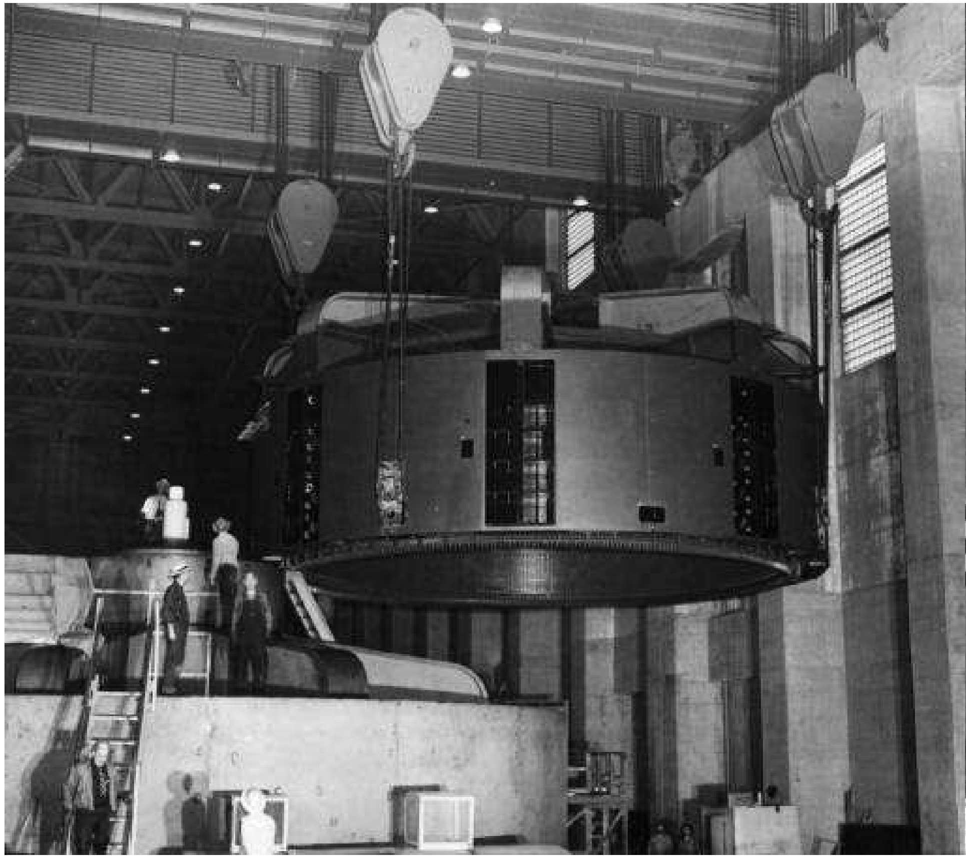
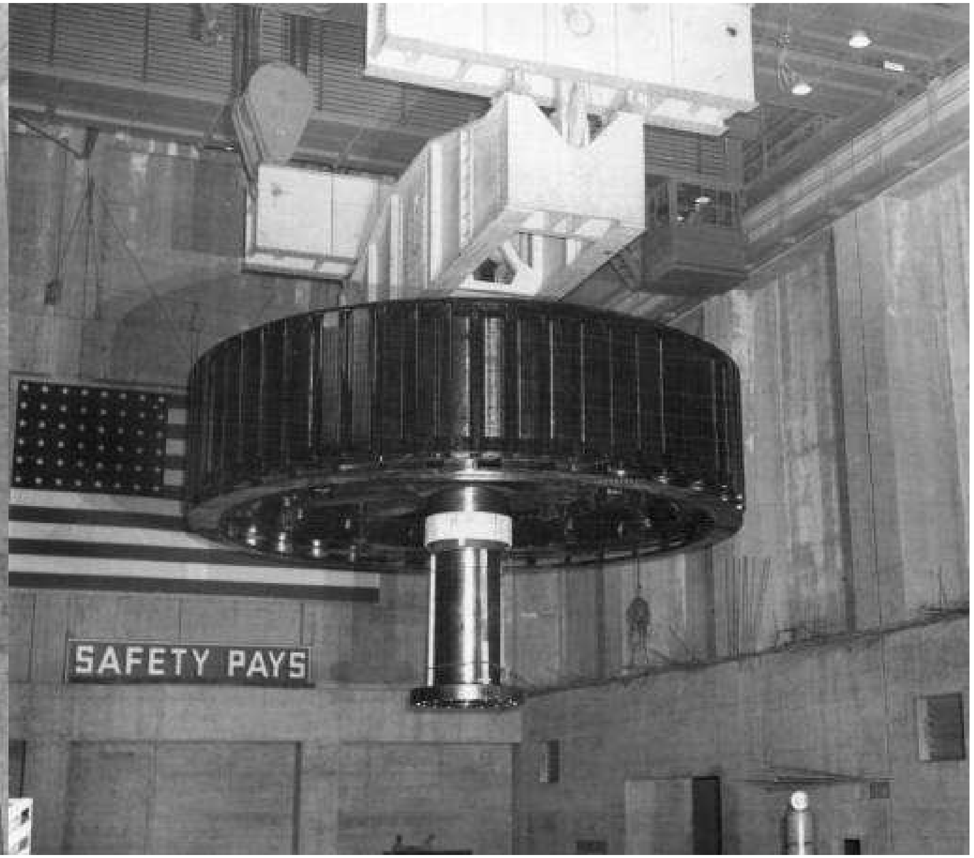
**<u>Above</u>: caption: "Workers at Grand Coulee erect a large steel girder"**
**<u>Left</u>: caption: "Synchronized trucks handling huge, heavy section of steel roof girder, transporting it to the east powerhouse, September 1942"**



**Above: caption: "View of the vertical lift hoist, block 10, with cable trays on either side and transit conduit in the background"**
**Left: caption: "Completing the elevator shaft that extends the full height of the structure"**

***"…The main power units will each consist of a 1108,000-kilowatt generator and a 150,000-horsepower turbine. The two generating units for local service will each include a 10,000 kilowatt generator and a 14,000-horsepower turbine. The five generators are under construction by the Westinghouse Electric and Manufacturing Company. One of the three initial generators alone will weigh about 1,000 tons and will have a stator and frame twenty-two feet high and forty-five feet in diameter. The parts of each generating set would fill a train of forty-five or fifty cars. Aside from pumping needs, about 8,000,000,000 kilowatt-hours of firm power and an additional 2,000,000,000 kilowatt-hours of secondary power will be available and can be distributed economically through all of Washington and parts of other states…"***

***Popular Mechanics,* April 1940**


**<u>Left</u>: caption: "Stator and bracket assembly for main unit L-6, weighing 335 tons, being lifted into its permanent position in bay 6. Two traveling cranes, with a lifting capacity of 375 tons each, are shown carrying the unit from its temporary point of assembly, between main units L-2 and L-3, May 1943"**

**<u>Right</u>: caption: "Rotor for main generator unit L-6 in the west powerhouse at Grand Coulee Dam being carried to final position by two overhead traveling cranes using an equalizing beam. The rotor, 31-feet in diameter, weighing 535 tons, rotates at a speed of 120 revolutions per minute within stator, and develops 106,000 kilowatts of electrical energy, June 1943"**

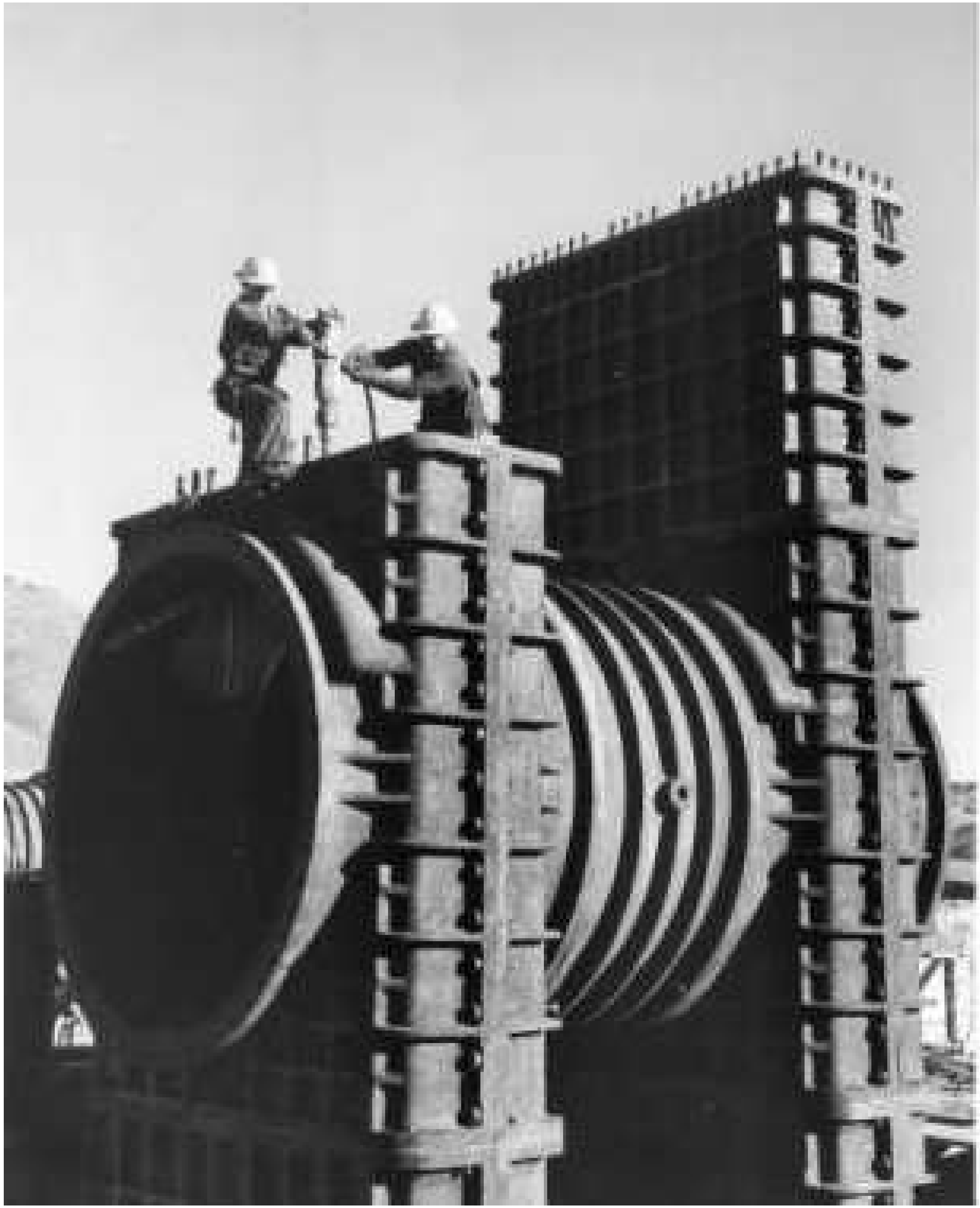
# Go With the Flow

***"…The most important of these hydroelectric developments, just now going into operation, is contained in the twin power-houses of Grand Coulee dam in the state of Washington. Here 12,510,000,000 kilowatt-hours of electricity will be generated annually. Eighteen huge generators, driven by water turbines rated at 2,700,000 horsepower, are being installed. One of these generators alone could illuminate one and a half million 60-watt lamps. Three of them could furnish normal lighting for New York City and Chicago combined…"***

***Popular Mechanics,* May 1942**

***“The Bureau of Reclamation, at its Denver office, on November 2, will open bids for 20 sets of 102-inch paradox and ring follower gates – the largest job of its type ever put on the market – to be installed in the foundation for the Grand Coulee dam. The gigantic gates are for the control of 20 8½-foot outlets in the spillway section of the dam. At elevation 934, which is approximately a foot or two below the average river level at low water, there will be 20 long tubes 8½-feet in diameter in the dam running from the upstream face through the concrete into the bucket of the spillway. The 20 tubes will form a horizontal row in the spillway section, and the 20 gates will be placed in the tubes, not far from the upstream face, inside the concrete dam. The huge gates open by means of a hoist motor…”***

***Hover Columbian,* October 23rd 1936**



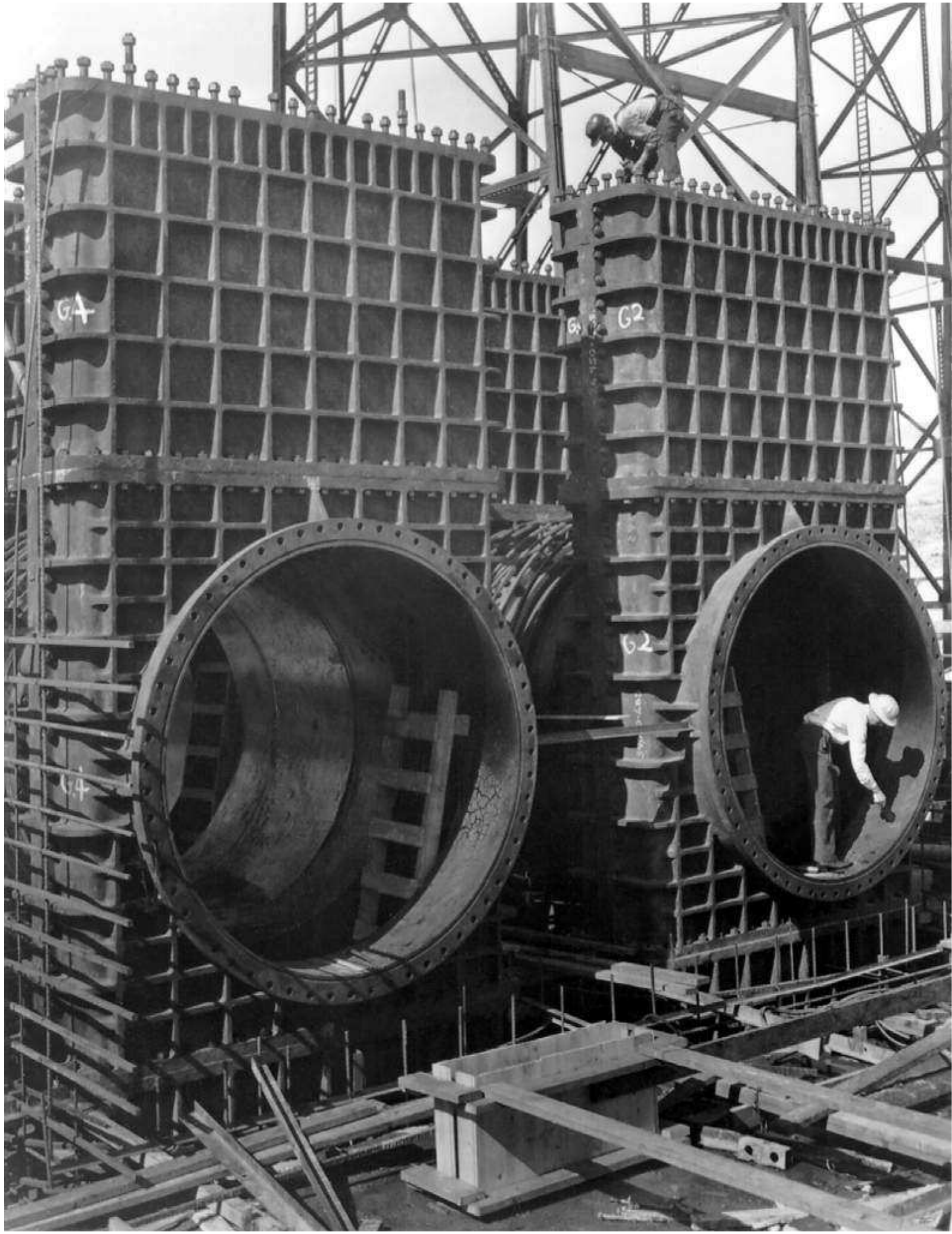
***"…Award of the contract for manufacture and delivery of twenty sets of gates for the first tier of outlet works, announced recently by Secretary of the Interior Harold L. Ickes, marks an important milestone in the Grand Coulee project, engineers said yesterday. The contract was awarded to the Hardie-Tynes Manufacturing Company of Birmingham, Alabama, on its bid of $1,454,141.21…"***

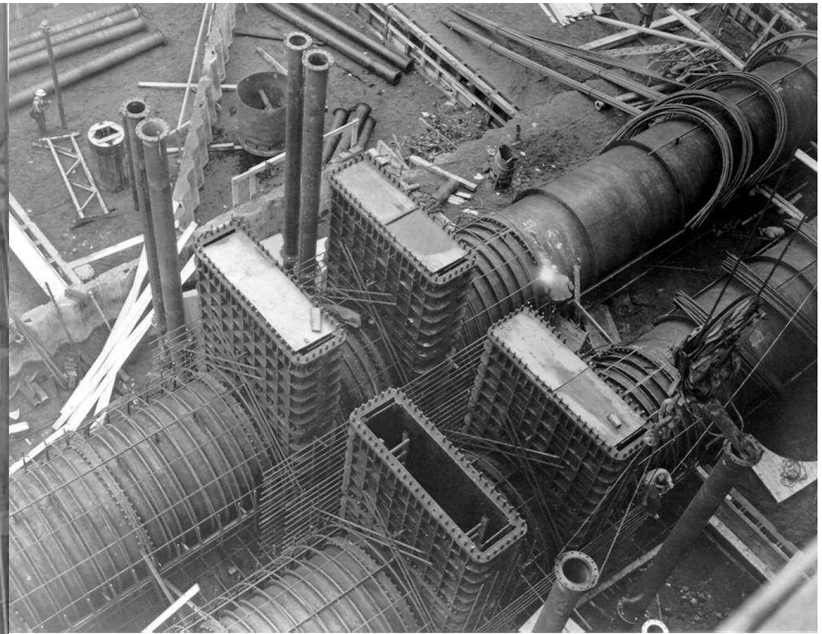
***Seattle Post-Intelligencer,*** **December 8th 1936**

**<u>Left</u>: caption: "Outlet tube gate construction, February 1940"**

***“…Although expensive, these gates will seldom be used, the Reclamation Bureau engineers say, as they serve the purpose of allowing the engineers to lower the forebay, or Columbia river reservoir, in case of emergency, such as cleaning the trash racks in front of the outlet works, or the penstocks leading to the power houses…”***

***Hover Columbian*, October 23rd 1936**



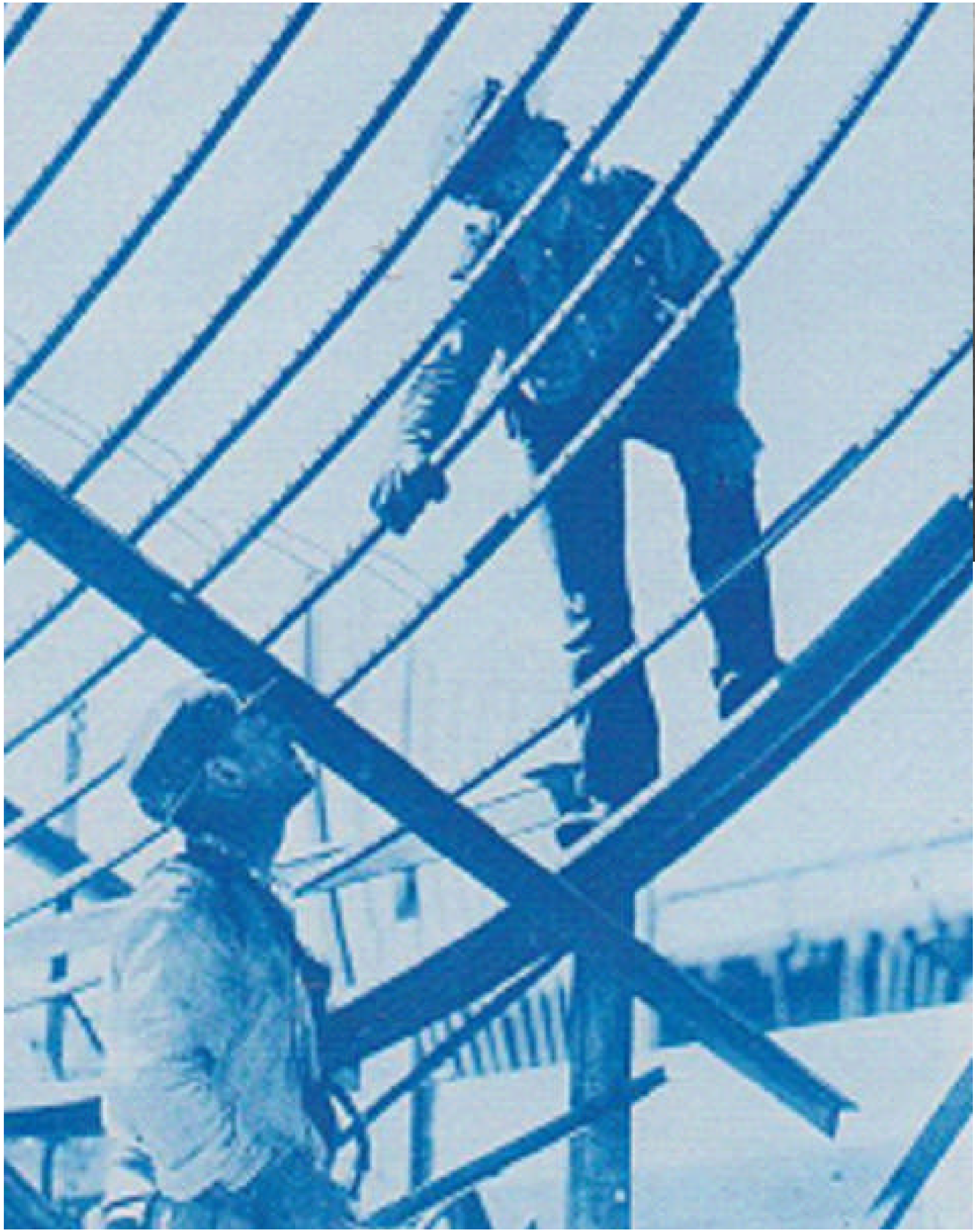


**__Above__: caption: "Photograph of a set of outlet tube gate valve assemblies. Note the welder to the right of the upper set of valves. Photo taken on January 2, 1940."**

**__Left__: caption: "Close-up of two of the upstream/down-stream sets of gate valves which control flow through the dam's sixty outlet tubes. The outlet tubes are 102 inches in diameter. Photo taken on May 2, 1939."**

***"…About four miles of galleries have been completed during the MWAK contract, now ending. They are of three sizes, five feet by seven feet high, six by eight, and seven by twelve. They are built with arched roofs. Grouting and cooling of the dam is the main work conducted from the galleries. Big trunk lines carrying the river water to smaller pipes imbedded in the concrete, lie along one side of the tunnels. Big pipes protrude through rooftops of the galleries, these to be used to hydraulically control the big gates of the outlet tubes, through which the government can control the elevation of the lake behind the completed dam."***

***Spokane Chronicle,*** **December 31st 1937**



***"…72,000,000 pounds of reinforcing steel are being placed in the powerhouse bases at either side of the dam and around the inspection galleries that swerve back and forth through the mass…"***

***Popular Mechanics,* April 1938**

**<u>Above</u>: caption: "Inspection Gallery, Grand Coulee Dam, November 1937"**

**<u>Left</u>: caption: "Placing reinforcing steel in what will be a tunnel in the dam"**

*"…The spillway, which is to have a capacity of a million cubic feet of water per second, will be in the central section of the dam. Below it will be the three tiers of outlet tunnels. The crest of the dam will be 4,200-feet long, of which 1,650-feet will be the spillway. In high water seasons, the water will flow over this spillway. Each of the sixty outlet tunnels will be eight and a half feet in diameter. It is for the first tier of these tunnels that the control gates will be built under the contract awarded by Secretary Ickes."*

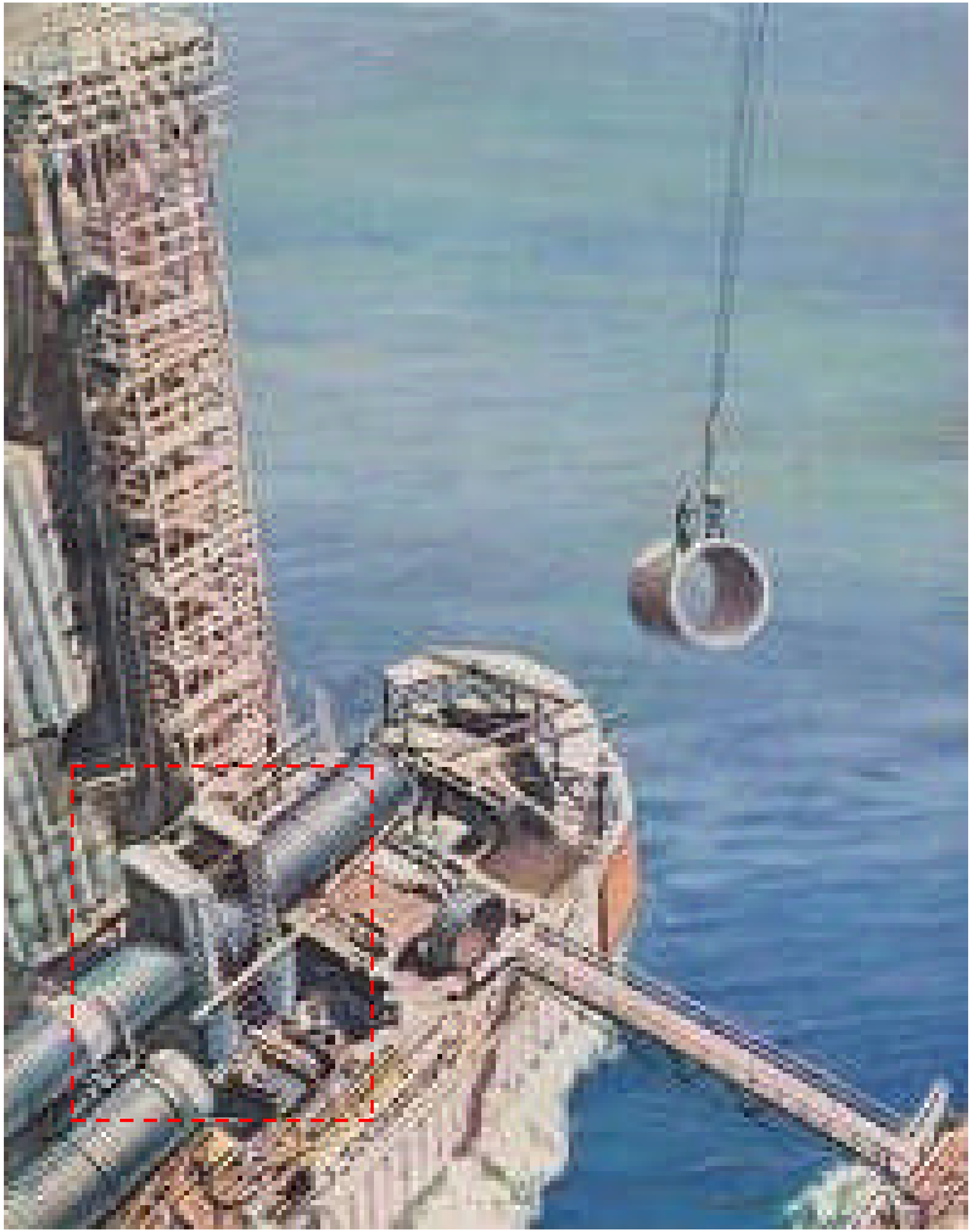
***Seattle Post-Intelligencer,* December 8th 1936**



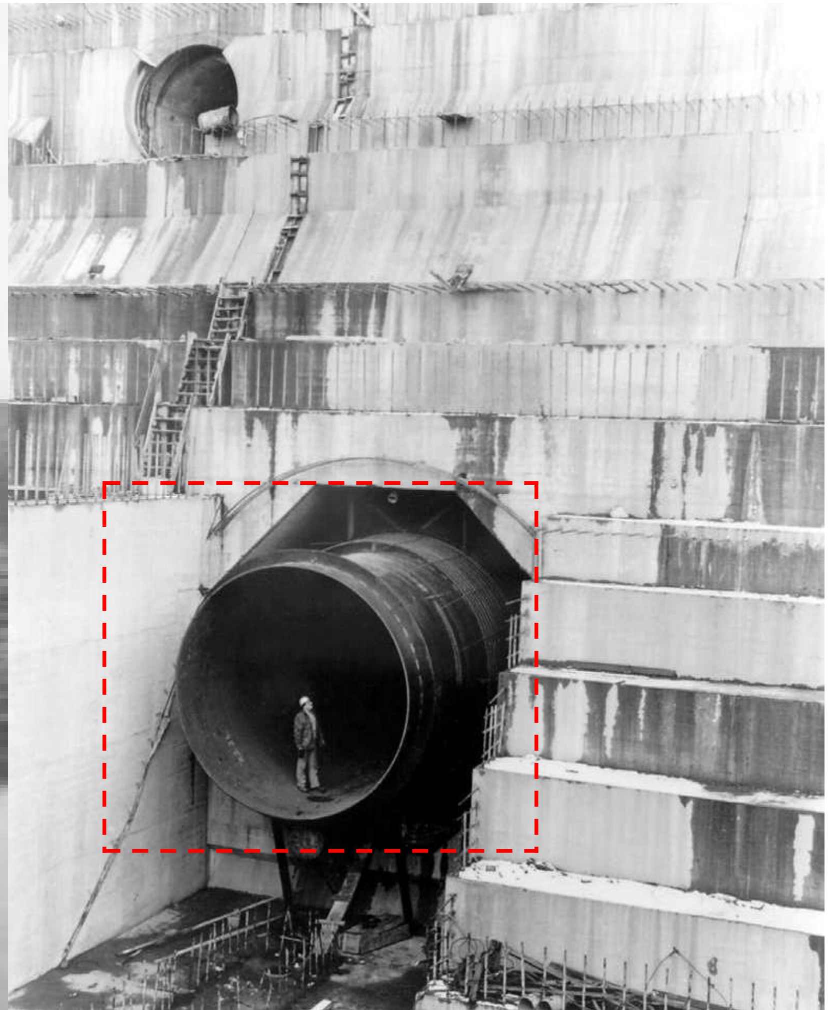
**Left: caption: "Outlet Valve"**

***"…During the construction stage the 20 sets of tubes will play an important part in the diversion of the river. The gates and tubes are to be installed by the MWAK during its contract. After concrete is high enough on the east side and in mid-river, the Columbia must be turned back into its regular course and blocked by the barrier of concrete. The west side will be dried up again, the water passing through these 20 8½-foot outlet works."***

***Hover Columbian,* October 23rd 1936**

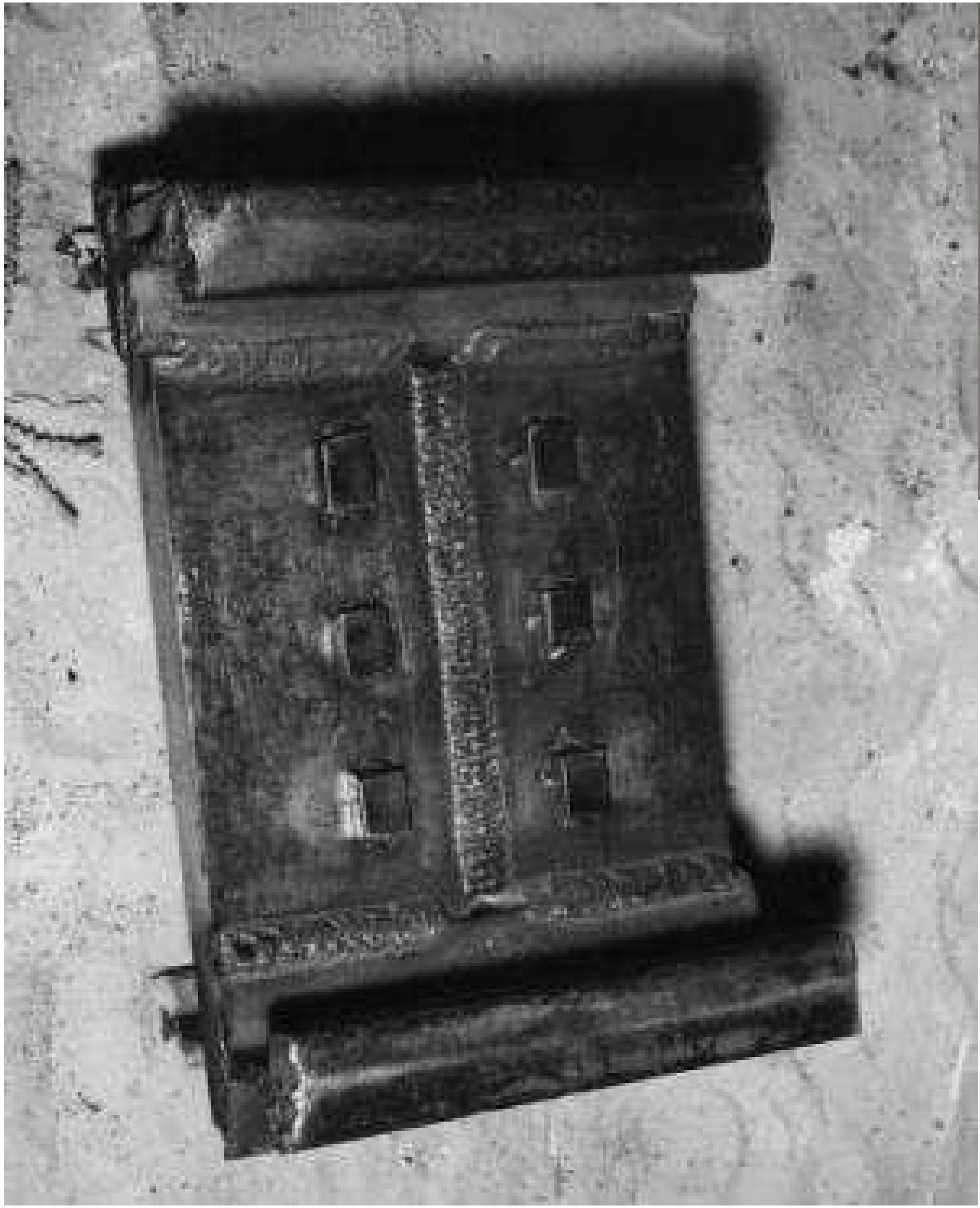


**At left, two workmen hitch a ride on a section of outlet tube being installed in the spillway section of the dam. The dam contains sixty outlet tubes which were laid-out in three rows of twenty tubes each. The 102-inch diameter tubes were initially used as a means to divert the river as dam construction progressed. They now serve as a supplementary method of controlling the level of *Lake Roosevelt*. As shown, the outlet tubes are placed in pairs. In this photograph (taken in 1941) the upstream and downstream gate valve assemblies are installed (highlighted). After dam construction was complete. the bottom twenty tubes were filled with concrete.**

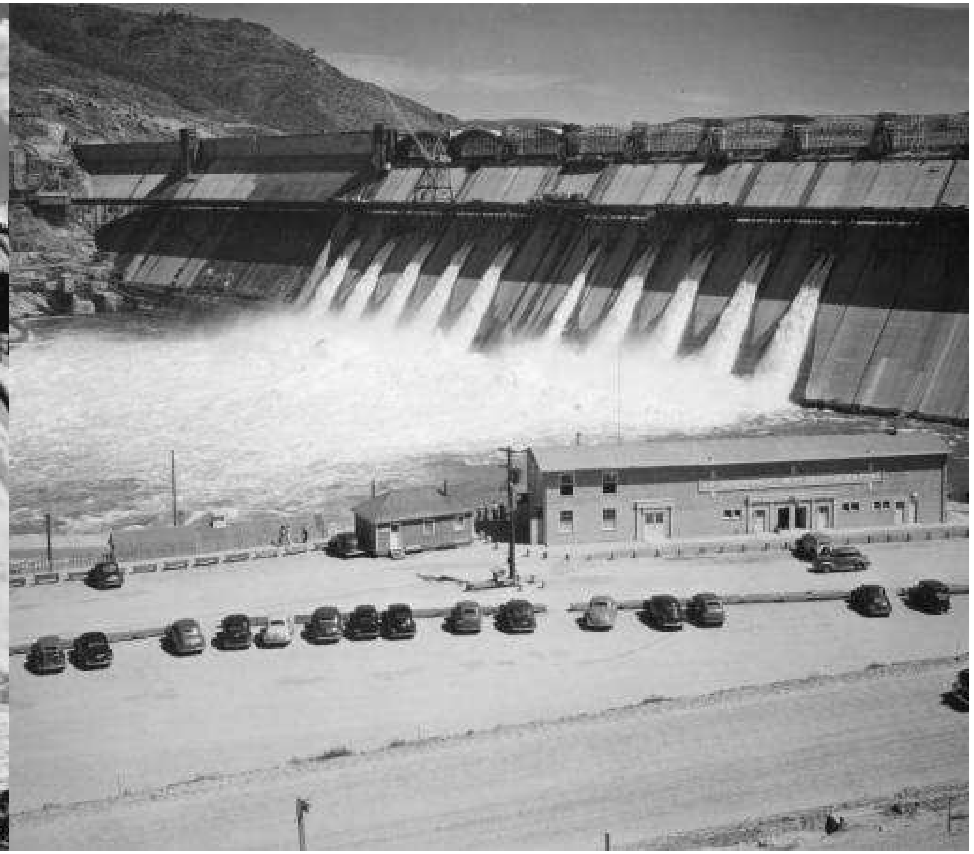


**<u>Above</u>: caption: "Workman standing in one of the dam's original 18-foot diameter generator penstocks. The penstocks carry water from the upstream side of the dam into generator's turbine area. Photograph was taken January 10, 1940."**

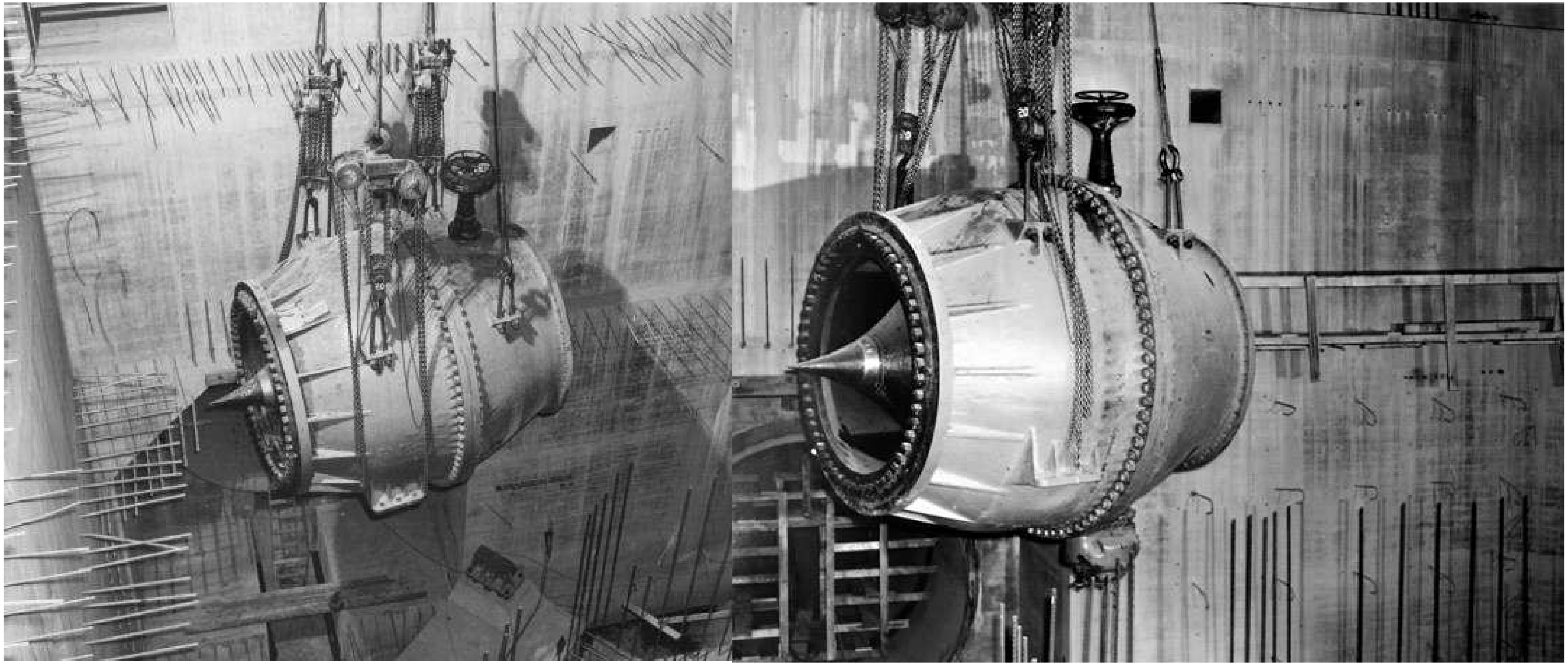
**<u>Left</u>: caption: "Lowering tube for placement in outlet works at elevation 1137, January 1940"**



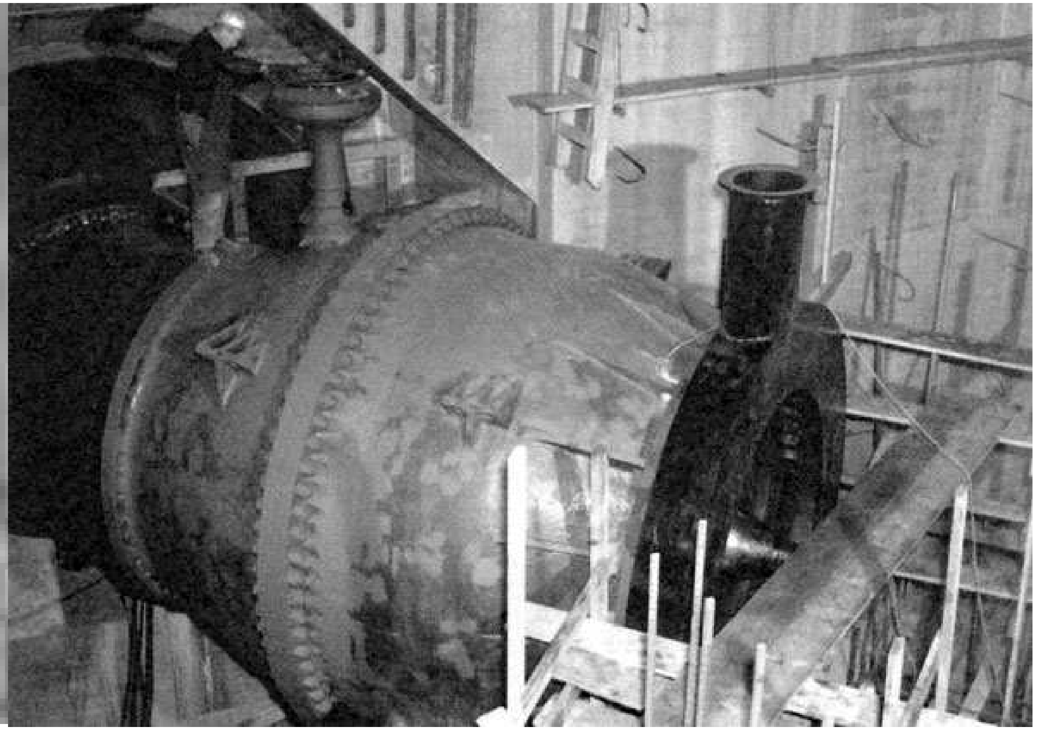
Above: caption: “Portable X-ray machine rolls into the 18-foot penstock to examine its welded joints for any hidden flaws”
Left: caption: “Weld test”

**Left: caption: "View of the outlet works near the base of the dam. A man is standing in foreground for scale, June 1941"**
**Right: caption: "View of the dam with newly constructed observation building in the foreground, July 1941"**



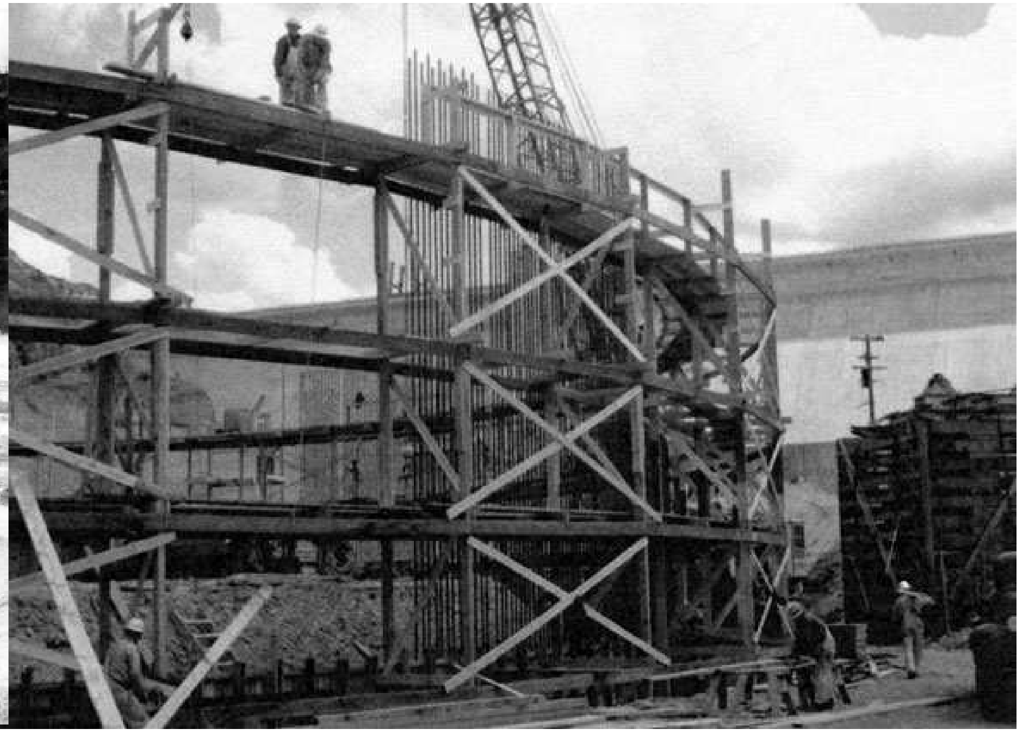
**<u>Top L&R</u>: caption: “Needle valve being lowered to base in R-8 of East Powerhouse, November 1944”**

**<u>Left</u>: caption: “84-inch needle valves are being installed in the east powerhouse at Grand Coulee Dam between the penstocks and draft tubes for water diversion, January 1945.”**

**<u>Right</u>: caption: “Eight of these needle valves, transferred from Boulder Dam, are being temporarily installed in the turbine pits by use of steel reducers (elbows) joining the valve with the 18-foot in diameter penstock tubes. A portion of the stream flow of the Columbia River is to be passed through those needle valves during the low water season. The flow through the needle valves, in addition to that portion of the river flow passing through the turbines in the left power house will make unnecessary the use of the spillway. This program of diversion will provide a minimum of turbulence in the water at the foot of the spillway section, facilitating future repair work to the concrete bucket or trough at the base of the spillway. At some future date, the needle valves will be replaced by 150,000 horsepower hydro-turbines, designed to propel 108,000 kilowatt hydroelectric generators.”**

<u>Left</u>: caption: “41-degree, cast steel elbow, installed between penstock reducer section and needle valve in bay R-9 of the right powerhouse at Grand Coulee Dam. Eight needle valves, each having an 84-inch discharge, are being installed in the right powerhouse. The portion of the Columbia River stream flow not used through the turbines in the left powerhouse, is to be passed through the needle valves installed in the right powerhouse during the low water season. This plan will eliminate the use of the spillway during certain months of the year, assuring a minimum of turbulence in the water downstream from the dam, to facilitate necessary repairs to the concrete spillway bucket, Jan. 1945.”



<u>Left</u>: **caption: "Caisson graving dock where caisson will set. Caisson will be used for spillway bucket repair at Grand Coulee Dam (June 1944)"**

<u>Right</u>: **caption: "Placing reinforcing steel prior to pouring the concrete at the caisson drydock at Grand Coulee Dam (June 1944)"**

<u>Top</u>: caption: “Interior of caisson drydock showing rock that is being placed in bottom. Sand will be placed on top of rock and reinforced concrete atop the sand. The four piers form the resting place for the caisson (November 1944).”

<u>Bottom</u>: caption: “Excavating river bottom prior to setting up caisson for spillway bucket repairs at Grand Coulee Dam (January 1947)”

Left: caption: “Despite the absence of flow down Grand Coulee dam’s spillway, the Columbia river is choppy as a huge barge with its steam-operated crane dredges out debris. Turbulence is caused by underwater pressures from the powerhouse out-pourings. The dredge, which first saw service in 1949-51 after the 1948 flood, will be operated on a two-shift-per-day basis five days a week until high water this summer forces the operation to cease. The dredge moves downstream periodically so that discharge tubes can spill water from Lake Roosevelt, whose level has remained high all winter.”

**Left: caption: “Concrete being repaired on face of Grand Coulee Dam, March 1949**
**Right: caption: “Workers repairing spillway face, September 21, 1951”**


Grand
COULEE DAM
Washington

# Part 20

# The Power to Serve

# The Power Market

***"…The Grand Coulee dam in Washington represents the greatest single harnessing of hydro-electric power resources in the world. With a maximum surface elevation at 1,111 feet, the dam will back up the Columbia river about fifty feet in the vicinity of Hunters and three miles up the Spokane to near old Fort Spokane. Ultimate development of the dam site calls for construction of a single concrete gravity dam about 500-feet in height with a crest of 4,000-feet. The dam will create a reservoir of approximately 17,500 acres with a capacity of 1,200,000 acre-feet. An acre-foot is the amount of water that will cover one acre of ground one feet deep…"***

***Popular Mechanics,*** **January 1935**

**<u>Left</u>: caption: "Grand Coulee Dam from the air"**

***"…An important factor in the feasibility of this project as a whole is the market that may be available for the power that is produced at the Grand Coulee Dam. The market area in which this power may be absorbed includes the area within a radius of three-hundred miles of the dam and includes all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana. During the ten-year period ending with 1930, the require-ments for power in the territory described as constituting the power market area increased at an average rate of 9.5% per year, compounded annually. The installed generating cap-acity of power plants serving the territory in 1930 amounted to 1,145,0000 kilowatts and during that year there were gen-erated 4,029,000,000 kilowatt-hours by these plants…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

# Old Man Depression

***"…The effect of the depression was to suspend for about four years the normal growth of the power market. Production fell off after 1930 and reached a minimum in 1933, but during 1934 returned to the 1930 maximum and in 1935 resumed its former rate of increase, with the result that the production that year substantially exceeded all previous records…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

# Judging the Future

***"…If we may judge the future by the past, there is every reason to believe that the rate of increase in power production for the ten-year period prior to 1930, amounting to 9.5% compounded annually, will continue. But if we assume the rate of increase starts off at but 8% compounded annually and decreases uniformly to 4% during the next thirty years, and if we assume further that the Grand Coulee will absorb only one-half of the increase after its completion, leaving the other half to Bonneville and other new developments, all of the Grand Coulee commercial power will be absorbed by the market in fifteen years. And if the commercial power can be sold at 2½ mills at Grand Coulee, equivalent to 3 mills on the coast, the cost of the Grand Coulee Dam and power plant, with interest at 4%, can be liquidated in fifty years with a surplus of $144,500,000 available for the partial liquidation of the irrigation investment or other purposes, and after the fiftieth year, the annual surplus would amount to $15,000,000. The cost of operation and maintenance of the irrigation project, including the coat of power for pumping, is estimated at $2.60 per acre annually. The construction charge, if the irrigation development is deferred until the power income substantially exceeds the annual cost of power development, may not exceed $2.50 per acre a year…"***

**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

# Plenty to Go ‘round

***“…Aside from the agricultural empire that is to be made possible by the dam, it will generate enough power to serve markets as far away as Idaho and Oregon, even after pumping requirements are subtracted. The reservoir behind the dam will have an area of 128 square miles and a maximum depth of 375 feet. Its capacity of 10,000,000 acre-feet of water will be equivalent to 2,000 gallons for every person on earth. After one-tenth of the Columbia’s flow is diverted for irrigation, more than enough water will always be available to keep the generators in continuous operation and to maintain the river level at approximately twice its past minimum flow…”***

***Popular Mechanics,*** **April 1938**

# Supply & Demand

***"…Conditions in the power-market area tributary to grand Coulee at this time are illustrated by the fact that both Portland and western Montana are calling for power from the Washington Water Power Co. to which the company is responding to the extent of its ability, while Tacoma is feeding into Seattle all the power that its interconnecting systems will handle. It is not contemplated, of course, that the power plant will be constructed to its full capacity in the first instance; but rather that the units will be added progressively as required to meet demand for power. Likewise the development of the irrigation features should be made to conform to the demand for the land. The development would be progressive to meet the growing requirements of the country…"***

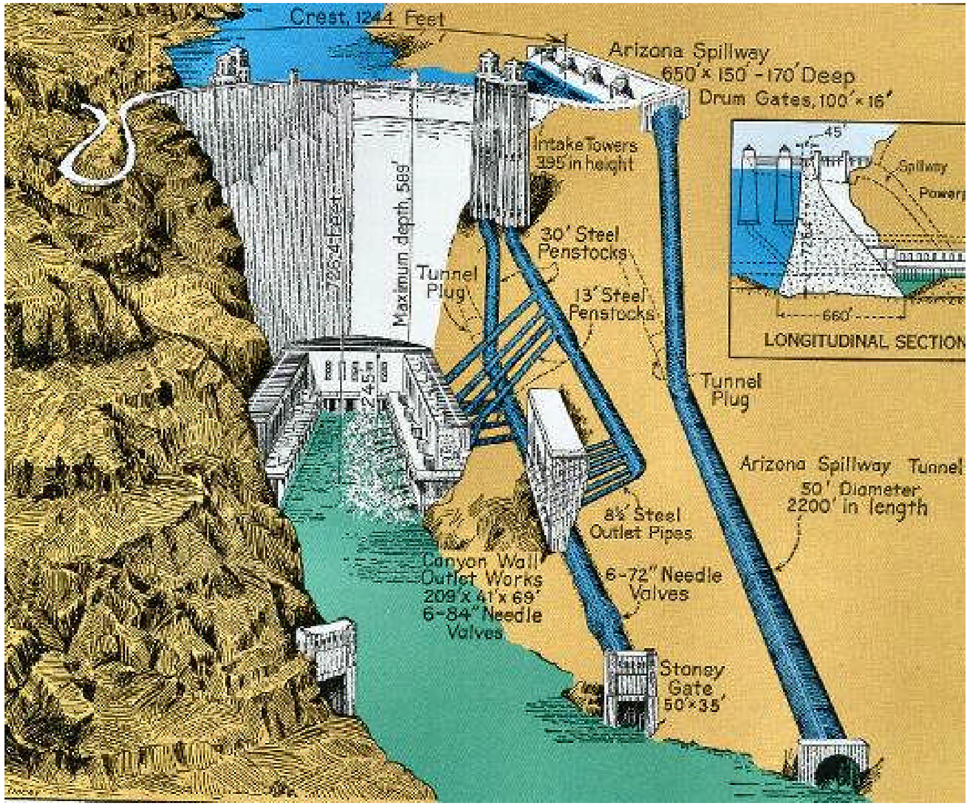
**RE: excerpt from *Columbia Basin Project - Grand Coulee Dam* (U.S.B.R. 1936)**

# It's a Good Thing

***"During the last few years, the United States has tremendously speeded up its program for developing to the utmost the vast water-power resources of the country. It is a good thing that we did because, suddenly, power in unprecedented amounts is needed to turn the wheels of our great rearmament industries. Ninety-six giant power projects were being completed or were under construction a little more than a year ago…"***

***Popular Mechanics,*** **May 1942**

**Left: caption: "One steel casing for a giant turbine at the Grand Coulee Dam makes a full carload. Water from the Columbia River, falling through this 16-foot runner at the rate of 141-tons a second, will drive the biggest electric generator ever built, to produce electricity for the manufacture of aluminum, vital need of the defense program."**

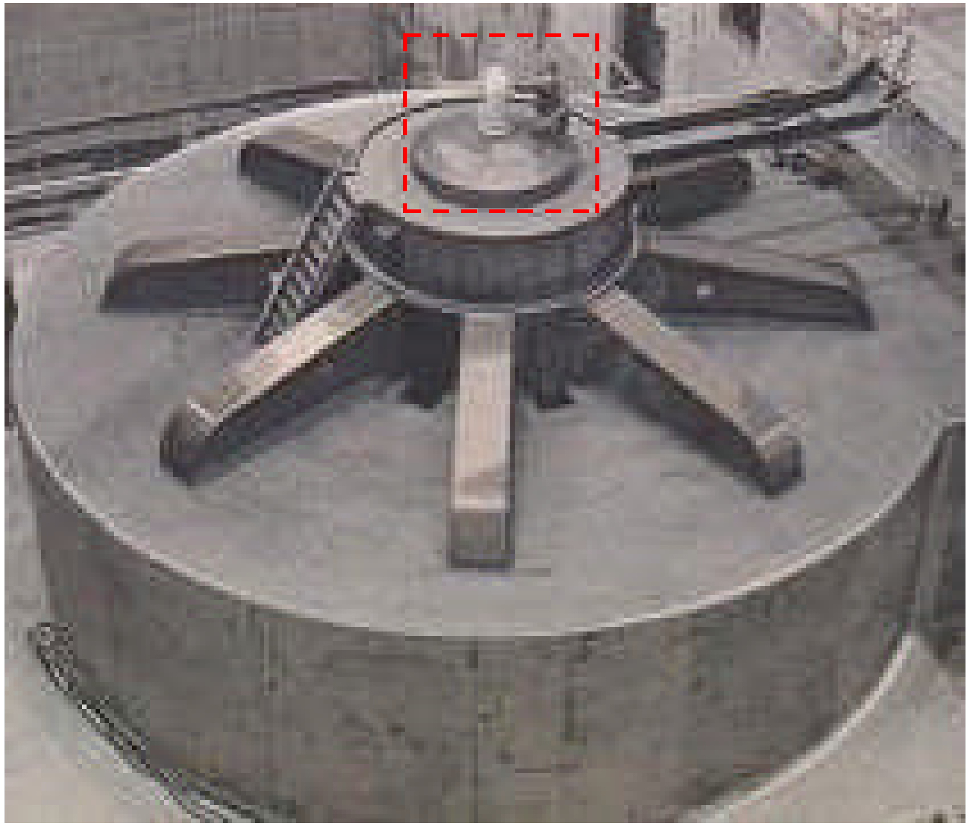



***"…Up in the Pacific Northwest, five aluminum refining plants that didn't exist three years ago are now producing more aluminum than was produced in the whole country five years ago. This is possible because of the electrical output of Bonneville and Grand Coulee dams on the Columbia River. Power from Grand Coulee alone would light three 60-watt bulbs in every home in the United States. Even so, installation of the turbo-generators that will make Grand Coulee the world's greatest powerhouse has not yet been completed. That title is still held by the generators at Boulder Dam…"***

***Popular Mechanics,* June 1944**

**<u>Left</u>: *Hoover Dam* power generation diagram**

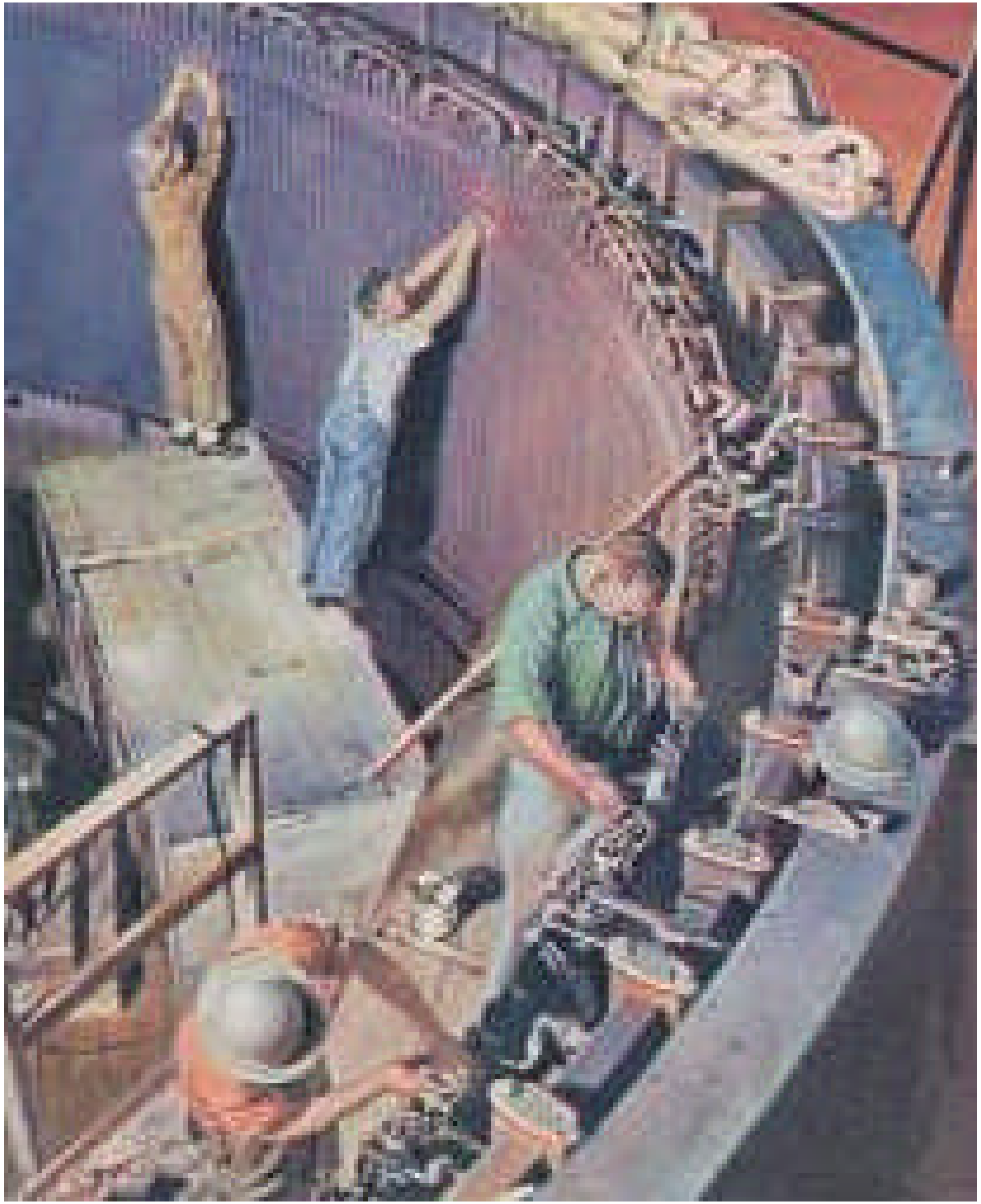
# “V” is for Victory



***"…More important today, the output of one generator can produce 100 tons of aluminum a day, equivalent to half a dozen Flying Fortresses or 32 fighter planes. Last year no aluminum was being refined west of the Mississippi; this year one third of the nation's greatly expanded aluminum manufacturing capacity will be located in Washington State, using power extracted from the Columbia River…"***

***Popular Mechanics,* May 1942**

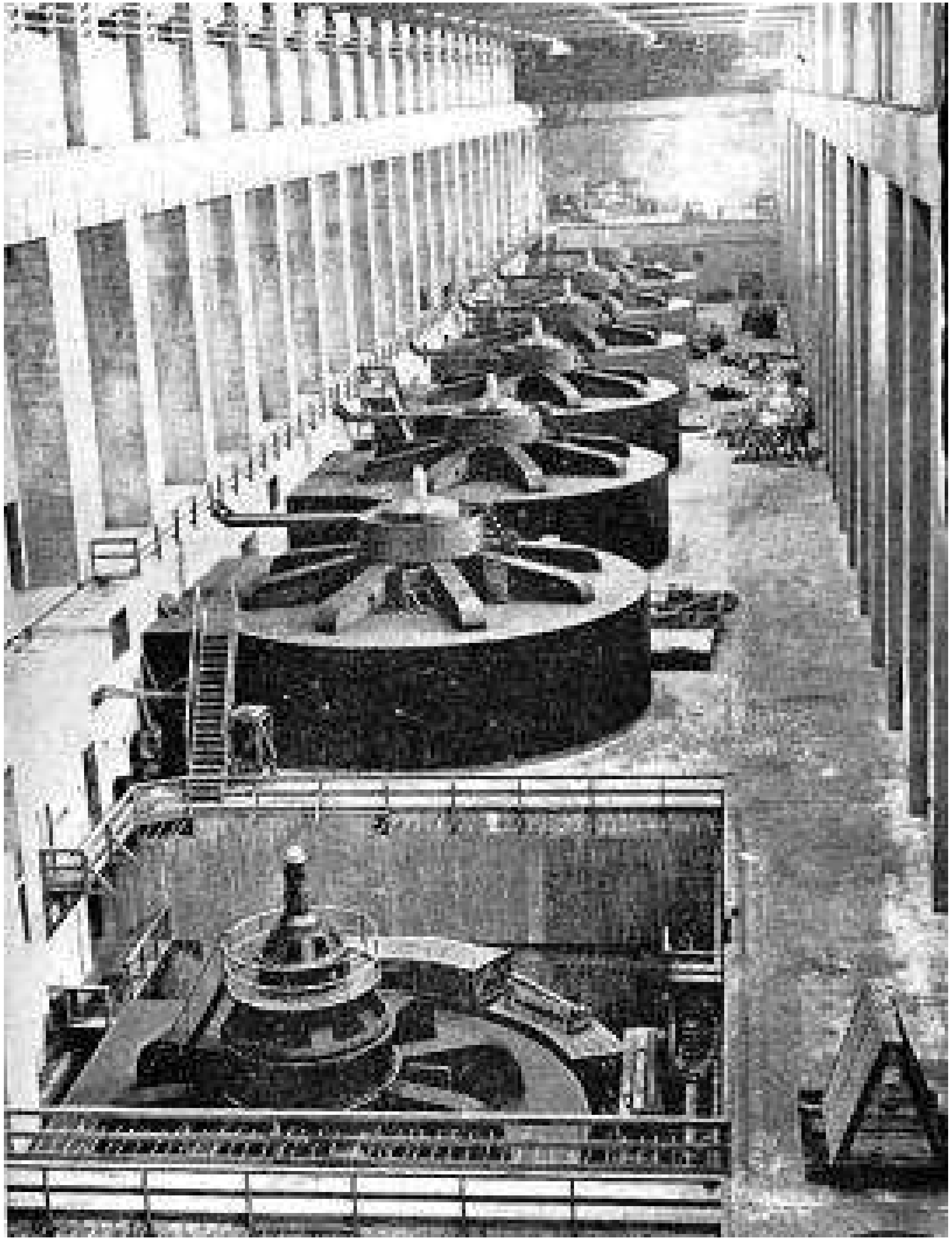
**Left: caption: "Light on top of Grand Coulee's first completed generator shows the 108,000-KW unit is operating"**



*"…Two of the Grand Coulee generators are now in use, a third is being assembled, and three more will go to work during the year. The rest will be installed as fast as they can be built if the demand for power continues…As much as possible, completion of the Grand Coulee power facilities as well as other hydroelectric projects in other parts of the country are being rushed to completion because of the war…"*

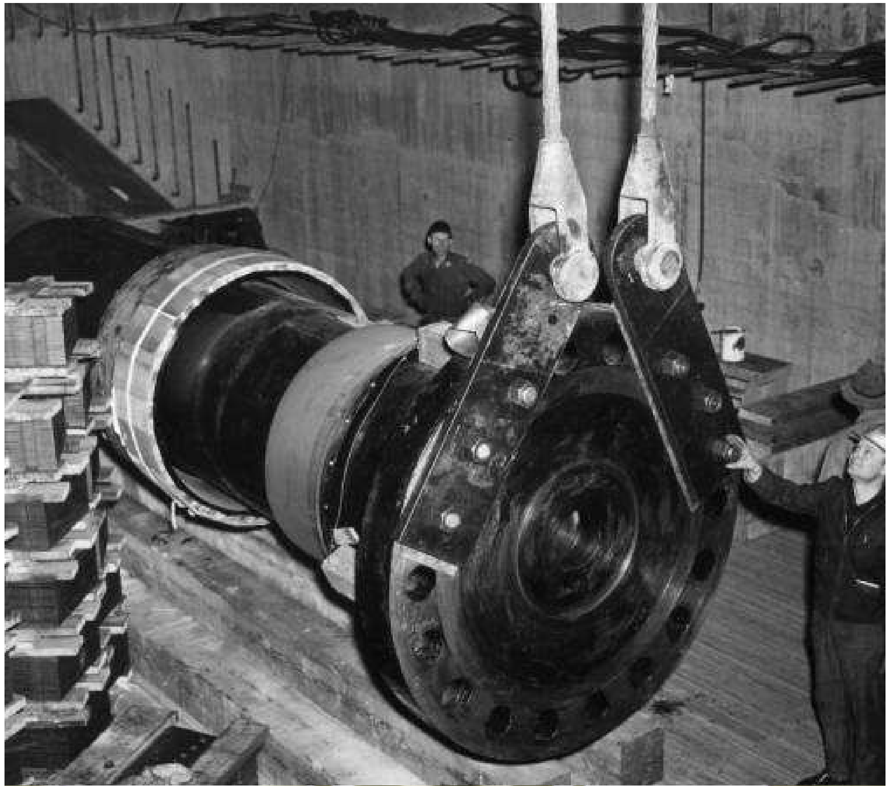
***Popular Mechanics*, May 1942**

**Left: caption: "Assembling the coils of one of the 274-ton stators"**



Left: caption: “The giant Bureau of Reclamation power plant at Grand Coulee Dam in March 1944, set a world’s record for electrical production by a single plant in a month’s time with a gross output of more than 621,000,000 kilowatt hours. Almost the entire Grand Coulee production was transmitted to Pacific Northwest aluminum plants and other war industries. The power house became the world’s greatest power producer in less than three years after the first generator was installed. The rated capacity of the present installation is more than 800,000, less than half the ultimate development. The small machine in the foreground is one of two 75,000 kilowatt units transferred from Shasta Dam to Grand Coulee Dam in 1943 to expedite delivery of additional power for war use. The six other units, each rated at 108,000 kilowatts, are the largest generators in the world.”

# Power Generating Units

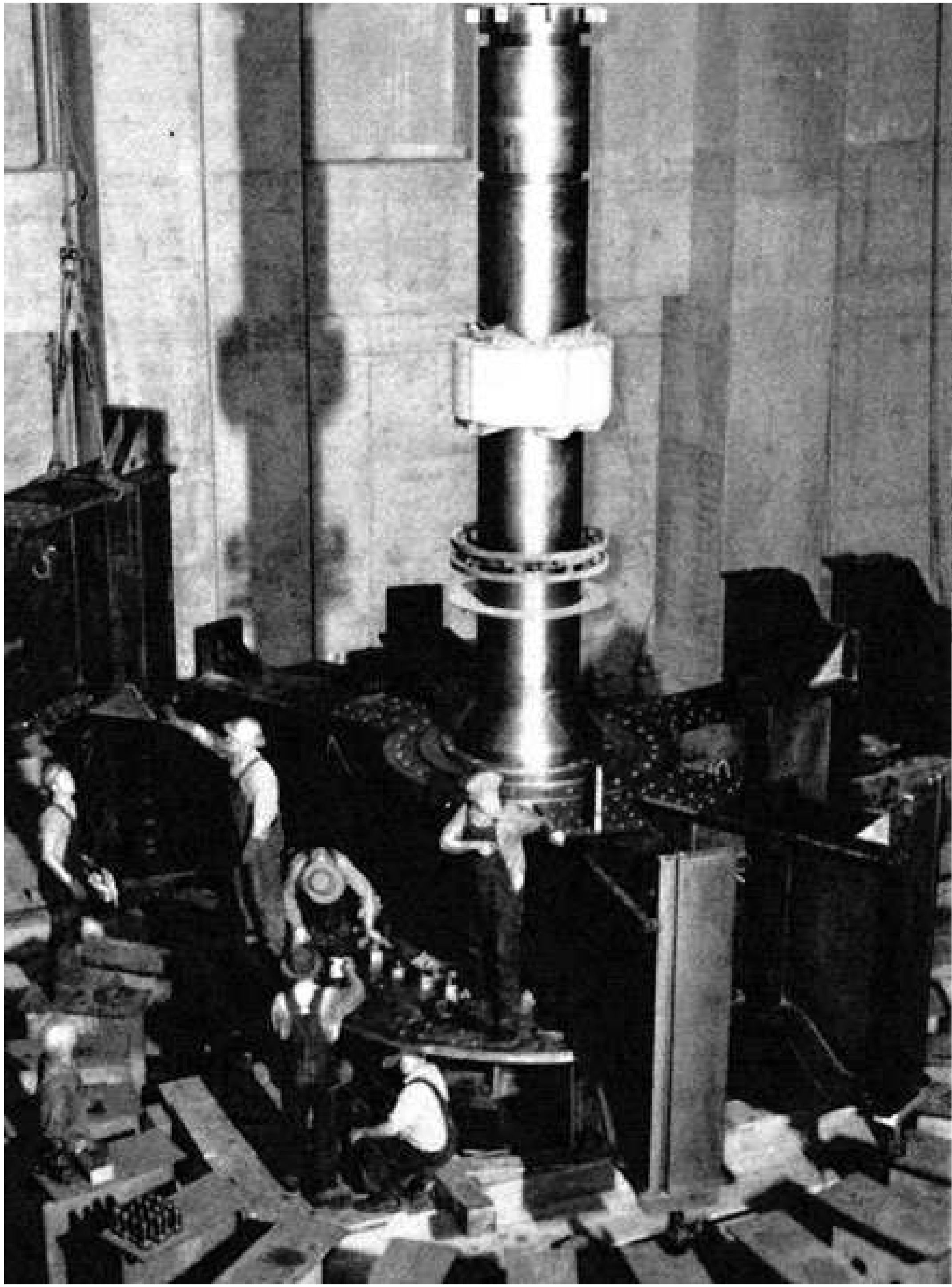


***"Latest of the mighty machines developed to produce vast quantities of power is the world's largest water-wheel generator now being installed at Grand Coulee Dam. It will go into service this summer. Built by Westinghouse, this machine is composed of 1,000 tons of parts, the heaviest of which are the steel frame, the 'spider' – as single piece of steel weighing 50 tons and used to support the rotating mechanism on a shaft, which weighs 150 tons and is so long it had to be made in two parts and bolted together…"***

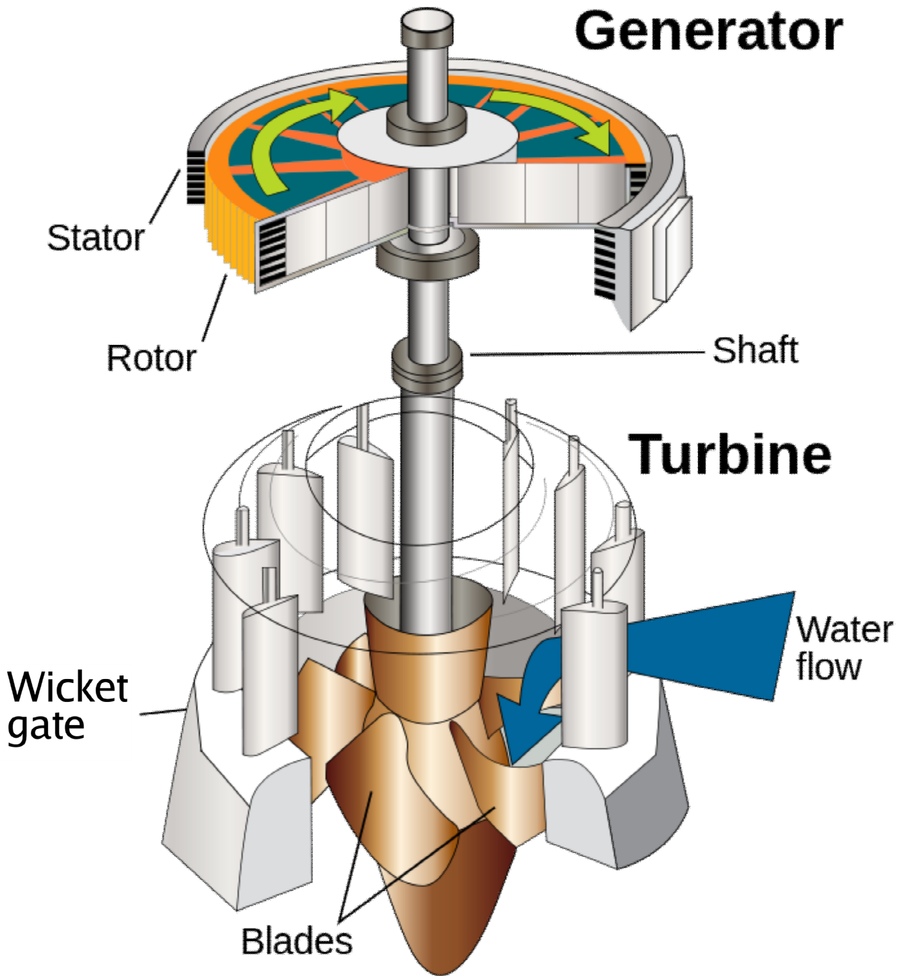
***Popular Mechanics*, June 1941**

**Top: caption: "Hitch used for lifting one end of 85-ton shaft"**

**Bottom: caption: "Turbine shaft in left powerhouse"**



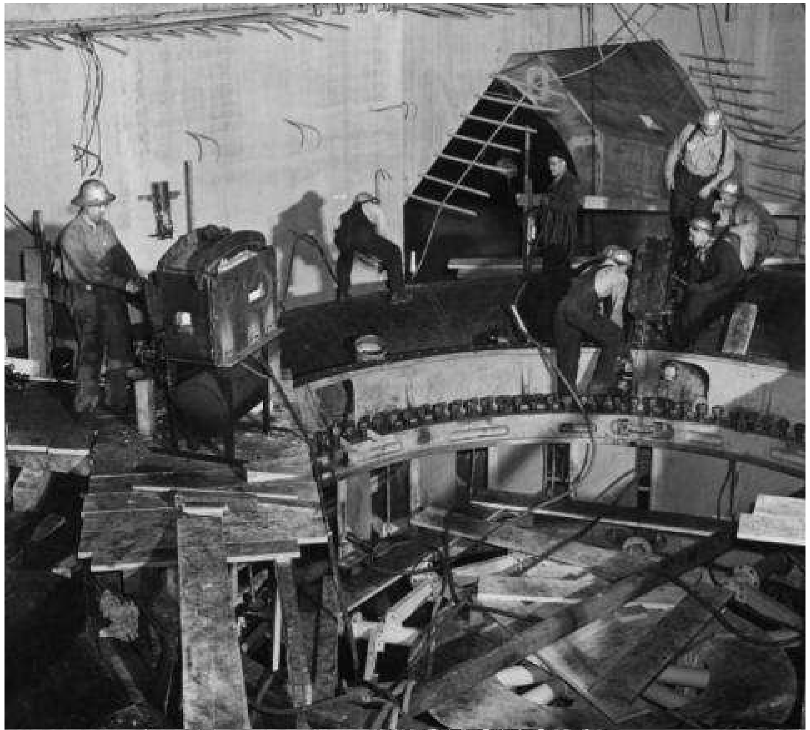
**<u>Above:</u> caption: "Transporting spider to the powerhouse - Grand Coulee in background, Feb. 1941"**
**<u>Left</u>: caption: "Assembling the structural steel spider of a Shasta generator at Grand Coulee Dam (July 1942)"**

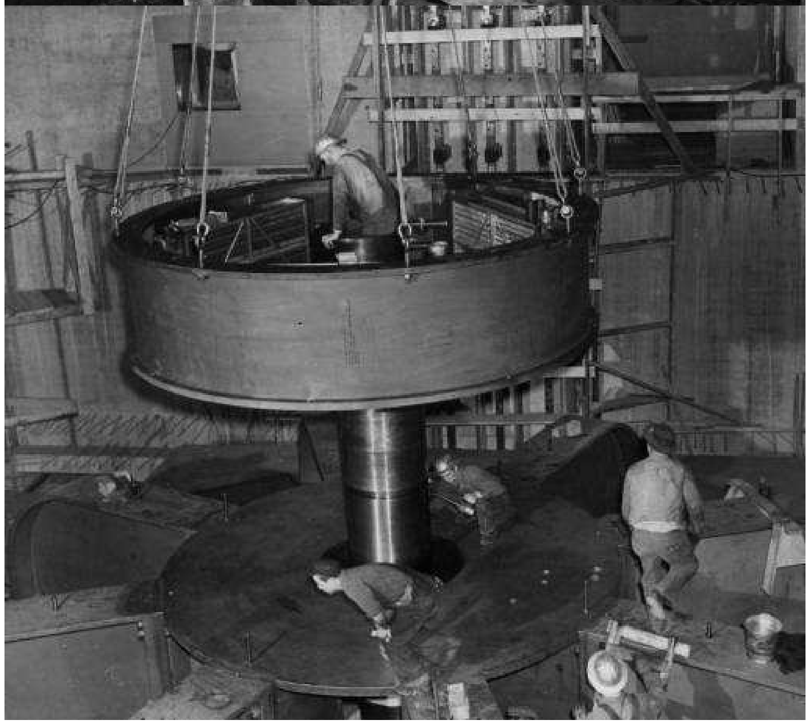



***"…The generator now being installed is the first of three identical super machines planned for Grand Coulee. Each is designed to produce 30% more power than any other water-wheel generator ever built in this country. Combined output of the three giants will be sufficient to light about 5,500,000 60-watt house lamps. If the 435,000 horse-power of the three could be harnessed to the task, they could lift a 33,000-ton battleship more than 200-feet in one minute…"***

***Popular Mechanics*, June 1941**

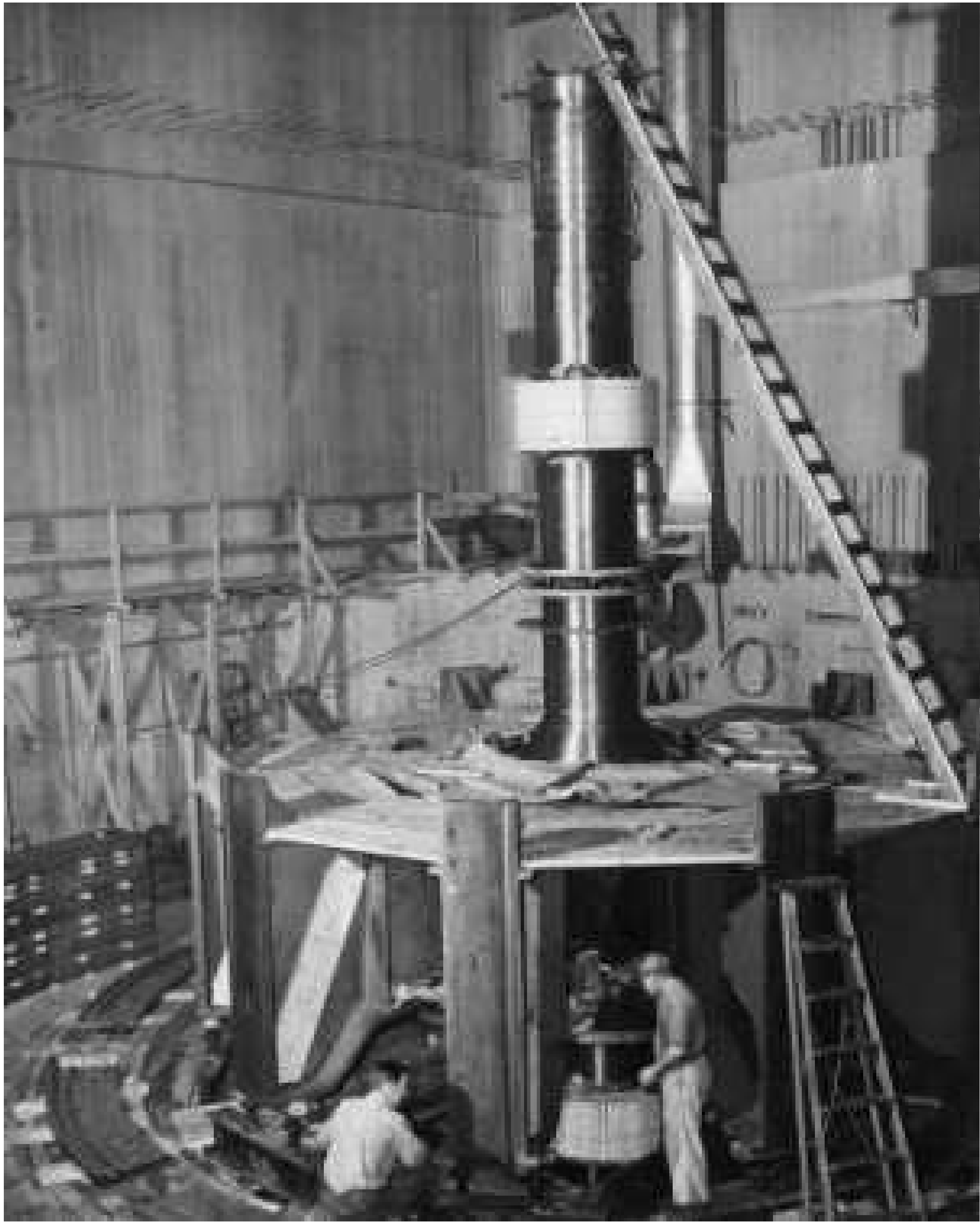
**<u>Left</u>: caption: "Water Turbine"** 1553

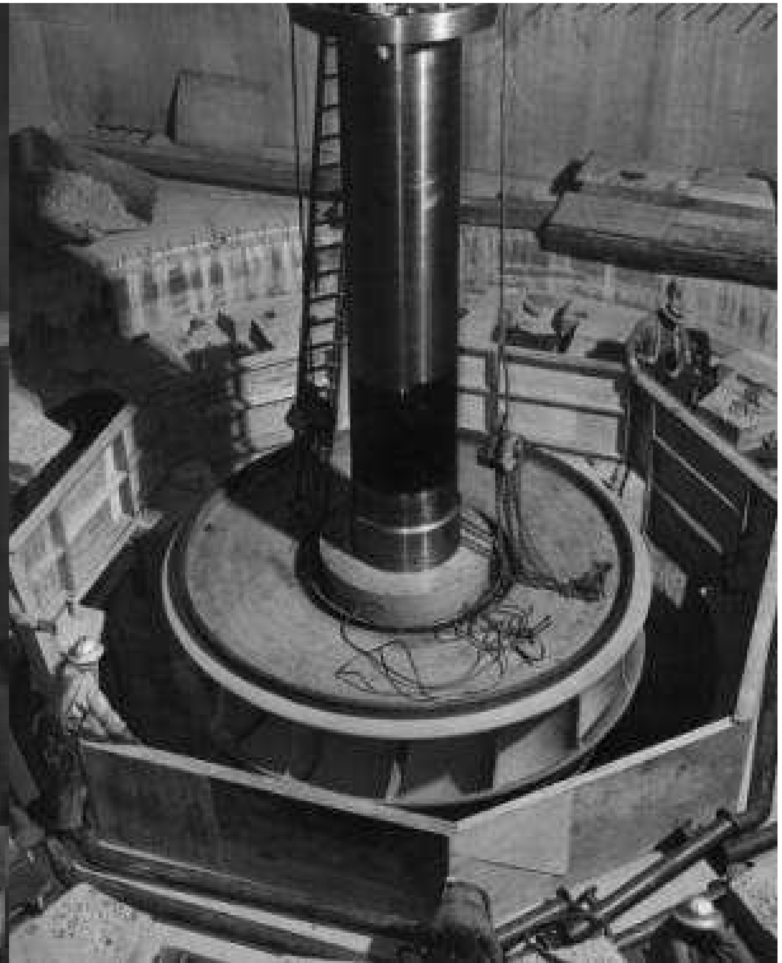




Top: caption: “Riveting together the sections of the No. 1 Shasta turbine scroll case in pit 7. This unit consists of several radial and on straight section of welded plate steel riveted with double butt straps. Before being poured in concrete, the scroll case is given hydraulic test of 310 psi. This scroll case, designed for use at Shasta Dam in northern California, is temporarily installed at Grand Coulee Dam by order of the War Production Board, as construction at Shasta Dam had not progressed sufficiently to make immediate use of turbine at that point. With the waters of the mighty Columbia River as a driving force, this turbine now installed is spinning a giant generator at a rate of 138.5 rpm, producing more than 75,000 kilowatts of electrical energy, Feb. 1942”

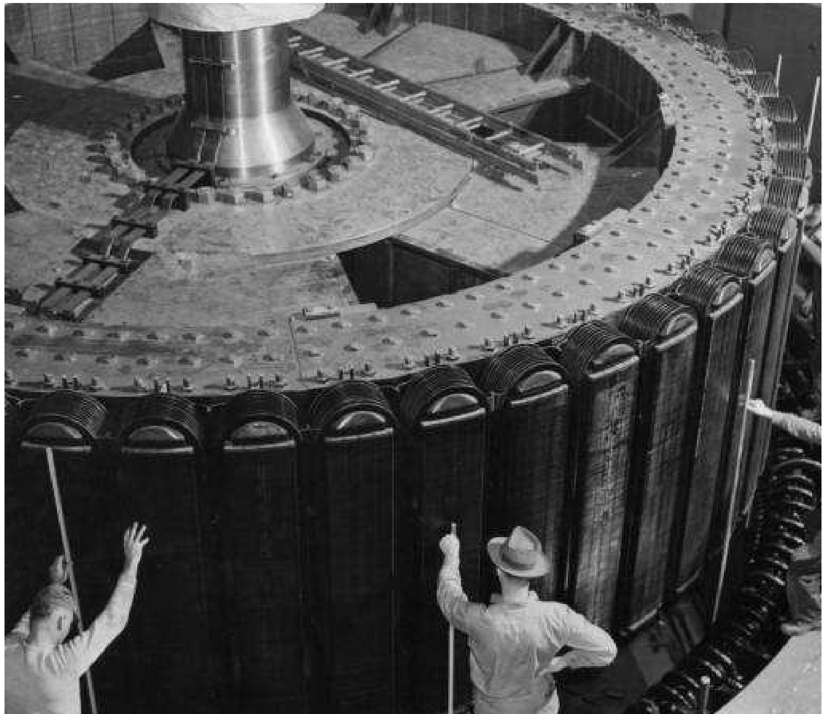
Bottom: caption: “Part of the assembly of thrust bearing for generator Shasta L-8 being lowered into position”

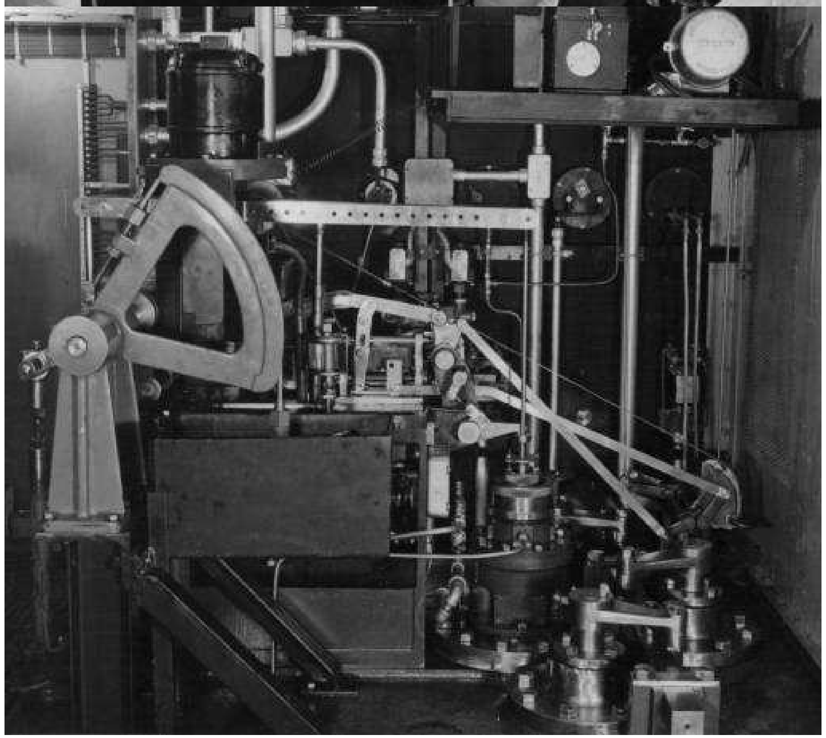




__Above__: caption: “Lowering the turbine runner for the No. 1 Shasta Dam generator. The wheel is seen as it is entering the well at el. 979. The weight of the runner with its 41½” shaft is about 85 tons, October 1942”

__Left__: caption: “Assembly of rotor of Shasta generator to be used in west powerhouse, August 1942”





**<u>Top</u>: caption: "A tight fit. The clearance between the huge 25-foot rotors and the stators of the two 75,000 KW Shasta Dam generators, being installed at Grand Coulee Dam to make additional power available for war industries, is only 5/8-inch. Lowering this 450-ton wheel into place, the operators of the two powerhouse cranes, that jointly supported the load, were guided by work-men, stationed around the rim, who inserted sticks between the stationary and moving parts to measure the clearance and prevent contact. When the unit goes into service next February, the outer rim of this rotor, which is 7-feet high, will spin at 125 mph. Attached to the rim are 52 magnets, weighing 3,300 lbs. each, Nov. 1942"**

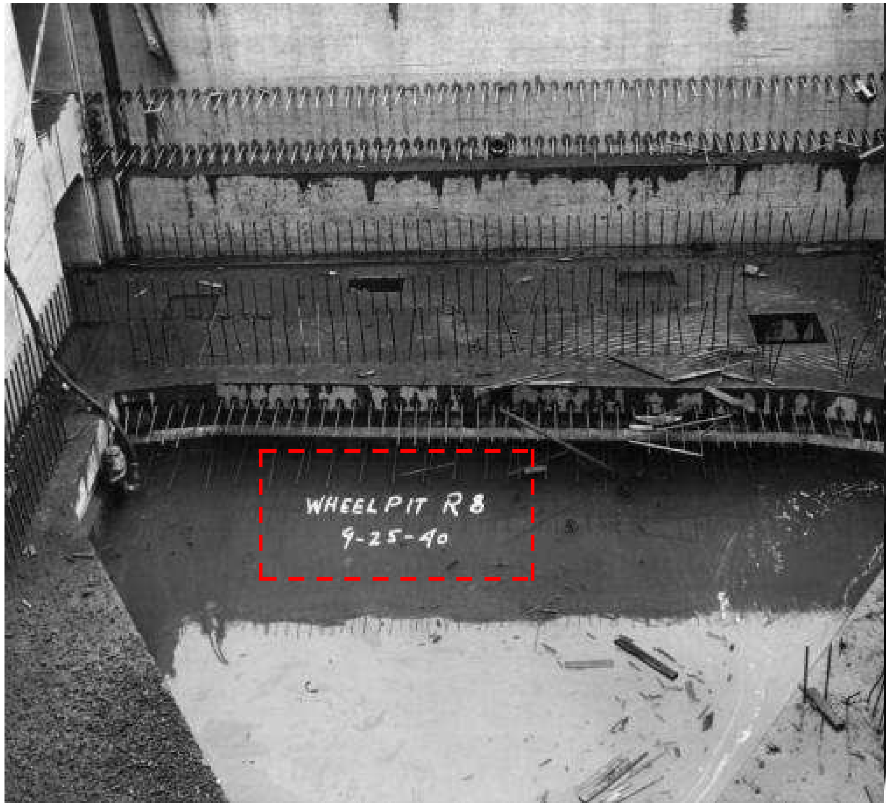
**<u>Bottom</u>: caption: "View of the Allis-Chalmers governor for Shasta unit U1 in L7 position showing the speedball motor, relay, and operating linkages"**

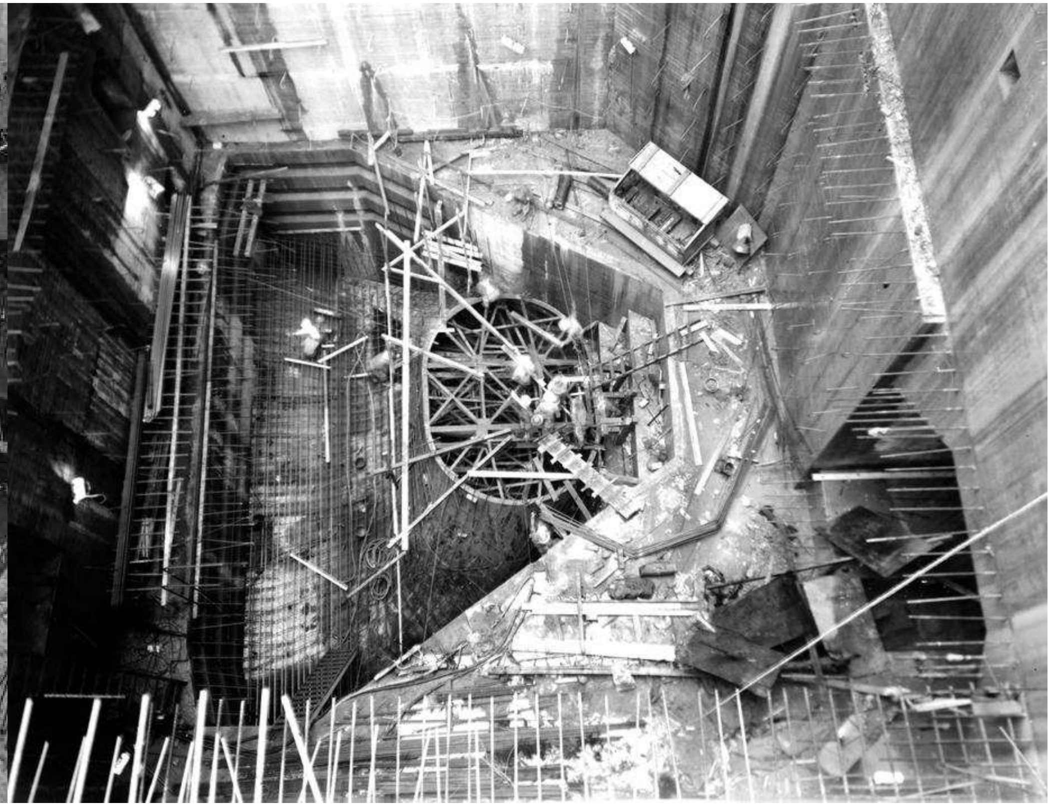
*"…Water from behind the dam flows through a steel pen-stock tube 18-feet in diameter and enters the turbine at 53 miles per hour. At full load 141 tons of water a second pass through the turbine. The water used by seven of them would supply the whole population with 150 gallons a day…"*
***Popular Mechanics,*** **May 1942**
**<u>Left</u>: a 150K-HP rated turbine impeller being unloaded at the dam site after a 5K-mile voyage from Newport, VA. The unit was built by the *Newport News Ship-building and Drydock Co.* It couldn't be transported by rail directly to the dam because it would not clear tunnels along the shortest route. Photo was taken on June 25th 1947.**

***“Measuring 21-feet 8-inches in diameter, a giant ink drawing will serve as a guide in making a government mosaic. The U.S. Bureau of Reclamation drawing shows an inverted outline of man’s mightiest hydroelectric generator at Grand Coulee Dam in Washington. It will be outlined in permanent terrazzo in the west powerhouse at the dam. Travelers who visit the dam by the thousands, will walk across the mosaic…”***

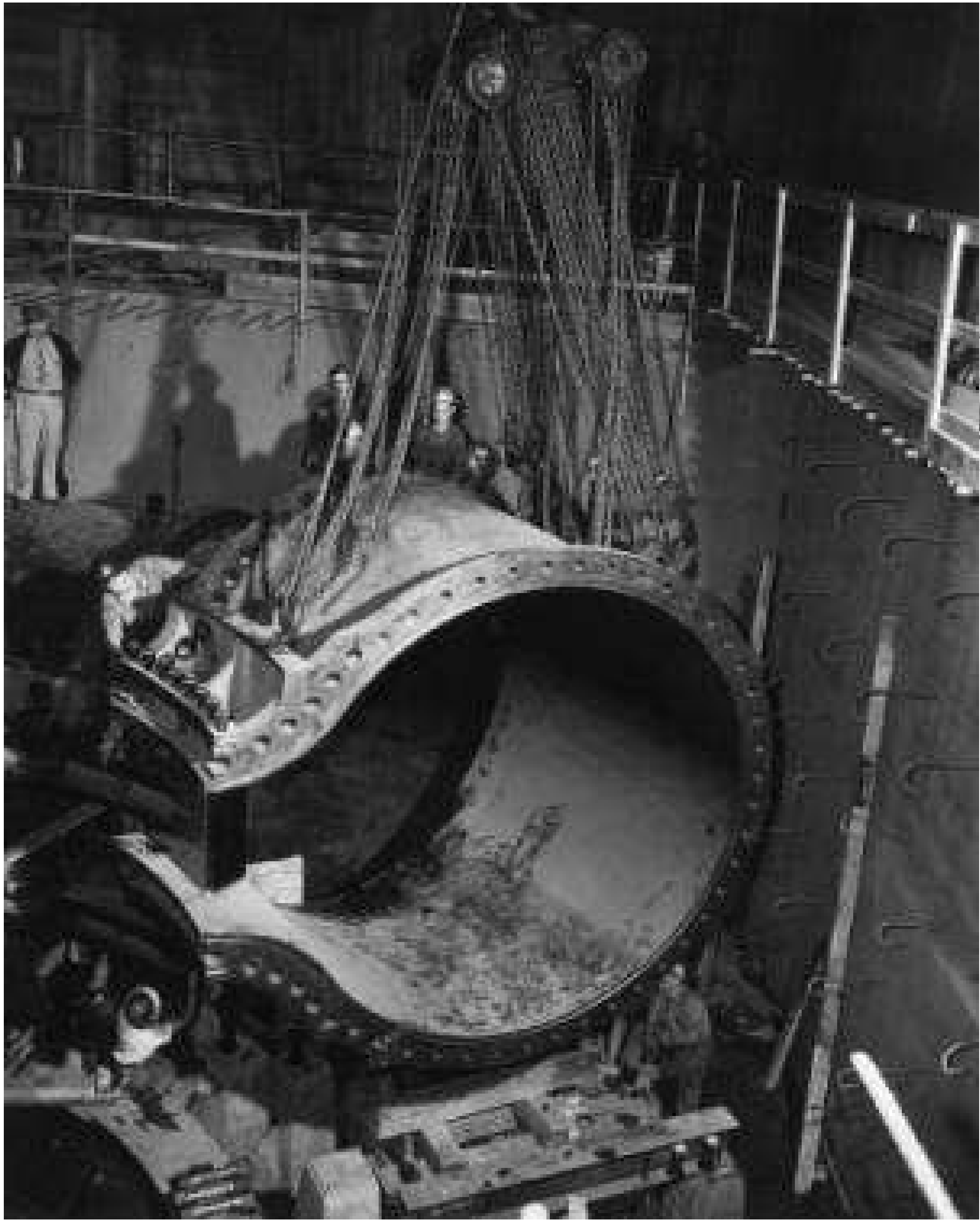
***Popular Mechanics,* August 1949**

**<u>Above</u>: caption: "Waterwheel depicted in the terrazzo floor of the left powerhouse"**
**<u>Left</u>: caption: "Waterwheel for one of the 150,000-horsepower turbines"**



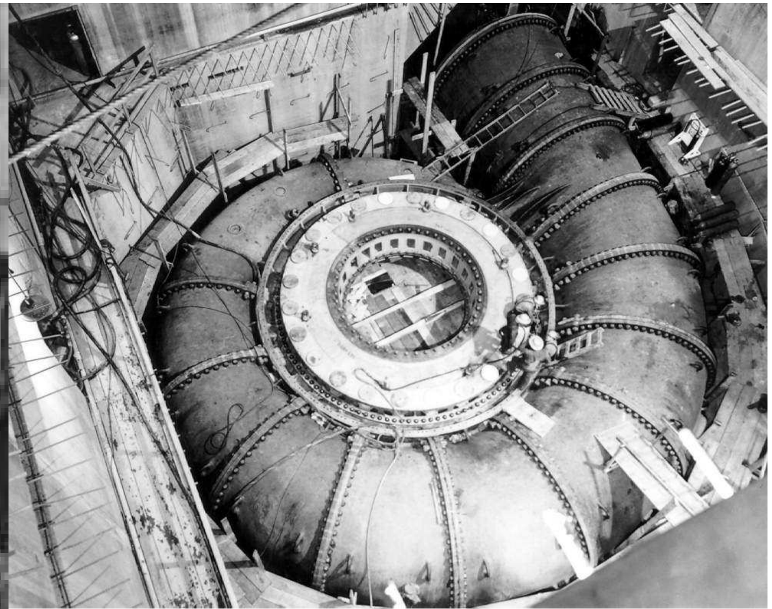



<u>Left</u>: caption: “Wheel pit R-8 looking downstream from 965 step. East Powerhouse base, September 1940”
<u>Right</u>: caption: “Waterwheel Pit”



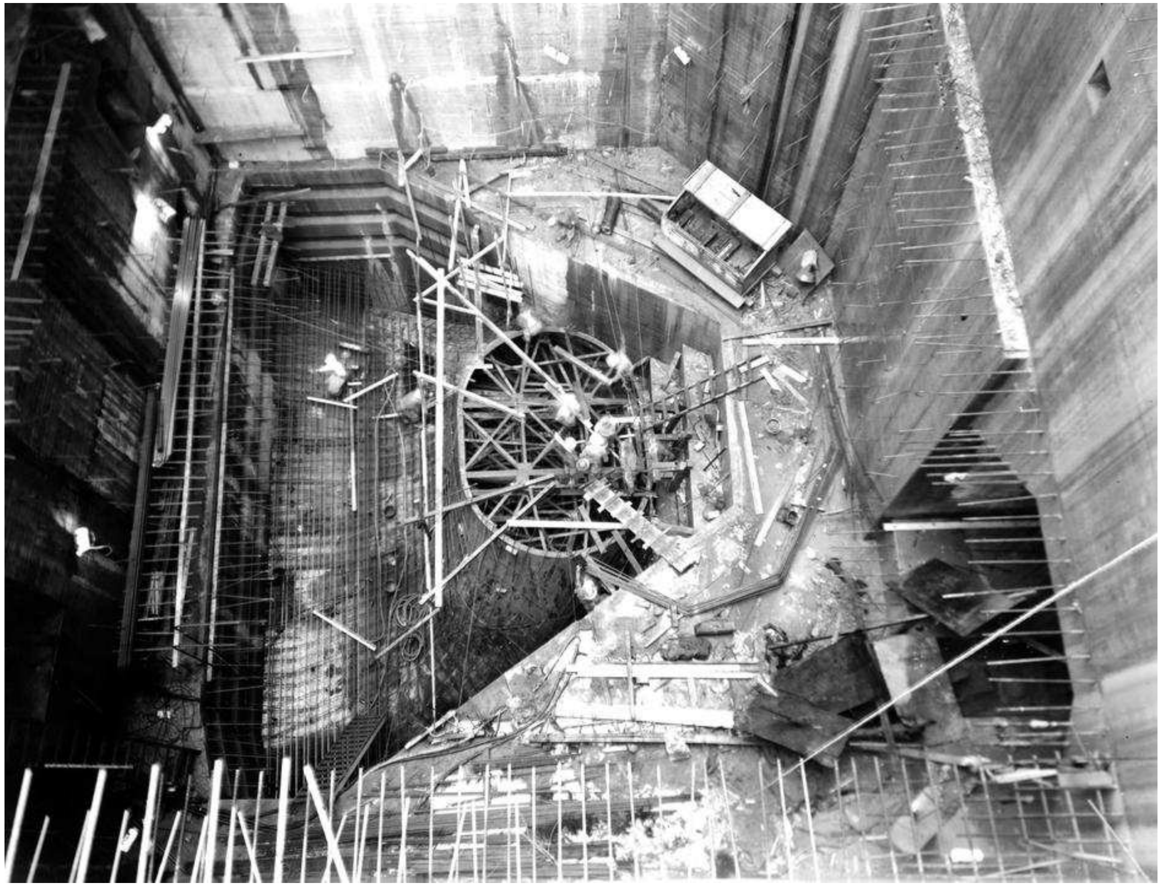
**Above: caption: “Workman inspecting one of the generator turbines just before its installation. Photo was taken on December 18, 1942.”**

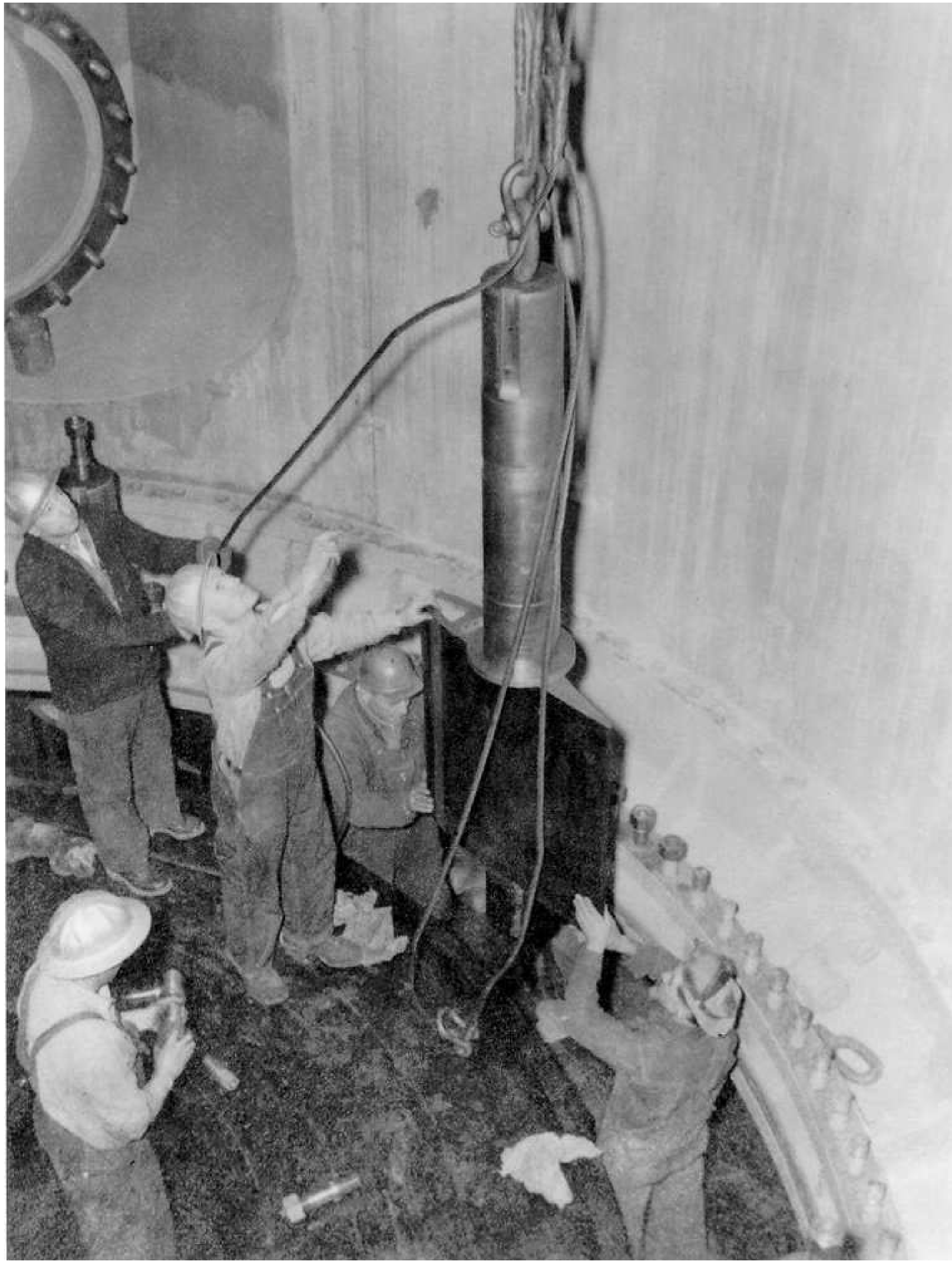
**Left: caption: “Placing scroll case section L1 W. powerhouse, August 1941”**



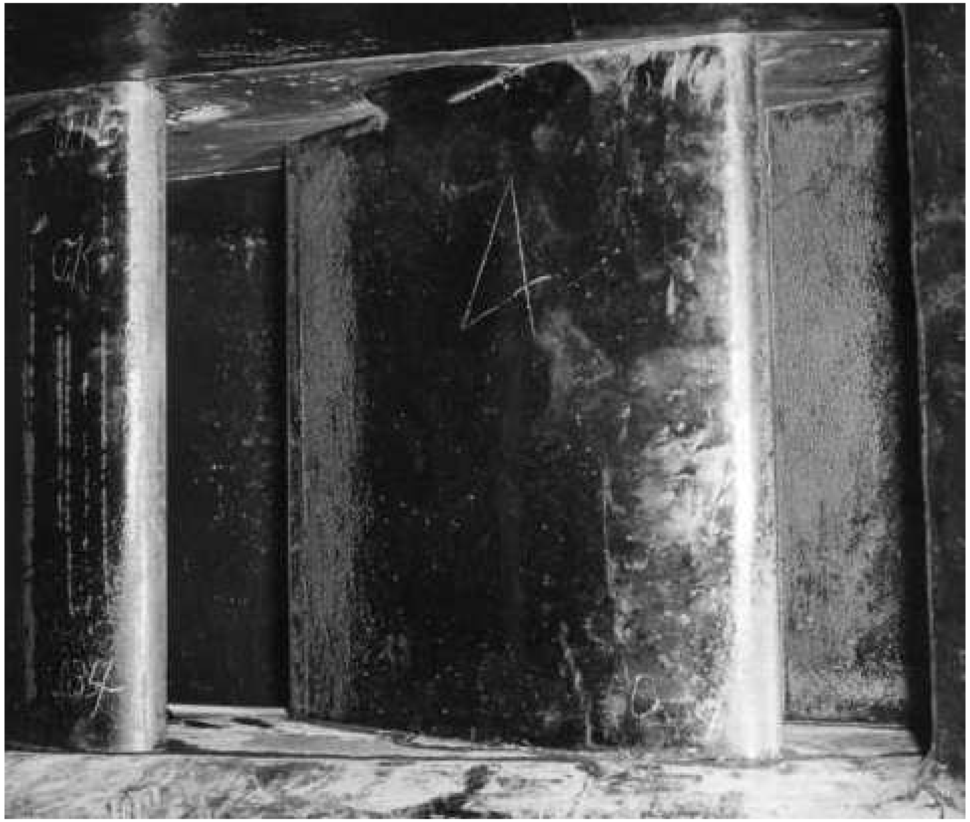
**<u>Above</u>: caption: “Snail-like scroll case feeds water to turbine waterwheel at 53 mph.” This is the scroll case for generator L-1 (now G-1). The central depression in the snail-shaped scroll case is the turbine pit. Water flows into the turbine from all sides through the rectangular slots visible in the sides of the pit. The diameter of the pipe forming the scroll case steadily decreases from 18-feet at the penstock outlet (on the right). This provides an equal flow of water into all sides of the turbine. The L-1 generator went on-line on April 7, 1942. Photo taken on September 11, 1941.”**

**<u>Left</u>: caption: “Concrete breaker used to tighten bolts on L-6 scroll case”**





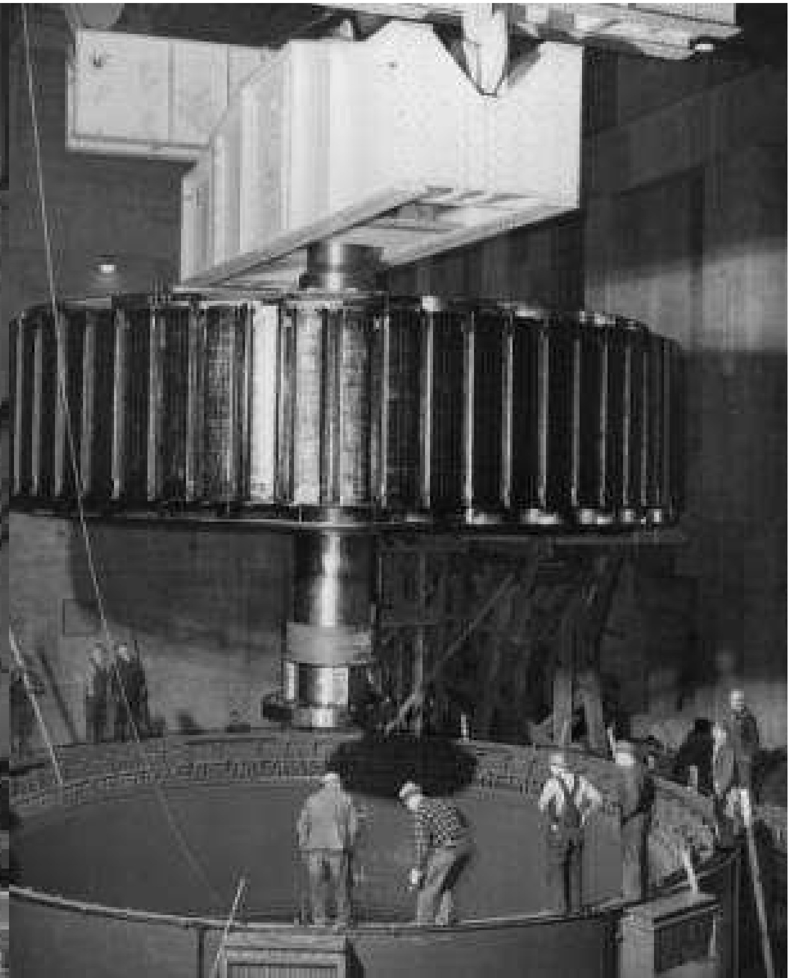
**<u>Left</u>: workmen install one of the wicket gates in the L-4 (now G-4) turbine pit. This and other wicket gates form a ring of louvers around the turbine which can be opened and closed like venetian blinds to control the flow of water. As the electrical demands on a generator increase, more water is required to keep it spinning at the same rate. Once a generator is up to speed and on-line, minute changes in the position of the wicket gates are used to keep the generator spinning at exactly 120 rpm. The rotation rate is a function of the generator circuit design (120 rpm results in 60Hz AC power). This photo was taken on Nov. 15th 1943.**



Left: caption: “This is the painted surface of a wicket gate for Turbine L-2. The view is representative of the painted surface on the outer face of the wicket gates and shows the alligatoring of the paint along the trailing edge, July 1942”

Above: caption: “Workmen placing the thin sheets of iron which form the L-9 (now G-9) generator's stator core. Each iron sheet is insulated from those above and below it by a thin layer of lacquer preventing the changing magnetic fields inside the operating generator from producing eddy currents in the steel which would rob the generator of power and create undue heating. Note the slots in the steel plates. The copper coils which form the generator’s stator winding fit between these slots.”

Left: caption: “As each segment of the winding is placed into its slot it is connected to the other segments at top and bottom to form a continuous circuit. The winding segments are insulated from the steel core by a fiber/resin insulation.”

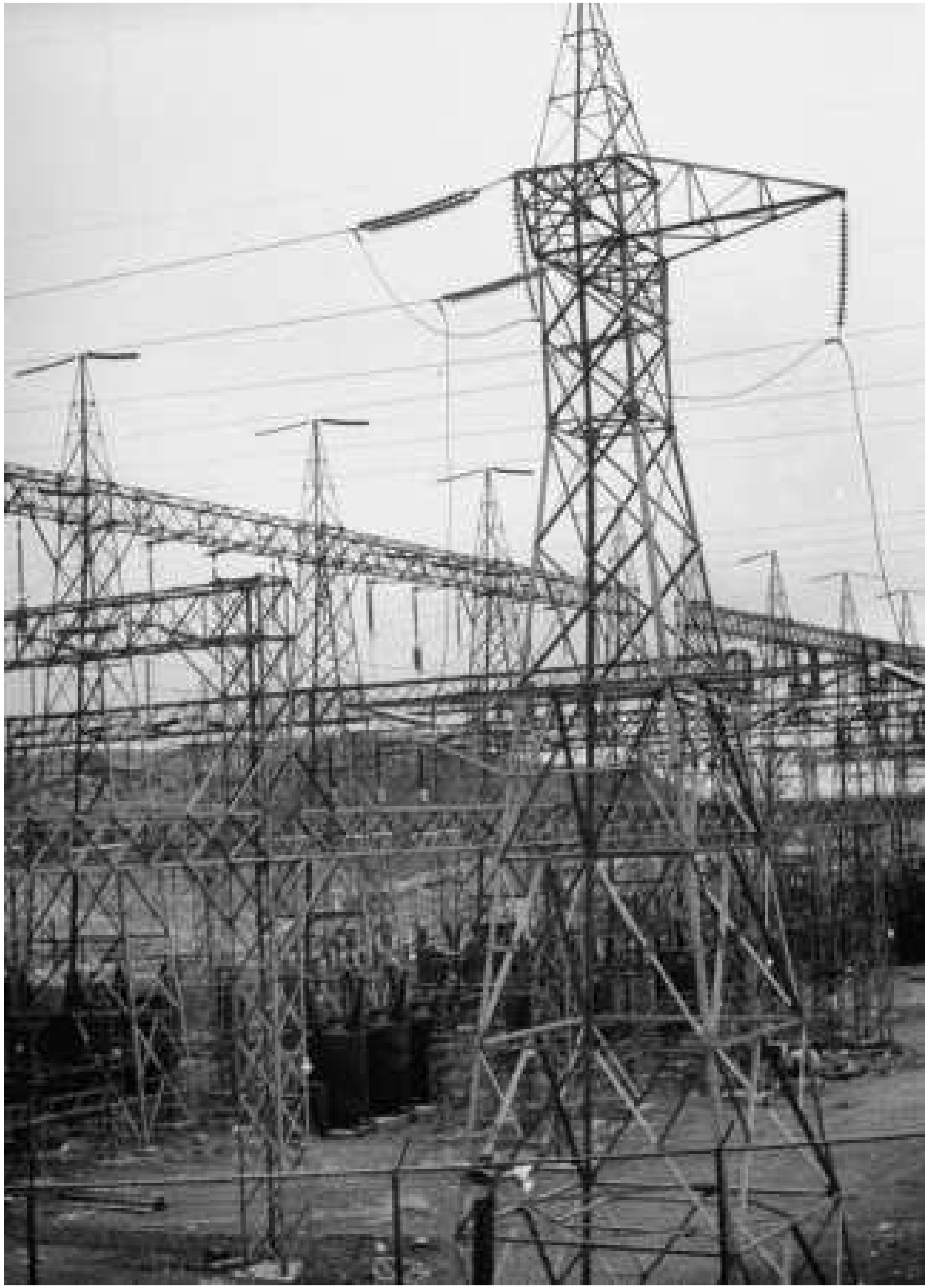


**<u>Above</u>: caption: "Lowering the L-7 rotor into place, February 1942"**

**<u>Left</u>: caption: "Man stands on the rotor - which nears complet-ion, July 1941"**

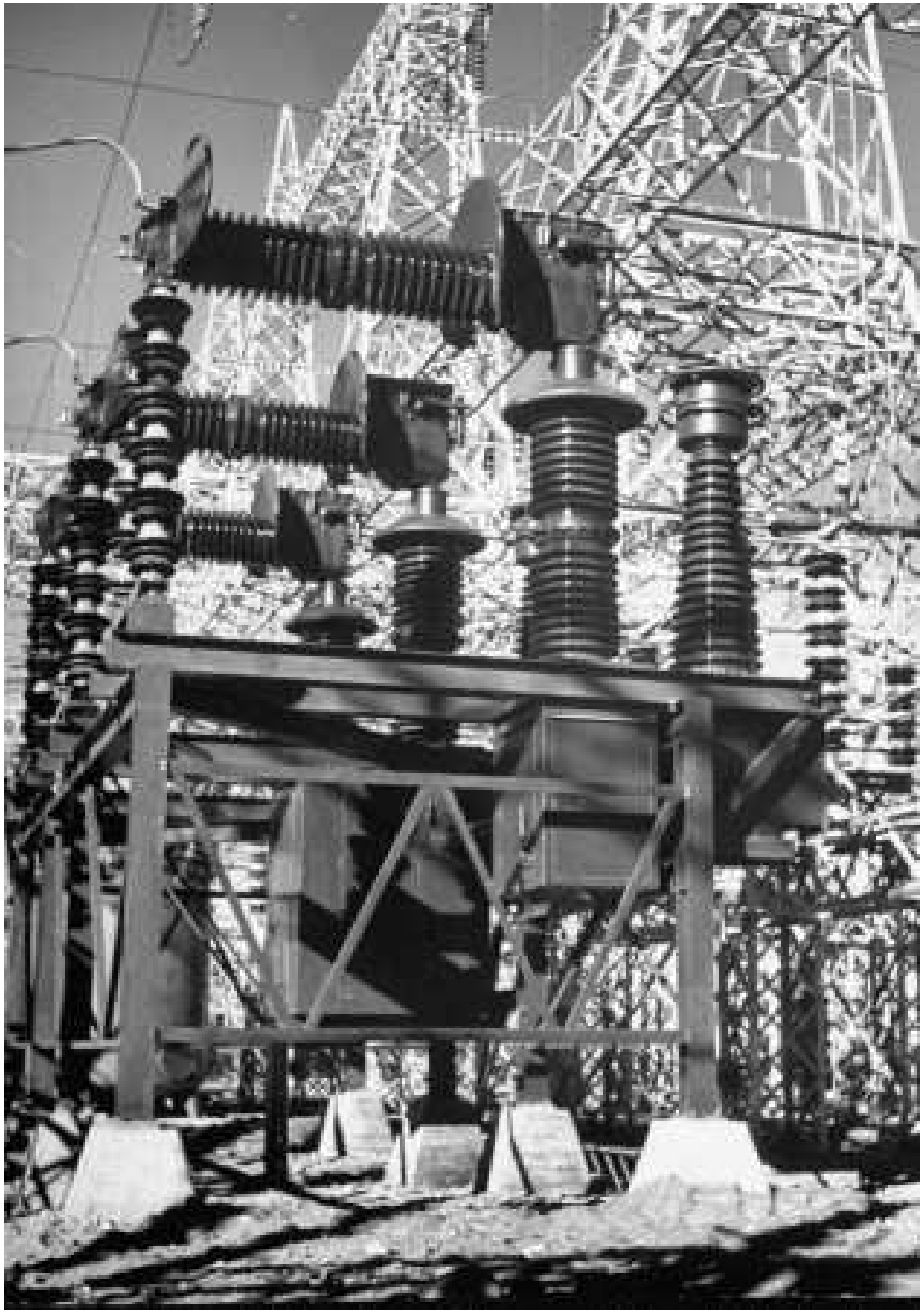
**<u>Above</u>: caption: "Lower face is shaft to water wheel - upper face is 74-ton shaft connecting to rotor shaft. Shaft above is being lowered into place. The two faces are being carefully cleaned and inspected to insure perfect union. There does not dare be any metal dust or grit. Faces are oiled, June 1941"**

**<u>Left</u>: caption: "Men sighting through bolt holes to line them up as 74-ton shaft is lowered into place, June 1941"**



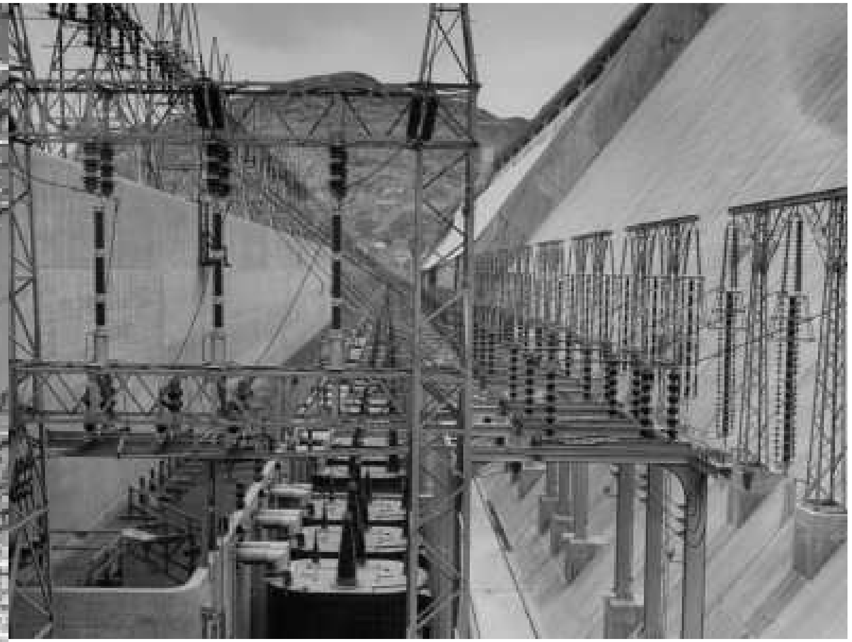
***"Pent-up power of the water behind Grand Coulee Dam, man's mightiest structure, is being harnessed to three gigantic generators – the largest water-wheel generators ever built in the United States. When engineers turned the valve to let Columbia River waters spin the first of these wheels, 108,000,000 watts of electric power began flowing at the speed of light over a new 230,000-volt transmission line to Bonneville Dam. There a transformer steps down its voltage, and the power flows on to operate a new aluminum manufacturing plant at Vancouver, Wash., and other industries of the Pacific Northwest…"***

***Popular Mechanics,*** **November 1941**



***"Protecting the power line from Grand Coulee Dam is a gigantic circuit breaker, said to be the world's largest, that can interrupt an electrical fault of 10-million-kilovolt-amperes. Exceedingly fast despite its massiveness, the breaker can clear transmission-line trouble in 1/20 second. The disconnect switches are motor-operated. Twelve similar breakers will be installed in the new east switch yard of the Grand Coulee Dam."***

***Popular Mechanics,***
**February 1950**



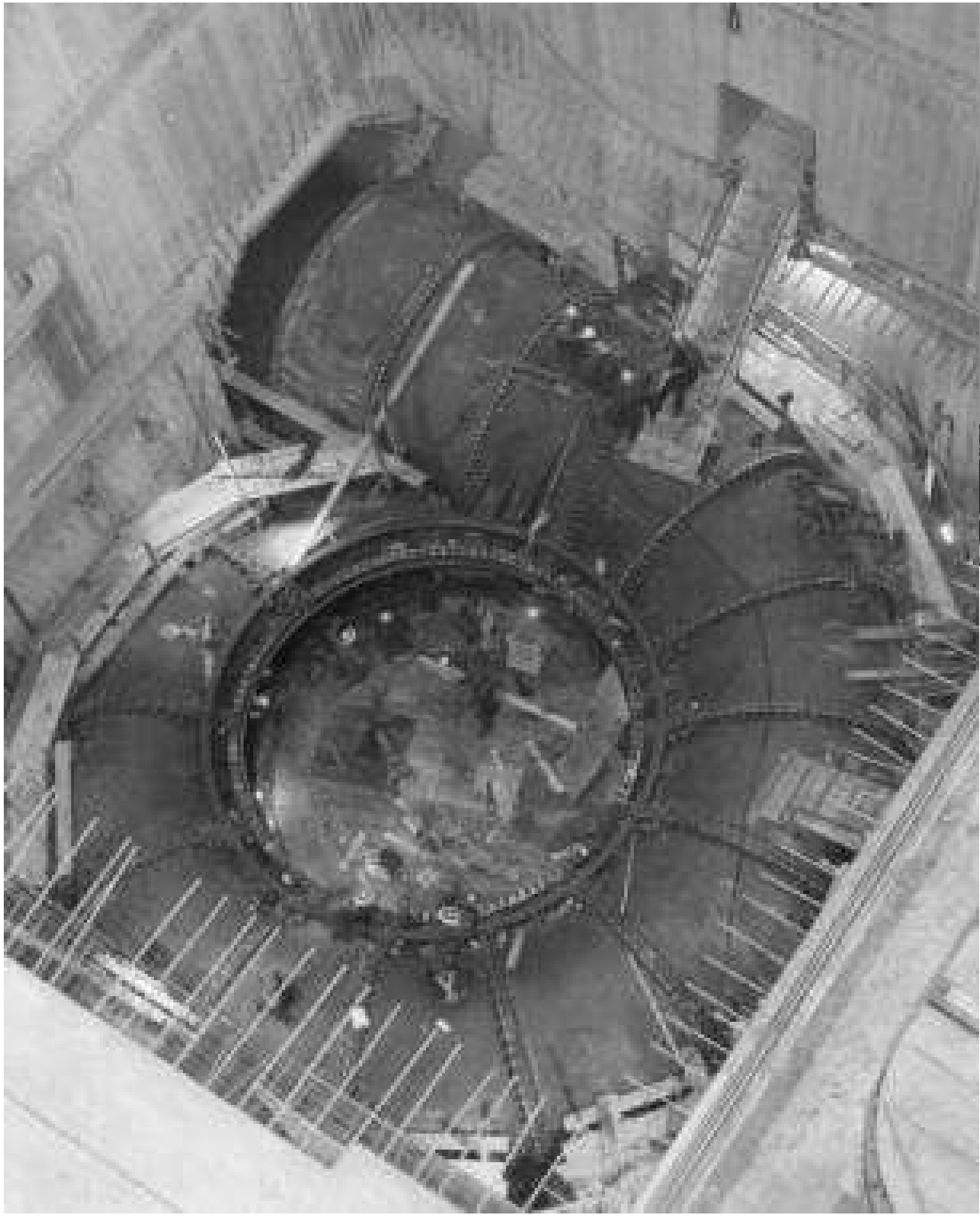
**<u>Above</u>: caption: “Electrical transmission apparatus atop Grand Coulee Dam powerhouse”**

**<u>Left</u>: caption: “Circuit breaker prevents lightning damage to power system”**

***"…These power units are three stories tall, the largest ever made. Each is costing one and a half million dollars. They are so big that each powerhouse really consists of a number of separate steel and concrete boxes, each containing and supporting a power unit and separated from its neighbors by cork expansion joints. Stairs and galleries make all parts of each unit accessible, down into the turbine pit where the roar of water rushing past the enclosed blades is too loud for conversation…In addition to its main generators the installation includes three smaller service generators for local power needs…"***

***Popular Mechanics,* May 1942**

**Left: caption: "Interior of Grand Coulee Dam power plant showing six of nine generators in-place, ca, 1940)**




**<u>Above</u>: caption: "View of the east end of the left powerhouse, with turbine pit No. 6 in the immediate foreground, November 1942"**

**<u>Left</u>: caption: "View of pit No. 6 showing scroll case in place, February 1943"**

***"…Each of these generators – the third is scheduled to be operating by next spring – is rated at 108,000 kilowatts and is driven by a 150,000-horsepower water wheel turbine. The generator housing is 45-feet in diameter and 24-feet high. The 1,000 tons of parts forming each generator required thirty-eight freight cars for shipment from the Westinghouse plant at East Pittsburgh, Pa."***

***Popular Mechanics,*** **November 1941**

**Left: caption: "Westinghouse work crew, original units at Grand Coulee Dam (ca. 1944)"**

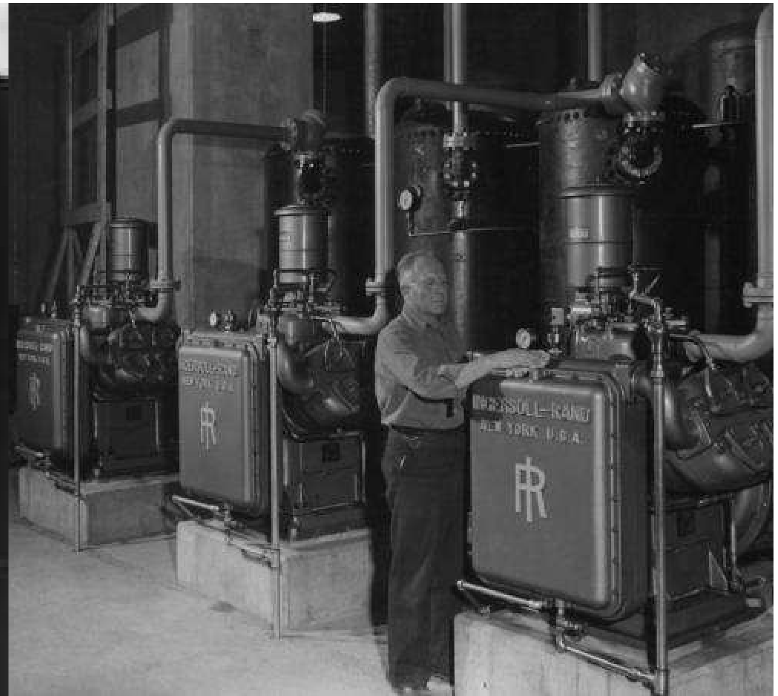
# From Time-to-Time

***"…Sturdy as they are, the units were designed with the knowledge that they may need to be taken apart for repairs from time to time. Sections of the shaft that connect the waterwheel with the generator are flanged and are joined together with oversize bolts that were temporarily shrunk down to size with Dry Ice when being installed. Holes have been drilled through the bolts so that liquid air can be shot through them to shrink them down again for removal. The entire rotating weight can be brought to a stop from 25 revolutions per minute in 60 seconds by air brakes which, when oil is substituted for the air, become hydraulic jacks by which the rotating parts can be raised…"***

***Popular Mechanics,*** **May 1942**

**<u>Left</u>: caption: "These huge nuts, used to couple the shaft of the waterwheel to the generator rotor, were shrunk with Dry Ice to 80 degrees below zero so they will expand and tighten after fitting"**

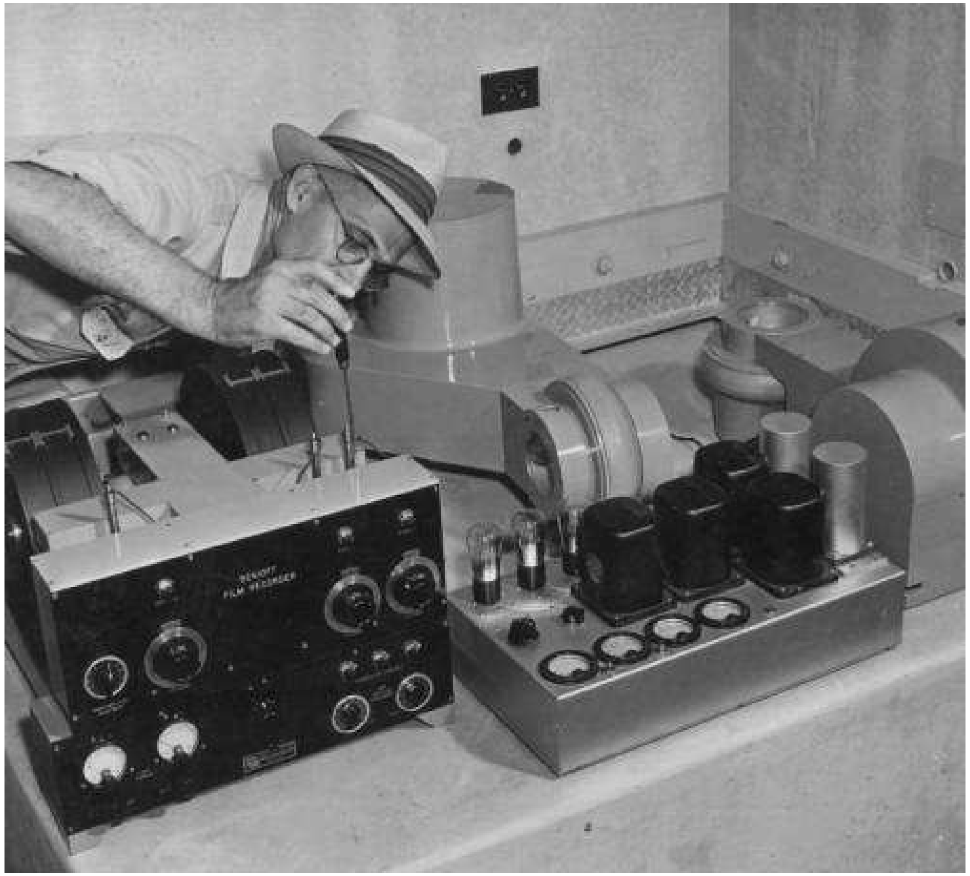
**<u>Left</u>: caption: "These 193 lb. bolts and nuts couple the two shafts together on a main unit at Grand Coulee Dam, December 1942"**



**<u>Above</u>: caption: “Air compressors in powerhouse”**

**<u>Left</u>: caption: “Lubricating and insulating oils, received in tank cars, are stored in a lower section of the control bay. Tanks are provided for new and used oils of both kinds; and, oil can be pumped to or from any power unit. Oil pumping equipment, with air compressors and banks of carbon dioxide tanks, occupy a room adjoining the oil tank vault.”**

**<u>Left</u>: caption: “A centrifugal oil purifier, a filter, and automatic electric heater, and meter, pumps, gauges, pipes, and necessary appurentenances are mounted on a simple truck for use in various parts of the plant. The unit is designed to handle lubricating, governor, and insulating oils. Operating on insulating oil at about 90 degrees, the centrifuge is guaranteed to reduce moisture from 1/10 percent to 1/1000 percent in 1,200 gallons of oil per hour, and to raise its dielectric strength to at least 30,000 volts. The filter, designed to remove carbon and fine particles that pass the centrifuge, take standard 12-inch filter papers.”**



Left: caption: “Grand Coulee Dam Seismograph Station, showing seismograph equipment before installation, arranged only for photographic purposes. Dr. Dead S. Carder of the U.S. Coast and Geodetic Survey is simulating the adjustment of position of galvanometers on the Benioff film recorder. In the right foreground is the 10-cycle tuning fork amplifier, and in the back, a horizontal and vertical seismometer, September 1942”

# Command and Control

*"…Each unit has a local control station where it may be started and stopped, where load and temperatures are indicated, and where voltage and frequency are automatically maintained. An automatic governor on the turbine water gates changes the opening when the turbine speed varies as little as 0.01 percent. A main control room in each powerhouse is used to distribute loads among the generators, adjust frequencies and voltages, and operate circuit breakers. Every part of the electrical equipment is protected by automatic relays…"*

***Popular Mechanics,* May 1942**

**Left: caption: "Here workmen are erection an electric switching station. Every part of the power line from Vancouver, Seattle and Tacoma must be fully protected by automatic relays."**

***"…If one of the generators should break down, for instance, circuit breakers automatically open, turbine gates shut themselves, and carbon-dioxide gas is immediately released into the generator housing. Annunciators at the control station show the location of electrical troubles, abnormal temperature changes, and interruptions of oil and water circulation…"***

***Popular Mechanics*, May 1942**

**<u>Left</u>: caption: "Another big item is the 16-foot-tall bushing which is to be fitted into one of the transformers"**

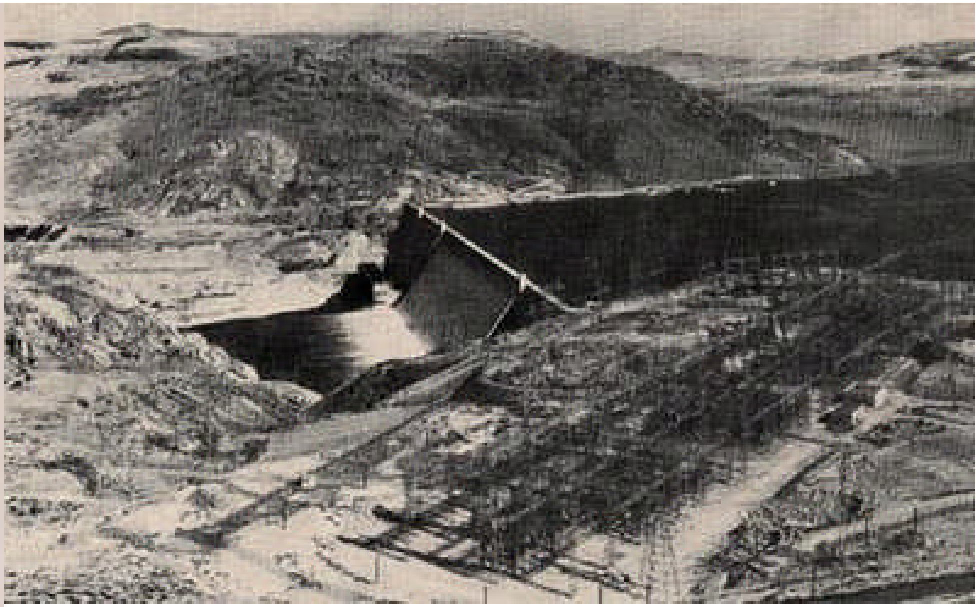
# Shaken, Not Stirred

***"…Ice formations must be guarded against at several points. Water in the lake adjacent to the trash racks behind the dam is kept agitated in cold weather by an air bubbling system using air from compressors inside the dam. If spray from the spillway waterfall forms ice on insulators and conductors in the electrical switchyards above the power-houses, these circuits can be isolated and shorted to a small generator that heats the system and melts off the ice…"***

***Popular Mechanics,*** **May 1942**

**Left: caption: "Workman on safety line removes temporary construction material on lower face of dam"**

# Where It Can Do the Most Good



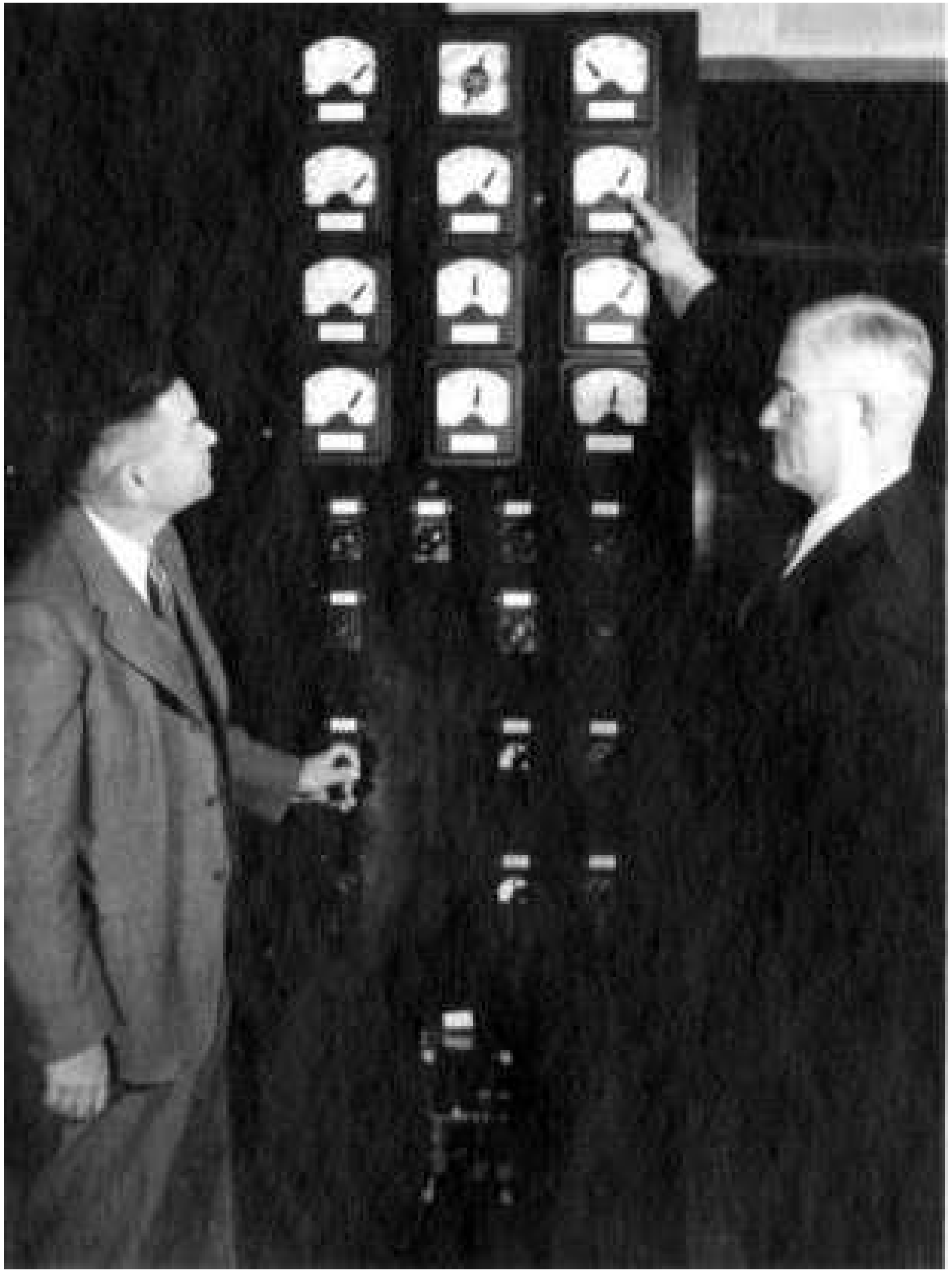
***"…Energy from the generators passes through transformers and is distributed to the Bonneville Power Authority, now finishing a 230,000-volt line to Puget Sound and a 115,00-volt line to Spokane…"***

***Popular Mechanics,*** **May 1942**

**Above: caption: "The first switchyard at Grand Coulee"**

**Left: caption: "The human fly at left is measuring the sag of wires from one of more than 2,200 towers on a 450-mile transmission line"**

# Zero to Hero



## *"…transformed from stand-ins to heroes"*

***The Seattle Times*, March 23rd 1941**

**RE: on March 22nd 1941, two small service generators at *Grand Coulee Dam* went online for the first time, sending ten-thousand kilowatts of electricity into the Bonneville Power Administration's transmission network (the generators were originally intended to produce power only for operations at the dam itself). Due to demands for electricity by defense industries, the event marked the beginning of Grand Coulee Dam's great contribution to the war effort (though America was still officially neutral). An estimated ten-thousand people assembled at the dam for ceremonies marking the symbolic unleashing of the nation's largest hydroelectric facility. By contrast, there was no celebration whatsoever when the first of the dam's eighteen main generators went into service on October 4th 1941; a date that marked the beginning of commercial power production at *Grand Coulee Dam*.**

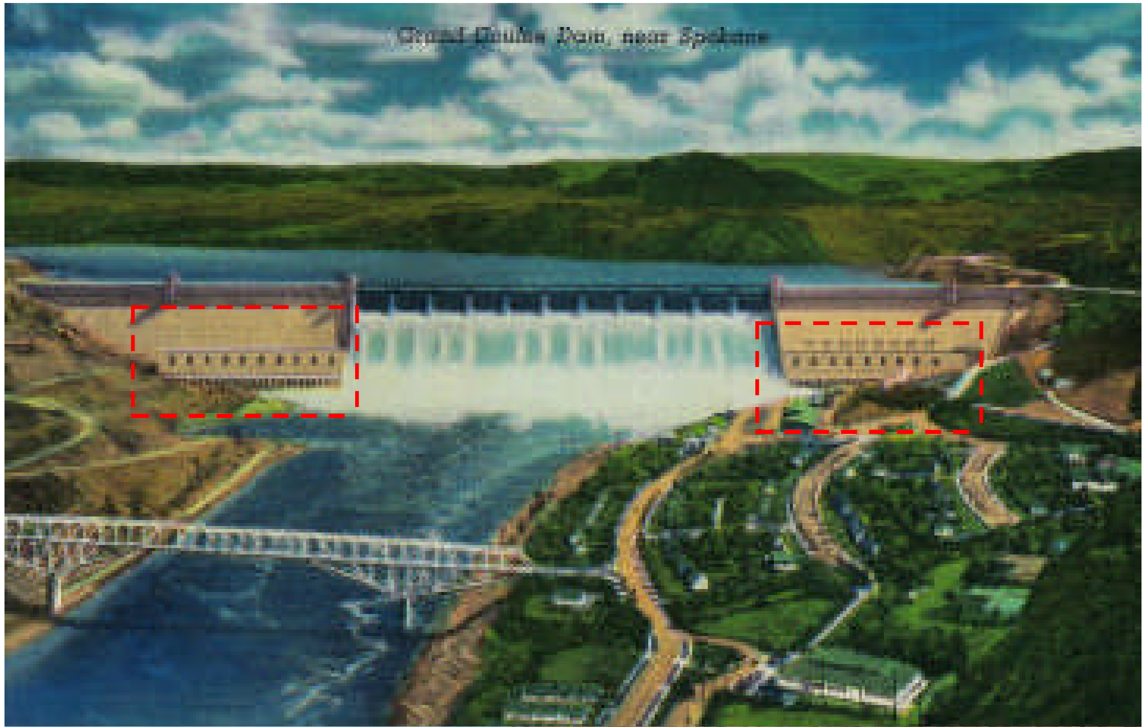
**Left: caption: "Construction Engineer A.F. Darland and Supervising Engineer F.A. Banks watching operation of main unit generator L-3, as load of 105,000 kilowatts is reached. 10/3/1941."**

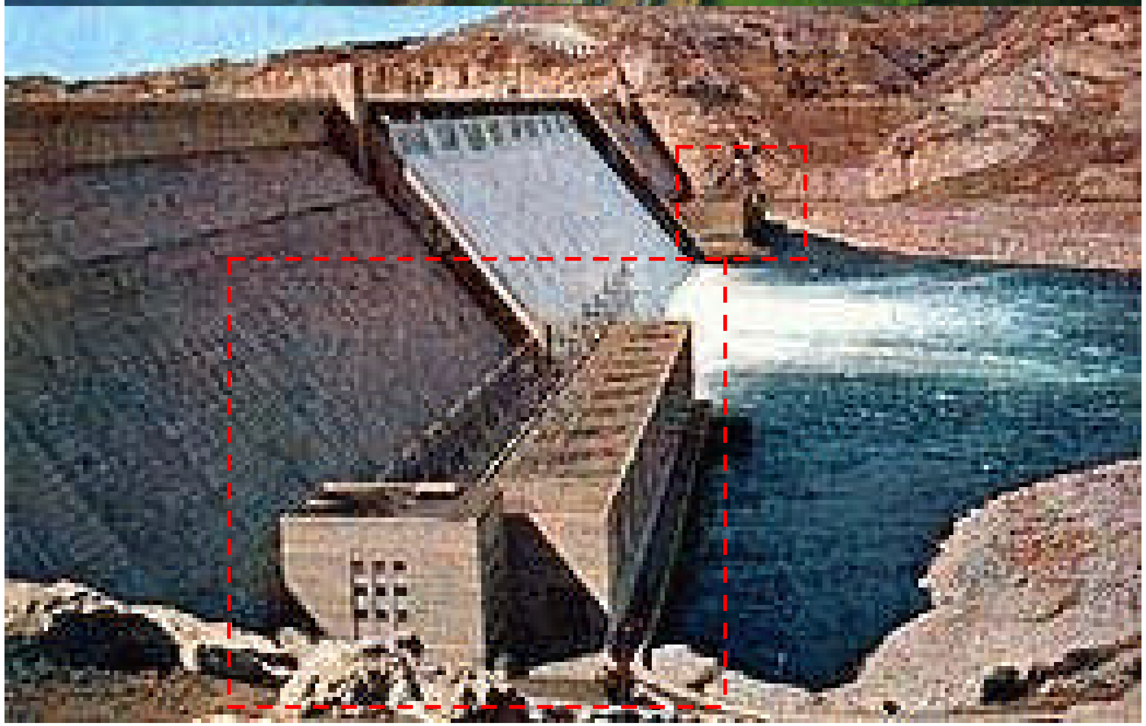

**The generators were able to operate at only about half their capacity because there was not yet enough water behind the dam. Even so, the excitement was palatable. At 1:30 p.m., a switch was thrown and Units No. 1 and No. 2 began feeding kilowatts into a transmission line stretching 238 miles away to *Bonneville Dam*, headquarters for the *Bonneville Power Administration* (BPA). From there, the first trickle from Grand Coulee would become part of the stream of electricity flowing from BPA to towns, businesses, and industries around the Northwest. Meanwhile, outside the powerhouse, a band launched into *America the Beautiful*.**

**RE: March 22nd 1941**

**Left: ca. 1942 BPA poster: "Power Builds Ships" - about the expansion of the aluminum industry and shipbuilding industry in the Northwest during WWII due to the abundant hydropower provided by BPA Dams on the *Columbia River***

Left: caption: “March 22, 1941: The Opening Ceremony. Eight years after beginning construction, the Grand Coulee Dam is formally dedicated in front of a crowd of 8,000. The Grand Coulee High School marching band leads a parade to celebrate the official start of the dam’s in-house generators. Harold Ickes venerates the dam, calling it ‘the greatest single structure man has built.’”



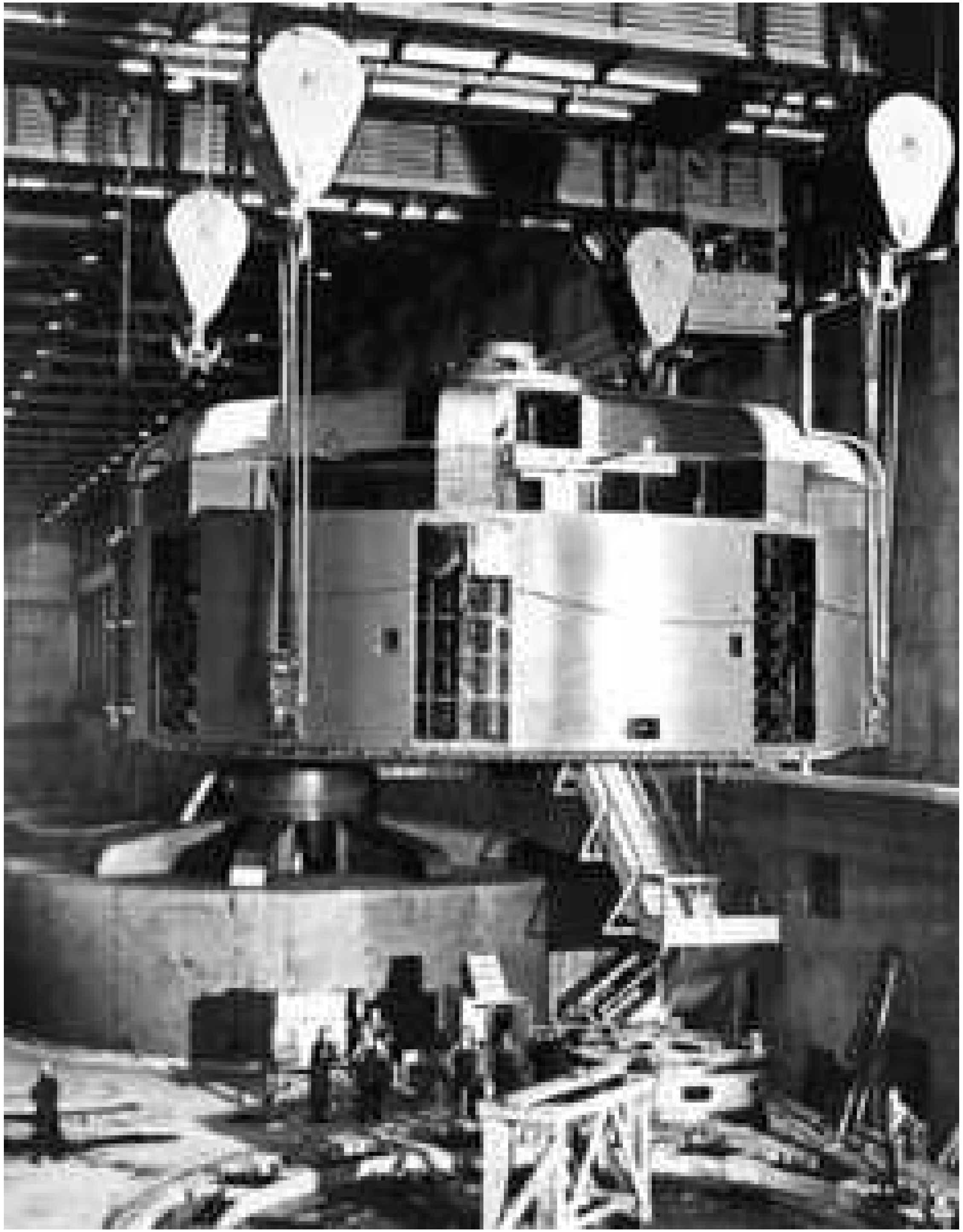



***"Pride and humility mingle in our hearts today. We Red Americans are glad to join the White Americans to celebrate the beginning of generation of power"***

**Chief *Jim James*, March 22nd 1941**

**RE: James - a member of the *San Poil* tribe on the *Colville Reservation*, had participated in the groundbreaking ceremonies at *Grand Coulee Dam* on July 16th 1933**

**<u>Left T&B</u>: vintage postcards of *Grand Coulee Dam* (powerhouse/s highlighted)**



***"This project will have served in two emergencies. It served to provide much useful employment at a time eight years ago when it was important that we find at once a means of avoiding complete economic stagnation, and it will serve now to provide the power to make aluminum for airplanes and otherwise to speed our protective arms."***

**POTUS *Franklin D. Roosevelt*, March 22nd 1941**

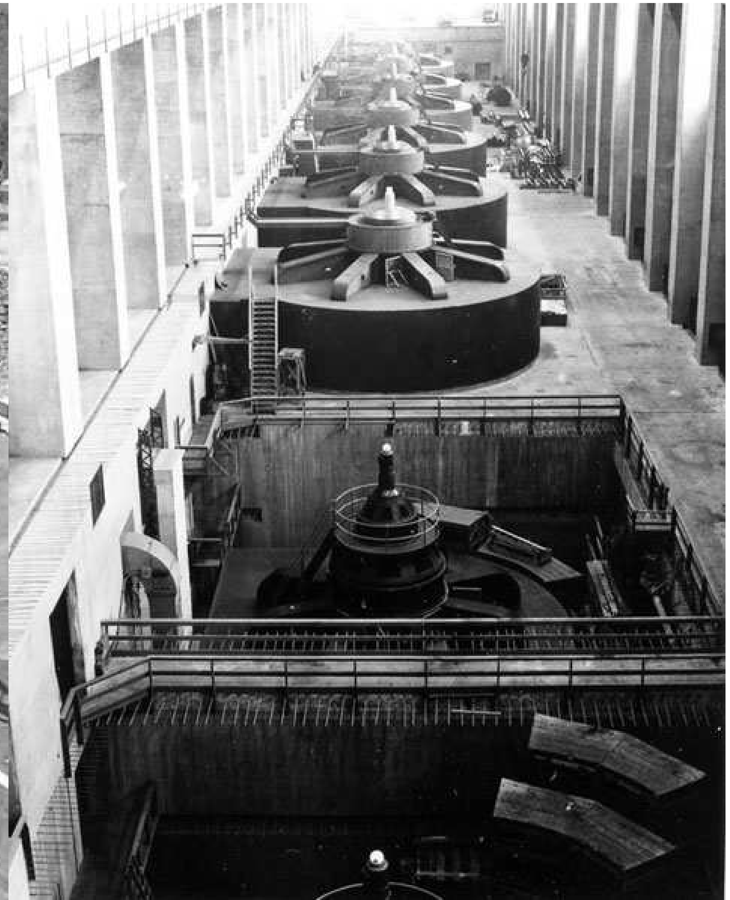
**RE: FDR, who had visited the dam twice before (in 1934 and again in1937), did not attend the opening ceremonies, sending instead a congratulatory telegram**

**<u>Left</u>: caption: "Grand Coulee dam generator under construction, 1941"**


***"They started the horses of electric power galloping out of the Grand Coulee"***

***The Seattle Times*, March 23rd 1941**

**RE: *Grand Coulee Dam* was designed as an irrigation project in the 1920s and financed as a jobs program in the 1930s. The focus shifted to power production after the outbreak of war in Europe in 1939, when the U.S. became the "Arsenal of Democracy." American manufacturers increased their production of planes, ships and armaments for delivery to overseas Allies as well as for national defense. Engineers rushed to put generating equipment into place to meet the needs of Northwest defense industries, particularly the power-hungry aluminum industry. The production of aluminum, which is essential to airplane manufacturing, requires huge quantities of electricity. The dam was designed to include two power plants, each equipped with nine massive generators, each with a rated capacity of 108K KW The service generators were located in the left powerhouse which was the first to be completed.**

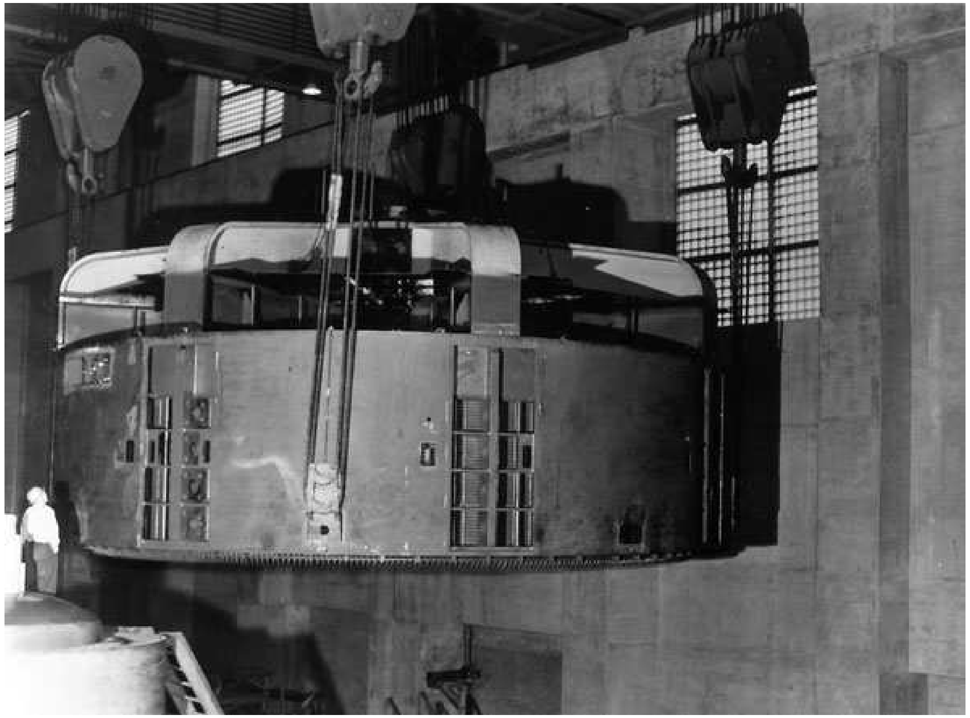


**<u>Above</u>: caption: “Interior of the west powerhouse at Grand Coulee Dam, December 1943**
**<u>Left</u>: caption: “The left (west) powerhouse (ca. 1942)”**

***"A prime factor in preserving the democratic way of life"***

**U.S.B.R., October 1941**

**RE: there were no bands, no message from the president and no fanfare seven months later when the dam began producing hydroelectric power for the outside world in early October 1941. *The Seattle Times* didn't even bother to send a reporter to cover the commissioning of the first main generator (on October 4th 1941), relying instead on a brief wire service story. The account pointed out that the generator was larger by one-third than any other in service anywhere in the world at that time: 22-feet high, 45-feet in diameter and producing more than 100 megawatts of electricity an hour. The venerable *New York Times* gave the story only one paragraph (from the *Associated Press*), published two days after the generator was activated.**



**Five more generators were rushed to completion in the left powerhouse before the end of WWII in 1945. The last of the eighteen generators in the two original powerhouses went into service on September 14th 1951, giving *Grand Coulee Dam* an installed capacity of 1,974,000 kilowatts and making it, at the time, the largest hydroelectric dam in the world.**

**<u>Left</u>: caption: "L-8 stator on way to permanent position in west powerhouse of Grand Coulee Dam (December 1947)"**

BPA

75 YEARS

1937-2012

SERVING THE NORTHWEST

# <u>Part 21</u>

# Trifecta

# The Flood of ‘48

**The need for more water storage on the *Columbia River* became evident in the spring of 1948 when the river overflowed its banks due to a heavy snowpack and "rain-on-snow" events. Not even *Grand Coulee Dam* could hold back all the flood waters. With the flow of the river measured at 573K cfs on May 29th 1948, a levee broke on the lower *Columbia River* and twenty-thousand homes in Vanport, OR were destroyed. Over the next decade, discussions occurred between Canada and the United States concerning additional water storage space.**

**<u>Left T&B</u>: the disastrous effects of the 1948 Columbia River flood**


**<u>Above</u>: caption: "The 1948 flood extended from British Columbia to the Pacific Ocean, and the Vanport disaster became the symbol for future flood control on the Columbia. River communities experience over $100 million in property damage and lost 51 lives in the flood."**

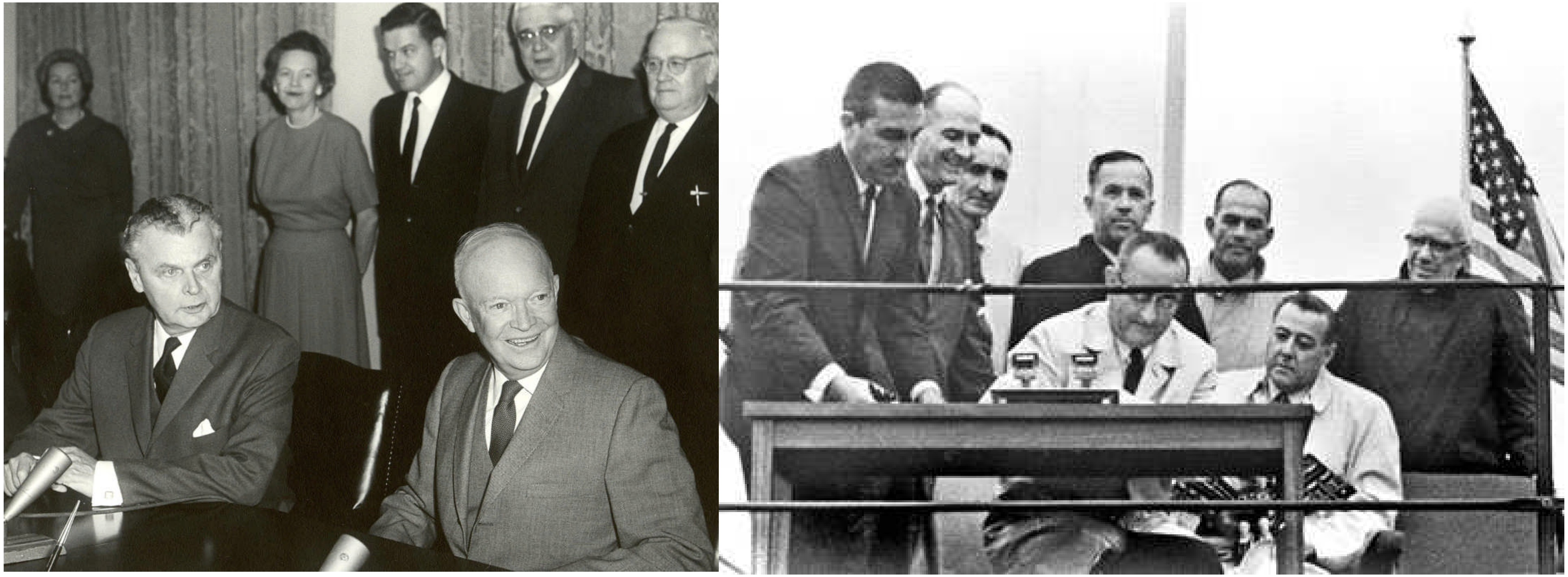
**<u>Left</u>: caption: "1948 Columbia River Flood. Looking toward the Washougal River and Camas, WA."**

**A compromise between the two nations in 1960 called for the construction of *Duncan Lake, High Arrow* and *Mica Dam/s* in Canada and *Libby Dam* in the U.S. The agreement further specified that the U.S. would pay one-half the cost allocated to flood control and Canada would not divert *Columbia River* water for at least sixty years.**

**<u>Above (left-to-right)</u>:**

- ***Duncan Dam* built at the north end of *Kootenay Lake* (completed 1967)**
- ***Arrow Dam* (later renamed *Hugh Keenleyside Dam*) is built on the Columbia River north of Castlegar (completed 1969)**
- ***Mica Dam* built on the Columbia north of Revelstoke (completed 1973)**
- ***Libby Dam* built on the *Kootenay River* in Montana (completed 1973)**

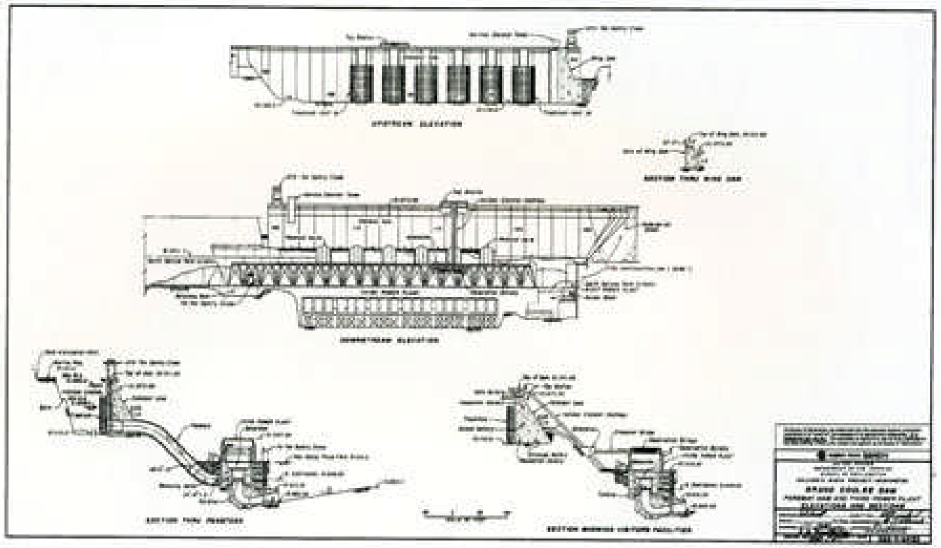
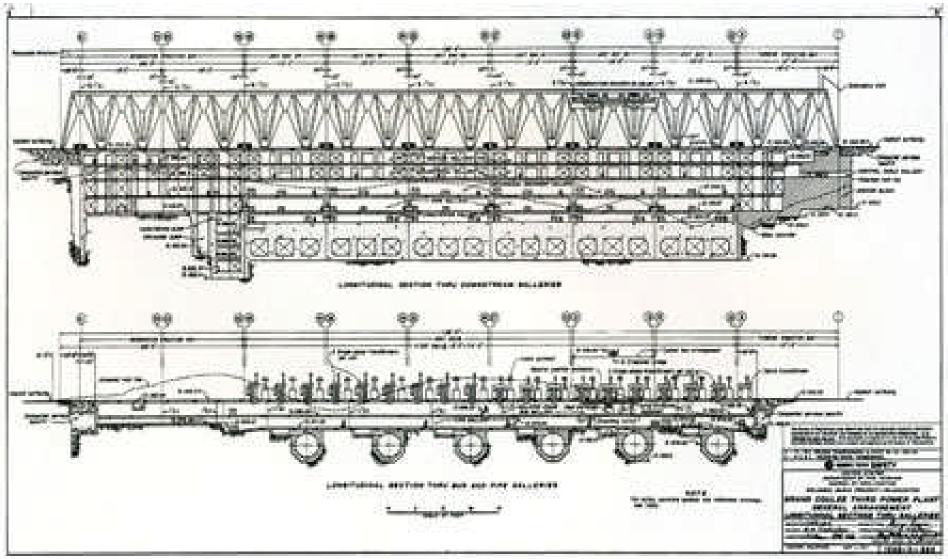
**On January 17th 1961, President Eisenhower signed the *Columbia River Treaty*. Congress ratified the treaty but the Canadian government did not. The provincial government rejected the use of American funds to construct Canadian storage reservoirs and expressed concern over recovery of the Canadian share of the jointly produced power. It took another two years for the two sides to come to an agreement. In 1964, President Johnson and Prime Minister Pearson signed the new *Columbia River Treaty and Protocol* on September 16th 1964 at the *Peace Arch* in Blaine, Washington. The signing of the treaty and construction of storage reservoirs in Canada finally made a third power plant at *Grand Coulee Dam* feasible. On June 14th 1966, President Johnson signed a bill authorizing construction of the *Third Power Plant* in a White House Rose Garden ceremony.**



**Left: caption: “Canadian Prime Minister John Diefenbaker (seated left) and US President Dwight Eisenhower at the signing of the Columbia River Treaty, January 1961”**

**Right: caption: “On January 22, 1964 the two countries agree to the Columbia River Protocol. On September 16, President Lyndon Johnson, Prime Minister Lester Pearson and Premier W.A.C. Bennett ratify the CRT and Protocol at a signing ceremony at the International Boundary at Blaine, Washington and Douglas, British Columbia.”**

**A third powerhouse had been anticipated in the overall plan and operation of the first two plants had barely become routine by 1952 when the U.S.B.R. began exploring possible sites for another plant. The project finally gained momentum by the mid-1960s as the U.S.B.R. sought to reduce the amount of water spilling over the dam, demand for power grew in the Northwest and the continent's power grids were interconnected. Thanks to improvements in hydroelectric technology, the anticipated capacity of the new plant had grown to nearly twice that of either of the existing plants. *Electrical World* remarked that the third power plant alone: *"exceeds the total capacity of all fifty power plants the Bureau has constructed."***

Construction of the *Third Power Plant* began in 1967 after Interior Secretary *Morris Udall* announced the new powerhouse would use 600,000 kW generators instead of 300,000 kW (as originally planned). This change would make *Grand Coulee Dam* the largest power producer in the world and home to the world's largest generators. Prior to issuing the specifications for the last three units, engineers realized that, by using stator windings that were water cooled, it would be possible to increase the capacity even further. Specifications for the last three units required a continuous overload capacity of 805,000 kW. These specifications meant that the units would be breaking new technological ground; U.S.B.R. engineers would have to solve any problems that developed along the way.

**Left: caption: "Grand Coulee Dam: Forebay Dam and Third Power Plant – Elevations and Sections."**

**Right: caption: "Grand Coulee Third Power Plant: General Arrangement – Longitudinal Sections thru Galleries."**

# Cold War Sparring

**The project's large scale was also justified by Cold War sparring. In addition to being stung by the launch of *Sputnik* in 1957, the U.S. had lost bragging rights to the world's largest hydroelectric facility two years earlier when the Soviets completed the 2.3-mega-watt *Kuibyshev* power plant on the *Volga River* (left). With more Soviet plants on-line by 1958, *Grand Coulee Dam* sank to fifth largest in the world. The third power plant would redeem the United States' top rank.**




**<u>Above & Left</u>: Soviet-era stamps**

**Not long after the Secretary of the Interior's announcement, the Soviet Embassy inquired of the *Department of the Interior* if the powerhouse contracts would be open to international bidding. If the Soviets won the bid, they could claim at least a portion of the world's largest power plant. The Department of the Interior ended all discussion on the matter by announcing only domestic bids would be accepted.**


**Part of the construction of the third power plant included removing a section of the existing dam. The east-end of *Grand Coulee Dam* was blown off and the new power plant structure was attached. The addition of the third power plant lengthened the dam to 5,223-feet, only 57-feet short of a mile.**

**<u>Left</u>: caption: "February 28, 1969. Taking off the end of Grand Coulee Dam."**

**<u>Right</u>: caption: "May 4, 1969. 260-feet of Grand Coulee Dam was removed for the Third Power Plant."**

**In the midst of construction activities, President Nixon announced budget cuts aimed at reducing government construction activities by 75%. However, the urgency to meet Pacific Northwest power needs and fulfill Canadian treaty agreements allowed the government to exempt *Grand Coulee Dam*. Construction remained largely on schedule with the plant being finished only a year behind schedule. The first of the six new generators went online in 1975, with the last in 1980. The plant contains three generating units rated at 600 MW and three units rated at 805 MW, resulting in a total capacity of 4,215 MW. The average power generation at Grand Coulee Dam is twenty-one billion MWH per year. The third power plant generates about two-thirds of the total power produced at Grand Coulee. When the third power plant was completed and the last generating unit went into service in 1980, Grand Coulee was the largest hydropower plant in the world. One of the generating units in the third power plant can supply a city the size of Seattle with all its power needs for a year. The power plant was built from 1967-1975, with the six generating units installed over the following five years. Preliminary site work for the project had begun in January 1967. A joint venture; *Vinnell-Dravo-Lockheed-Mannix* (VDLM), won the prime construction contract in 1970. Totaling $112.5 million, this was the largest single contract that the U.S.B.R. had ever awarded.**

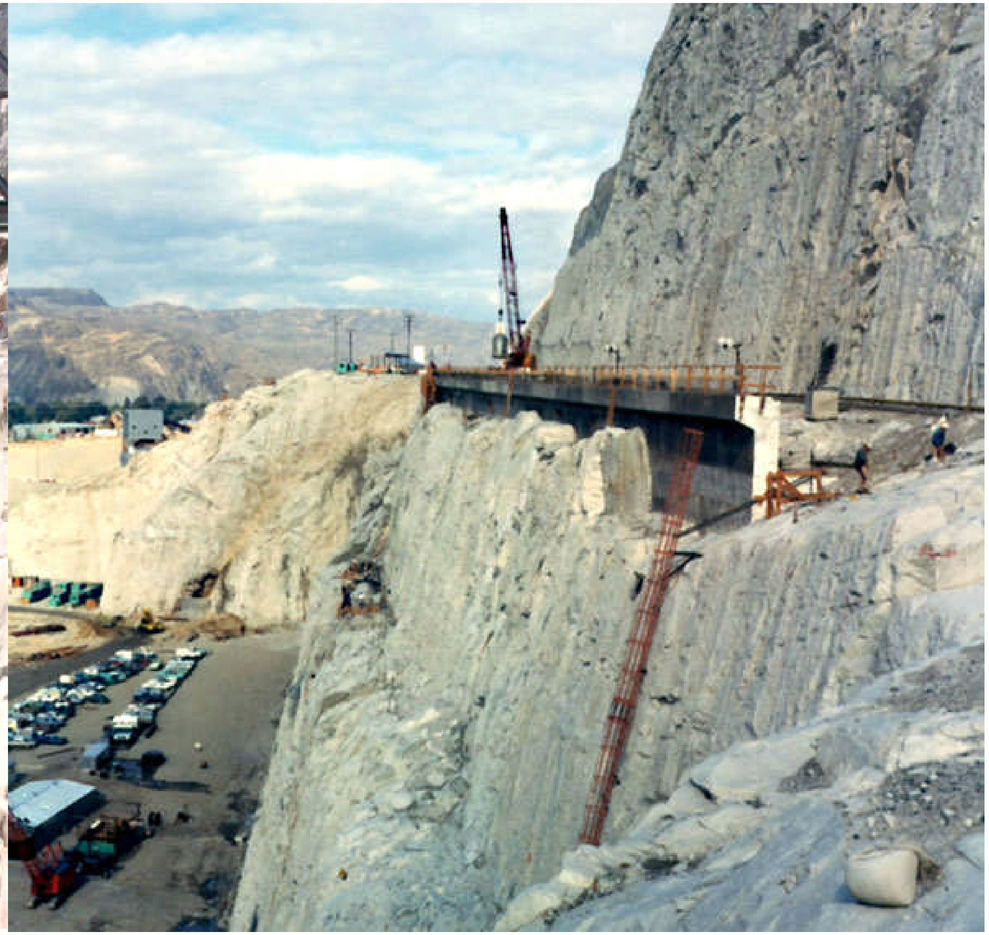
# Construction Sequence

**Left: caption: “April 9, 1970. Third Power Plant construction at Grand Coulee Dam.”**

**Right: caption: “May 4, 1970. Third Power Plant construction at Grand Coulee Dam.”**


**<u>Left</u>: caption: "May 20, 1970. Third Power Plant construction at Grand Coulee Dam."**
**<u>Right</u>: caption: "May 22, 1970. Third Power Plant construction at Grand Coulee Dam."**

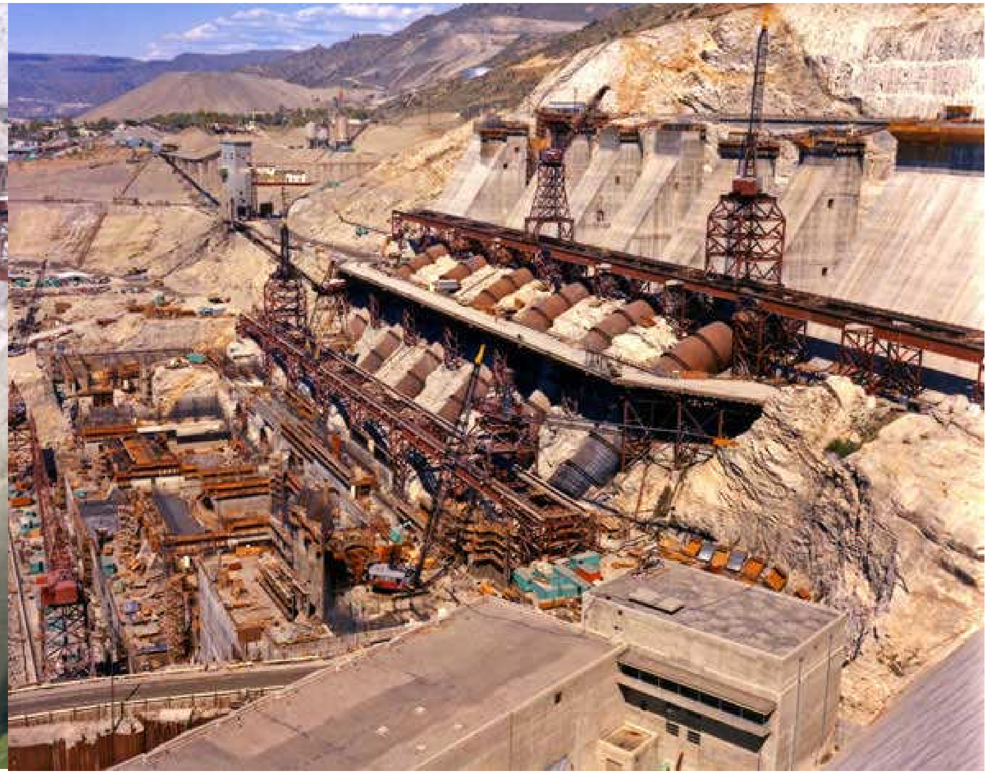
**<u>Above L&R</u>: caption: "September 29, 1970. Third Power Plant construction at Grand Coulee Dam."**



<u>Left</u>: caption: "September 29, 1970. Third Power Plant construction at Grand Coulee Dam."
<u>Right</u>: caption: "October 9, 1970. Third Power Plant construction at Grand Coulee Dam"


**<u>Left</u>: caption: "October 13, 1970. Third Power Plant construction at Grand Coulee Dam."**
**<u>Right</u>: caption: "October 21, 1970. First bucket of concrete for Third Power Plant."**


**<u>Left</u>: caption: “February 27, 1971. Placing a penstock section at Grand Coulee Dam, Third Power Plant.”**
**<u>Right</u>: caption: “March 29, 1971. Third Power Plant construction at Grand Coulee Dam.”**

**<u>Left</u>: caption: “June 10, 1971. Third Power Plant construction at Grand Coulee Dam.”**
**<u>Right</u>: caption: “August 1, 1971. Third Power Plant construction at Grand Coulee Dam.”**

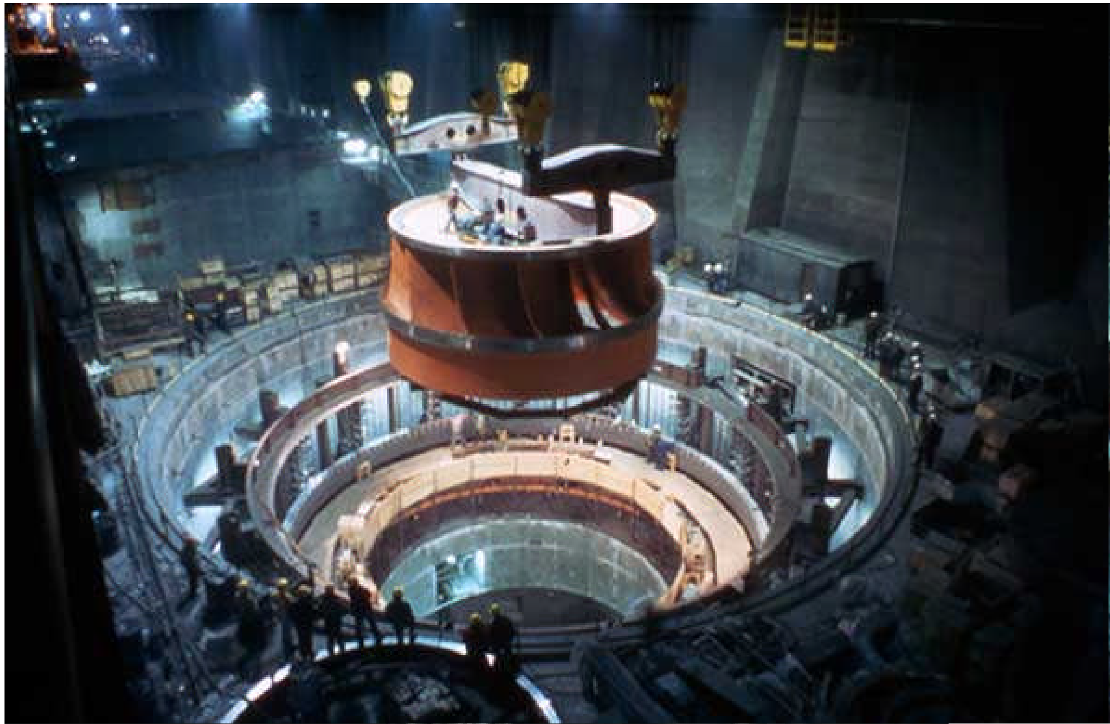
**<u>Above</u>: caption: "April 26, 1972. Third Power Plant construction at Grand Coulee Dam."**

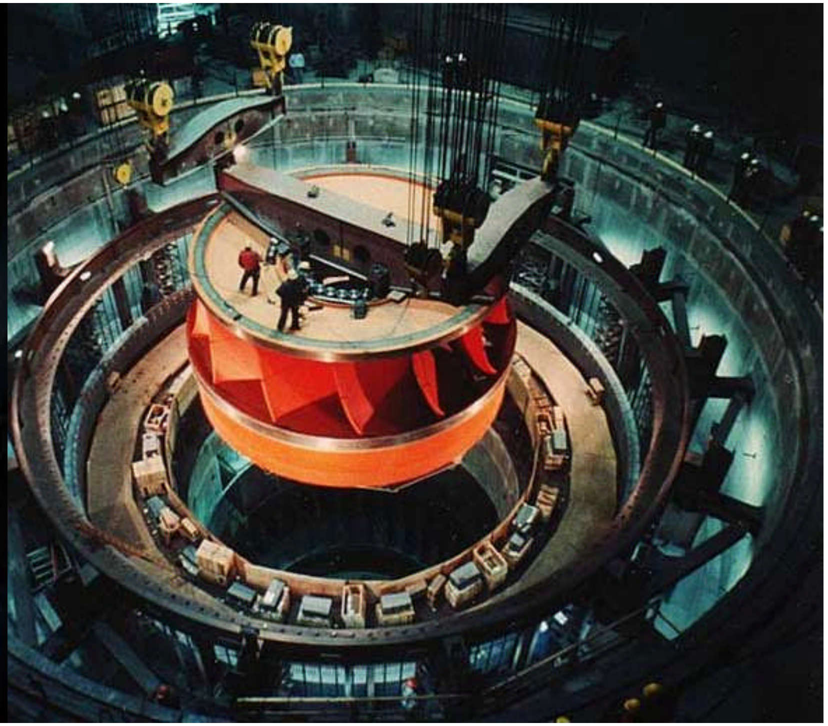
**<u>Left</u>: caption: "May 5, 1972. Third Power Plant construction at Grand Coulee Dam."**

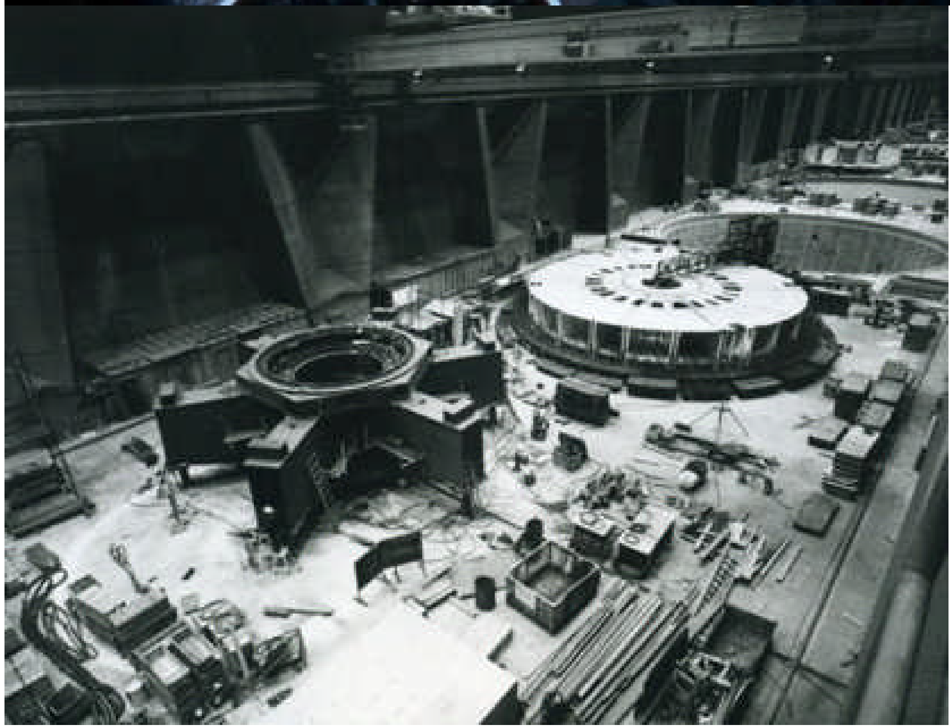
 

**Left: caption: "February 21, 1973. Third Power Plant construction at Grand Coulee Dam."**
**Right: caption: "May 5, 1973. Third Power Plant construction at Grand Coulee Dam."**

__Top Left__: **caption: "August 2, 1973. Third Power Plant construction at Grand Coulee Dam."**
__Top Right__: **caption: "November 19, 1973. Third Power Plant construction at Grand Coulee Dam."**
__Left__: **caption: "May 28, 1974. Third Power Plant construction at Grand Coulee Dam."**







**Above L&R: caption: “December 1974: Installing turbine blades at Grand Coulee Dam's Third Power Plant.”**

**Left: caption: “Generator Erection Bay – Unit 22 Rotor Steel Stacking. November 1976.”**

***“Hydroelectric generations is perhaps the most reliable way to make electrical power. But when the time comes to make repairs, the task is usually a whopper. One such project is under way at the Grand Coulee Dam, which spans the Columbia River about eighty-five mile northwest of Spokane, Washington. Siemens Power Corp. describes it as one of the largest hydrogenerator efforts of its type in the world. Begun shortly after Siemens won a U.S. Bureau of Reclamation contract in 1992, the work involves the design, manufacture and extensive testing and installation of three new stator cores for the dam’s G22, G23 and G24 generators. Rated at 836 megawatts, the trio holds the world record for power generation. The rebuilding will make them even more energy-efficient. The generators should go back online within the next three months.”***

***Popular Mechanics,*** **September 1997**

**A major overhaul of the third power plant, which contains generators numbered G19 through G24, began in March 2008. Among the projects to be completed before the generators themselves can begin to be overhauled include replacing underground 500 kV oil-filled cables (for G19, G20 and G21 generators) with overhead transmission lines (begun February 2009), new 236 MW transformers for G19 and G20 (begun November 2006) and several other projects. Planning, design, procurement and site preparation for the 805 MW G22, G23 and G24 generator overhauls were scheduled to begin in 2011, with the overhauls themselves to begin in 2013 (with the G22 generator), the G23 generator in 2014 and G24 in 2016 (with planned completions in 2014, 2016 and 2017 respectively).**

# Part 22

# The Master's Touch

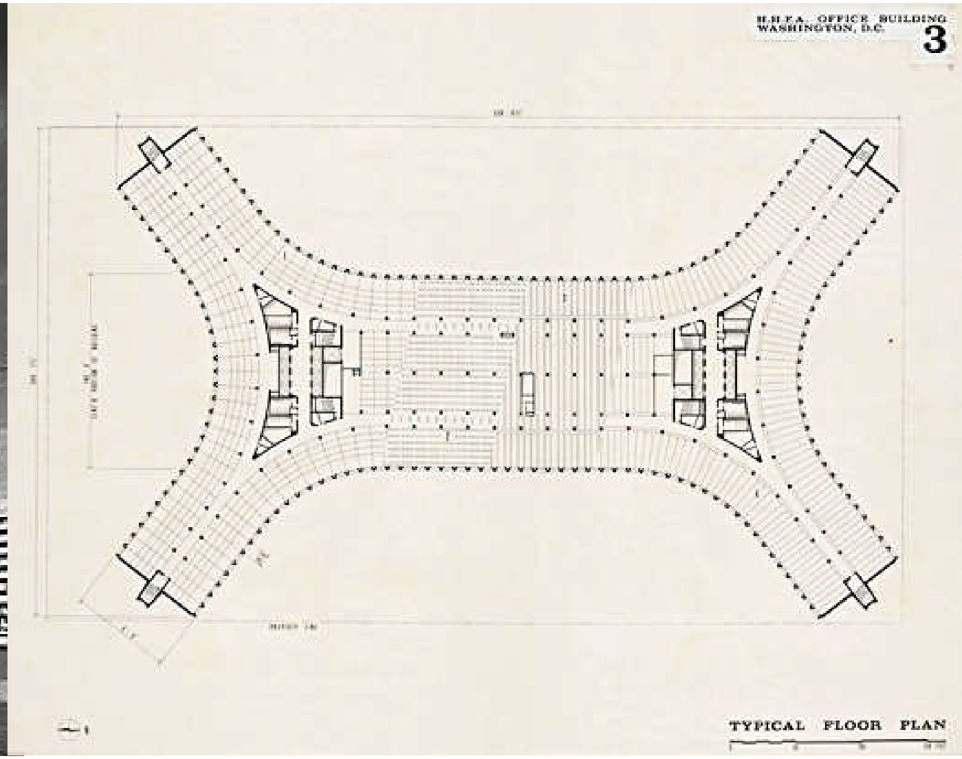
# Breaking the Mold

***“With the design, construction, and operation of the Third Powerhouse, the Grand Coulee Dam complex will achieve new magnitude in the public mind”***

***U.S. Bureau of Reclamation* (ca. 1967)**

**RE: the Reclamation Service’s in-house designers had designed the first two plants, which put function before aesthetics. The project’s understated details and massing reflected the *Streamline Moderne* style that was popular at the time, The third power plant was to break from this mold. The prominence of this exceptional engineering feat deserved an exceptional design, so the U.S.B.R. turned to *Marcel Breuer*, one of the top architects of the mid-twentieth century.**

**Born in Hungary in 1902, *Marcel Lajos Breuer* (1902-1981) was educated and taught at the *Bauhaus* before relocating to London in the mid-1930s and the U.S. in 1937. By the 1950s (after a number of years on the architecture faculty at the *Harvard Graduate School of Design*), Breuer (left) devoted himself to private practice and established a thriving international business based in New York City. His clients included the U.S. government, for which he designed an embassy in The Hague and new headquarters for the *Department of Housing and Urban Development* (HUD) and the *Department of Health, Education and Welfare*, both in Washington, D.C.**




**The HUD project (above L&R) is particularly noteworthy in relation to Breuer's work at *Grand Coulee Dam*. Erected from 1966–1968, the HUD building represented an early use of pre-cast concrete for a federal building. In addition to being economical, it was considered an aesthetic success. Aesthetics had come to play a more important role in federal construction after President Kennedy issued "Guiding Principles for Federal Architecture" (addressed to the heads of federal agencies) in 1962. The principals were first outlined in an essay by *Daniel Patrick Moynihan*, who was Assistant Secretary of Labor at the time. The beautification campaign was subsequently taken up by *Lady Bird Johnson*, who also became involved in environmental causes, including opposition to the U.S.B.R.'s plans for dams in the *Grand Canyon*.**

***“I was delighted, but not too surprised, when the board came back from a survey trip to assert that many of our dams were things of sculptured beauty. But they added that some appurtenant structures and surroundings left something to be desired. We took them at their word and have contracted with Marcel Breuer and Associates of New York to furnish architectural concepts for our biggest single job now underway.”***

***Floyd Dominy,*** **U.S.B.R. Commissioner**

**RE: in 1967, a “Board of Artistic Consultants” was appointed to provide advice to the U.S.B.R. on design issues for major projects**

***Progressive Architecture*** **magazine lauded the U.S.B.R's decision to retain Breuer as: *"an action believed to be without precedent."* The formal relationship began in September 1967 when U.S.B.R. staff visited Breuer's Manhattan office to negotiate a contract. *Tician Papachristou*, an architect on Breuer's staff, wrote a letter to the U.S.B.R. the following week summarizing what had been discussed, adding: *"Mr. Breuer has asked me to convey to you again his strong personal interest in this commission. Generally, we see our office as an instrument at your disposal to provide necessary consultations in questions of architectural or aesthetic nature…We assume, of course, that all engineering will be provided by you."* A later article in *Architectural Record* magazine summarized the relationship thus: *"Working with the 450-man A/E staff at the Bureau's Engineering & Research Center in Denver, Breuer's office…strove to give this massive and highly complex project a visual harmony with its setting and a sensitivity to user need."* With the hope of issuing the prime construction contract in June 1969, U.S.B.R. wanted plans ready in just 130 days. However, Breuer's office estimated that the process would take seventeen to twenty months. Ultimately, both Breuer and the U.S.B.R. agreed that conceptual studies and preliminary design development would be done within 180 calendar days of the contract award, with final plans and specifications finished 110 calendar days later. *Hamilton P. Smith* served as Breuer's partner-in-charge, with *Thomas Hayes* as associate architect. *Paul Weidlinger* was the structural consultant.**

***“The design of all visible parts of the proposed construction, including the Forebay Dam, the Third Power Plant, visitors’ facilities, etc., with particular attention to color, form, surface, choice of materials and lighting.”***

**RE: U.S.B.R. Scope of Work**

**<u>Above</u>: caption: “Discussing the architectural design of the third power plant and surrounding area from left are: Mr. Hamilton Smith, Marcel Breuer Associates, New York ; Mr. Kenneth Brooks, Spokane Architect; Mr. Harold Arthur, Denver USBR Office; Mr. Otis Peterson, Assistant to the Commissioner-Information, Washington, D.C.; and Mr. Marcel Breuer, Architect, New York. June 1968”**

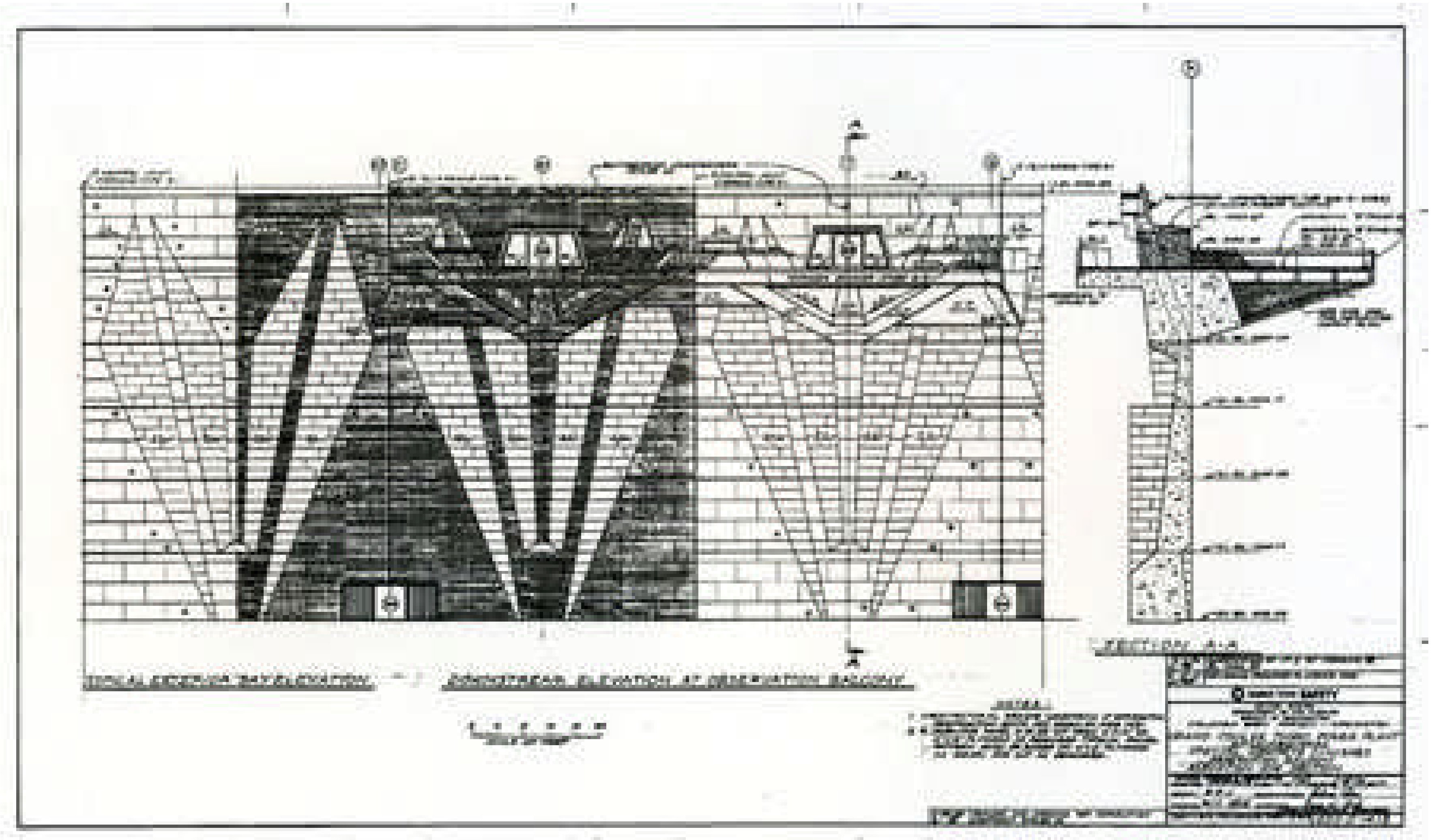
***"Features of the Breuer concept, which may still be modified before construction, include an inclined elevator, a glass-enclosed cab moving up and down the face of the dam's 475'-high penstocks. The elevator will stop midway along the incline to give visitors access to a platform cantilevered out of the rock cliff supporting the Forebay Dam, where a cross-over bridge spanning the transformer deck will lead to the powerplant…"***

***Progressive Architecture,* December 1968**

**RE: the concept design was well along by the end of 1968 when PA published a small, preliminary drawing of the plant. Visitors would also be able to ride to the bottom of the elevator shaft to see the turbines up close.**



**<u>Above L&R</u>: caption: "The third power plant's incline elevator"**



***"…Visitors will enter the generator hall of the power plant at a level above that of the bridge crane, and will be able to cross the gallery at this level to a balcony from which they may view the power plants, the spillway, and the Columbia River itself."***

***Progressive Architecture,* December 1968**

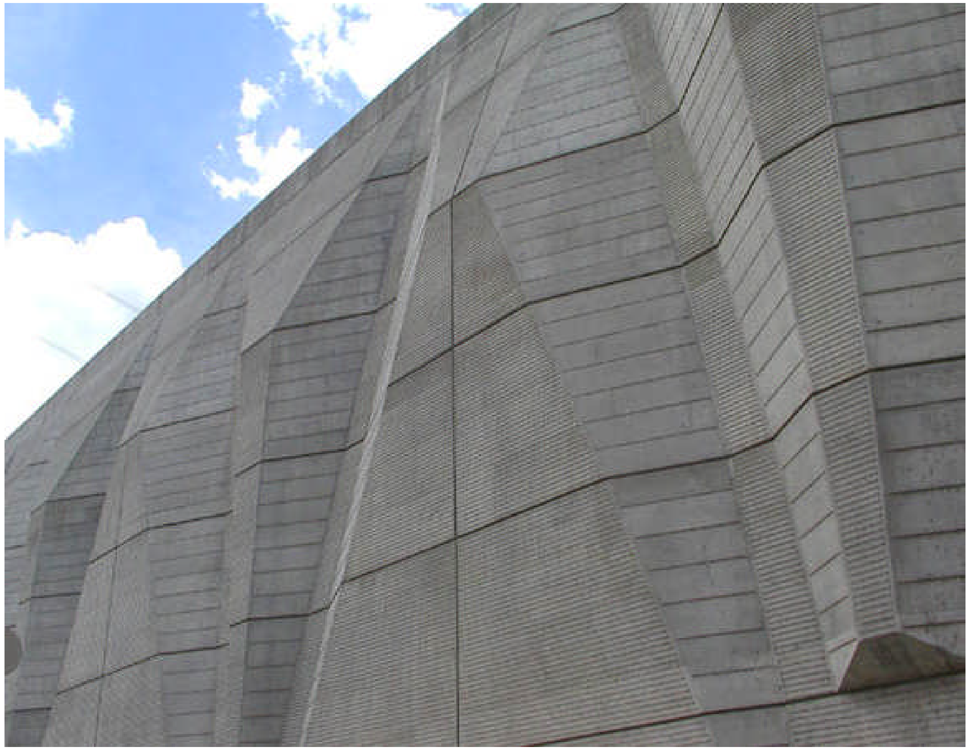
**<u>Above</u>: caption: "Grand Coulee Third Power Plant, Architectural: Special Concrete Finishes – Observation Balcony - Elevation and Section."**

***"Ironworkers are just now getting to the really difficult rebar placement - the building's folded, stiffened concrete walls, designed by New York City architect Marcel Breuer and Associates, to provide 'continuity, visual interaction and structural integration' with the dam…the 84-ft-high walls must be capable of supporting a pair of 275-ton bridge cranes, so there's a nightmare of ever-changing rebar configurations involved."***

***Engineering News Record*, August 1972**

**RE: the concrete sections stood 85-foot tall and were from 12 to 54-inches thick**

**<u>Left</u>: caption: "Detail of V-shape buttresses on outside wall of third power plant. View to south-east."**



***"I believe the architect can fully express himself as an artist by means of concrete…The greatest esthetic design potential in concrete…is found through interrupting the plane in such a way that sunlight and shadow will enhance its form, while through changing exposure a building will appear differently at various moments of the day."***

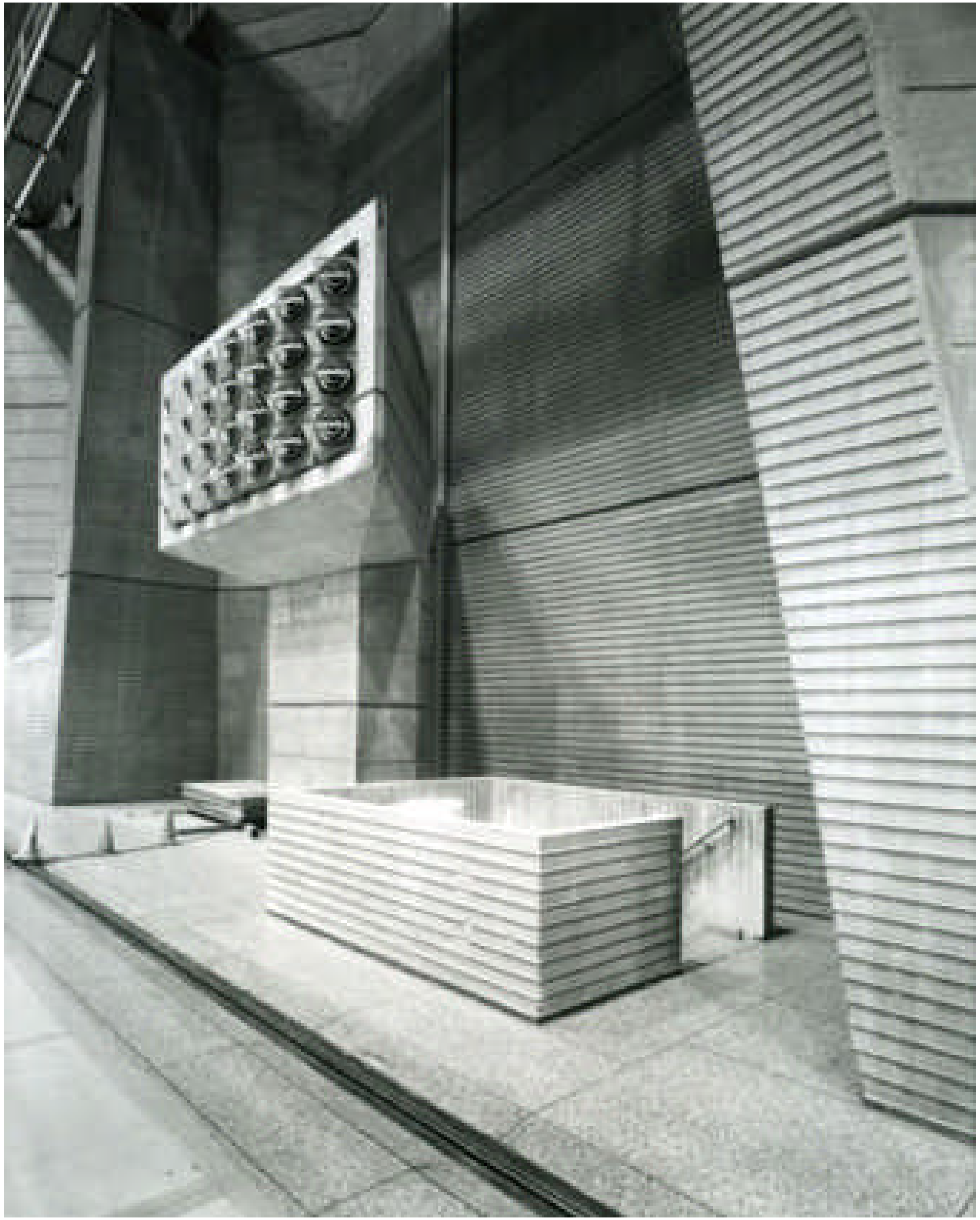
***Marcel Breuer,* Architect**


**Above: caption: "North end of third power plant. View to south."**

**Left: caption: "Detail of concrete ribbing on interior wall of Third Powerplant. M = main floor; el. 1012 = elevation 1012 feet above sea level. View to east."**

The pre-stressed, pre-cast roof tees were fabricated by the *Central Pre-Mix Concrete Company*, which began producing them at its Spokane facility in May 1972. By September 15th 1972, the company had placed concrete for every roof tee. The first tee was delivered to Grand Coulee in July. By the end of the year, all 122 tees were at the jobsite and 14 were in position over the turbine erection bay. The remaining tees were stored nearby until needed. The last concrete was placed for the superstructure on January 18th 1974 and VDLM had completed all pre-cast concrete members for the power plant structure, with placement for crossover bridge panels in the following month.

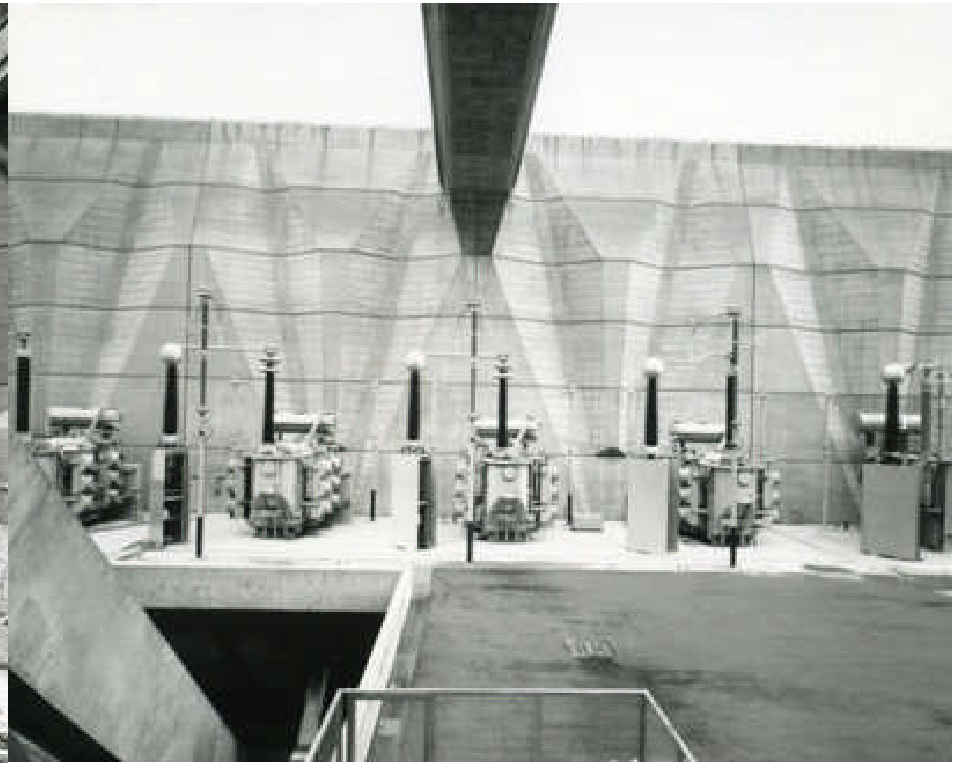
<u>Above</u>: caption: "Lifting beam used to pick exterior form for Super Structure. Specs. No. DC-6790 Contr. Vinnell-Dravo-Lockheed-Mannix. March 1972."



***"I have the feeling…that any space which is larger than necessary and higher than necessary, and in which the structure and the whole building of the space is visible…that this space created is simply automatically religious…We have built a rather large one, the expansion of the Grand Coulee Dam. I have not seen it yet because I cannot travel much, but I think that this must also have this feeling. It is an enormous empty space carried by monumental concrete walls, folded. Everything is dustless and spotless, there is no daylight, only artificial light, there are no people, only the heads of twelve turbines visible, of which each produces enough electricity to operate the whole city of Denver."***

***Marcel Breuer*, Architect**

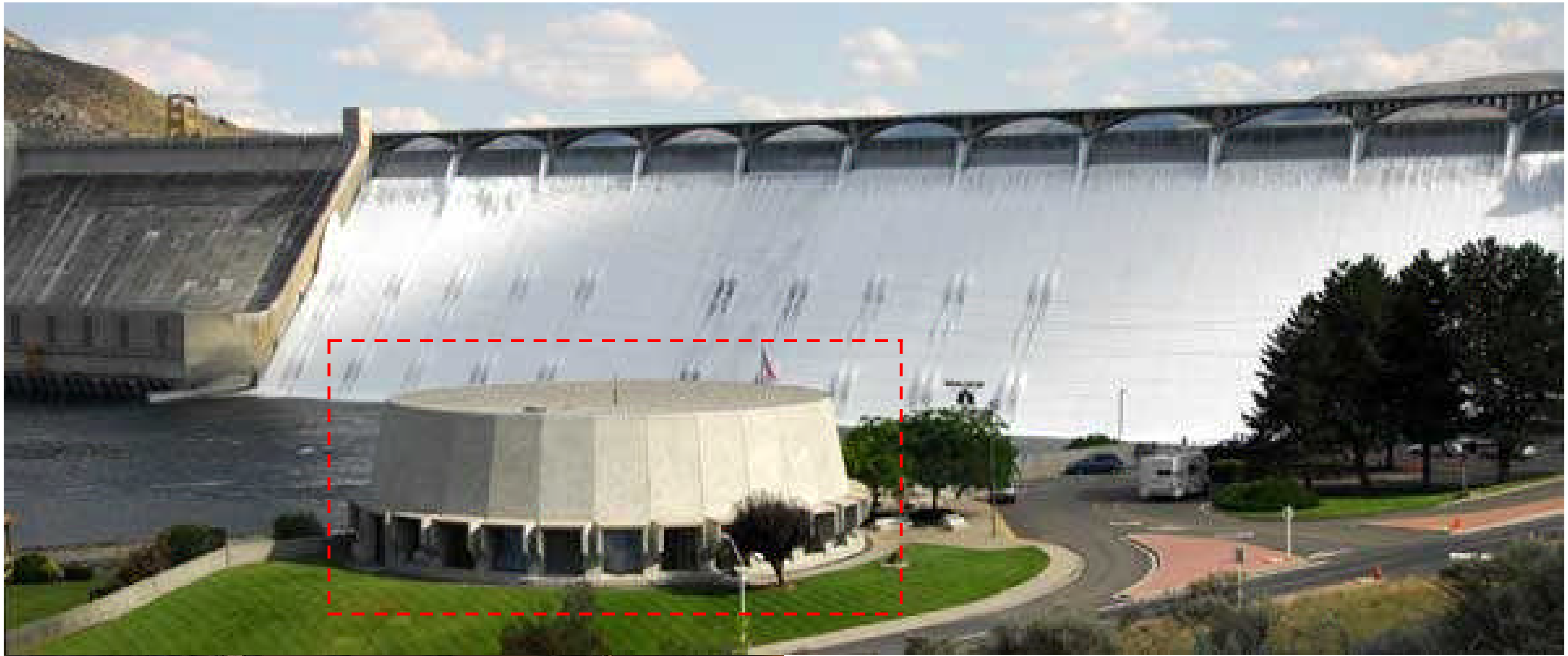
**<u>Left</u>: caption: "Stairwell and air intake on the main generator bay floor in third power plant. View to southwest."**



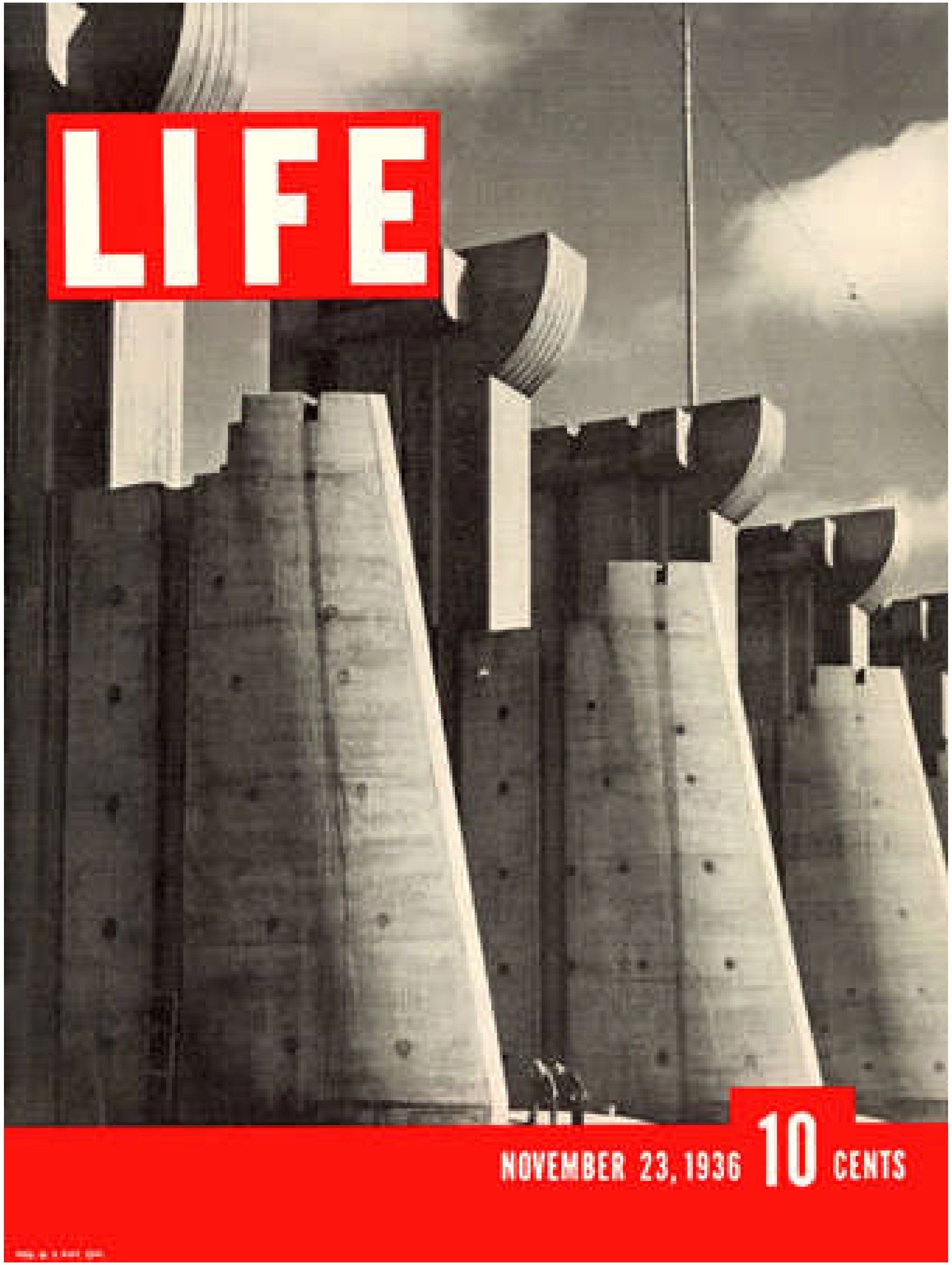
The columns for the rails for the three overhead, traveling cranes were incorporated into the building's concrete walls. There was also a 1,900-ton, self-propelled gantry crane that ran on steel tracks extending the entire length of the plant's main floor. It was custom-designed by the *R.A. Hanson Company*, which used its initials for the name of the model: the RAHCO 2000T. Reclamation was well aware that the architectural quality of the power plant could be undermined by an unsightly crane, so the bid documents had insisted that "care shall be used in the design of the gantry to produce a pleasing appearance."

**Left: caption: "2000-ton gantry crane inside third power plant. View to north."**

**Right: caption: "Transformer deck behind third power plant. Walkway for visitors is above. View to west."**

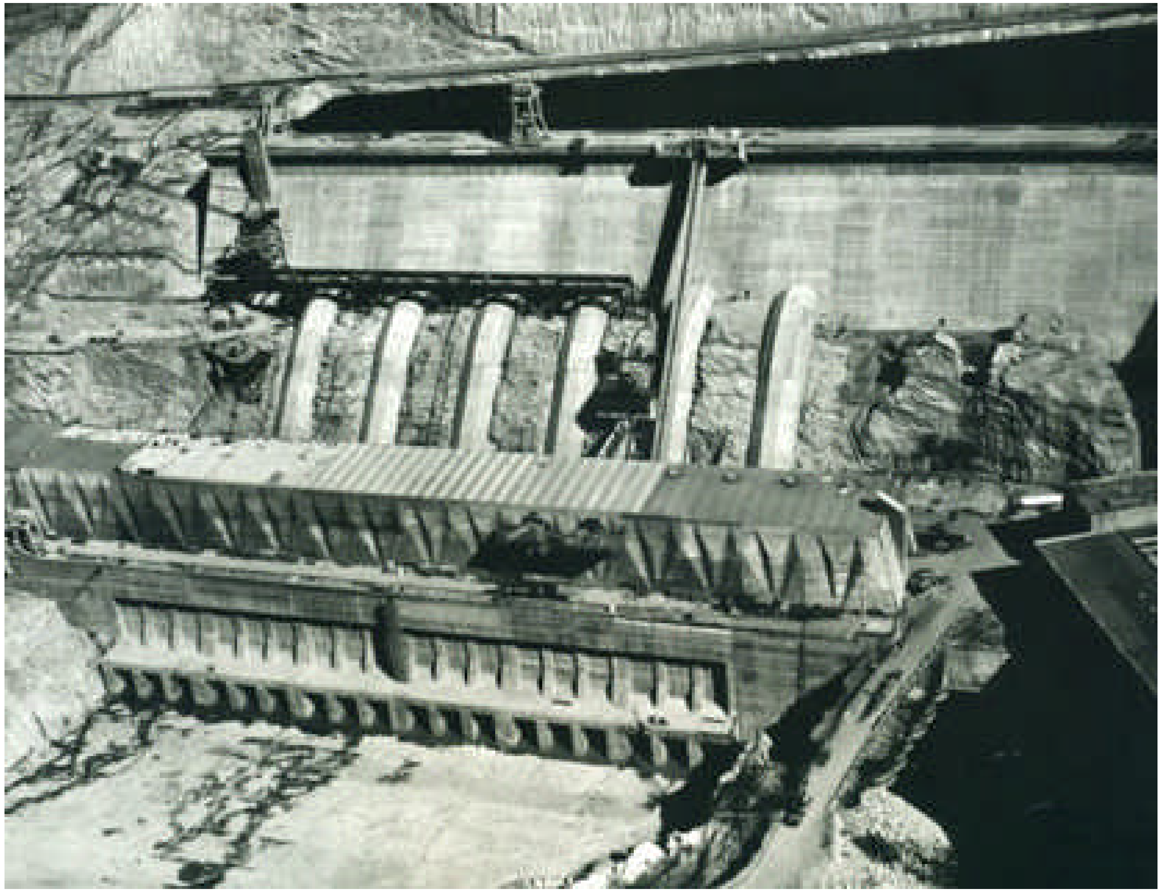


The first turbine-generating unit in the third power plant was started in August 1975 (construction was completed in 1974). By the end of the year, the plant had produced nearly 1 billion kilowatt-hours of electricity. Three years later, the eye-catching cylindrical *Visitors Center* (above & left), also designed by Breuer, opened on the opposite (east) side of the river.




**Some have speculated that Breuer's "Brutalist" design was influenced by *Fort Peck Dam* in Montana, particularly a photograph taken by *Margaret Bourke-White* and featured on the cover of the first issue of *Life* magazine in November 1936. Breuer credited a much earlier source, describing the plant's giant concrete form as having "dimensions truly Egyptian." As one biographer observed: "*Breuer had a deep interest in the monumental architecture of Egypt and its formal constructs - the ramps, the battered walls of the pylons, the flat-topped inclines of the low-lying mastabas, the trapezoidal masses of heavy stone, and the serial repetition of individual elements, all of which found their way into his work.*"**

**Left: caption: "Fort Peck Dam on cover of first issue of LIFE magazine, 1936"**



**Left: caption: "General view of Grand Coulee Dam and town of Coulee Dam from Crown Point vista. View to south. The third power plant is at the left end of the dam complex."**
**Right: caption: "In the 1960s, forecasts of energy shortages led to the construction of Grand Coulee's third power plant. A treaty with Canada provided for upriver storage reservoirs, ensuring adequate flow for the additional turbines. The third powerplant, begun in 1967 and completed in 1980, more than doubled Grand Coulee's generating capacity."**

***"Breuer and concrete construction came together with colossal force at the third power plant and forebay dam sited at Grand Coulee against the imposing backdrop of the Columbia River Basin."***

***Isabelle Hyman*****, Marcel Breuer's biographer**

**RE: Breuer's health was failing by the time his office received the commission and he was unable to visit the completed project before he died in 1981.**

**<u>Top</u>: caption: "July 16, 1983. The 50th anniversary of the dam and the dedication of the third power plant."**

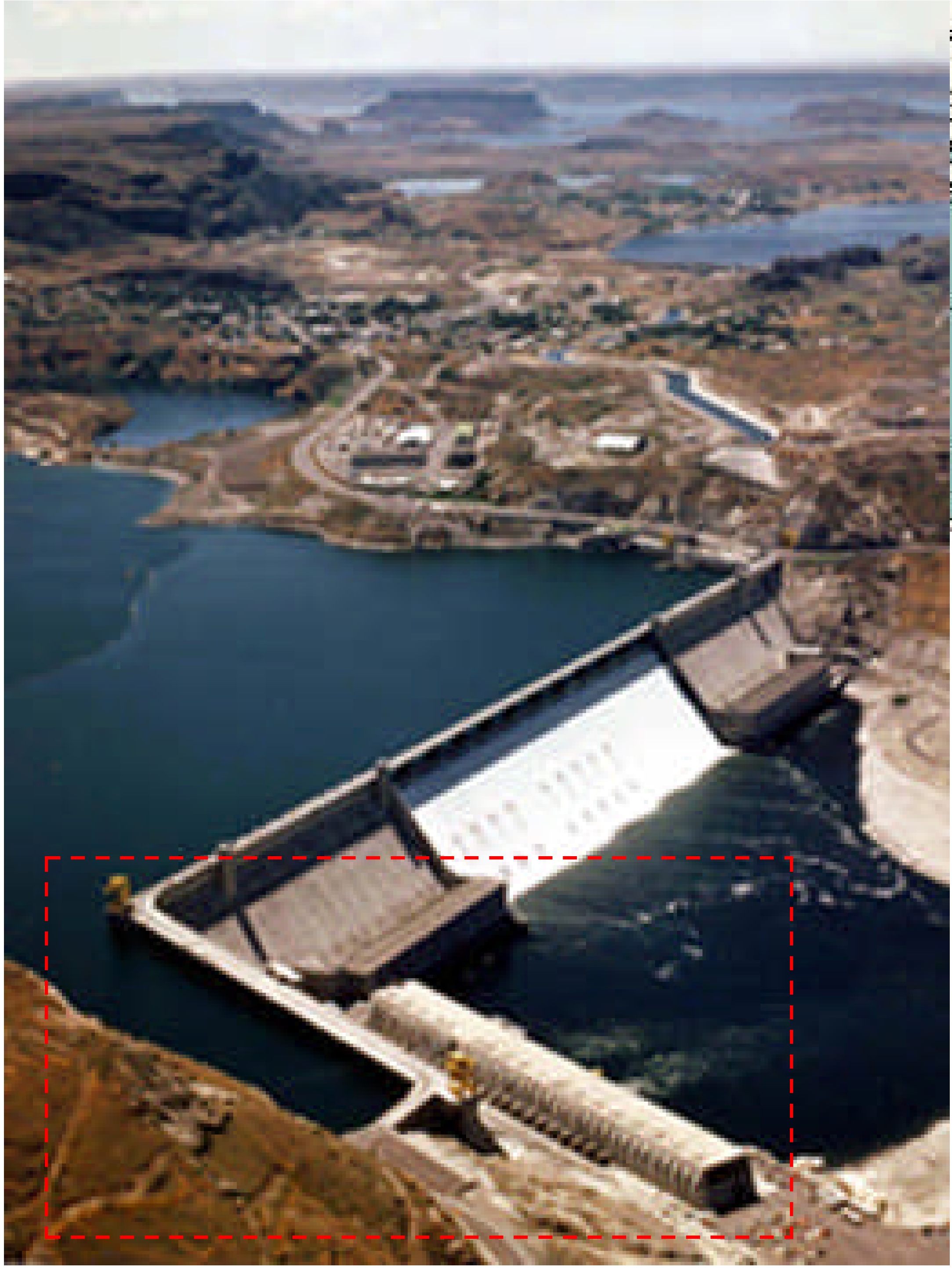
**<u>Bottom</u>: caption: "July 16, 1983. Lights and fireworks for Grand Coulee Dam's 50th anniversary. Columbia Basin Project, WA"**

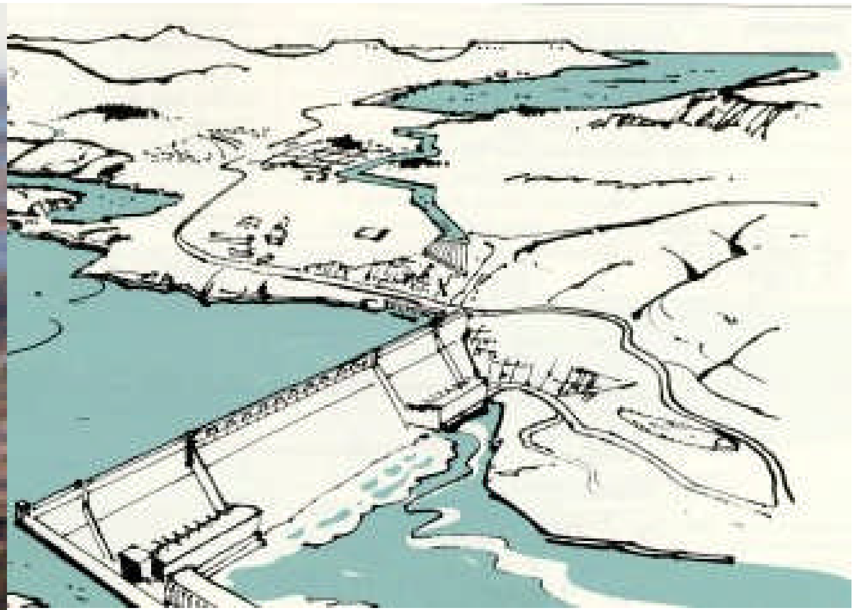
**<u>Above</u>: caption: "June 30, 2011. Aerial view of Grand Coulee Dam releasing downstream an unusually large and late spring time water flows of over 200,000 cfs. Broken out, it's 33,800 cfs, over the spillway and 167,000 cfs through the hydropower generators."**

<u>Top</u>: caption: "November 21, 2013. Long exposure night shot of Grand Coulee Dam and the third power plant taken from Crown Point."

<u>Bottom</u>: caption: "November 21, 2013. Long exposure night shot of Grand Coulee Dam and the third power plant taken from above the John W. Keys III Pump-Generation Plant."

# Used to Be





***"Used to be great flows hurtled over this spillway. Didn't do anybody much good. Now that we have storage reservoirs and the new power plant, that doesn't happen. The river can do more work."***

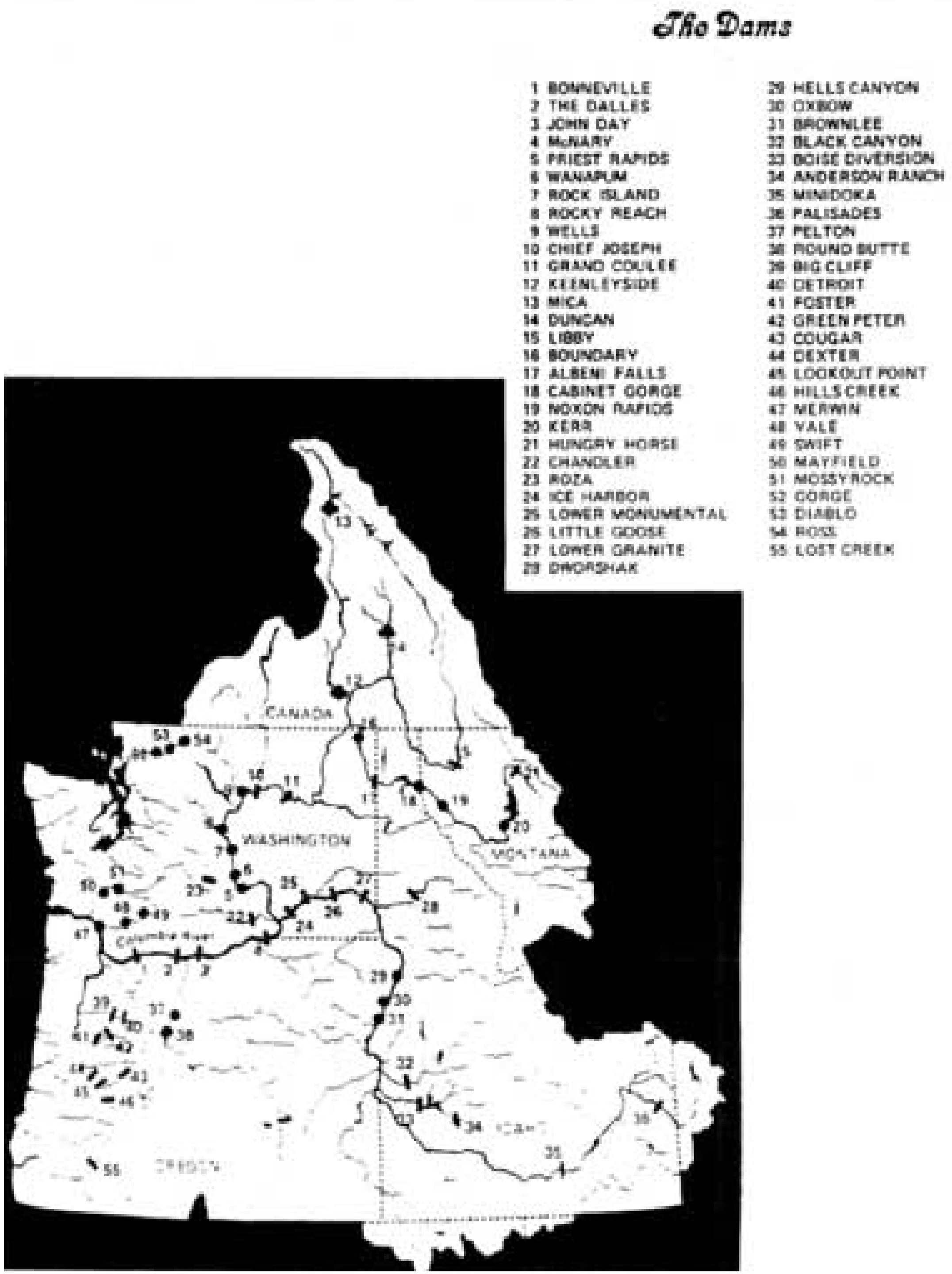
***Grand Coulee Dam* Tour Guide (ca. 2013)**

# Part 23

# Paradise Lost & Found

# Drawdowns & Showdowns

**In 1950 and 1951, the *Roosevelt Lake Log Owners Association* complained to politicians and agencies about the difficulties that fluctuating lake levels caused its members. The thirteen firms depending on *Lake Roosevelt* for log storage and transportation employed over two-thousand workers. The drawdowns, which the association believed were due to "experimental" flood control, affected the *Kettle Falls* water supply, the few beaches that had been established, log dumping sites, transportation and storage facilities, fire protection, transportation of logs on the lake and docking facilities. The association reported that 70% of all operations on the lake required an elevation of 1,274-feet or higher. It was agreed that either the NPS (on weekdays) or the *U.S. Army Corps of Engineers* (on weekends) would notify the association of any anticipated drawdowns that might seriously affect their operations.**




**Under the terms of the *Columbia River Treaty* signed in 1961 by President Eisenhower, Canada agreed to provide reservoir storage in exchange for a share of the resulting power benefits at the eleven downstream U.S. power-generating plants. The U.S. also agreed to pay Canada for water storage that helped with flood control in the United States. Canada then built three storage dams and reservoirs to hold spring flood waters for gradual release later in the year. The new upstream reservoirs were expected to reduce the need for seasonal drawdowns at *Lake Roosevelt*, but this did not materialize because of the construction of the third powerhouse at *Grand Coulee Dam* that began in the 1967.**

**Left: caption: "Major dams on the Columbia River and its tributaries"**

**The third power plant affected the elevation of *Lake Roosevelt* on both a temporary and long-term basis. During the construction of the new plant, the U.S.B.R. drew the level of Lake Roosevelt down 130-feet in 1969 and 133-feet in 1974 to allow for dry excavations. Crowds came to view the re-emerged *Kettle Falls* each time. Since completion of the third power plant, *Grand Coulee Dam* has been used to cover peak loads rather than base loads. This "peaking" caused the reservoir levels to fluctuate more than in previous years. The normal maximum fluctuation in water level each year is now 82-feet, although the average is lower. In a typical year, the reservoir is drawn down from January through June in preparation for spring runoff and peak seasonal power demand. It reaches its lowest level during April and it is generally at full pool between July and December. The *Kettle Falls Chamber of Commerce* initiated a campaign in the 1960s to maintain high summer lake levels on behalf of recreation on Lake Roosevelt, but this was a losing battle. The drawdowns met complex needs throughout the *Columbia River Basin*, making their modification unlikely to meet the recreational requirements of one reservoir in the system.**

<u>Left</u>: caption: “Aerial view of Kettle Falls, partially exposed during drawdown in April 1969. The large drawdowns during construction of the third power plant enabled archaeologists to reach previously inundated sites, including some particularly significant ones at Kettle Falls.”

**To facilitate building the third power plant, the U.S.B.R. needed to dramatically lower the water in *Lake Roosevelt* each spring; an action that would expose hundreds of archaeological sites never before recorded. To prepare for this anticipated archaeological bonanza, the *Western Regional Office* of the U.S.B.R. funded *Washington State University* (WSU) for the 1966 and 1967 seasons to do survey work around much of the reservoir. The *National Park Service* (NPS) continued the same funding arrangement for two more years as the lake levels dropped. Late in 1967, the NPS initiated discussions with the U.S.B.R. concerning funding for a major archaeological salvage program at Lake Roosevelt during the third power plant construction. Regional Archeologist *Paul J.F. Schumacher* stressed the importance of the sites that would be exposed and recommended that U.S.B.R. provide $37K per year in 1968, 1969, and 1973, the years of the lowest expected drawdowns. He also requested $17K for each of the other three years, bringing the total to $162K.**

**The expenses were higher than normal since they would need to hire a field crew on the open market instead of being able to use low-cost student workers who were available only during the summer months. The drawdowns for the powerhouse project during the late 1960s and early 1970s spurred significant archaeological work at *Lake Roosevelt*. Supervision changed from WSU to the *University of Idaho* in 1970, about the time U.S.B.R. assumed responsibility for funding the work. Projects included extensive surveys around the reservoir and excavations concentrated in the *Kettle Falls* area.**

**Top: caption: "Part of Takumakst (the Fishery), an Indian village at Kettle Falls, 1861. This site was partially excavated during the drawdowns for the third powerhouse construction."**

**Bottom: caption: "Excavation of site at Kettle Falls"**

**Lake Roosevelt's original recreation facilities were not designed for the large drawdowns that began in the late 1960s. However, by 1971, modifications made launch ramps and docks at selected sites useable during drawdowns of up to 50-feet below full pool. NPS regularly submitted *Project Construction Proposals* for extending or building new launch ramps that would be useable at lower elevations. Two new low-water ramps were built in 1974, but few others were funded in the 1970s. It was planned that, eventually, all docks would be floating. Until then, drawdowns of just 3-feet had serious negative impacts on recreation. For example, in 1975 only the floating docks at *Spring Canyon* were useable between 1,285.5 and 1,288-feet. At that elevation, only four launch ramps were functional, many swim areas could not be used and none of the fuel docks could be reached by boat. After a public meeting in 1976, U.S.B.R. and the NPS worked together on a plan to build additional boat ramps and floating gas facilities at various places on *Lake Roosevelt*.**

**By the the mid-1980s, most of Lake Roosevelt's recreational facilities still had not been adapted to lower summer lake levels. At 1,270-feet, about half the launch ramps were not operational. Below about 1,235-feet, no ramps were useable and most water recreation stopped. Designated swim beaches could not be easily used, and some became dangerous. Some campground water systems were left high and dry, and boat-in campgrounds became unusable. Courtesy docks were stranded on dry land at elevations below 1,280-feet, and many boat harbors could not be reached. Log booms for swim beaches, mooring buoys, and navigational aids had to be moved. Concessionaires' marinas had to be repositioned, making them inconvenient to use and operate.**

**Left: caption: "Kettle Falls Marina during drawdown, May 1983"**



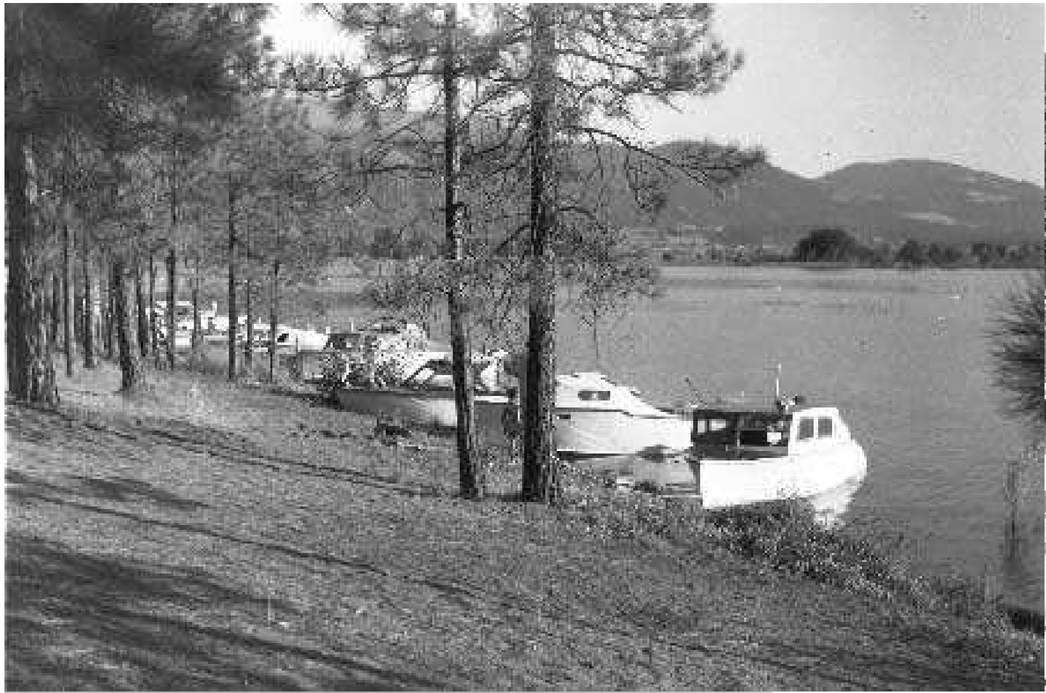
**Right: caption: "Grand Coulee Dam Yacht Club picnic at Plum Point, July 1944"**

**An unexpected drawdown during the recreation season sometimes damages boats and other facilities. Visitation drops (particularly when the media report on the drawdown) and concessionaires suffer economic hardship. This happened in the summers of 1984 and 1985. In July 1984, the lake level dropped to 1,277-feet despite continuing pre-dictions of stable or rising lake levels. This unexpected drawdown was caused by a combination of high power demand, weekend shutdowns of the *Hanford Nuclear Power Plant* and poor forecasting. In 1985, the lake was at 1,267-feet in mid-June and it did not reach a pool elevation of 1,288-feet until after September 1985. The concessionaires at *Kettle Falls* and *Keller Ferry* were severely impacted, suffering both damaged boats and lowered visit-ation. The U.S.B.R. made some changes in the early 1990s that somewhat improved the fluctuating lake level situation on *Lake Roosevelt*. In 1990, a new minimum-lake-level limit of 1,220-feet replaced the earlier limit of 1,208-feet, effective except in critical flood-control situations. In addition, U.S.B.R. instituted a costly hard constraint of 1,285-feet by July 1st. The agency followed this action in 1991 by listing recreation as an "A" priority for the first time ever.**

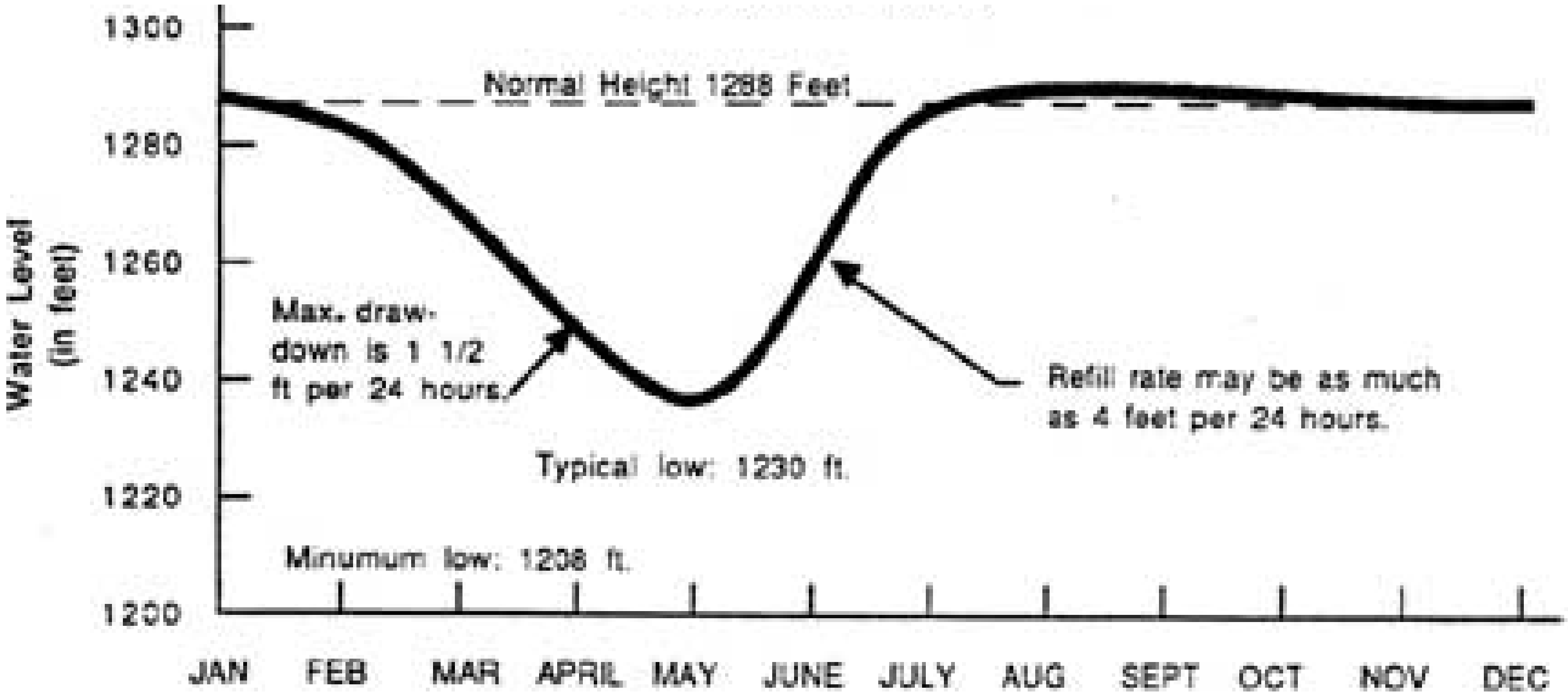

**One of the causes of low summer elevations since 1984 has been the use of water from *Lake Roosevelt* to help flush anadromous smolt (salmon and steelhead) toward the Pacific Ocean. Starting in 1984, three million acre-feet of Lake Roosevelt water was dedicated annually for spring and early summer salmon flushes. Following the passage of the *Endangered Species Act* and the 1993 inclusion of *Snake River* chinook, sockeye, and coho salmon on the endangered species list, an additional 3.5 million acre-feet was dedicated to the flushing project. In July 1994, a drawdown to help anadromous fish caused the lake level to drop below 1,274-feet through early August. As a result, the concessionaire's marina at *Kettle Falls* had to move its rental docks out of the harbor for the first time during the visitor use season. In 1995, a *Biological Opinion* allowed as much as 10-feet of water to be drafted from Lake Roosevelt, generally in August, to augment flows for downstream fisheries.**

**Left: caption: "Boaters from Wenatchee and Ellensburg starting off on a trip to the Arrow Lakes in British Columbia, June 1947"**

**Right: caption: "Launching a boat at Kettle Falls"**



**<u>Left</u>: caption: “Boats moored to trees and bushes at Kettle Falls, 1956. This was a common sight in the early years because of the lack of public docks.”**
**<u>Right</u>: caption: “Kettle Falls Marina, 1958”**
**<u>Left</u>: caption: “The ‘Pelican’ – a military-surplus landing craft, being lowered into Lake Roosevelt, 1961”**




***"Annual drawdown of the lake from October through April leaves a wide desolated band of discolored rock between the shoreline plant communities and low water. An average draft of 40 to 60-feet exposes either vast expanses of sand or steeply eroding banks at most development sites."***

**NPS, *A Master Plan for Coulee Dam National Recreation Area,*1968**

**<u>Above</u>: caption: "Typical water levels of Lake Roosevelt over the course of an average year in the 1990s"**

# Hazards to Navigation

***“At the present time, Lake Roosevelt is navigable only with danger. Boats have to pick their way between the great floats of debris and it is desirable that this cleanup work be gotten under way as soon as funds can be made available. This is important more for the clearing of the debris so that it will not have to pass over Coulee Dam or any of the dams below, as well as from the point of view of boating on the lake, which, of course, is of secondary importance during this war period.”***

***Frank A. Kittredge*, U.S. Army Corps Chief Engineer, Region 3, 1950**

**In the 1940s and 1950s, floating logs, trees, and other "woody debris" on *Lake Roosevelt* caused great concern. This debris was largely composed of logs, snags, and slash from logging operations, as well as uprooted trees and brush from lakeshore erosion that extended from *Keller Ferry* upstream. After the flood of 1948, the banks of Lake Roosevelt were lined with a band of "trash" as much as 50-feet in width. The debris piled up on beaches, while logs and "deadheads" (logs that have sunk at one end) posed a hazard to small boats and float planes. If the debris were not collected, it continued down the *Columbia River* and passed over a series of dams. Every year, spring high water brought more from Canada and large tributaries and the floating debris filled the lake in a solid mass from the dam to above *Spring Canyon*. Debris cleanup was one of the first activities to receive funding.**

**Top: caption: "Driftwood on beach, Lake Roosevelt, 1956"**

**Bottom: caption: "NPS boat among floating debris, 1960"**


**The NPS spent almost $122K on the lakeshore debris disposal program between 1961 and 1965, excluding capital investments. However, after that period, the work was reduced. An additional $14K was spent on debris cleanup from 1966-1968. The next year (1969), the amount of debris was much higher than usual because of the drawdowns for construction of the third power plant. Collection facilities at the mouth of the *Kettle River* were completed in 1969. With the passage of new national air pollution standards in the early 1970s, the practice of piling debris along the lakeshore and burning the piles would have to be phased out.**

**Left: caption: "Portable sawmill owned by Hal Marchant, downstream of Spring Canyon, 1957. The sawmill was mounted on a barge and towed to places on Lake Roosevelt where drifting logs had accumulated."**

**Right: caption: "Barge with backhoe and extension boom removing beached debris, and small tug pulling sweep boom, 1976"**

# Erosion

Landslides along the shores of *Lake Roosevelt* were a major problem in the early years of the reservoir when the rising waters caused hillsides to slump. Lake drawdowns continue to cause landslides because the steep, saturated banks become unstable when support from the water in the lake is removed. Waves from boat wakes or high winds also cause shoreline erosion and other minor factors include heavy rainfall, earthquakes, irrigation of adjoining land, freezing and thawing, building construction and wedging action by tree roots. Many slides occurred in the 1940s, both as the reservoir filled and after it reached high pool in mid-July of 1942. Perhaps the largest was a 1949 slide in *Hawk Creek Bay* that created a wave about 65-feet high that swept across the lake and continued more than 100-feet up the opposite bank. All told, about five-hundred slides occurred between 1941 and 1953. Sand slides along the lakeshore usually stabilized after one slippage, but slides in silt and clay slid repeatedly.

**Between 1941 and 1969, approximately six-thousand acres of slide-prone land were acquired. For land in potential slide areas within the two reservations, legislation amending the *Act of June 29, 1940*, allowed the federal government to take such land without challenge. However, the government did have to pay fair market value. Graves from a number of cemeteries had to be relocated in the 1940s and 1950s because they were located in critical slide areas. Construction of homes along the lakeshore in the 1960s led to higher land values. The U.S.B.R. focused on acquiring unstable areas that were most likely to be developed. During the 1970s, the *Colville Confederated Tribes* (CCT) expressed concerns about the U.S.B.R. program to acquire land threatened by landslide activity. They wanted any such lands that had shown no slide activity returned to the tribes (some believed that land had been taken under false pretense). This remained an issue well into the 1980s, but U.S.B.R. continues to acquire land in potential slide areas.**

**Above: caption: "Building a concrete retaining wall at Evans Beach, early 1960s. Gabions and metal-sheet piling have also been used to reduce erosion at developed sites."**

**Although landslide activity decreased after the 1950s, some large slides did occur in later years. In March 1969, a landslide dammed the *Spokane River* for nearly thirty-six hours. The river rose approximately 30-feet behind the fifteen million cubic yards of earth before breaching the dam. This and other slides that year were associated with the extreme drawdown due to the construction of the third power plant.**

**<u>Left:</u>: caption: "Sockemtickem slide near Fort Spokane, April 1969"**

**Overall slide activity increased between 1969 and 1975 and then tapered-off again. Erosion of the lakeshore by wave action also remained a problem at some developed areas and caused many trees to fall into the lake. The U.S.B.R. had an ongoing program to stabilize the most critical slide areas. All eroding shorelines in major developed areas were surveyed in 1972 resulting in the installation of concrete sea walls, gabion bags and/or riprap to counteract the erosion process.**

# Learning to Play

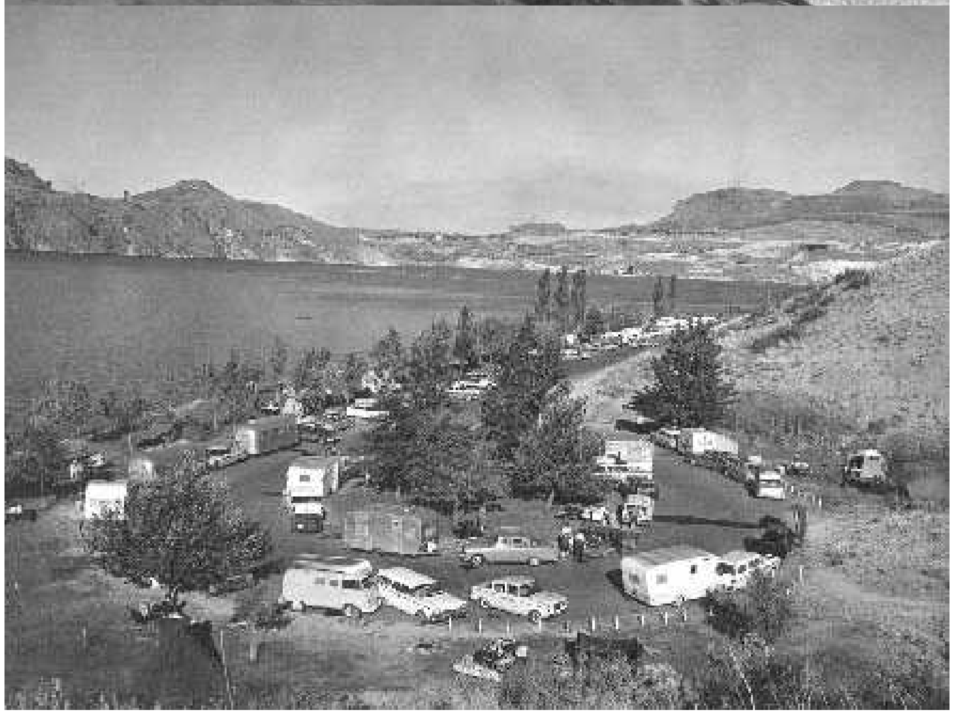
***"The people of no other country and no other age had ever had anything like the leisure, the discretionary income, or the recreational choices of the American people in mid-twentieth century. It was overwhelming…Even though they might not always have used this leisure to the best advantage, the American people had learned to play."***

***Foster Rhea Dulles*, Author**

**RE: excerpt from *History of Recreation,* 1959**

**The development of recreation facilities by the NPS outside the traditional national parks became increasingly important to the agency in the 1930s. As the 1941 NPS report on the nation's recreation facilities commented: *"Artificial bodies of water in interesting settings, and man's ingenuity in creating them, have strong recreational appeal."* Purists criticized NPS involvement with recreational areas as a lowering of agency standards. They were uneasy about the consolidation of state and national park planning. Some also found it ironic that the NPS was administering recreation at certain reservoirs while actively fighting dam proposals in areas where dams threatened national parks and monuments. The NPS sidestepped the inherent contradictions in its actions by launching a new recreational program centered on large reservoirs. Some saw this expansion of recreational opportunities as a good way to relieve visitation pressure on the traditional national parks.**


**The first recreational planning by the NPS done in cooperation with U.S.B.R. was the planning for *Lake Mead*, the reservoir created in Nevada and Arizona by *Boulder Dam*. In 1936, shortly after the dam was completed, the U.S.B.R. entered into a *Memorandum of Agreement* with the NPS to create the *Boulder Dam Recreational Area*, the country's first *National Recreation Area* (NRA). The NPS was also involved with recreational planning for reservoirs in the *Colorado River Basin* and in other areas in the early 1940s. Between 1933 and 1964, five reservoir-based NRAs were added to the *National Park System*, including Boulder Dam (renamed "Lake Mead National Recreation Area" in 1947) and *Grand Coulee Dam* ("Lake Roosevelt National Recreation Area". The emphasis at these NRAs was on recreation and consumptive use of park resources such as mining, hunting and grazing were permitted. By 1997, even after some NRAs had been turned over to other agencies, the NPS was managing twelve NRAs centered on large reservoirs. The reservoirs that the NPS continued to manage, including *Lake Roosevelt*, were believed to have national rather than state or local significance.**



**<u>Top</u>: caption: "Looking across Spokane Arm to site of Fort Spokane, 1958. The campground and swim beach are on the lower bench near the bridge, and the historic grounds and buildings are on the bench to the right of the road."**
**<u>Bottom</u>: caption: "North Marina Campground, 1962. Visitation to Lake Roosevelt NRA increased this year because of travelers to the 1962 World's Fair. This campground was very popular until it closed in 1967 because USBR needed the site as a staging area for construction work."**

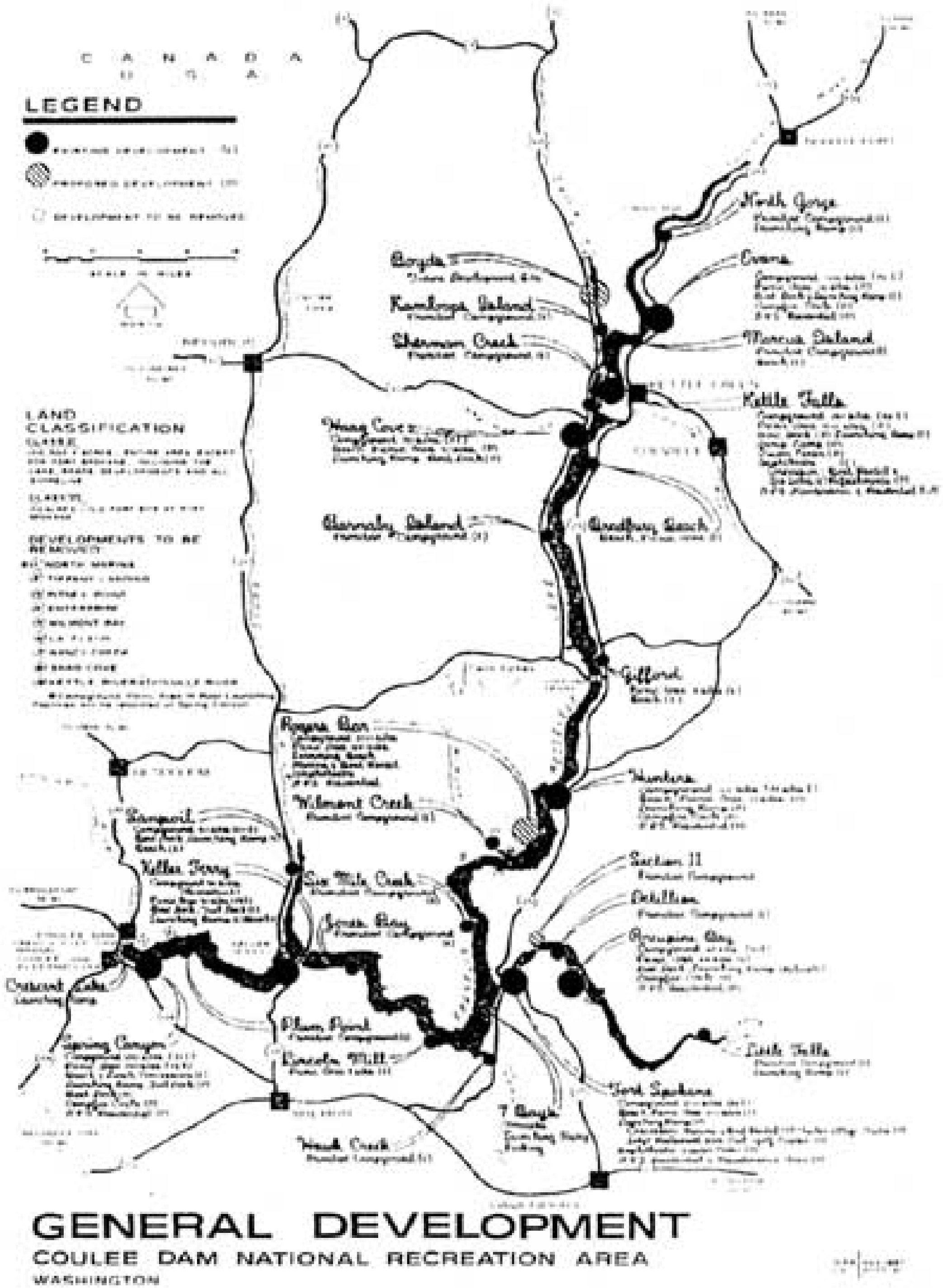
**<u>Top Left</u>: caption: "Swimming class at North Marina, August 1946"**

**<u>Top Right</u>: caption: "Swim beach at Kettle Falls, 1965"**

**<u>Left</u>: caption: "Camping at Fort Spokane campground, July 1972"**

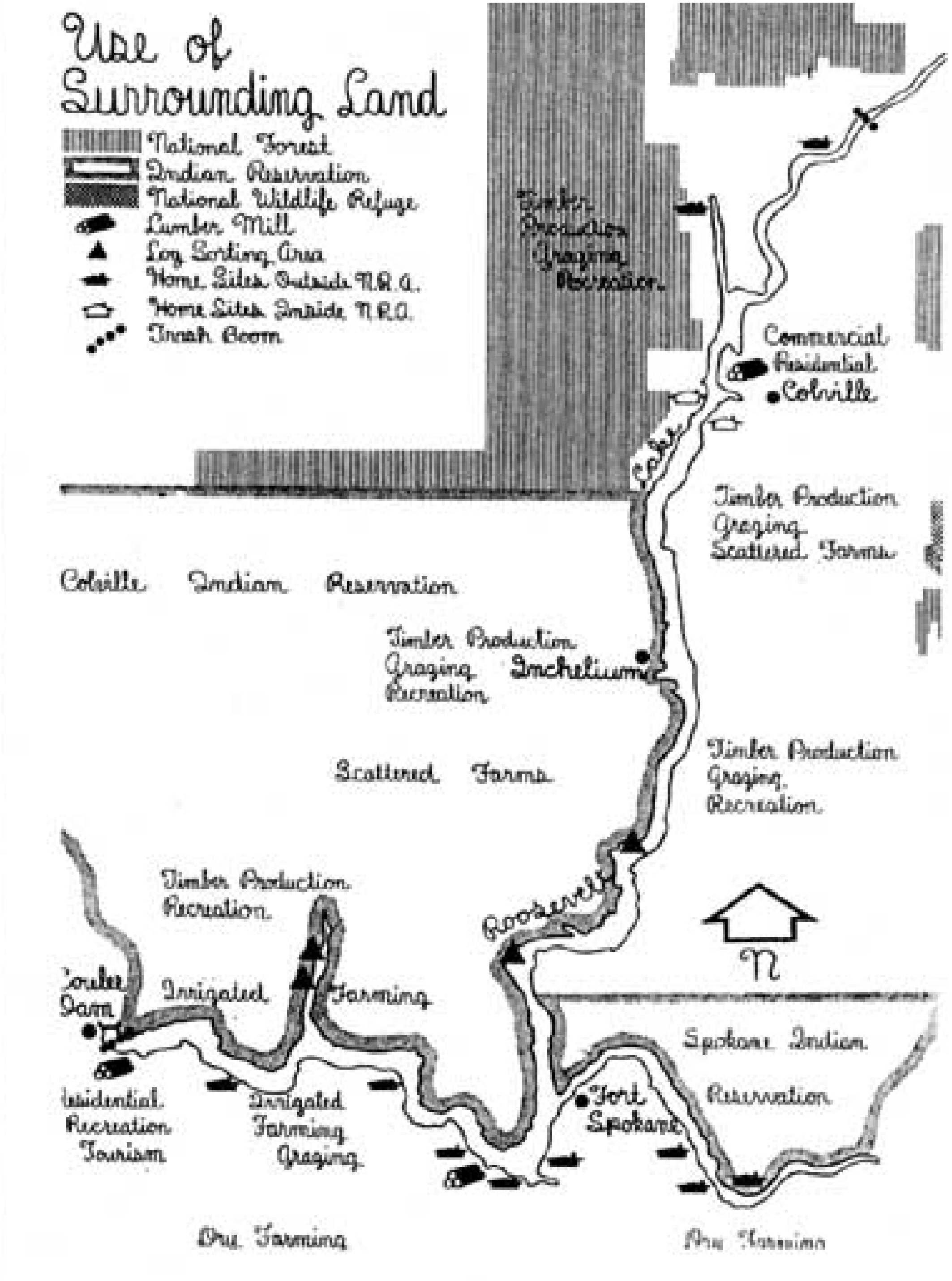
**Left: caption: “Crescent Bay Lake in background and South Marina site in foreground, before removal of sawmill, 1977”**
**Right: caption: “Sawmill at the South Marina site, November 1956. This was one of several sawmills that were granted permits to operate along Lake Roosevelt.”**

# Mission 66




**In 1966 the NPS would be celebrating its fiftieth anniversary. Beginning in 1956, a ten-year program (aptly named "Mission 66") aimed to bring every park up to standard by 1966 was initiated. The entire NPS was highly motivated; regional office and park staffs developed individual project plans and supplied cost estimates for each park. In Washington D.C., the park packages were reviewed until the total plan (containing the management and budget requirements for each of the 180 parks) had been completed. The total *Mission 66* program was projected at $800 million. That the actual expenditure would pass $1 billion was not realized until much later.**

**<u>Left</u>: caption: "Map showing both existing and proposed development at the end of the Mission 66 period, 1967"**

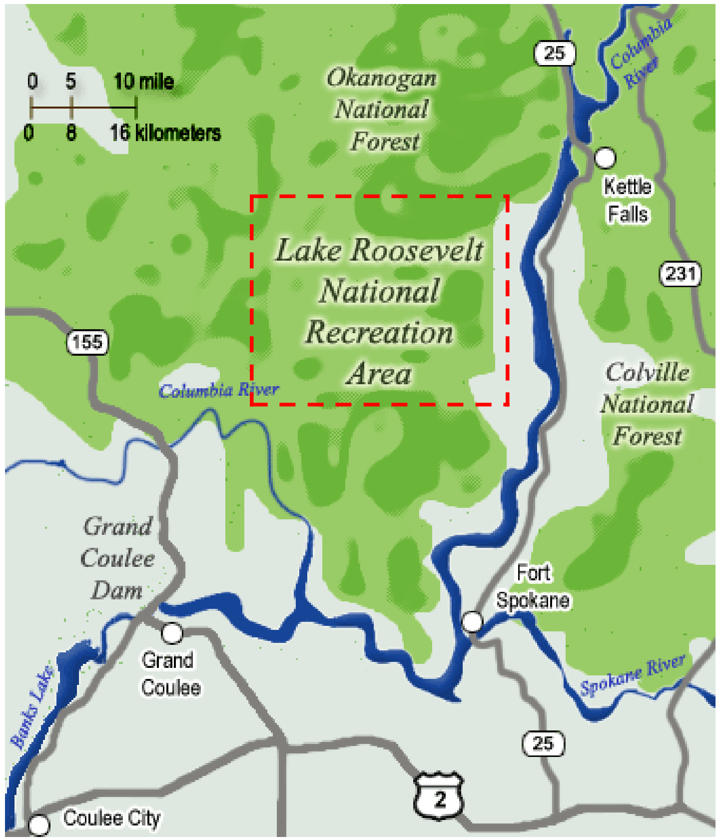



***"The beautiful lake was a political nightmare marked by powerful crosscurrents and competing channels…The story goes that if a body were found floating in Lake Roosevelt no-body would pull it out because no one knew who had juris-diction over it. It'd just have to float around out there."***

***Lake Roosevelt Forum***

**<u>Left</u>: caption: "Map showing uses of lands along Lake Roosevelt, 1968"**


Bellingham
Anacortes
Mount Vernon
Port Angeles
Port Townsend
Forks
Everett
OLYMPIC MTS
Seattle
Redmond
Bellevue
Bremerton
Auburn
Tacoma
Puyallup
OLYMPIA
South Bend
Chehalis
Long Beach
Longview
Mt. St Helens
Mt. Adams
CASCADE RANGE
Columbia
Mt. Baker
North Cascades N. P.
Winthrop
Okanogan
Chelan
Lake Chelan
Leavenworth
Wenatchee
Roslyn
Ellensburg
WASHINGTON
Moses Lake
Ritzville
Yakima
Mt. Rainier N. P.
Hanford Site
Richland
Pasco
Kennewick
Prosser
Walla Walla
Pomeroy
Asotin
Colfax
Snake
Spokane
Colville
Franklin Roosevelt Lake
Model Area


0 5 10 mile
0 8 16 kilometers
Okanogan National Forest
Lake Roosevelt National Recreation Area
Colville National Forest
Kettle Falls
Columbia River
Grand Coulee Dam
Grand Coulee
Coulee City
Banks Lake
Fort Spokane
Spokane River
25
155
231
2


# Milestones

**<u>Above L&R</u>: caption: "June 11, 1948. President Truman visits the dam and speaks to the assembled crowd"**

**<u>Left</u>: Caption: "Dedication of Grand Coulee Dam on May 11, 1950"**

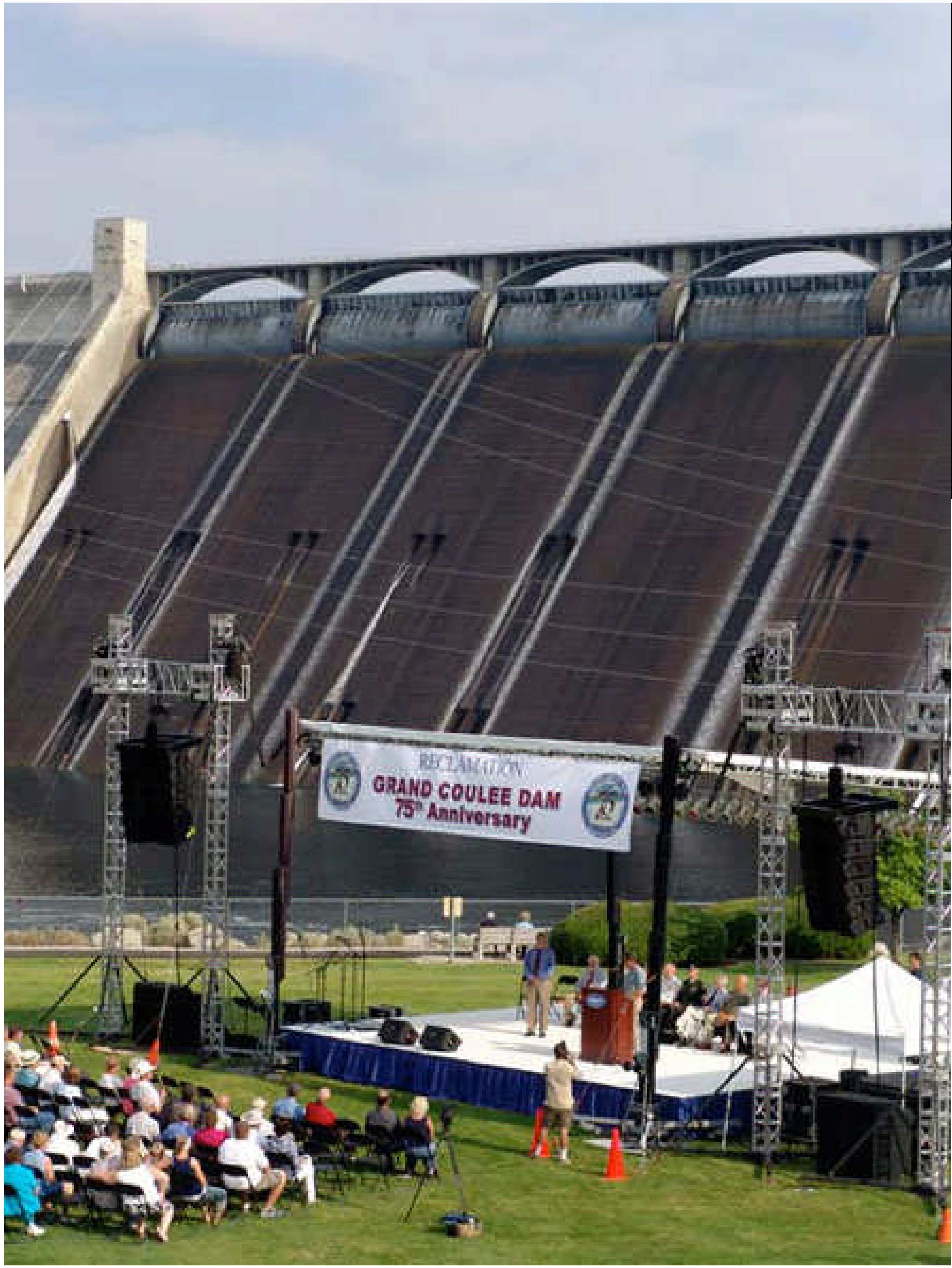
***"Grand Coulee Dam's contribution augmented those of Hoover Dam, the Tennessee Valley Authority dams and other hydro and non-hydroelectric projects nationally…Grand Coulee allowed the government to produce aluminum and run Hanford while not disturbing the day-to-day lives of most Americans. The government could have diverted power from domestic uses but Grand Coulee, among other projects, made this unnecessary…"***

***Paul Pitzer*, Author/Historian**

<u>Left</u>: caption: “June 14, 1951. fifty maidens from fifty U.S. states at feeder canal ceremony at Grand Coulee Dam. Arizona only brought one-half gallon of water. Arizona said that California took the other half.”

***"Probably Hitler would have beaten us in atom bomb development if it had not been for the hydroelectric development of the Columbia, making possible the big Hanford project which brought forth the bomb."***

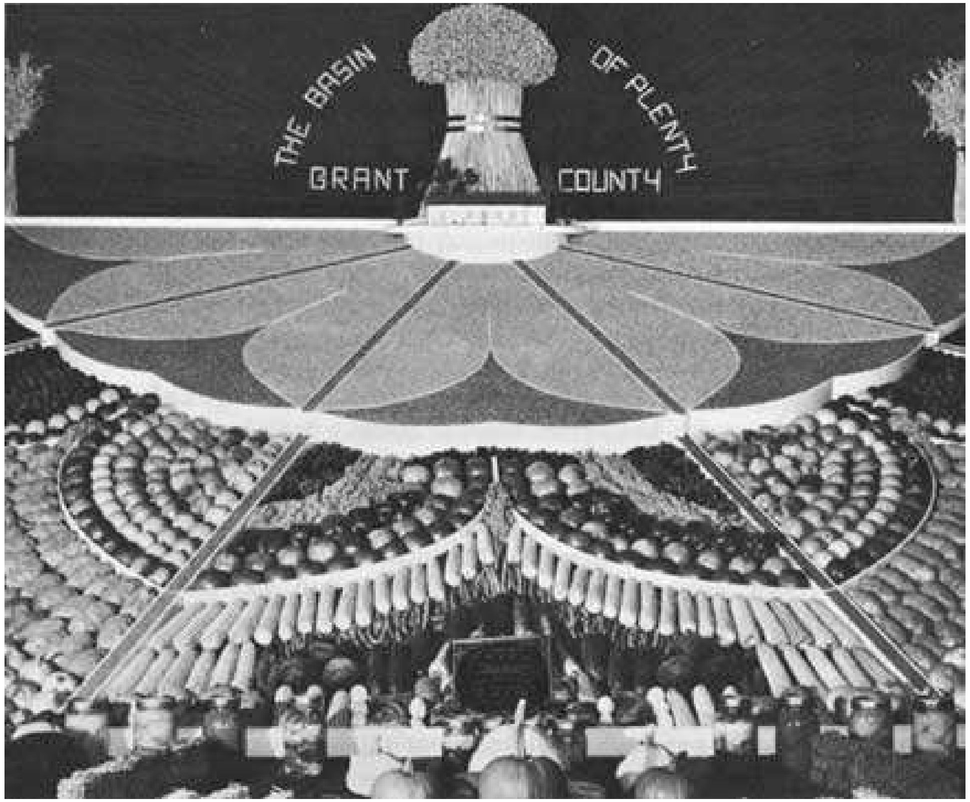
***Earl Warren*, 1948 Vice Presidential Candidate**




<u>Above</u>: caption: "May 24, 1987. Lights and fireworks at Grand Coulee Dam. Columbia Basin Project, Washington"

<u>Left</u>: caption: "July 7, 2008. Celebrating the 75th anniversary of the start of Grand Coulee Dam. About 250 people attended the afternoon program and evening concert."

# What Use Have We?




***“What do we want with this vast tractless area, this region of savages and wild beasts, of deserts, of shifting sands, and whirlwinds of dust, of cactus and prairie dogs? To what use could we ever hope to put these great deserts or these great mountain ranges, impenetrable and covered to their base with eternal snow?”***

***Daniel Webster***

**Left: caption: “Grant County fair with a display of basin crops”**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